

# **In Pursuit of More Energy: Equipping our Armed, Security and Emergency Services**

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July 2003



# Agenda

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## *The Pursuit of More Energy: Equipping Our Armed, Security and Emergency Services*

- History of Secondary Military Batteries
- The Lithium-ion Advantage
- Military Drivers
- The Evolution of Intelligence & Impact on Logistics
- The Search for More Energy & the Digital Battlefield

# History of Military Batteries

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- 1799 First Battery
  - 1859 First Lead Acid Battery
  - 1898 First Commercial Battery
  - 1910 First Battery in the armed forces
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# History of Military Batteries

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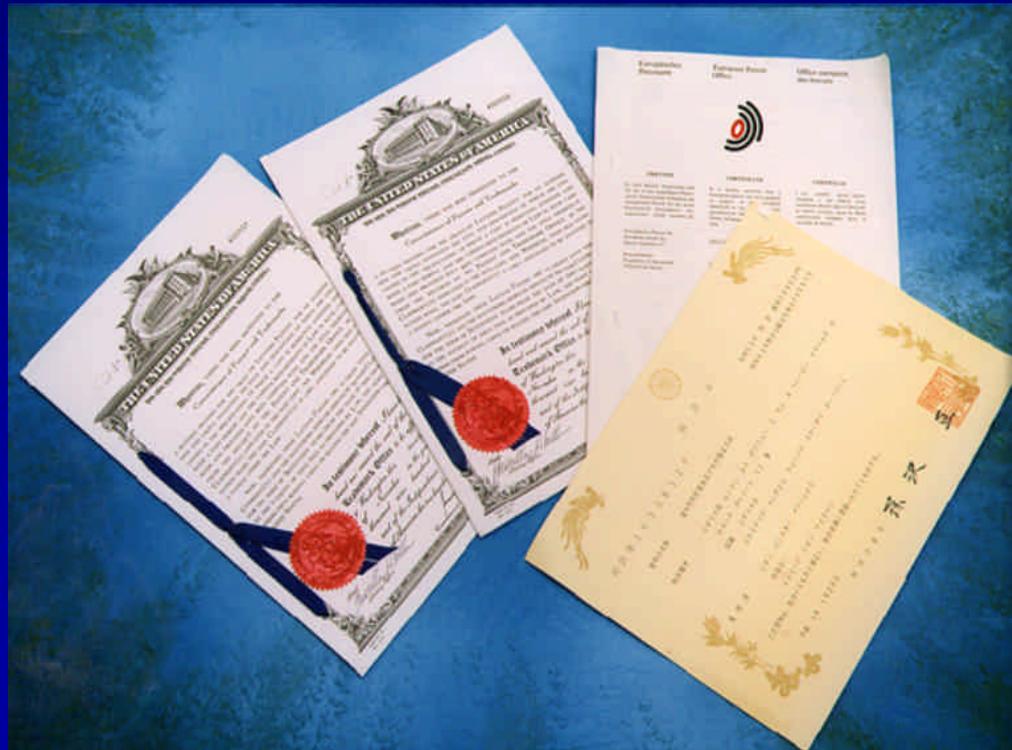
- 1970 NiCd adapted for military use



PRC351-1 (Clansman)

# History of Military Batteries

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- 1979 AEA Lithium-ion materials patented



# History of Military Batteries

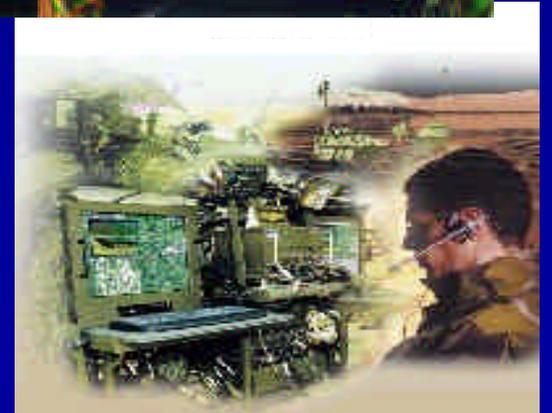
- 1970 NiCd adapted for military use
- 1979 AEA Lithium-ion materials patented
- 1994 AEA grants Licenses



