



# PROJECT PITCH SESSION

March 28, 2023



ONTARIO AEROSPACE COUNCIL



**BEYOND THE  
BARRIERS**

Building the  
Ontario Aerospace  
R & T Community



## Projects

- **HORIZON AIRCRAFT:** Engineering Design of a Hybrid Power System Novel Power Distribution Scheme
- **HEBE HYDROGEN:** Hydrogen Storage and Management for Aircraft
- **SOLID ULTRABATTERY:** Development of Lithium-ion battery for Drone and UAV applications
- **CENTENNIAL COLLEGE:** Partnering on Sustainable aerospace projects

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# SOLID ULTRABATTERY

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Chief Executive Officer



Developing the Next  
Generation of Energy Storage  
Systems

# High Energy Lithium Ion Battery



- Solid Ultrabattery began as a Waterloo based startup acquired by Volt Carbon in May 2021
- Guelph Plant commissioned in Dec 2021, continued partnership with University of Waterloo
- Since Jan 2022 - Multi year plan for development of Proprietary Lithium Metal battery technology
- Potential mass-market applications including automotive, aerospace, consumer products<sup>1</sup>



# Solid Ultrabattery

## PROJECT DESCRIPTION/OBJECTIVES:

- Development of a 5Ah Lithium Ion Battery for Drone and UAV applications. (1kg weight class)
- Exceed Current State of the Art in Energy Storage<sup>1</sup>

## ENVIRONMENTAL IMPACT:

- Electrification will lower Carbon footprint
- Higher Energy Density Batteries will enable longer duration flights and wider range of use cases<sup>1</sup>
- Augment with Solar Energy to further increase endurance<sup>1</sup>

## CURRENT TRL:

- TRL6 - System/subsystem model or prototype demonstration in a simulated environment

## CURRENT PARTNERS:

- University of Waterloo – Battery Research
- Toronto Metropolitan University – Aero Expertise, Flight Controls, Testing

## PARTNER OR EXPERTISE LOOKING FOR:

- Drone Manufacturers & Operators across various industries looking for extended range

# Lithium Metal Pouch Cell Specification

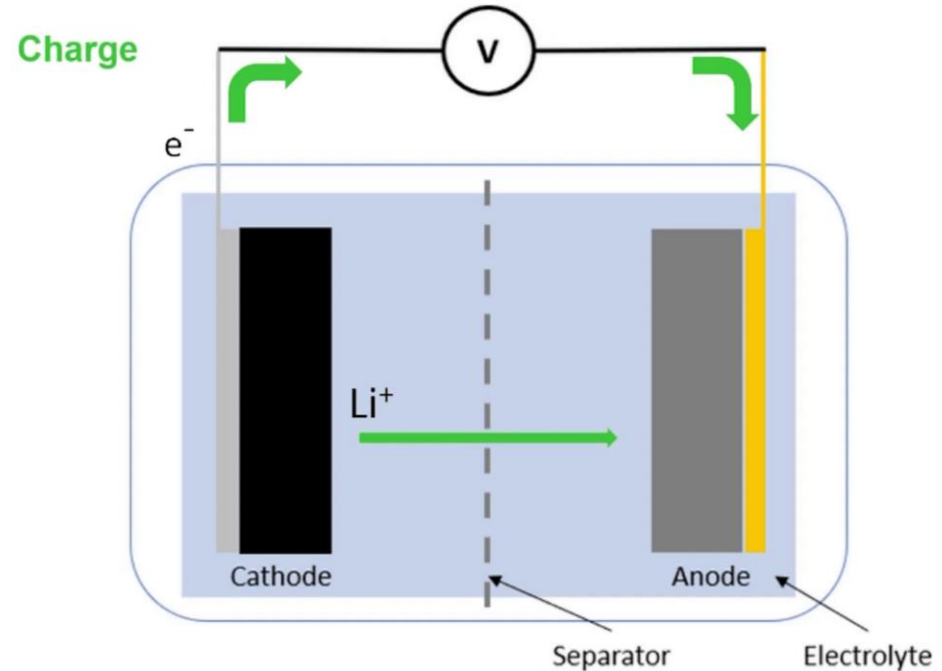
- **Capacity:** 5 Ah Target Cell
- **Voltage:** 2.8V – 4.2V Operating
- **Size:** 10cm x 10cm x 0.5cm
- **Energy Density, 2 Versions:**
  - 260 Wh/kg
  - 400 Wh/kg
- **Mass Est:** 75 g (260 Wh/kg)
- **Mass Est:** 50 g (400 Wh/kg)



