

A close-up, black and white photograph of several circular, metallic components, likely part of a battery or a mechanical assembly. The components are arranged in a grid-like pattern, with some in sharp focus and others blurred in the background. Each component has a central circular feature and concentric rings around it.

Development of a Passive Propagation Resistant Battery for Small Sat Payloads

Presented by Chase Rodriguez

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AGENDA

1. Our Company
2. KULR ONE Space Concept
3. KULR ONE Space Design Solutions
4. Thermal Management Solutions

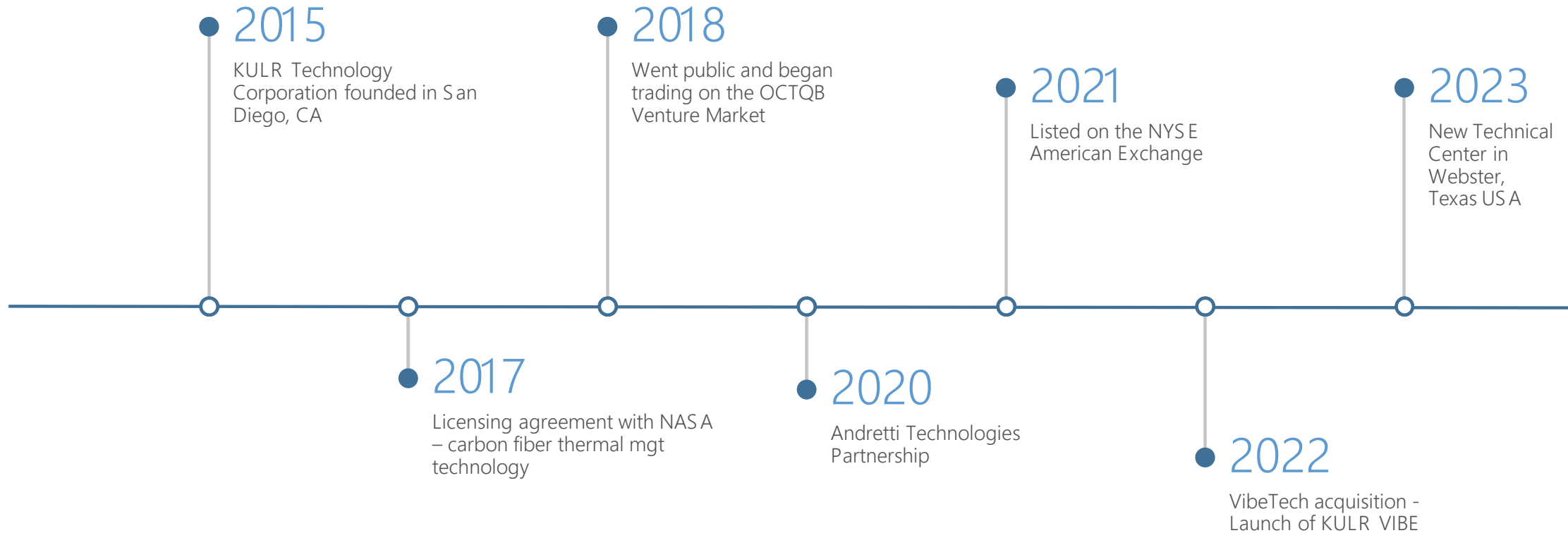


OUR COMPANY

A black and white photograph of a hand holding a globe of the Earth. The hand is positioned at the bottom, with fingers gently cradling the globe. The globe shows continents and oceans. The background consists of numerous thin, radiating lines of light that create a sense of energy and focus on the globe. The overall tone is serious and forward-looking.