# History of Military Batteries

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- 1970 NiCd adapted for military use
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- 1994 AEA grants Licenses
- 2002 AEA Lithium-ion BOWMAN  
(replacement for Clansman batteries)



# Operational Advantages

## *Li-ion Clansman Arctic Field Trials*

- Norway Jan-Mar 02
- 6 day patrol
  - 2 Li-ion vs 4 Ni-Cd  
(2.7 kg vs 13.9 kg)
- Base station radio trial
  - Li-ion : 30 hrs at -32°C
  - Ni-Cd: no performance



# Operational Advantages

## *Li-ion Clansman Trials - 3 Para (16 Air Assault Brigade)*

➤ Sept - Oct 02: 10 Day Eagle Lift Exercise

• Operational benefits confirmed:

- |  | Li-ion   |    | NiCd     |
|--|----------|----|----------|
| — LIFE:  | 48 hours | Vs | 18 hours |
| — WEIGHT:                                      | 4kg      | Vs | 20.8kg   |
| — Space savings                                |          |    |          |
| — No conditioning required                     |          |    |          |
| — Rapid deployment due to instant availability |          |    |          |





- **Location:** → Thurso, Caithness, Scotland
- **Formed:** → 1998
- **Purpose:** → Manufacture of High Technology Li-ion Cells

- Joint Venture:



60%



22%

 **MITSUBISHI MATERIALS**



18%

- Coating



- Calendering



- Winding



- Electrode fabrication control
  - coating to  $\pm 1.5\%$  by weight
  - calendering to  $\pm 1\%$  by thickness
- Jelly roll winding control
  - electrode alignment to  $\pm 1\%$   
over 6 feet length

