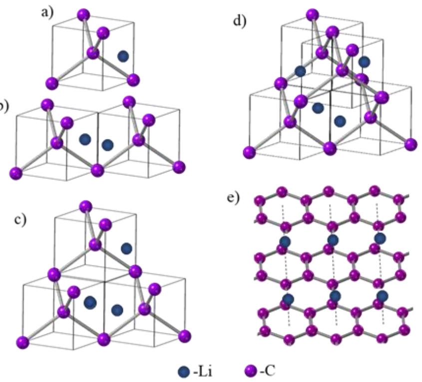
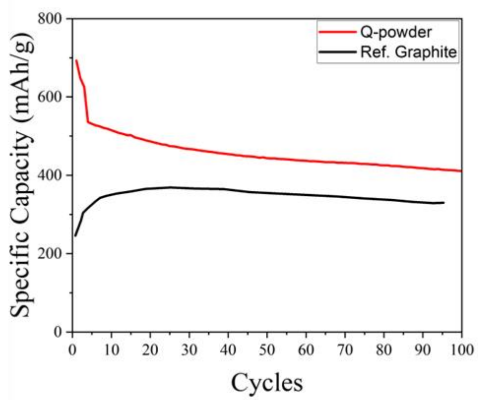
New Hard Carbon for High Efficiency and Fast Charging Li and Na Ion Batteries - PI: Jagdish (Jay) Narayan*, North Carolina State University, **Team:** B. Gwalani, E. Kautz, R. J. Narayan, (NC State); P. Paranthaman (ORNL)

Project Overview





- **Q-carbon** can trap one Li or Na ion per two carbon atoms, compared with one Li per six carbon atoms (LiC_6) in graphite anodes.
- **Q-carbon** anodes could increase Li/Na battery capacity by ~3×, with an additional ~2× improvement possible when mixed with Q-Si.
- The amorphous structure of Q-phases helps them withstand stress without cracking and supports faster charging in Li- and Na-ion batteries.
- Higher efficiency batteries (safe and reliable) through Q-carbon and Q-Si anodes solve critical challenges and provide foundational technology for electrically rechargeable batteries with high energy and power density.
- **Q-carbon and Q-Si** will be synthesized in Prof. Narayan's Labs at NC State, scale-up processing has been already established for Q-carbon, Li and Na ion batteries with Q-carbon and Q-Si anodes will be fabricate at NC State and ORNL, optimized materials and proceeding transitioned to manufacturing (TRL-4, validation in a laboratory environment).

Teaming Overview and Capabilities

- J. Narayan (PI): Inventor of Q-carbon (new hard carbon) and Q-Si for high-efficiency and fast charging Li and Na ion batteries, Q-carbon synthesis and characterization Labs, > 70 publications, US Patents 10586702 & 10 566193 Granted, and R&D-100 (2017, 2018 & 2019) Awards
- B. Gwalani (Co-PI): Expertise in non-equilibrium processing, surface engineering, high-res characterization, electrometallurgy (>10 relevant publications-https://www.nature.com/articles/s41563-024-02057-x)
- Elizabeth Kautz (Co-PI: Li isotope measurements, laser-material interaction (NCSU-PNNL affiliations), in situ characterization.
- R. J. Narayan (Co-PI): Co-inventor of Q-carbon and Q-Si, >20 relevant publications, and R&D-100 (2017, 2018 & 2019) Awards, Q-carbon scale-up processing and modeling
- P. Paranthaman (Co-PI) ORNL: Scale-up fabrication of high-efficiency and fast charging Li and Na ion batteries and characterization facilities (>50 relevant publications and three R&D-100 Awards).

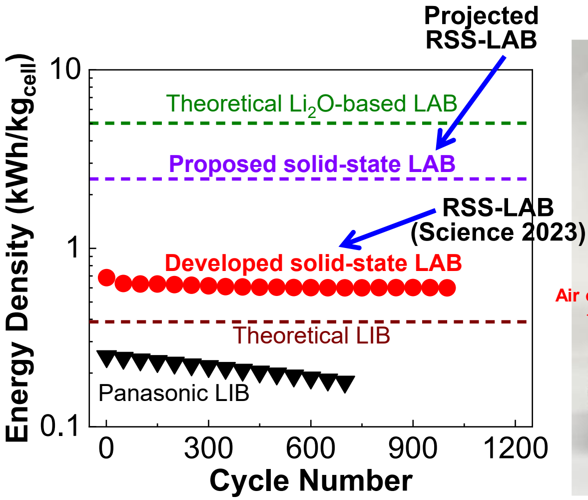
Teaming Needs

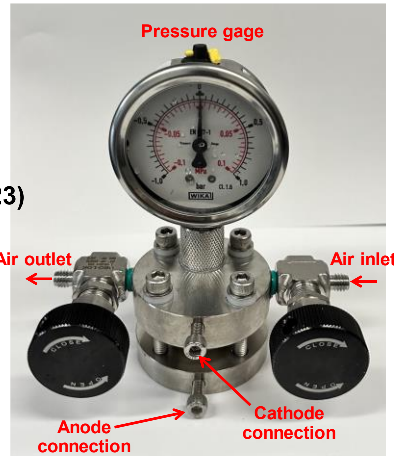
- The team will pursue partnerships with national labs, such as ORNL, to conduct independent testing of Q-carbon, hard carbon, and Q-Si battery materials and verify their performance, safety, and durability.
- Seeking partners to scale-up processing and manufacturing of optimized high-efficiency batteries with fast charging of the order of minutes.
- Collaboration is needed to integrate these advanced anode materials into practical Li-ion and Na-ion battery architectures with improved energy density, capacity retention, and cycle life.
- The team will work with battery manufacturing companies, such as Qcarbon Inc. (> 1kg/Hr), to translate the technology from laboratory-scale demonstrations toward manufacturable battery components and full-cell prototypes. TRL-4, validation in a laboratory environment.

