1K Rechargeable Solid-State Li-Air Battery (RSS-LAB) for Aviation

Asadi, Illinois Tech

Team Members: Argonne National Lab and RTX

PROPEL-1K Program
Annual Meeting
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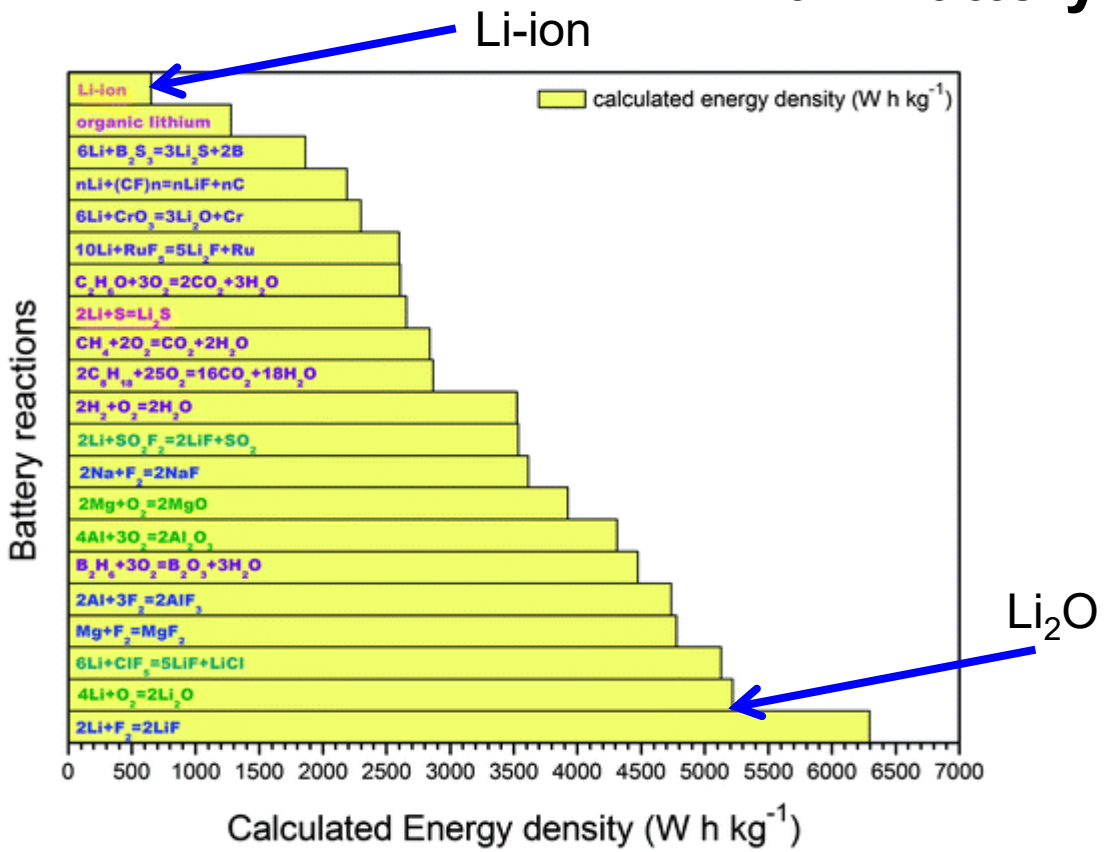
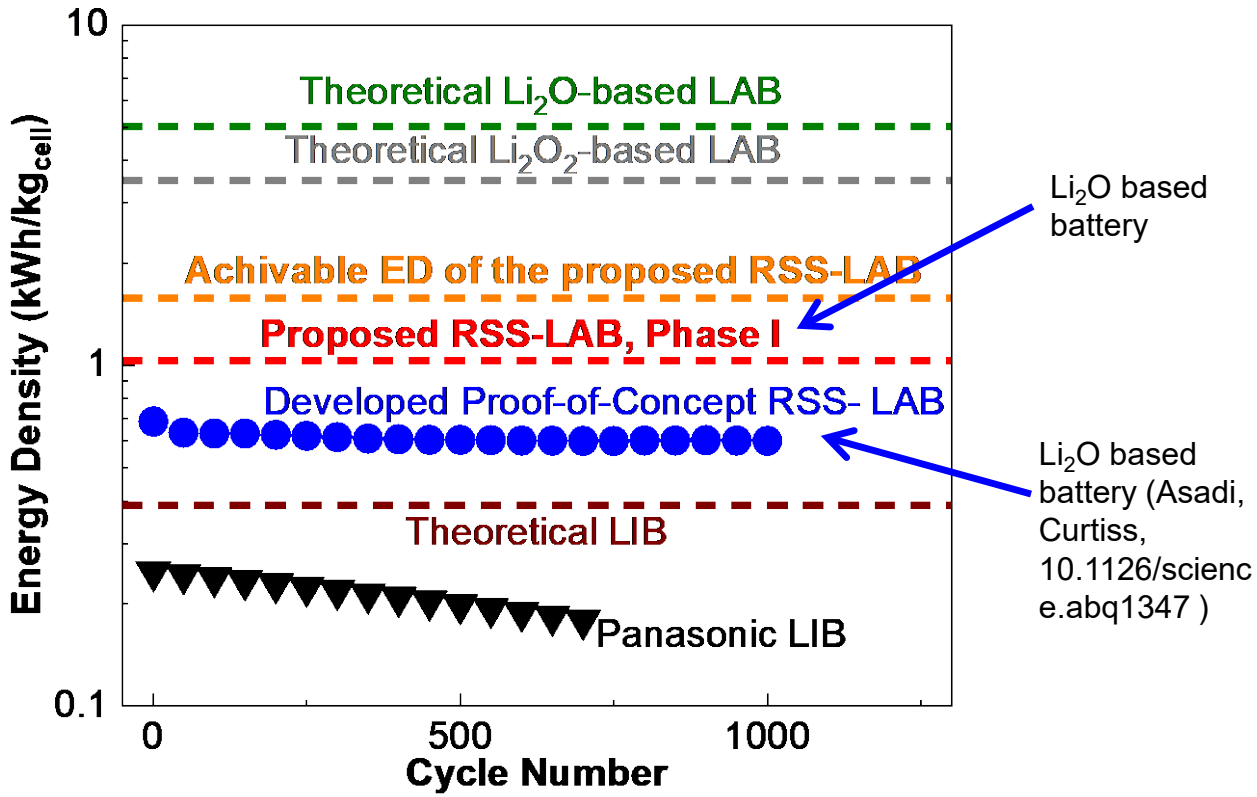
Project Vision