# AGM

## D Cell Features

Energy

5.6Ah

Cycle Life

1,100

Safety

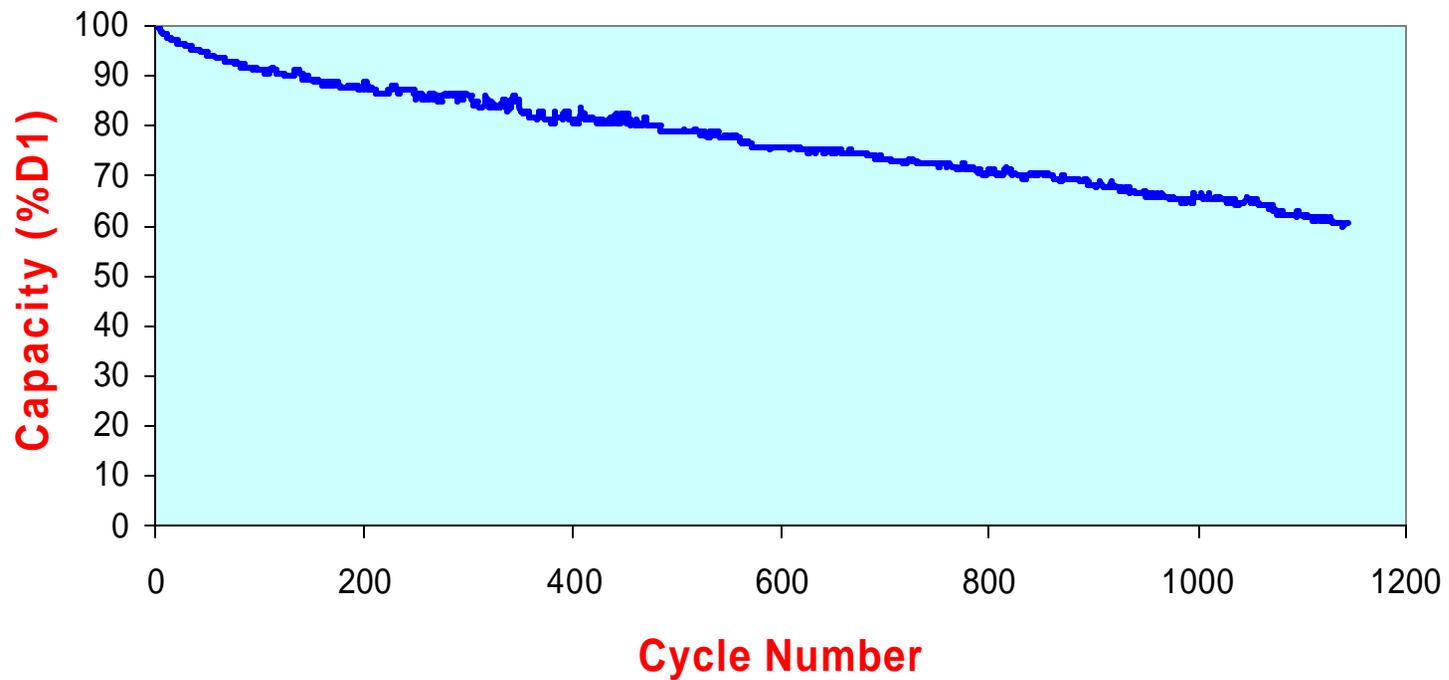
Meets UN Transportation  
Regulations

Temperature  
Range

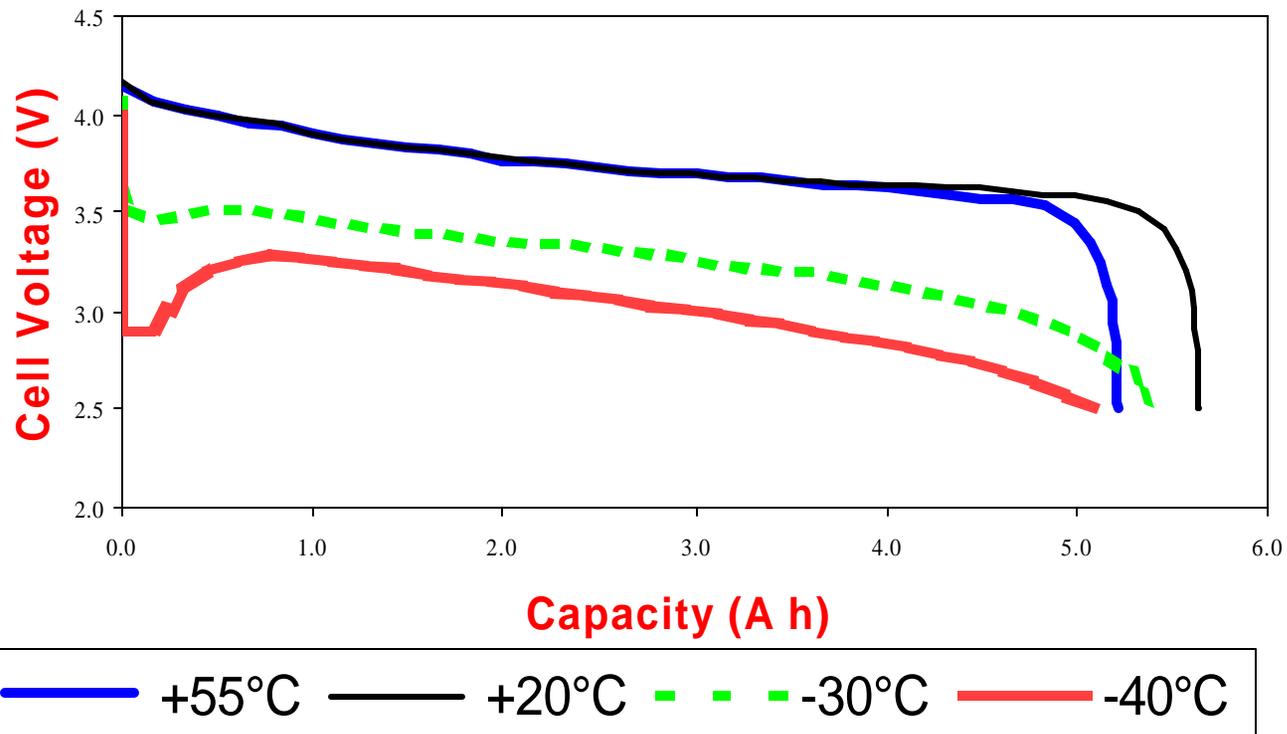
+75°C  
to  
-51°C