*Professor Jay Narayan, Department of Materials Science & Eng., NC State University, Raleigh, NC 27695-7907. Email: Narayan@ncsu.edu, (919) 515-7874

Benjamin Drake, Co-Founder and CEO, Air Energy, Inc.
Collaborating Institutions: Air Energy, Inc., Illinois Tech, RTX, NLR

Project Overview – 4X Endurance Without Fuel Logistics Using Rechargeable Solid-State Lithium-Air Batteries (RSS-LAB)





M. Asadi, L.A. Curtiss et al. Science, 2023, 379, 499-505.

- **OBJECTIVE:** Develop electrically rechargeable solid-state lithium-air (SS-LAB) batteries with **Ultra high energy and power density**, delivering **~4X Li-ion energy density** and enabling **~4X mission endurance or range**.
- **APPROACH:** Leverage one of its kind solid-state electrolyte to achieve 4e- reaction with reversible formation/decomposition of lithium oxide (Li_2O) by overcoming rxn kinetics, O_2/air flow mgt., and mass transport constraints in high-energy and –power rechargeable architectures.
- **PRROGRAM PHASES:** 1) Cell + system validation; 2) Prototype build and pilot-scale manufacturing, 3) System integration + mission demo

Teaming Overview and Capabilities

Air Energy, Inc. – Solid-state lithium-air battery architecture, cell engineering, prototype R&D pilot line, and commercialization strategy
Illinois Tech (Fulton Labs) – Advanced electrocatalysis, solid-state electrolyte development, materials characterization, and electrochemical diagnostics
RTX – Mission modeling, techno-economic analysis (TEA), and defense platform integration concepts
NLR – Failure mode and effects analysis (FMEA), reliability engineering, and aviation system validation

Teaming Needs

Key Collaboration Areas

- Air-breathing oxygen management systems
- Scalable solid-state electrolyte manufacturing
- System integration and demonstrator platforms
- Thermal management and safety engineering
- AI/ML for new materials development

Transition Strategy

A design-for-manufacturing (DFM)-driven development pathway will advance, prototype performance, manufacturability, system reliability, platform integration readiness. The effort is structured to accelerate transition into long-endurance defense systems and next-generation electric aviation platforms.

Contact info– bdrake@airenergy.io – 312-203-5600

Zeta Energy Corporation — Houston, TX

Battery Cell Attributes for Drones+

Current 6.4 Ah Cells:

350 Wh/kg

Same Weight as Cylindrical 21700

40% Longer Flight

Shelf-life: 1% discharge per year

Positioned for FEOC Compliance

2027 Cell: 450 Wh/kg
2028 Cell: 600 Wh/kg

Project Overview

- **Goal:** Commercialize Lithium Sulfur (Li-S) batteries with highest energy density on battery market. Sulfur allows energy densities unattainable by Li-ion.
- **Approach:** Pair Sulfurized Carbon cathodes with lithium-metal anodes — **eliminating cobalt, nickel, manganese, and graphite**. Enables domestic supply chain.
- **Manufacturing:** Produce Sulfurized Carbon material at Houston HQ. Drop-in compatible with existing manufacturing equipment; work with partners for cell assembly.

Teaming Overview & Capabilities

- **Zeta Houston HQ Established in 2022** with core technology spun out of Rice University.
- **Partnerships:** Joint development with Stellantis; collaboration with Caterpillar.
- **IP portfolio:** 60+ patents and applications on cathode and anode technology.
- **Recognition:** Awards from U.S. DOE ARPA-E and Vehicle Technologies Office, plus the World Materials Forum.

Teaming Needs

Key collaborators sought:
- Field trials of our cells.
- Pack/module integrators for aerospace and defense applications.

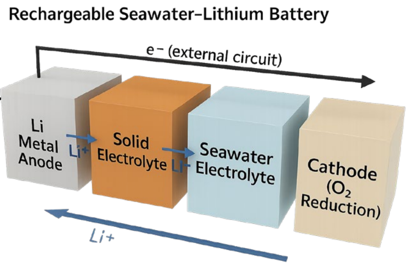
Transition path:
- Scale-up via existing Li-ion manufacturing base.
- Pilot production of material already underway in Houston.
- Setting up pilot production of cells at UT Austin.

