Manufacturing Improvements for DLA Lithium Batteries

TurnAround Factor
Overview

- DLA & TurnAround Factor SBIR Project
- Goal: improvements to battery supply chain:
  - PRC-148
  - PRC-152
  - PRC-154
  - BB-2590
  - PLM-4 (USAF test unit)
Existing Batteries
Where We Are Today
### 18650 Cells in the Batteries

<table>
<thead>
<tr>
<th>Battery</th>
<th>BB-2590 (BT-70791CG)</th>
<th>Thales AN/PRC-148</th>
<th>Harris AN/PRC-152</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Manufacturer</td>
<td>Panasonic</td>
<td>Panasonic</td>
<td>Panasonic</td>
</tr>
<tr>
<td>Country of Origin</td>
<td>China</td>
<td>Japan</td>
<td>Japan</td>
</tr>
<tr>
<td>Cell Model</td>
<td>NCR18650B</td>
<td>CGR-18650HG</td>
<td>CGR-18650DA</td>
</tr>
<tr>
<td>Cell Quantity</td>
<td>24</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Cell Retail Cost</td>
<td>$3.20 ea. ($76.77/pack)</td>
<td>~2.00 ea. ($12/pack)</td>
<td>~3.00 ea. ($18/pack)</td>
</tr>
<tr>
<td>Pack Price Today</td>
<td>$142.24</td>
<td>$197.24</td>
<td>$233.70</td>
</tr>
</tbody>
</table>
Key Observations

- The only part of the packs **failing are the cells**
- All batteries under study use voltage-compatible Lithium-Ion cells in various configurations
- All the cells themselves are COTS and fairly inexpensive relative to the cost of the NSN

Tesla Model S Battery with 8,600 Panasonic 18650 cells
Key Observations

- All use Texas Instruments “Gas Gauge” ICs (BQ2050, BQ20Z655, BQ20862)
- External Comms: SMBus, DQ, HDQ
- All have a ruggedized military case
- Only the cells are “expended”
- Only the cells are shelf life limited
Teardown Key Takeaways

1. The **cells** cause the majority **inventory management problems**
   - Shelf-life limits and backorders during operations

2. **Cells** are a **COTS** part with **strong industrial base**
   - Mitigates surge issues.

3. Cells and packs have **different supply chain management** characteristics
Batteries Concept
Standardized Modular Battery Packs

6-cell, 2-module battery pack
Key Benefits
Battery Supply Chain

● Creates a non-shelf life military specific case separate from the shelf-life limited COTS cells

● Dramatically Increased Surge Capacity
  ○ Allows vendor-managed, government-owned stock of military-specific cases
  ○ Simplified COTS cell insertion process as final step into government-owned stock of cases

● Competitive Standards allow reuse of packs across a wide range of future weapons systems
Key Benefits
Reduced Lifecycle Cost

- Standardized packs allow for competition (esp. PRC-148/152/154, future systems)
- Recurring Costs
  - Simplified stock management
  - Disposal/retrograde savings
  - Long-term: Stock or Pre-position packs without cells
  - Long-term: Streamline cell technology insertion
Safeguards & Protections

- Equal or greater protection than existing packs
- All batteries to use modern safety designs
  - Monitor and Balance EVERY cell
  - E.g., -148, -152 don’t monitor each cell
  - Future capability to further improve charge safety
- Additional safety monitoring/protection circuitry to enable simplified COTS cell insertion process
- Demonstrates concept feasibility, safety features
- Compatible with existing chargers
- Establishes baselines for standards

First Generation PRC-148 Prototype
Next Steps, Discussion

- Socialize the concept with Army, USMC, SOCOM
- Establish Service SME lines of communication — lay groundwork for eventual pilot testing and adoption
- Refine based on customer input
- **Prototype additional packs**
  - PRC-154, BB-2590, PLM-4, etc.
- Iterate draft standards