This 1K rechargeable solid-state Li-Air battery with ultra-high energy density is expected to revolutionize the aviation market by reducing battery weight and manufacturing cost with improved safety.

Achieving >1 kWh/kg Energy Density with a Solid-State Li-air Battery (SS-LAB) based on Li_2O





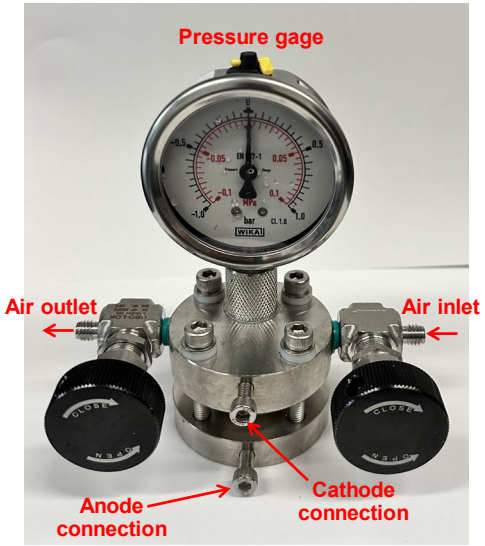
- Li_2O has one of highest potential energy densities
- Energy density >1000 Wh/kg (includes all cell components at chemistry level)

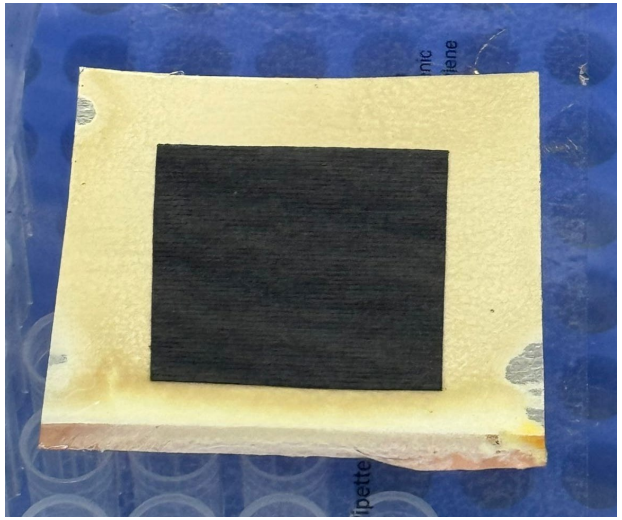
- Runs on air at ambient temperature/Pressure
- Use of solid electrolyte drives reaction to Li_2O @ 4 electron transfer reaction

Major Technical Highlights

- Cyclability at the capacity of 4.5 mAh/cm^2 with energy efficiency of 83.5 % and having Li_2O as the major product.
- Rate capability up to 1 mA/cm^2 having Li_2O as the major product.
- Custom designed solid electrolyte coating in a dry room considering parameters such as: coating rate, thickness (<20 µm), solution viscosity etc.
- Custom designed cathode with designed and optimized morphology to host solid phase products.
- Developing anode protection layer to avoid dendrite formation and soft short circuit.