Boris Maslov, CEO | boris.maslov@zetaenergy.com

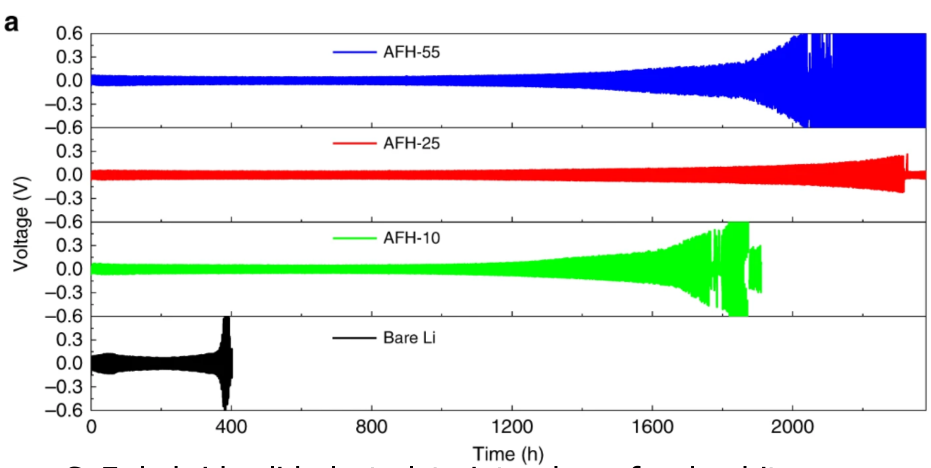
Quinn Qiao & Changmin Shi
Syracuse University

Project Overview

- Rechargeable seawater-lithium (Li) battery with an exceptionally high energy density.
- Challenge: Li dendrite penetration under fast charging conditions. New surface passivation and solid electrolytes to improve cell energy density especially under fast charging conditions.
- Phase Structure:
  - Q1–Q2: cathode development with relevan solid electrolyte modification
  - Q3: Cell structure development
  - Q4–Q5: Cell validation and large-scale evaluation



Key Accomplishments



SnF_2 hybrid solid-electrolyte-interphase for dendrite-free lithium deposition, *Nat Commun* ***11**, 93 (2020)*

Teaming Overview and Capabilities

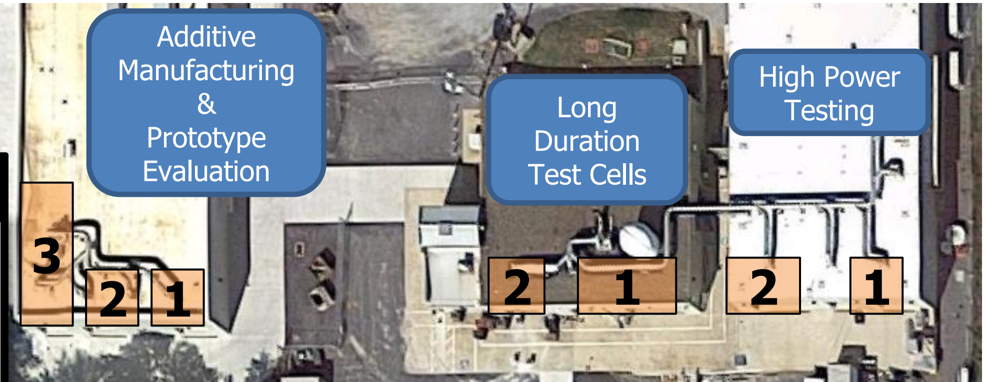
- NSF Energy Storage Engine in Upstate New York ($160M for 10 years, 2024-2034) and NSF IUCRC ($1.5M for 5 years, 2021-2026)
- 2 postdocs and 6 doctoral students focused on battery materials synthesis and processing, and cell structure development
- Relevant experience: over 20 years of R&D experience in high-energy-density solid-state battery design, with over 270 publications and patents.

Teaming Needs

- Seeking industry partners for cathode materials development, battery cell structure development, and large-scale cell product testing and evaluation

Quinn Qiao – quqiao@syr.edu; Changmin Shi – cshi21@syr.edu

Penn State Applied Research Lab – Battery Technology Group



0.5 Mega Watt Power Processors

Pair of 250 kW bi-directional units
Supports up to 1kV, 2kA, or 0.5MW

High Power Test Cells

Long Duration Cell Testing

Cell Level Testing

Cell cyclers paired with a environmental chambers for mission AoA testing

Hardware in-the Loop

1000HP & 250HP dynos & 250kW sink/source

- Assist **government and industry teams** in battery testing, characterization, IV&V
- Integrate cells and **BMS HW/SW** to meet form factor and function of application devices
- Battery system **modeling**
- Conduct cell/system testing to characterize normal operation and **failure modes and effects**
- Conduct cyclic testing using controllable loads under **environmentally controlled conditions** to recreate operating conditions and gather statistically consistent results

High Power Test Facilities & Equipment

- Power processors and test chambers (up to 500kW)
- Battery system prototyping and construction
- BMS design, fabrication, integration, and HIL testing

University Affiliated Research Center

- Serve as government teaming trusted agent
- Industry teaming is non-exclusive and respectful of proprietary information

Timothy Cleary PhD – battery@psu.edu – (814) 867-3769

Xiao-Dong Zhou, c2ePower LLC and UConn

Project Overview

2025 ARPA-E Summit

2026 ARPA-E Summit Carbon Cell System

2026 Flight Demo to UConn BOT

- **Tech Challenges:** (1) energy like hydrocarbons (2) power like a fuel cell and (3) ease of access.