"Developing Energy Management Platforms to Accelerate the Global Transition to Circular Electrification Economy"

Our History From the Beginning



Markets Served



Aerospace & Defense



E-Mobility



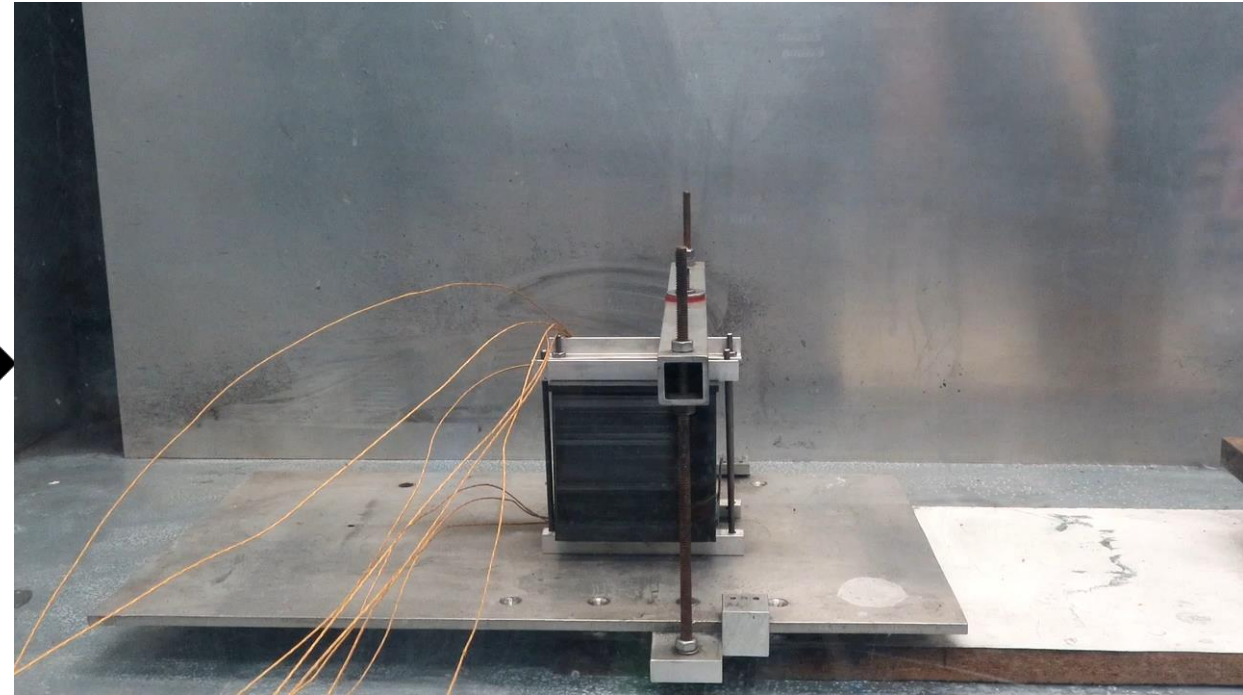
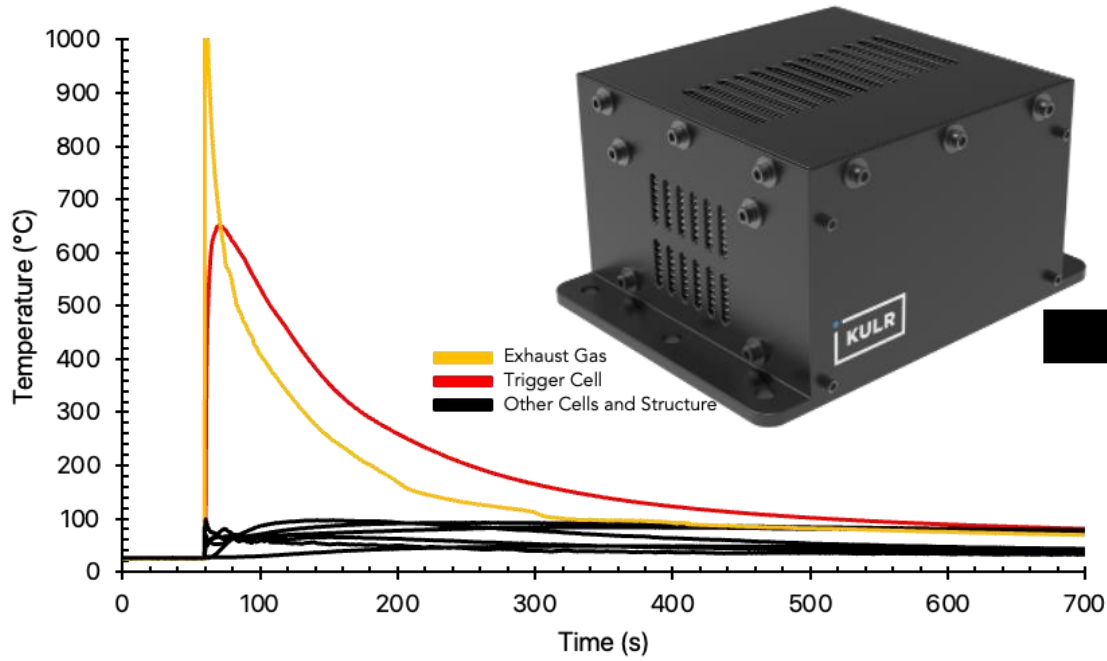
Industrial & Consumer



