



Soldier Borne Power Generation In Tier 1 Environments

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“When you are short of everything but the enemy, you’re in combat”

MLoC

Challenges

- Soldiers will be used for missions of longer duration and will be more isolated from supply lines
- Soldiers today use more technology to act as force multipliers
- The trend is to use more electronics
- Capabilities = Batteries = Weight Burden = Ineffective Soldiers





Battery Types

- Primary Batteries

- Pro

- Higher energy density allows for longer running time of equipment (120-300 Wh/Kg)
 - Less expensive

- Con

- Cannot be recharged

- Rechargeable Batteries

- Pro

- Rechargeable. (200+ recharging cycles)
 - Long term costs are reduced

- Con

- Energy density is lower (80-125 Wh/Kg)
 - Initial cost is high
 - Requires recharging capabilities



Recharging Batteries

- Fossil fuels
- Clean technologies
- Harvesting

Fossil Fuels

- Pro
 - High energy density (1 kW)
 - Low exertion from user
 - Low cost
- Con
 - Fuel logistics
 - Weight
 - Noise
 - Smell



- Solar

- Pro

- Lightweight
- Silent
- Power (c. 50 W/m²)

- Con

- Not rugged
- Time/weather limited
- Signature
- Cost



- Fuel Cells

- Pro

- Steady power (10-50 W)
- Silent
- Clean waste

- Con

- Cost
- Fuel logistics
- Weight



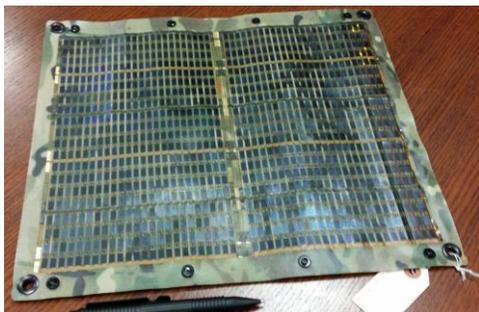
- Solar

- Pro

- Lightweight
 - Power (c. 130 W/m²)

- Con

- Not rugged
 - Cost



- Kinetic

- Pro

- Lightweight
 - Power availability

- Con

- Low to medium noise
 - Effort required
 - Acceptability





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Backpack Frame Kinetic Harvester

- Energy generator based on frequency and mass
- Power: 8 – 40 W
- Weight: 10 lbs. frame
- Material: plastic
- Can be used as a static power generator
- Ruggedized frame able to handle up to 100 lbs.

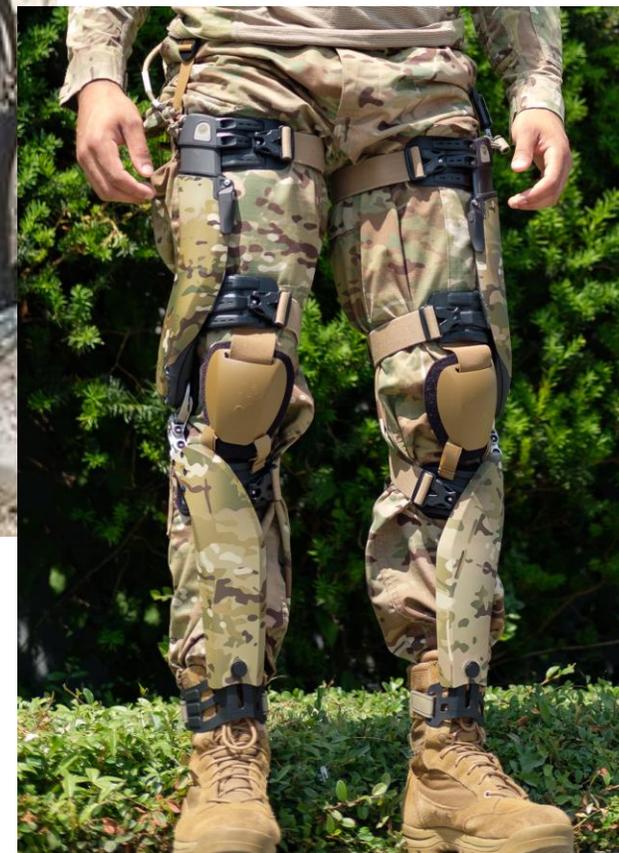




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Kinetic Knee Harvester

- Energy Generator based on knee movement
- Power = 9-12 W
 - Uphill ≈ 6 W
 - Downhill ≈ 30 W
- Weight: 5 lbs
- Materials: Kevlar and carbon fiber
- GPS denied navigation
- Augmentation (fatigue reduction)





Observations

- Energy requirements are rising exponentially and is becoming an unsustainable trend for the dismounted Soldier
- Current battery load is 16-20 lbs.
- Other capabilities (UAS, UGS, etc.) add additional power requirements and associated weight
- Emerging capabilities (augmentation) will add to the overall power demand



“I don’t care if I am low on everything, as long as I have power, I can call for those items that I need”

CO from a 25th ID company