Phase 1 (0-18 Months)

Device-Ready Packs

- ARPA-E REEACH manufacturing + Stack
- BoP Modeling
- Drone duty cycles and integration drive

Phase 2 (18-36 Months)

Peak Power Flight Demo

- High-power stack; Air/thermal mgmt.
- Target: 3x peak specific power
- Flight platform validation

Teaming Overview and Capabilities

Core Team Members

Xiao-Dong Zhou (PI)
Batteries; fuel cells, carbon-fueled systems

William Watson
Stacks, fuel cells, ASPEN BOP Analysis

Padraigh Fitzgerald
3D printing; piloting

Nengneng Xu (UConn)
Cell and stack fabrication and testing; electrochem.

Megan Cunningham (UConn)
Heat and power mgmt.

Institutional Assets

- > 144 cm^2 cell manufacturing
- 1,000 A & 10 V testing facilities
- 3D printing for drone hardware
- Flight capable test fields

Relevant Experience

- DOE ARPA-E REEACH Phase 2
- Carbon-fueled fuel cells
- > 50 relevant publications

Key Collaborators Sought:

1. ***Carbon source and handling:***
   Feedstock prep, storage, delivery, and safe handling
2. ***Recharge and controls:***
   Power electronics, SOC/SOH monitoring, safe charge
3. ***Platform transition partners:***
   Drone, ground vehicle, or heavy-equipment partners for duty-cycle definition, and field testing.

Technology Transition

Leverage DOE ARPA-E REEACH manufacturing, stack testing, BoP modeling, and flight-capable test fields.

→ Validate pack-level performance under flight demo to support Phase 1 testing and Phase 2 integration.

Contact Information | xiao-dong.zhou@uconn.edu | 509-554-9420

Asegun Henry, MIT, Triple-Phase Flow Battery

Project Overview

- New battery architecture enables simultaneous high energy and power density (1 kWh/kg, 1kWh/L, 1 kW/kg), rechargeable (80% RTE) or refuellable (load ingots), via separable power and energy components 1-1000 hr durations.
- New battery architecture redesigned to operate like an internal combustion engine, with fuel injection to enable high energy/power density with inherent architectural safety. Can enable 10X in range.
- Single cell prototypes work well (100's of cycles with no degradation), need to make multi-cell prototypes and larger scale, with full automated systems integration. Need applications insight.

Teaming Overview and Capabilities

- Asegun Henry (MIT) – Heat transfer & energy systems, high temperature systems, liquid metal
- Matt McDowell (GTech) – Electrochemistry, battery materials characterization and optimization
- Guinness World Record – Highest Temperature Pump (1200C) → 2400C used at founded company (Fourth Power: gofourth.com
- Previous World Record for Thermophotovoltaic Efficiency (40%)
- MIT facilities/assets: Bates Lab - https://bateslab.mit.edu/about/

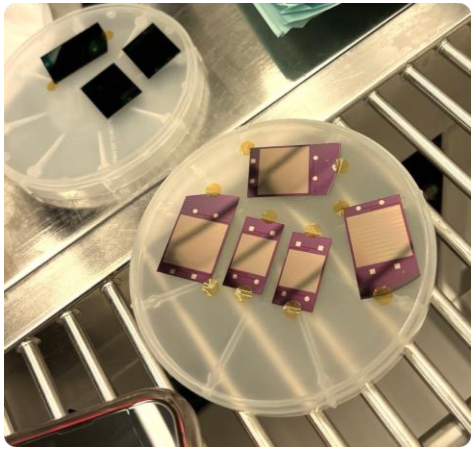
Teaming Needs

Key:
- Battery abuse testing
- Systems integration and controls
- Application specific insight (sizing requirements etc.)

Other:
- Planning to pursue a startup company
- Looking to learn more about specific defense applications
- Need insights on first prototype applications targets

Contact Information: – ase@mit.edu – 617-335-6599

Dr. Harold "Sonny" White, *Casimir Inc.*



Casimir power chips —
working prototypes

Project Overview

Solid-State Continuous Power Cells for Fuel-Independent Systems

We developed solid-state power cells that provide continuous electrical output for long-duration systems without recharging. Unlike conventional batteries, which are constrained by finite stored energy, our architecture enables sustained electrical output at the device level.

Current prototypes produce 100–250 mV of stable continuous potential, with very low current density, in RF-shielded enclosures, sustained over weeks.

Approach to ExPEDitions:

- Phase 1: Scale current output via parallelized chip architectures
- Phase 2: Integrate chips into modular power blocks
- Phase 3: Develop prototype power modules to meet program requirements

Key technical challenge: increasing current density and system-level power from pW to practical scaling (µW → mW → W → kW)

Teaming Overview and Capabilities

Team: H. White (PI, 20+ yrs dynamic vacuum physics, fmr. NASA JSC Advanced Propulsion lead, APS published), L. Dudzinski (SVP, fmr. NASA Planetary Science Chief Technologist, multi-site nanofab program mgmt), J. Vera (co-PI NASA JSC, chip design & modeling), J. Slentz (nanofab engineer), and more.
Partners: Lincoln Labs, Texas A&M, Atomica, Izentis, MIT Nano

Experience: Successful DARPA DSO Disruption Opportunity performer. Publication of physics theory in Tier 1 research journals (APS Physical Review Research). 7 generations of working prototypes. Expertise in device design, chip modeling, nanofab, systems integration, and commercialization.