Recycling

KULR ONE SPACE (K1S)

Previous Generation



Nail Penetration Test on MSFC CubeSat Battery

KULR ONE SPACE (K1S)

Potential Configuration

Feature	KULR ONE Space (M35A)	Feature	KULR ONE Space (M35A)	Feature	KULR ONE Space (M35A)
Cells	INR-18650-M35A	Cells	INR-18650-M35A	Cells	INR-18650-M35A
Cell Count	4	Cell Count	8	Cell Count	16
Pack Configuration	1P-4S	Pack Configuration	2P-4S	Pack Configuration	4P-4S
Pack Energy	50.4 Wh	Pack Energy	100.8 Wh	Pack Energy	201.6 Wh
Pack Max Capacity	3.5 Ah	Pack Max Capacity	7 Ah	Pack Max Capacity	14 Ah
Pack Voltage (Peak)	16.8 V	Pack Voltage (Peak)	16.8 V	Pack Voltage (Peak)	16.8 V
Pack Voltage (Nominal)	14.4 V	Pack Voltage (Nominal)	14.4 V	Pack Voltage (Nominal)	14.4 V
Maximum Rated Charge	0.5 C (1.7 A)	Maximum Rated Charge	0.5 C (3.4 A)	Maximum Rated Charge	0.5 C (6.8 A)
Maximum Discharge Rate	2.8 C (10 A)	Maximum Discharge Rate	2.8 C (20 A)	Maximum Discharge Rate	2.8 C (40 A)
Max Allowable Pack Mass	.43 kg	Max Allowable Pack Mass	.85 kg	Max Allowable Pack Mass	1.7 kg
Target Grav. Energy Density	120 Wh kg⁻¹	Target Grav. Energy Density	120 Wh kg⁻¹	Target Grav. Energy Density	120 Wh kg⁻¹
Target x,y,z Dimensions	100 mm x 90 mm x 30 mm	Target x,y,z Dimensions	100 mm x 90 mm x 60 mm	Target x,y,z Dimensions	100 mm x 90 mm x 120 mm
PPR, Contains Flames/Effluents	Yes	PPR, Contains Flames/Effluents	Yes	PPR, Contains Flames/Effluents	Yes

Battery Design

Service Description

- Specialized battery design services, delivering efficient and reliable power solutions for your unique requirements
 - Passive Propagation Resistance(PPR), flame arresting devices & cell side wall rupture protection
 - Low mass / Low volume structures, ablative reinforcement, blast shield protection & thermal insulation protection

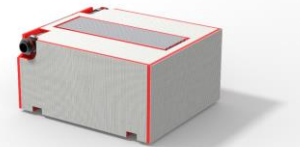
Value Proposition

- Customized power solutions to meet unique requirements
- Enhanced safety features for better product safety
- Improved battery performance and durability

