Investigative Update of Battery Fire
Japan Airlines B-787 - Jan 7, 2013

Deborah A.P. Hersman
Chairman
January 24, 2013
Timeline – JAL Battery Incident

• 10:06am - aircraft arrived at gate in Boston from Narita, Japan
  • 183 passengers and 11 crew deplaned
• 10:32am - Cleaning and maintenance crew noticed smoke in cabin
• 10:35am - Mechanic noted flames coming from APU battery in aft electronics bay
Timeline, cont.

• 10:37am – Airport Rescue & Fire Fighting notified
• 10:40am – Fire and rescue personnel arrive on scene
• 12:19pm – Fire and rescue personnel report event was “controlled”
APU Battery

Exemplar Battery  

JAL Event Battery
Damage to Aft Electronics Bay
Investigative Activities

• Battery exam and teardown at NTSB Materials Laboratory

• Component exam and teardown
  • Tucson, AZ – Battery Charger Unit and Start Power Unit (Securaplane Technologies)
  • Phoenix, AZ – APU Controller (United Technology Aerospace Systems)
  • Seattle, WA – Two General Purpose Modules (Boeing Commercial Airplanes)
  • Fujisawa, Japan – Battery Monitoring Unit (Kanto Aircraft Instrument)
JAL APU Battery Cells

Exemplar Battery  JAL Event Battery
# Cell and Battery Specifications

<table>
<thead>
<tr>
<th></th>
<th>Cell</th>
<th>Battery</th>
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<tbody>
<tr>
<td>Nominal capacity (Ah)</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Nominal voltage</td>
<td>3.7</td>
<td>29.6</td>
</tr>
<tr>
<td>Operational voltage range (V)</td>
<td>2.5 – 4.025</td>
<td>20 – 32.2</td>
</tr>
<tr>
<td>Weight (lb.)</td>
<td>6.0</td>
<td>63</td>
</tr>
<tr>
<td>Dimensions (in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>5.2</td>
<td>10.9</td>
</tr>
<tr>
<td>D</td>
<td>2.0</td>
<td>14.2</td>
</tr>
<tr>
<td>H</td>
<td>7.7</td>
<td>8.5</td>
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</table>
Cell Design

(Unit: inch)

7.7 (including terminal)

7.0

5.2

2.0
Electrodes

Current collector
Negative electrode
Separator
Case
Rupture valves

Negative terminal
Positive terminal
Positive electrode

NTSB
Electrode Construction

Not to scale

- Separator
- Graphite
- Cu
- Graphite
- Li-CoO$_2$
- Al
- Li-CoO$_2$
Example of a Cell CT Scan
NTSB Lab Activities
**Cell Examinations To Date**

<table>
<thead>
<tr>
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<th>• CT scan of entire assembly</th>
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<tr>
<td>8</td>
<td>• dismantled</td>
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<tr>
<td>7</td>
<td>• CT scan</td>
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<td>• CT scan</td>
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<td>• SEM</td>
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<td>• EDS</td>
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**SEM** – Scanning Electron Microscopy

**EDS** – Energy Dispersive Spectroscopy
We Are Looking For:

• Signs of thermal runaway
• Signs of electrical short circuiting
• Manufacturing defects
• “Anything unusual”
Damaged Electrode - Internal Short Circuit
CT Scan of Battery
Findings To Date

• Fire was present
• Signs of thermal runaway
• Signs of electrical short circuiting
Next Steps

• Complete the in-house laboratory examinations
• Conduct examinations and testing of exemplar batteries
• Synthesize lab examination findings with fire forensics and aviation systems investigation
Parties to Investigation

- Federal Aviation Administration
- Boeing Commercial Airplanes
- Accredited Representatives
  - Japan – JTSB
    - GS Yuasa
    - Japan Airlines
  - France – BEA
    - Thales Avionics Electrical Systems
- Technical assistance provided by Carderock Division, Naval Surface Warfare Center
JTSB Investigation
ANA Battery Event

Photo by Reuters/Kyodo/Landov