Assets: 20+ yrs Casimir cavity physics research. Proprietary numerical models. Patents. 4 parallel nanofab pipelines. Working prototypes with measurable output.

Teaming Needs

Key — seeking collaborators for:

- Nanofab partners to accelerate multi-layer chip scaling
- Power electronics and system-level integration
- Platform demonstrators (UAVs, sensors, edge systems)

Other — transition path:

Near-term: low-power electronics, distributed sensors
Mid-term: autonomous systems, small UAVs
Long-term: fuel-independent expeditionary power

Casimir welcomes DARPA investment to scale power output to ExPEDitions goals and transition to DoW users through OTAs, LRIP, and programs of record.

sonny@casimir.inc – 409-927-9799 – casimir.inc

A continuous power source removes fuel logistics as a constraint.

Tom Bishop, Paleblue

Project Overview

- Paleblue is working to improving soldier tactical power to increase mission capabilities, operational flexibility, and reduced physical and cognitive load by development of OSCAR (Operational Single Cell for Accessory Readiness)
- Building a domestic supply chain for 14400 cell and tech on-board battery production.
- We are looking for clearly defined pack development opportunities to leverage the OSCAR battery and/or its constituent subsystems.

Teaming Overview and Capabilities

- Team includes product engineers, developers, and manufacturing experts with focus on advanced small batteries.
- 4M+ COTS batteries sold, $1000 ROI per battery compared to alkaline.
- Performing under OTA with DIU, with support from Army Development Command to develop OSCAR.
- Focused on development of advanced batteries with on-board tech to unlock attributes and innovation potential.

Teaming Needs

Key:

- Companies and organizations looking to advance their operational energy and power solutions who need:
    - Advanced battery packs who can benefit from the super high energy density, cold temperature performance, small cell size (increased packing density), and TAA compliance.
    - Distributed BMS architecture with several or many small high-energy density batteries (OSCAR).

Tom Bishop, CEO – tom@paleblueearth.com – 435.714.3424

Steve Dietz, Ph.D., TDA Research, Inc.

Project Overview

- As a company, we are focused as a materials supplier to battery manufacturers
- We have developed multiple enabling technologies for advanced energy dense batteries

Example Technologies:

- Continuous production process for high-performance LFP and LMFP cathode materials
- Novel solid-state electrolyte that can be used at ambient temperatures in multiple battery chemistries
- High-capacity cathode for Lithium-Sulfur batteries.
- Artificial SEI/CEI layer for High-voltage Li-ion batteries (>5 V)
- Nanoporous lithium-conductive polymer coating to enable the cathode and anode operation in extremely cold weather (-60°C)
- Ionic liquid electrolytes for Li-ion batteries operation at elevated temperatures (>60°C)

Teaming Overview and Capabilities

Steve Dietz, Ph.D. (Principal Scientist)

- Extensive background in materials synthesis for batteries, electrolyzers, fuel cells and ultracapacitors

Vinh Nguyen, Ph.D.

- Expertise in electrocatalysts and the fabrication and testing of batteries/fuel cells/electrolyzers

Institutional assets and core facilities

- Production capability from gram to ton quantities
- In-house testing capabilities include battery cell fabrication, testing and characterization (i.e., XRD, SEM, particle size)
- Information systems are compliant with NIST SP 800-171 Rev 2 and DoDI 8582.01

Teaming Needs

Key:

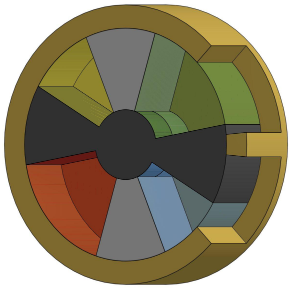
- Collaborations with battery manufacturers to evaluate and optimize our materials in realistic systems and conditions

Business Model:

- Identify opportunities with industry
- Perform R&D
- Secure intellectual property
- Commercialize technology via spin-offs licensing, joint ventures, internal business units

Steve Dietz – sdietz@tda.com – Work (303) 940-2312, Cell (303) 887-9510

Dr. Natalia Galin, Engineer/Founder



Galin Engine Ltd.
Queenstown, New Zealand

Project Overview

Galin Engine is developing a quiet, multi-fuel, software-controlled generator to complement rechargeable battery architectures. While ExPEDitions focuses on cell-level advancements, we propose increasing system-level energy density by tightly integrating the charging device with the battery. This holistic approach overcomes individual component limitations to extend expeditionary mission endurance.

Our contribution involves supporting demonstrations where adaptable auxiliary power is co-optimized with advanced batteries under realistic load profiles. Technical challenges include achieving scale-level efficiency and acoustic targets, validating dynamic load controls, and design of thermal/electrical interfaces required for a truly integrated hybrid system.