- **Cathode:** High Nickel NMC811
- **Anode:** Graphite or Li metal
- **Separator:** Ceramic coated polymer film
- **Electrolyte:** Carbonate-based Liquid

**Charge** is converting electrical energy directly to chemical energy.

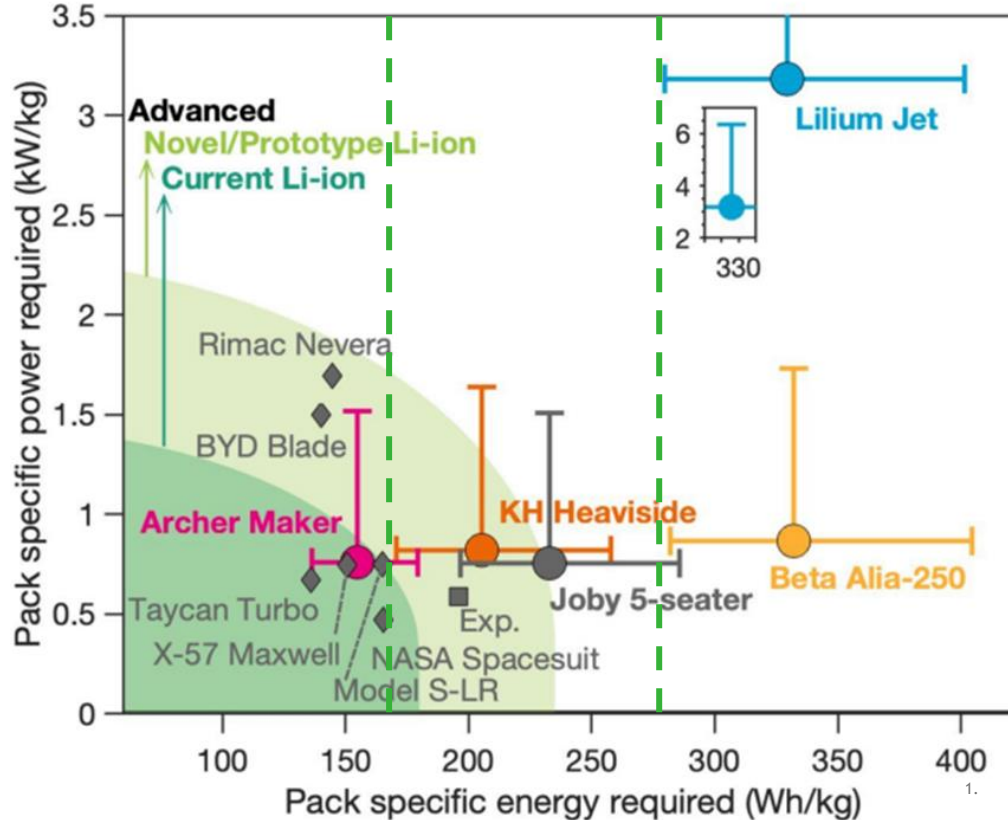
**Discharge** is converting chemical energy directly to electrical energy.