KULR ONE Space (Exterior)



KULR ONE Space (Thermal Protection)



KULR ONE Space (Thermal Runaway Cooling)



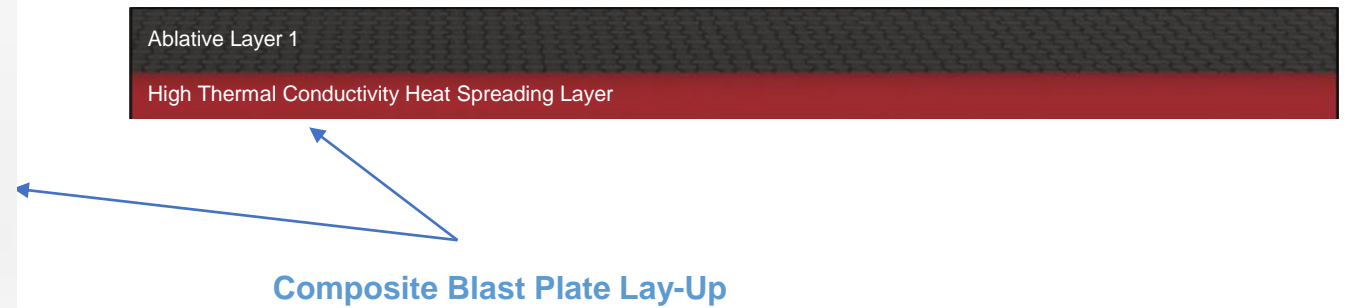
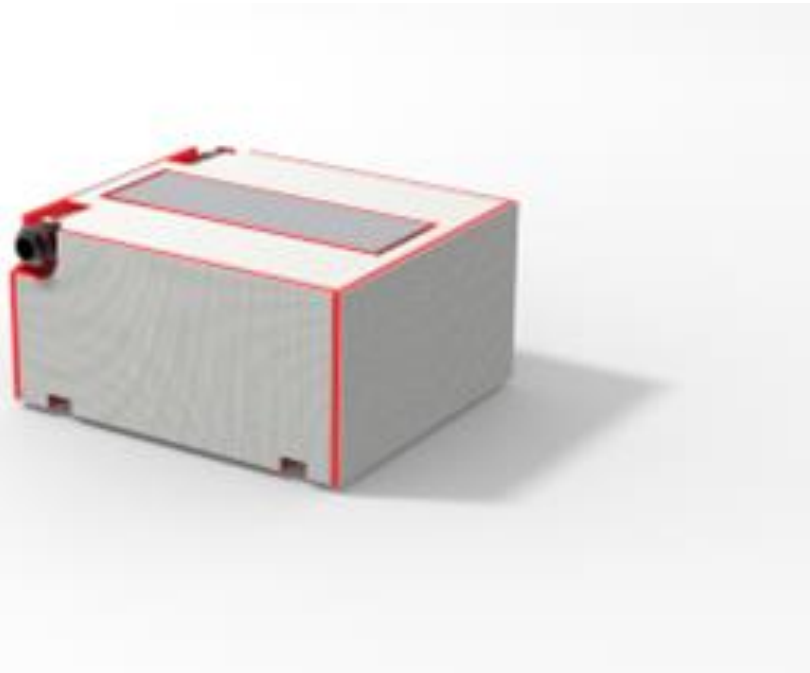
KULR ONE Space (Brick-Level)



KULR ONE Space (K1S)