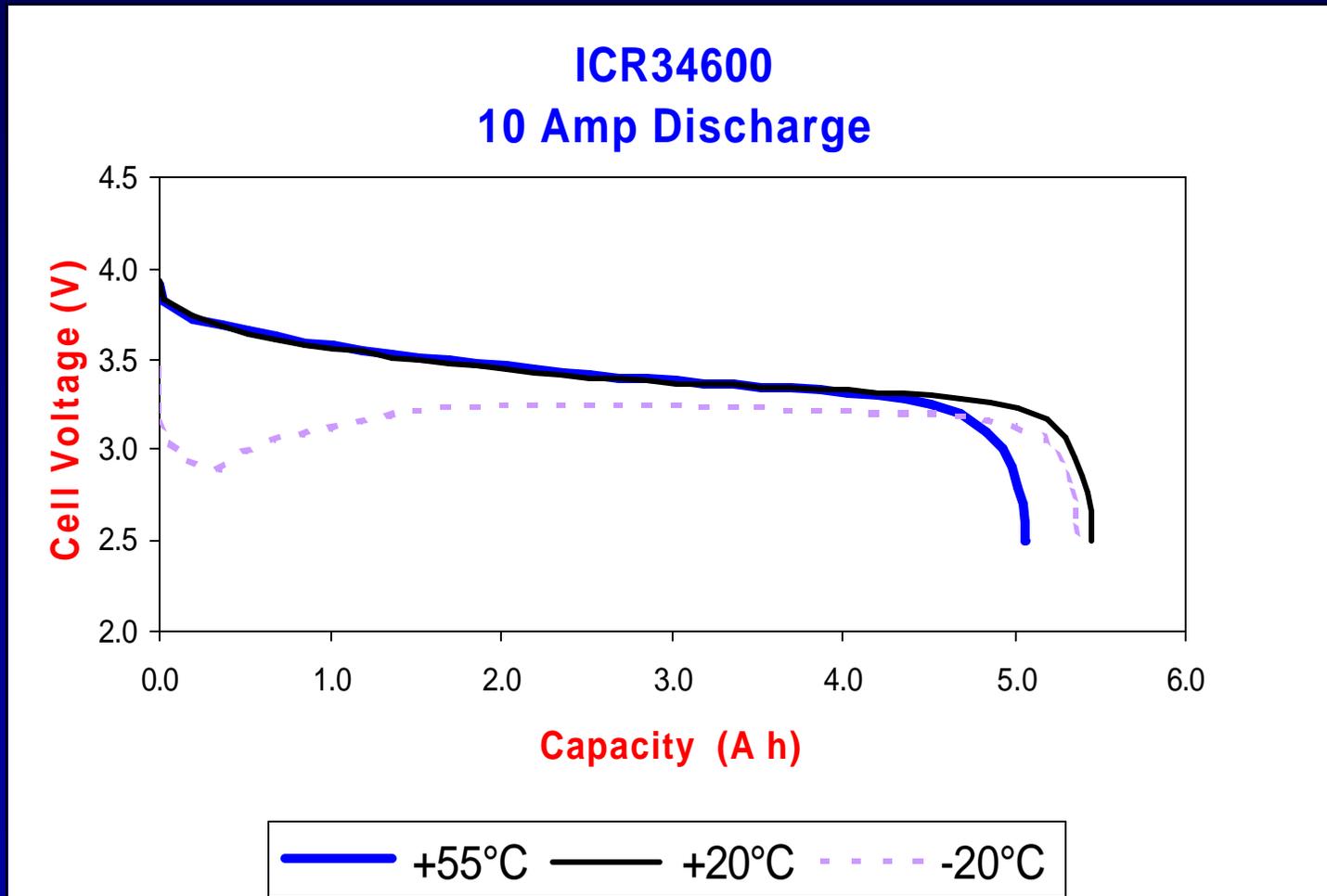


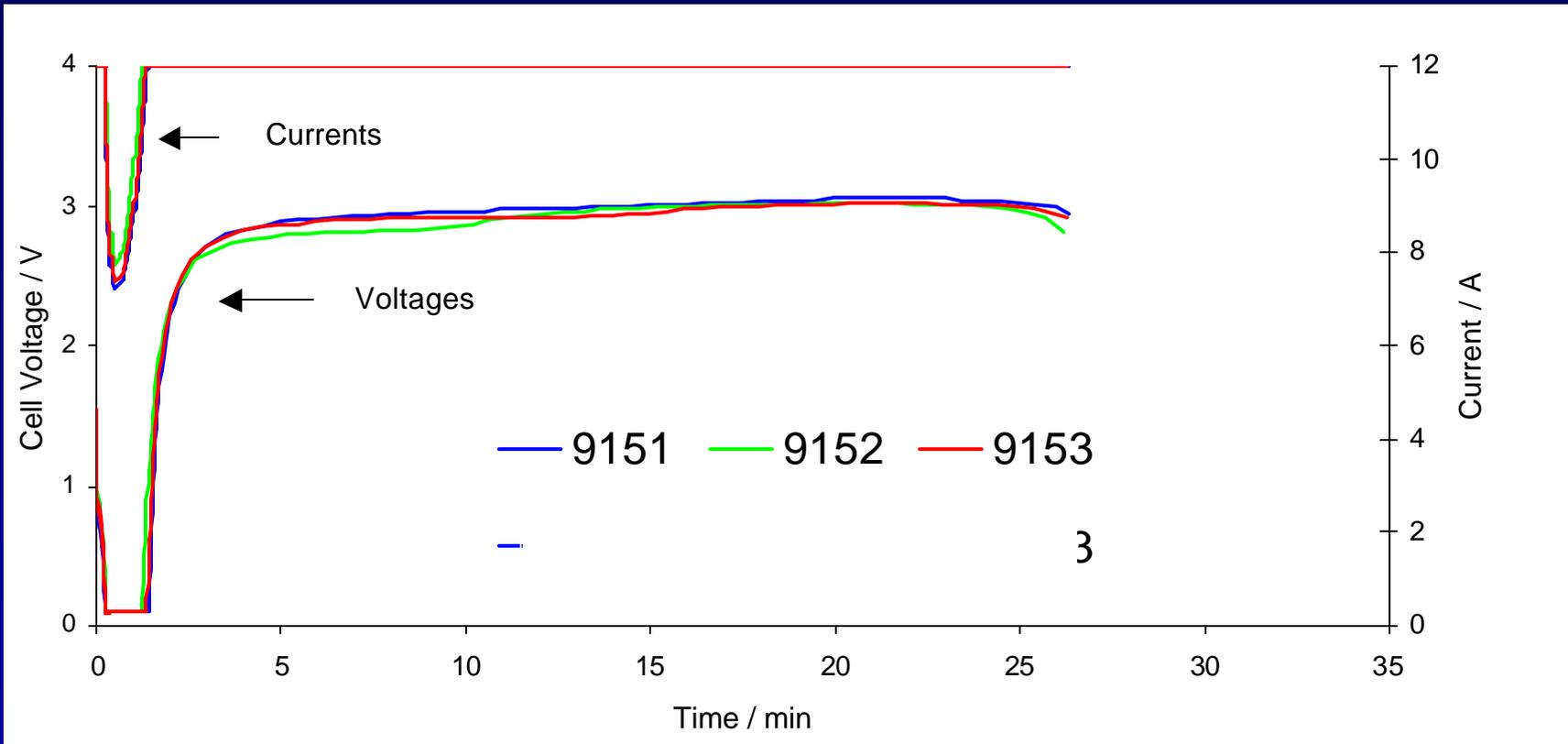
## Cycle Life



## ICR34600 2 Amp Discharge







- ✓ Pressure vent, shut-down separator
- ✓ Internal fuse - over-current protection
- ✓ Safety cap options - over-charge and re-settable over-current
- ✓ Passes all new UN transportation tests

- Li-ion D cell in volume production:
  - 5.6Ah (390Wh/l, 155Wh/kg)
  - 1,100 cycles
  - -40°C operation
- Selected for major military application -  
**Bowman**