# Future Outlook for Pack Specific Energy

Cell Specific Energy at 260 Wh/kg →

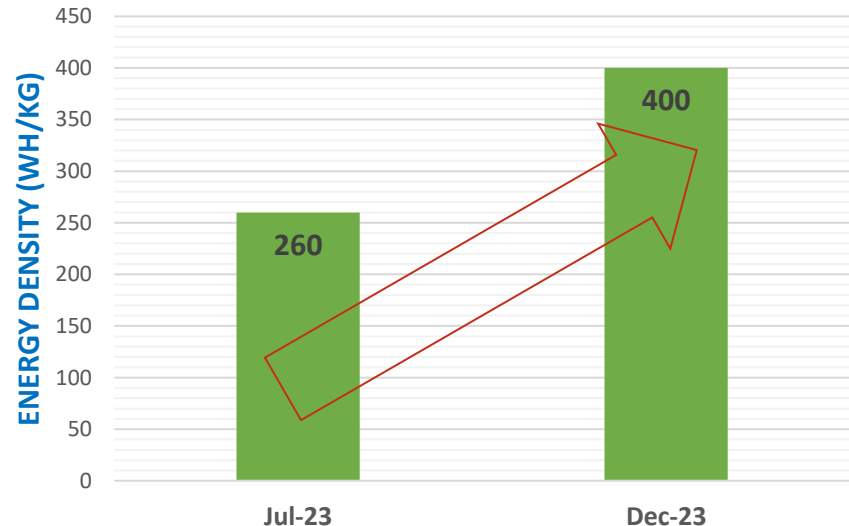
← Cell Specific Energy at 400 Wh/kg



# Energy Density Wh/kg - ramp up

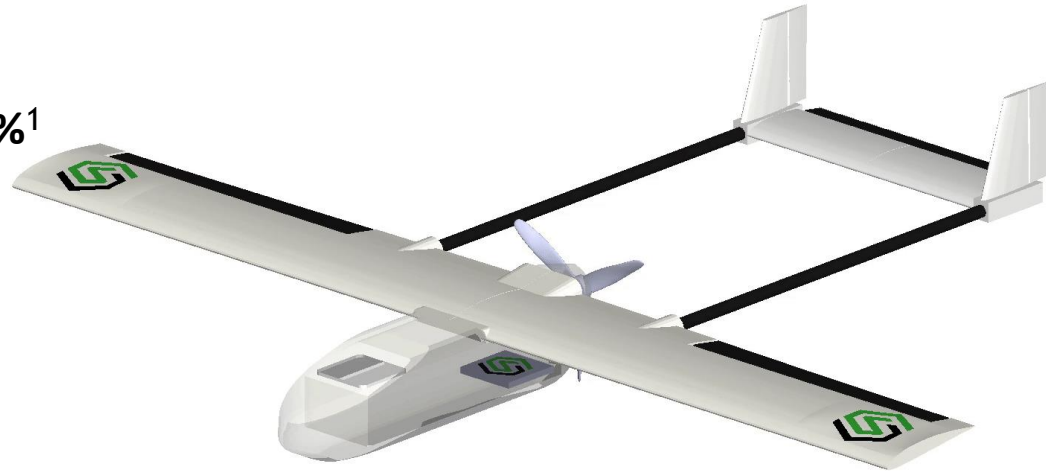
- **260Wh/kg targeted for July 2023**
  - Graphite anode
  - Performance will be evaluated in lab and on ground test rig
  - Flight Testing
- **400Wh/kg targeted for Dec. 2023**
  - Li metal anode for increase energy density
  - Electrolyte re-formulation
  - Performance will be evaluated in lab and on ground test rig
  - Flight testing in Nov

## Target Energy Density



# Project Goals

- Improve Drone/UAV Range by 20-30%<sup>1</sup>
- Achieve 400Wh/kg energy density<sup>1</sup>
- Improve Energy Safety Margins



- **Higher Energy Density - Higher Productivity across Industries**
  - Surveying, mapping
  - Utilities and engineering
  - Agriculture
  - Construction
  - Defense and Surveillance
  - Environmental monitoring
  - Forestry
  - Mining, quarries, aggregates
  - Cargo Transport
- **Replaces work performed by passenger aircraft**
- **“Right Sizing” tasks**



# Example - Airborne Survey for Mining



Mode of Airborne Survey	Helicopter		Drone	
Distance (km)		1,200		1,200
GHG (kg)	✗	2,500	✓	<5
Cost (CAD)	✗	200k	✓	<50k
Vehicle Mass (kg)	✗	2,020	✓	<10

# Project Schedule and Key Milestones



## Requirement Planning

Jan 2023

Drone specifications

Regulatory Requirements

Test procedures

Procurement:

- Explosion proof test chamber
- Battery testers
- Model Aircraft

## Fabrication of 1<sup>st</sup> 260 Wh/kg

Apr 2023



## Design & Fabrication of 400Wh/kg

Sept 2023



## Ground simulation tests of 400Wh/kg battery

Nov 2023



## Life testing of 400Wh/kg battery

Dec 2023

Design battery; drawing and specifications

Feb 2023

Performance & Cycle testing of 260Wh/kg

May 2023

Performance & Cycle test of 400Wh/kg

Oct 2023

Drone flight test & data collection

Dec 2023

Final report  
Dec 2023



THANK YOU!