Thermal Protection

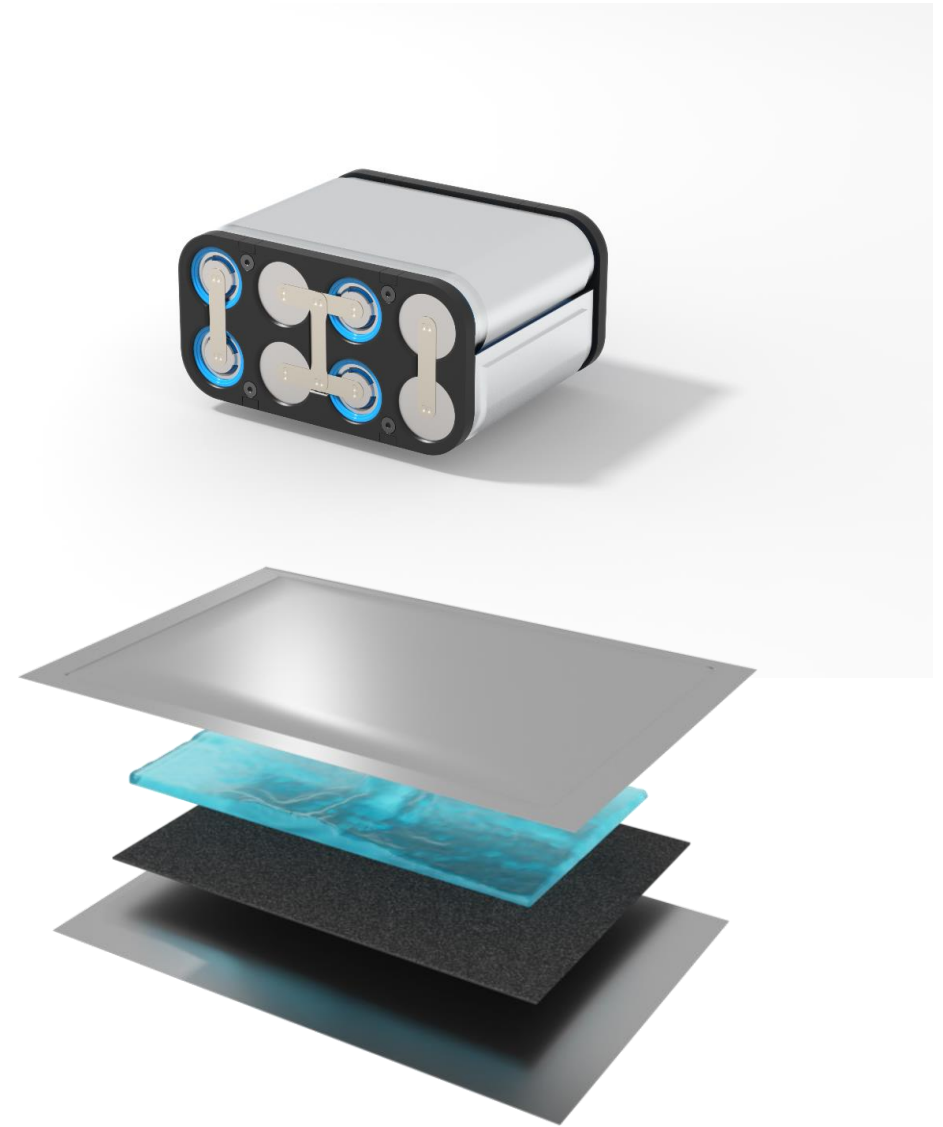
- Immediate protection from hot and high velocity ejecta in the impingement zone above the cell vent is critical for thermal runaway containment (i.e. no flames or ejecta leave the battery).
- KULR traditionally utilizes internal ablator with thermal runaway shield (TRS) wrap for heritage 18650 based designs.
- K1S design examines the benefits of going to lower thickness ablator and then combining with heat spreader layer



KULR ONE Space (K1S)

Thermal Runaway Cooling

- Patented Passive Propagation Resistant (PPR) safety solution that quenches & mitigates thermal runaway events in a lithium-ion battery packs
- Thermal Runaway Shield (TRS) utilizes phase change material to lower the temperature of a cell experiencing a thermal event thus reducing the temperature on neighboring cells
- Increased safety: Mitigates risk of thermal runaway
- Simplified design: Modular and customizable, easy to integrate
- Lightweight and flexible: Reduces overall weight and size of battery packs



Thank you
CubeSat Developers Workshop 2023



www.kulrtechnology.com