Teaming Overview and Capabilities

Current team includes Dr. Natalia Galin (founder; electrical engineer), Andrew Handmer (mechanical engineer), Werner Stapela (senior advisor). Our expertise is in electrically controlled engine/generator architecture, motor control, combustion-system design, and development of quiet, fuel-flexible off-grid power systems.

Relevant accomplishments include development of a 33cc aluminum prototype; laboratory demonstration of fuel delivery, ignition, motor control, and energy regeneration; and patent protection granted in multiple jurisdictions.

Current assets include prototype hardware, control-system development capability, and protected core IP.

Teaming Needs

Key: We seek collaborators in advanced batteries, hybrid system integration, controls, thermal management, and mission-relevant testing.

Other: Transition would proceed through subsystem validation and integration into mission-relevant demonstrators, followed by field evaluation with defense or industrial partners and eventual OEM transition where appropriate.

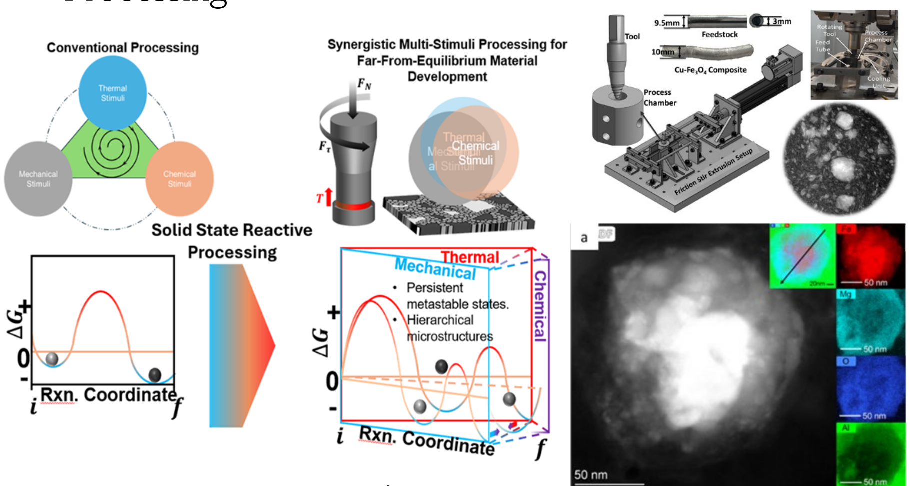
Dr. Natalia Galin - natalia@galinengine.com - +64 21975769

Title- Copper-Enabled Stabilization of Fe_3O_4 Conversion Reactions for Advanced Batteries

PI: Bharat Gwalani*, North Carolina State University, Team: Ruocun Wang (U North Texas), Elizabeth Kautz (NC State, PNNL), Jay Narayan (NC State), Rajan Patel (Ionic Mineral Technologies)

Project Overview

- Shear assisted Solid State Reactive Processing



$$Fe_3O_4 + 8Li^+ + 8e^- \rightleftharpoons 3Fe + 4Li_2O$$

- Develop high-energy, high-power rechargeable battery electrodes using Cu-Fe_3O_4 conversion composites with engineered transport pathways.
- Use solid-state shear processing to fabricate dense, binder-free electrodes with continuous conductive networks and nanoscale active domains.
- Non-equilibrium interfaces and defect-rich microstructures improve electrochemical kinetics, transport behavior, and cycling stability.
- Enable thick-electrode battery architectures with reduced transport limitations and improved high-rate performance.
- Demonstrate a scalable solid-state manufacturing route for next-generation rechargeable battery systems and prototype energy-storage devices.

Teaming Overview and Capabilities

- B. Gwalani brings expertise in non-equilibrium processing, powder synthesis, and friction stir extrusion/consolidation. Ruocun Wang adds battery science expertise, while Rajan Patel serves as an industry partner with expertise in anode materials. Industry partnership with Ionic Mineral Technologies will support translation toward higher TRL and integration of these advanced anode materials into practical Li-ion and Na-ion battery architectures with improved energy density, capacity retention, and cycle life.
- E. Kautz and J Narayan contribute to surface characterization, mass spectrometry and spectroscopy for Li/Na distribution and in situ characterization.
- The team has access to friction processing and synthesis, electrode fabrication, Li/Na-ion coin-cell testing, electrochemical characterization, and advanced materials characterization including pFIB-SEM, TEM, nanoindentation, PPMS, XFA, and XPS.

Teaming Needs

- Additional teaming is needed to support independent validation of Cu–Fe_3O_4 battery materials beyond initial laboratory-scale testing.
- Priority partners include university or national-lab groups with expertise in full-cell Li-ion and Na-ion testing, solid-state or composite electrode design, operando electrochemical characterization, and battery safety/durability evaluation.
- Collaboration is also needed to model transport and conversion kinetics at nanoparticle–matrix interfaces and to translate the materials into scalable electrode architectures with improved energy density, capacity retention, and cycle life.

Bharat Gwalani, PhD – bgwalan@ncsu.edu – 6822157029

PI: Dr. Sung-Jin Cho | Soelect Inc., Greensboro, NC | Team: TBD+Natrion

SOELECT INC
NO MORE BUT BETTER

PROJECT OVERVIEW

- Soelect's Lithium-X® Ultra-Light anode technology provides a transformative lightweight, high energy density battery solution for weight sensitive expeditionary defense platforms. By enabling cell level energy density exceeding 560 Wh/kg, the technology significantly surpasses current DoW battery capabilities and extends mission endurance for drone class unmanned systems, including UAS and UAV platforms.