Swagelok Cell for Study Phase I





Project Challenges

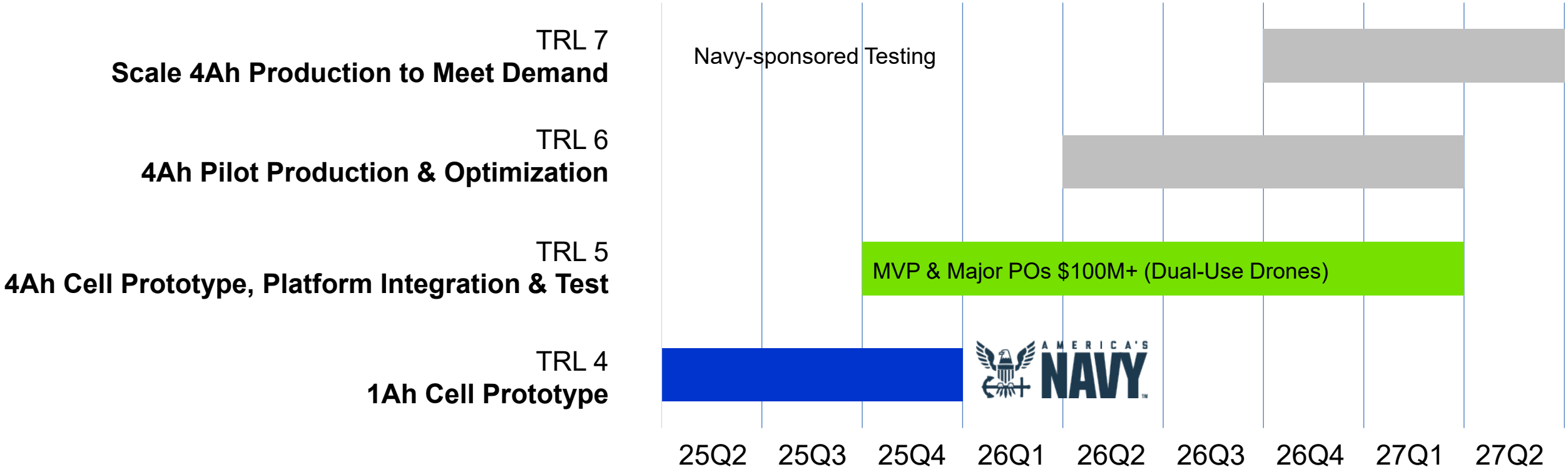
- Main technical challenges are:
  - Cycle life of >100
  - Power density requirements for aviation
  - High-rate capability
- Main barrier is demonstrating/manufacturing a pack size cell that establish a high energy density battery compared to conventional storage systems.
- Our biggest commercial challenges would be to find OEM partners for cell design and manufacturing as well as role to role manufacturing of the solid-state electrolyte.

Technology to Market (T2M)

Technology Roadmap

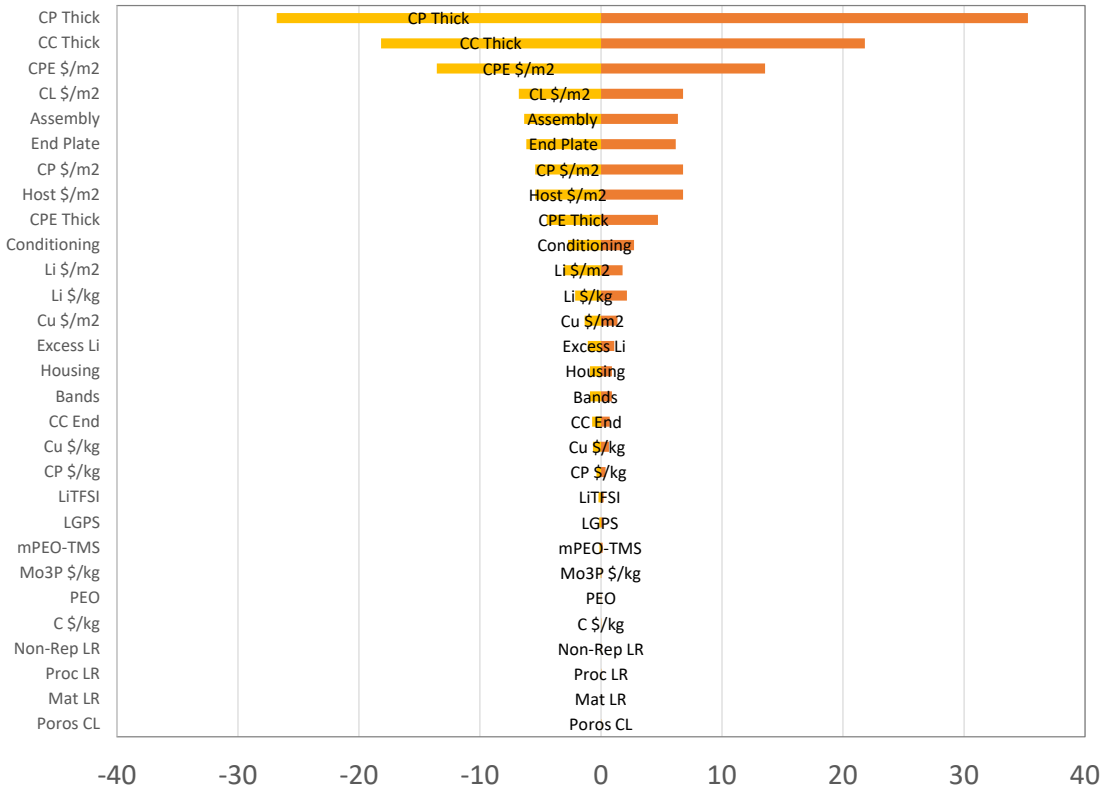
Secured Exclusive World-Wide License for Entire Market