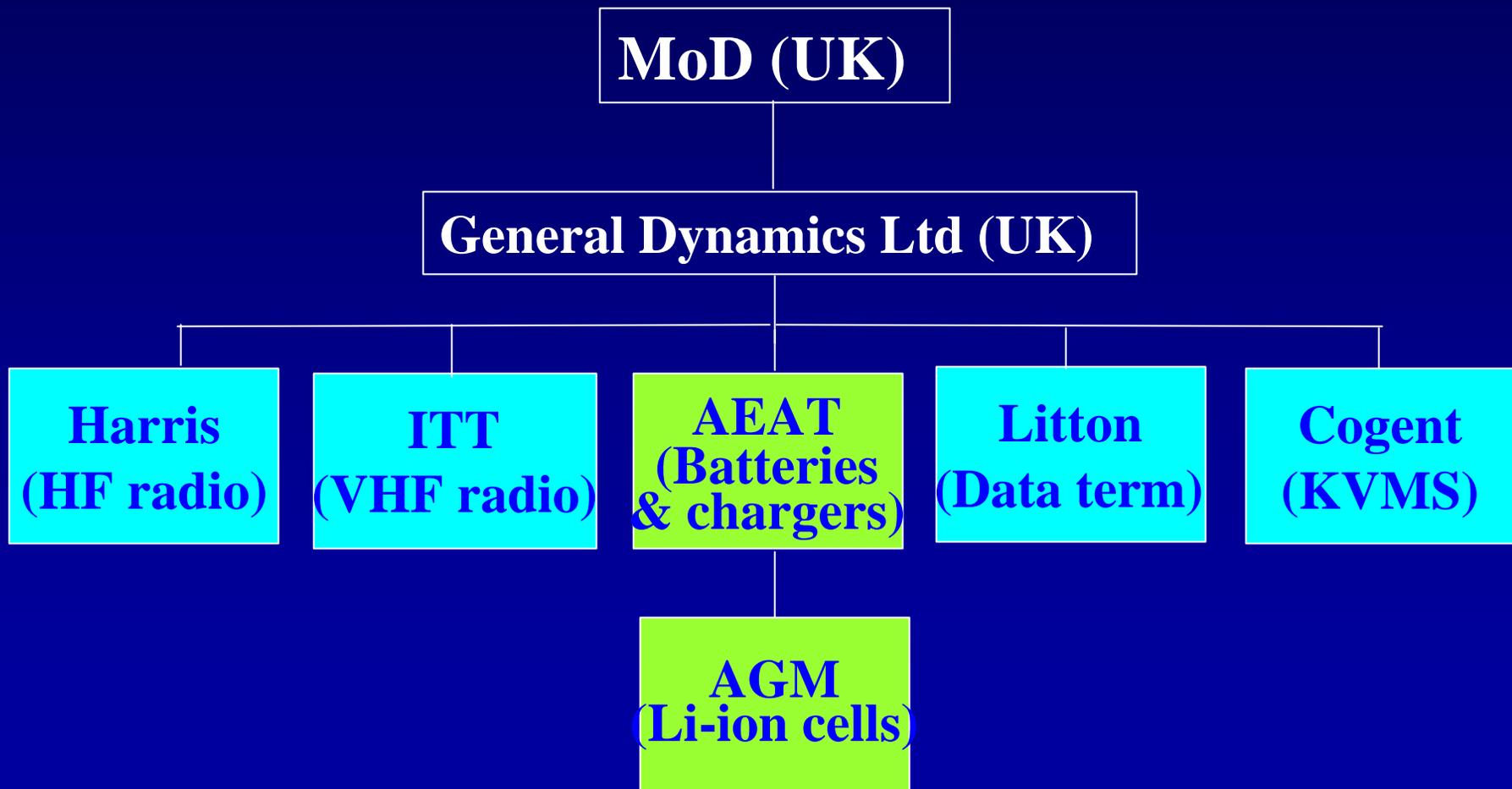
# BOWMAN

## *BOWMAN Requirements*

- To provide a communications system until at least 2026
- 50,000 radios & 25,000 computer terminals
- Deployment on:
  - 18,000 vehicles
  - 160 ships & 300 aircraft
- Will be used by 60,000 servicemen



## *Customer, prime & sub-contractor relationships*



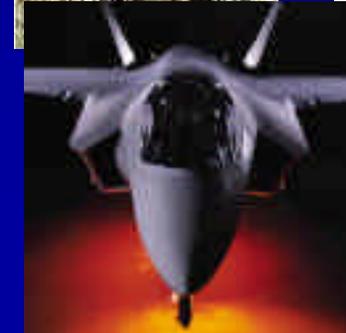
## *BOWMAN secondary batteries - Requirements*

- AGM cell is a key component for HF & VHF radio batteries that require
  - -40C operation
  - -50C storage
  - high cycle life
- Data terminals & KVMS use small cells



# Military Drivers

- **Even more energy**
- More intelligence
- Cost & logistics benefits
- Environmentally friendly