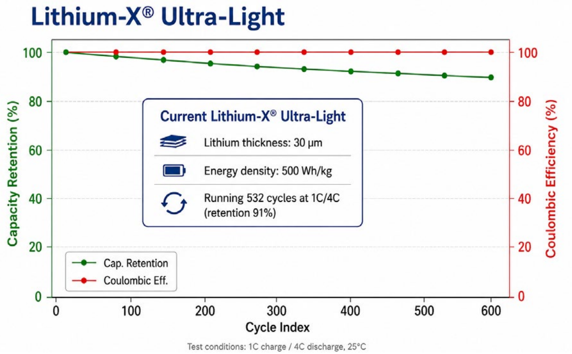
US Patents

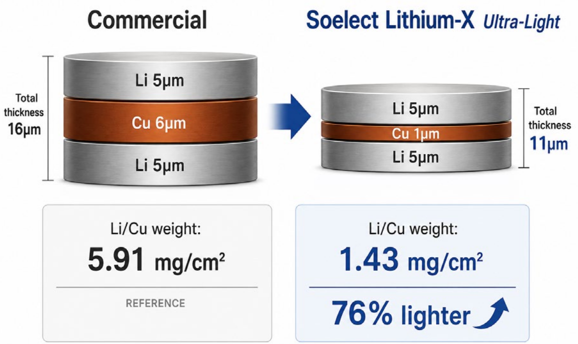
12,040,493 B2
12,095,096 B2
64,047,701 (Pending)

Lithium-X® Ultra-Light Performance Targets

Parameter	Current DoD (State-of-the-Art)	Lithium-X® Ultra-Light Target
Nominal Capacity	12.5 Ah	5–20 Ah
Energy Density	290* Wh/kg	>560 Wh/kg
Power Density	—	>3,500 W/kg
Impedance	<10 mΩ	<10 mΩ
Cycle Life (1C/4C, 80% Retention)	>250 cy	>1,000 cy

*DIU FASTBAT-U spec (2024)





TEAMING OVERVIEW & CAPABILITIES

- **Soelect Inc. (Greensboro, NC)**
  Composite Lithium Metal Anode (Lithium-X®) mfg. | 10–100 Ah drone-class cell
  Army SBIR PH.I & II (solid-state/dry electrode all solid-state batteries)
- Natrion Inc. (Champaign IL / Buffalo NY): Subrecipient, Solid-state separator mfg. (1 km+ rolls) | 13 Ah Li-metal pouch cell production (~60 cells/wk) | DoD contracts >$1.5M
- **Joint Achievement**
  Soelect + Natrion full-cell demo: Lithium-X® anode improved cycle life 450 → 550 cycles (>20%) : proven U.S.-based cell stack synergy

TEAMING NEEDS

Key: Technical Collaborators Sought

- UAV / unmanned platform system integrators (UAS, UAV, UUV, UGV) for battery integration and field validation

Other: Technology Transition

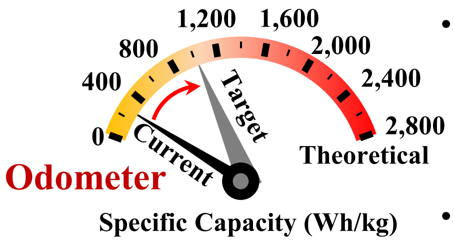
- DoD prime contractors or OTAs with pathway to transition battery technology into DoD platforms
- National labs or test facilities for independent MIL-spec validation

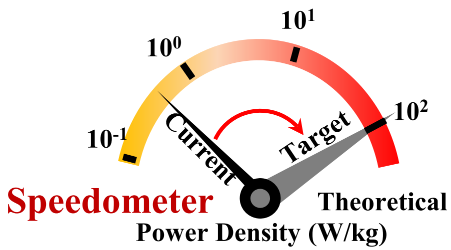
Contact Information – paul.kim@soelect.com – 336-500-8686 | www.soelect.com

High-Energy Rechargeable Lithium-Air Battery

PI: *Dr. Xianglin Li, Associate Professor, Washington University in St. Louis*

WashU

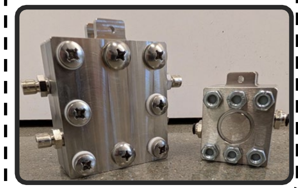




Project Overview

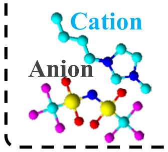
- **Goal:** The team will build a safer, rechargeable battery that has >3X more energy density than today's lithium-ion batteries, so drones and vehicles can run much longer without needing fuel supply lines.
- **Approach:** We will use non-flammable liquid electrolyte to enable a high-energy rechargeable batteries. Our designs are stackable for high energy and power output.
- **Phases:** Phase 1 focuses on building high-energy battery cells and small stacks, and Phase 2 increases the power density and cyclability of the battery.