(Drones, eVTOL, EVs, Personal Electronics, Energy Storage Systems)

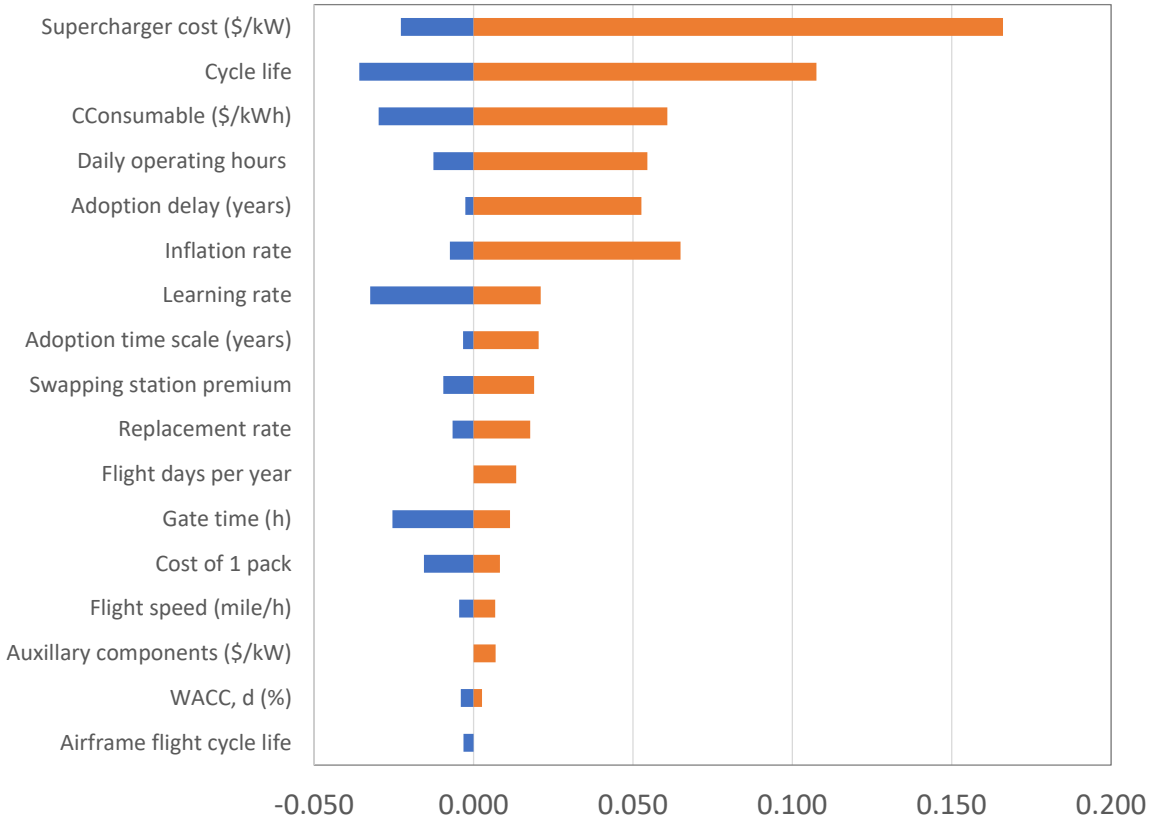


Technoeconomic and LCOS Analysis

Cost Sensitivity of Bipolar Battery Stack



Sensitivity of Levelized Cost of Energy Storage



Current estimate meets 0.030 $/kWh target

Our Team

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