



Hybrid Battery Systems for High Energy and High Power

THE NEXT GENERATION OF PORTABLE POWER.™

What We'll Explore

- **The Problem: Power or Energy?**
- **Long Duration, High Peaking Applications**
- **The Double Hybrid**
- **The Triple Hybrid**
- **Path Forward**

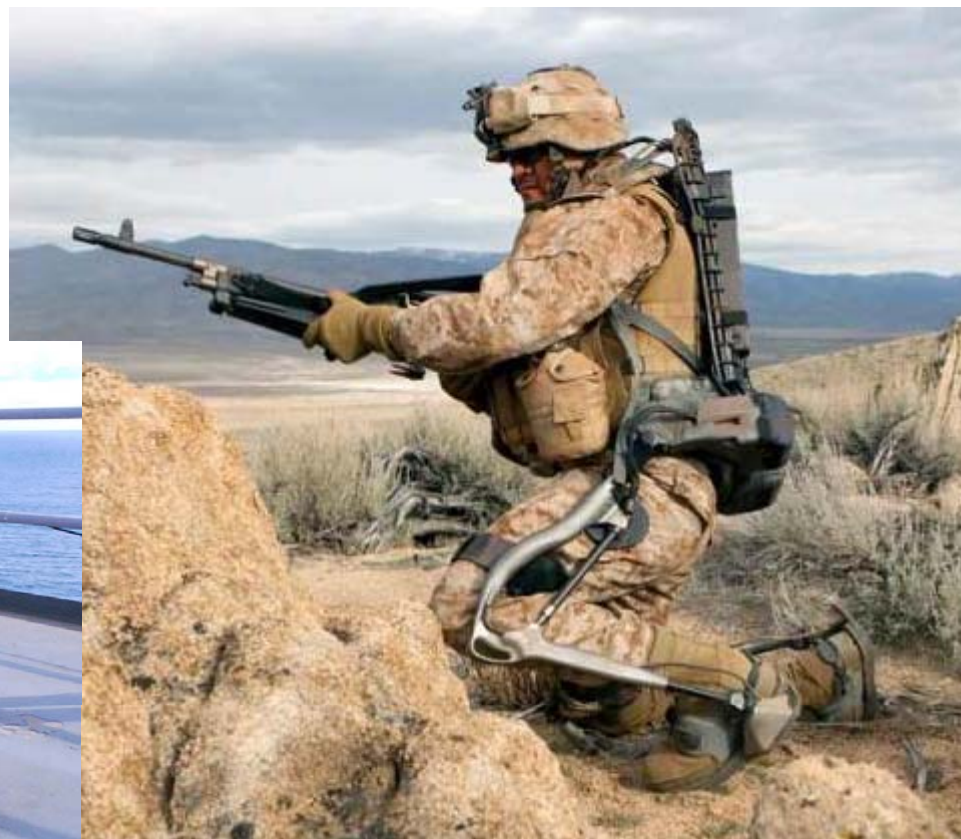
The Problem: Power or Energy

- **Li-FeO₂** – Incredible power density, marginal energy density
 - **Li-Ion** – Good energy density, marginal power density
 - **Others?**
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- **What about applications that are very long duration (say 72 hours) and yet which require very high peaking powers?**
 - High power batteries – can't support mission duration
 - High energy batteries – can't support peaking requirements

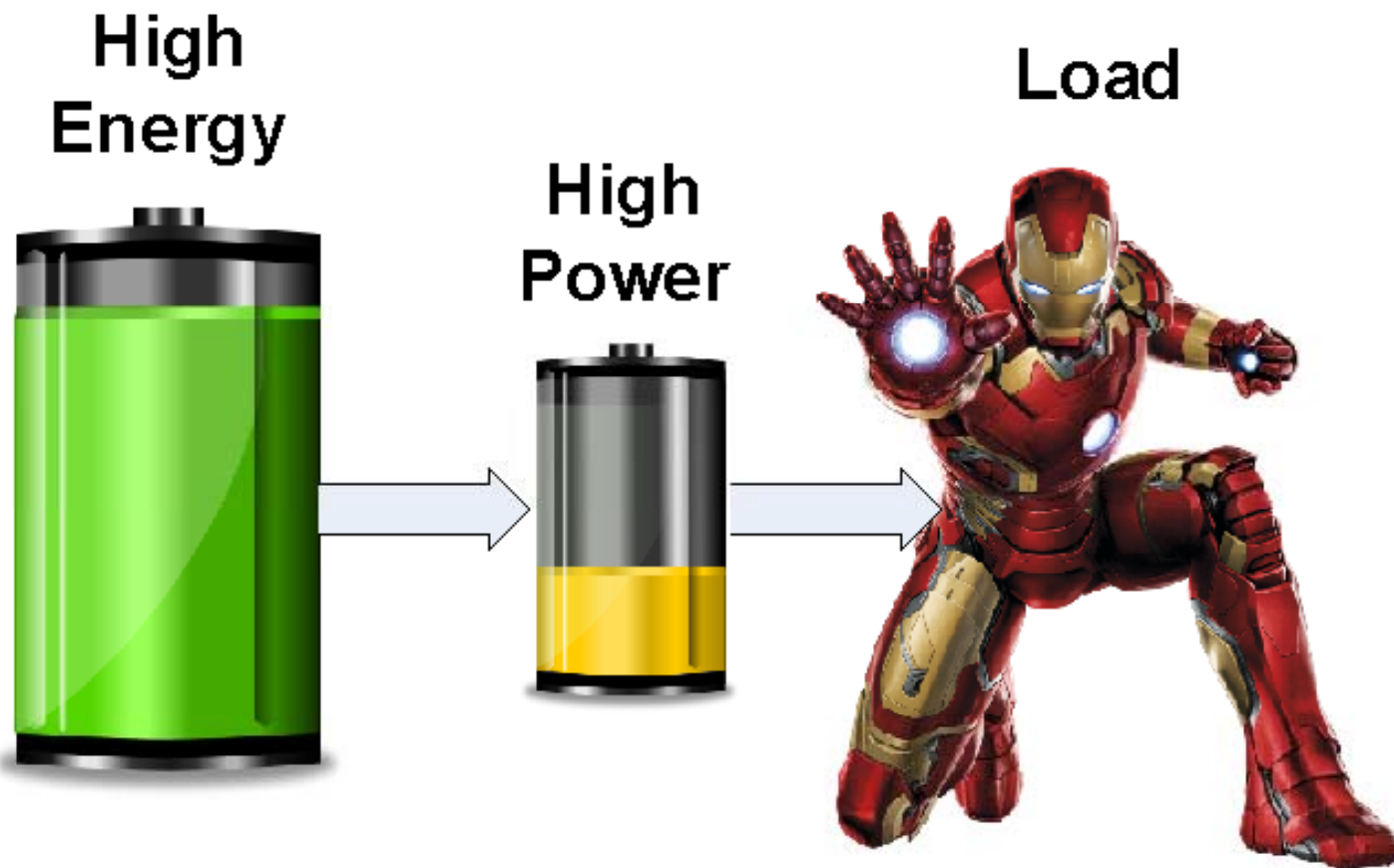
When Do We Need High Energy And High Power?



- Human Performance Enhancement
- Directed Energy
- SatCom Radio



The Double Hybrid





Double Hybrid Implementations

ProtonEX™



Results

The Triple Hybrid

- Add a Fuel Cell

 Protonex™

More Results

 Protonex™

Path Forward