ELA NASA BATTERY WORKSHOP PRESENTATION

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Johnson Controls Battery Group, Incorporated

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Marshall Space and Flight Center

David Hall
TRUE BIPOLAR BATTERY DEVELOPMENT
WPAFB CONTRACT

• GOALS:

Develop a Composite Bipolar Substrate Material with the Following Characteristics:

Resistivity: \(< 2 \Omega \text{ -cm}\)
Thicknes: \(< 0.064 \text{ cm}\)
Weight: \(< 150 \text{ mg/cm}\)
Area: \(> 400 \text{ cm}^2\)

The 270 Volt Battery will be Designed to be used in the More Electric Aircraft Program
TRUE BIPOLAR BATTERY DEVELOPMENT
WPAFB CONTRACT

- VALUE:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Total</td>
<td>1,013.4M</td>
</tr>
<tr>
<td>Spending To Date</td>
<td>636.4M</td>
</tr>
<tr>
<td>Funding For FY'94</td>
<td>377.0M</td>
</tr>
</tbody>
</table>

10% Cost Share to JCBGI
TRUE BIPOLAR BATTERY DEVELOPMENT
WPAFB CONTRACT

• APPROACHES:

Compound Stable Conductive Filler(s) into
Plastic or Thermosets to Produce Non-Porous
Highly Conductive, Lightweight Substrate
Material

Use Compounding Additives Which Enhance
Conductivity, and Manufacturability While
Eliminating Porosity
TRUE BIPOLAR BATTERY DEVELOPMENT
WPAFB CONTRACT

- PROGRESS:

Conductive Filler Stability Proven
Conductive Filler Supplier Qualified
Composition of Substrate Identified
Project Substrate Thickness of 0.010-0.015"
Numerous Batteries Tested To Date
TRUE BIPOLAR BATTERY DEVELOPMENT

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NEXT STEPS:

- Improved Containment Design Trial
- Improve Present Manufacturing Techniques - Mass Production
- Produce Lighter, Thinner, More Conductive Substrate
- Test for SIL, EV Applications
# JCBGI LABBM
300 Volt Bipolar Battery System
ELA Program

<table>
<thead>
<tr>
<th>Battery Parameter</th>
<th>Design Specs</th>
<th>WPAFB Goals</th>
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<tbody>
<tr>
<td>Substrate Thickness</td>
<td>0.015&quot;</td>
<td>0.025&quot;</td>
</tr>
<tr>
<td>Substrate Resistivity</td>
<td>2Ω -cm</td>
<td>2Ω -cm</td>
</tr>
<tr>
<td>Substrate Weight/Area</td>
<td>150 mg/cm²</td>
<td>150 mg/cm²</td>
</tr>
<tr>
<td>Substrate Area</td>
<td>1200 cm²</td>
<td>400 cm²</td>
</tr>
</tbody>
</table>
ELA Current Profile

20 amp Background, 310 amp 1.5 second Spikes

Discharge Current (amps)

Time (seconds)
**JCBGI LABBM**  
300 Volt Bipolar Battery System  
ELA Program

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Battery Size</td>
<td>15&quot; x 15&quot; x 9&quot;</td>
</tr>
<tr>
<td>Weight</td>
<td>228 pounds</td>
</tr>
<tr>
<td>Number of Cells</td>
<td>140</td>
</tr>
<tr>
<td>OCV</td>
<td>300 Volts</td>
</tr>
<tr>
<td>Cell Thickness</td>
<td>0.063&quot;</td>
</tr>
</tbody>
</table>
JCBGI Bipolar Battery Voltage/Power Profile
30 Amp Background, 200 Amp Spikes

- Battery Voltage
- Power (kW)
JCBGI Bipolar Lead/Acid
300 Volt Battery System 1
ELA Program

TOP VIEW

END BLOCKS

VENTS/PORTS

END VIEW

TERMINAL PAD

ENCASEMENT

SIDE VIEW

1993 NASA Aerospace Battery Workshop
-767-
Advanced Technologies Session
ELA Current Profile

30 amp Base Load, 400 amp Pulse for 0.2 Seconds

Time (seconds)

Current (amps)
### JCBGI LABBM
#### 300 Volt Bipolar Battery System
ELA Program

<table>
<thead>
<tr>
<th>Battery System 2 Parameters</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Battery Size</td>
<td>16.8&quot; x 16.8&quot; x 8.7&quot;</td>
</tr>
<tr>
<td>Weight</td>
<td>273 pounds</td>
</tr>
<tr>
<td>Number of Cells</td>
<td>140</td>
</tr>
<tr>
<td>OCV</td>
<td>300 Volts</td>
</tr>
<tr>
<td>Cell Thickness</td>
<td>0.061&quot;</td>
</tr>
</tbody>
</table>
JCBGI Bipolar Lead/Acid
300 Volt Battery System 2
ELA Program

TOP VIEW
- END BLOCKS
- VENTS/PORTS

SIDExVIEW
- TERMINAL PAD

END VIEW
- ENCASEMENT

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Advanced Technologies Session