# Even More Energy

## *AEA TARGET*

**STAGE 1** Improved performance through better cathode materials



**STAGE 2** Further improvement in performance through better anode materials

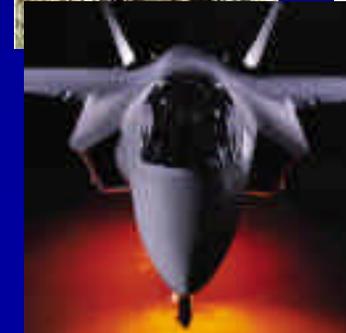


**STAGE 3** And beyond - fuel cells



# Military Drivers

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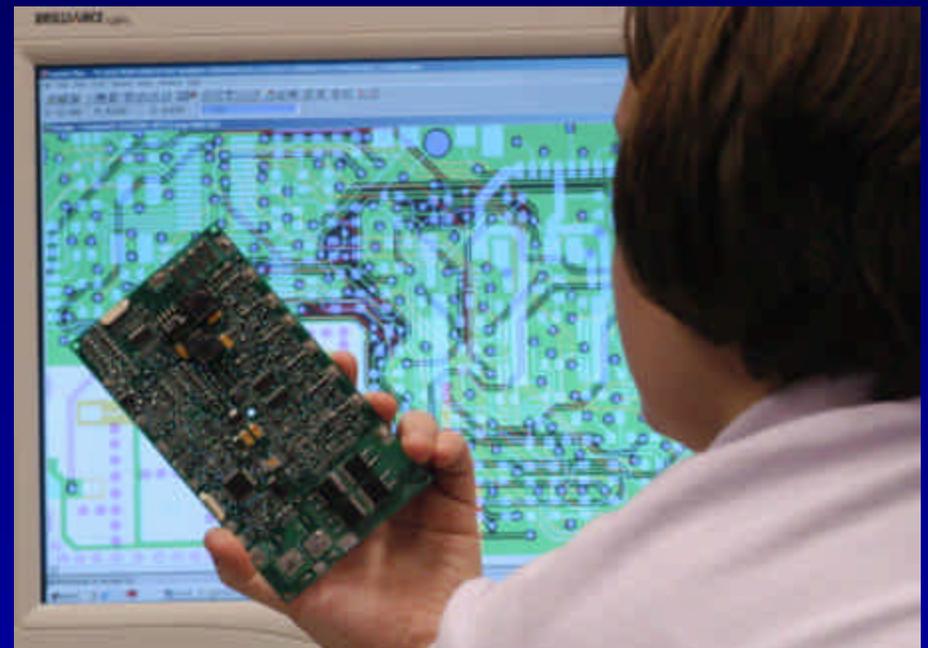


# More Intelligence

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## *Today's Electronics Technology*

- Fuel Gauge
- Safety and Balancing Circuitry
- SMBus Interface



**STANDARD**

# More Intelligence

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- **Capability:**

- Lower power circuitry
- Ruggedised SMART data acquisition systems

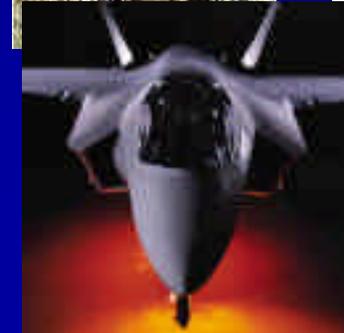
- **Benefits:**

- Extended shelf life
- Increased operational life
- Battery usage profiling – improved logistics



# Military Drivers

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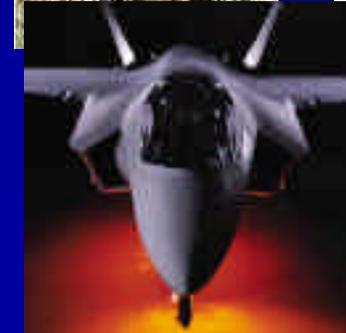
# Costs & Logistics

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- Significantly improved logistics
  - Warehousing
  - Maintenance
- Significant reductions in procurement & overhead costs

# Military Drivers

- Even more energy
- More intelligence
- Cost & logistics benefits
- **Environmentally friendly**



# Environmentally Friendly

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## *Lithium-ion recycling*



# How could this impact on you?

***Successful pursuit of more portable energy & associated intelligence will be a key military strategic advantage***



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