US ARMY POWER OVERVIEW

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Army S&T Vision

Current Force

- ~100 lb. load
- 70+ tons

Future Force

- < 40 lb. load
- < 20 tons

Enhancing the Current Force

- C-130-Like Transportability

Enabling the Future Force

- Fully networked

Speed, Reach, and Precision

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
BATTERY & CHARGER TECHNOLOGIES
- Non-Rechargeable Batteries: LiCF<sub>x</sub>, LiMnO<sub>2</sub>, Zn-Air, Li-Air
- Rechargeable Batteries: NiMH, Li-ion, NiZn
- Chargers: Smart Chargers - SMBUS

HYBRID POWER SOURCES
- Batteries & Fuel Cells (DMFC, RMFC, SOFC), Batteries & Stirling (LFP, Kinematic)
- Packaged & Reformed Fuels: Methanol, Propane, NaBH<sub>4</sub>, Ammonia Borane
- Direct JP-8 Fuel Goal – SOFC, Stirling Burner

RENEWABLES/ALTERNATIVE ENERGY
- Solar, Wind Energy Storage Systems
- Bio-Fuels, Hydrogen Generation

MOBILE ENVIRONMENTAL CONTROL UNITS
- Advanced CO<sub>2</sub> Cooling
- Co-Gen Systems (HAC & Stirling / Fuel Cell)
Existing Situation:

- Batteries are too large, heavy, and costly
- Too many battery types
- Too many batteries required to complete long missions
- Future power demands are increasing
Existing Situation:

- Generators are too large and heavy
- Generators use too much fuel
- Generators are noisy
- No integrated power management
Forward Looking Soldier and Mobile Power

**Battery Chemistries**
- Advanced Lithium - Lighter, Smaller, Longer Run Time, Reduced Logistic Cost

**Fuel Cells**
- Log and Alternative Fueled - ManTech Needed To Bring Affordability

**Alternative Energy Systems - Solar**
- ManTech Needed To Bring Affordability For Advanced Solar

**Advanced Engine Technology and Smart Power Electronic Controls**
- Smart Power Grids, CoGen, & Hybrids For Fuel & Weight Savings

### Near Term
- **Primary - Rechargeable -**
  - 300 Wh/kg
  - 200 Wh/kg

### Mid Term
- **MeOH Fueled -**
  - 500 Wh/kg
- **JP-8 Fueled -**
  - 250 Wh/kg
- **Hydrogen -**
  - 1000 Wh/kg
  - 300 Wh/kg

### Far Term
- **MeOH Fueled -**
  - 10 Efficiency % - Thin Film
- **JP-8 Fueled -**
  - 20 Efficiency % - Crystalline Si
- **Hydrogen -**
  - 30+ Efficiency % - Multi-junction GaAs

**Technologies**
- **Zn-Air**
- **Li-MnO2**
- **Li-Ion**
- **DMFC**
- **RMFC**
- **Adv RMFC**
- **Li-CFx**
- **Adv Li-Ion**
- **Li-Air**
- **Li-rechargeable**

**Photovoltaic Charger**
- **Fielded**
- **H2-Adv PEMFC**
- **Alkaline FC**

**Sensor Power**
- **Soldier System Power**
- **Soldier Power**
- **Less Weight**
- **Less Cost**
- **Longer Missions**

**Fuel Use Savings %**
- **30**
- **50**

**Weight Savings %**
- **25**
- **50**
SUMMARY

Recent technology advancements and systems approach are enabling advanced power systems:

– Micro-Nano areas
– Materials
– Modeling
– Accelerating chemical processes
– Component miniaturization
SUMMARY (cont.)

- **Batteries continue to improve** - lasting longer, lighter, and smaller.

- **Silent Fuel Cell and Stirling Power systems** emerging for extending missions.

- **Alternative Energy Technologies (such as Solar), Intelligent Power Management, and Co-Generation** gaining focus with the hope of improved fuel efficiency and reduced logistics.