Flow Battery Concept

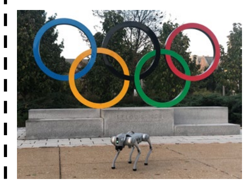


Scaleup Design

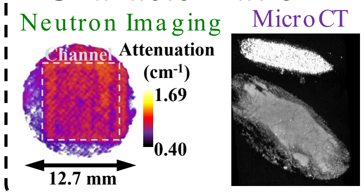
Materials Advancement



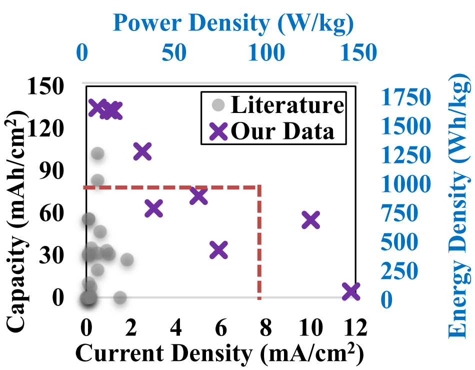
Demonstration

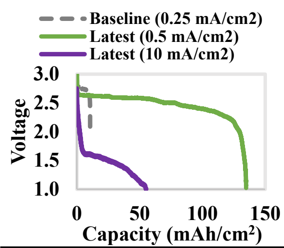


Characterization



Teaming Overview and Capabilities





	Specific Power (W/kg)	Specific Energy (Wh/kg)
Base-0.25	3.3	128.2
Latest-0.5	5.8	1,325.1
Latest-10	99.2	546.0

- DE-AR0001884 Final Technical Report DOI 10.2172/302769
- Xianglin Li, Journal of Energy Storage, 131 (2025) 117664.
- Patent/Application Number(s): 63/912,726
- iEdison Invention Repor Number: 9083901-24-0123

Teaming Needs

We are looking for collaborators with expertise on

- developing advanced anodes (including lithium metal or alloy anodes with effective protection to prevent dendrite growth)
- designing non-permeable separator or membrane that blocks unwanted crossover while allowing efficient ion transport in the Li-air flow battery system.

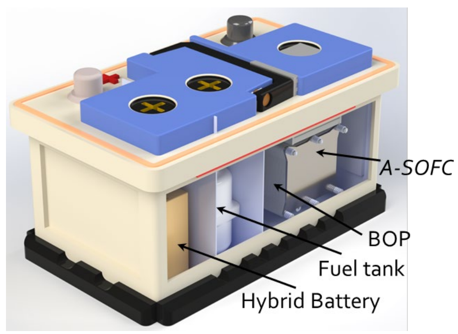
T2M Transition Strategies:

- Our economic analyses showing cost competitiveness with commercial Li-ion batteries
- We have filed multiple patents covering the core technology
- Our partners have product commercialization experience
- WashU's Office of Technology Management (OTM) and institutional culture supporting commercialization.

Contact Information: lxianglin@wustl.edu Phone Number: (314) 935-3249

Subir Roychoudhury, Precision Combustion, Inc.

Project Overview



State of the art: **0.45** kWh/kg

Goal: Up to **6** kWh/kg

Goals:
- Very high energy density battery
- Use energy-dense fuels
- Demonstrate for long-range UAV

Approach:
- Leverage recent advances in solid oxide fuel cell
- Hybridized w/ small battery for peak/idle loads
- Utilize readily available fuels (fuel flexibility)
- Symbiotic system for high system efficiency

Program structure:
- Phase I: Breadboard demonstration; Qtr 1 – 4
- Phase II: Prototype demonstration; Qtr 5 – 8

Teaming Overview and Capabilities

Team, partners:
- Subject matter experts in electrochemistry, materials, electrical, mechanical are on staff & available
- Team members have over 100 issued patents
- Legacy of transitioning innovations from TRL 1 to 7
- Partnerships w. National labs, Univ., DOW, NASA, ARPAE

Relevant experience
- Successful TRL 6 demo of SOFC vehicles, generators
- Competitively won development programs in progress
- Patents on intellectual property issued/ongoing
- All expertise, equipment, facilities available inhouse
- Presentations/publications ongoing
- Related manufacturing, system development ongoing

Teaming Needs

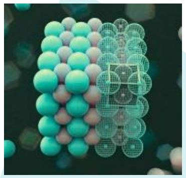
Collaborators:
- Analytical capabilities in microstructure analysis
- Electrochemical testing & analysis capabilities
- Packaging capabilities
- FMEA analysis
- UAV manufacturers, transition partners
- Battery manufacturers/developers

Transition:
- Collaborate with DoW & commercial transition partners
- Spinout to advance manufacturing/commercialization

Contact Information: sroychoudhury@pci.energy; 203 287 3700 x267

Matthew Seabaugh, Ph.D.
Material Impact Consulting

Industry-Leading Strategies for First-of-a-Kind Battery Materials Manufacturing



Design

Develop

Deploy

- The Material Impact Consulting and Nexceris team provides state of the art materials design, development and deployment for a wide range of battery types.
- MIC leads compositional and process design approaches for active battery materials.
- Nexceris provides materials synthesis capabilities from the bench to pilot scale manufacturing.
- Nexceris/MIC teams have decades of collaborative development and product launch experience.

Teaming Overview and Capabilities

Material Impact Consulting (MIC): Matthew Seabaugh, Ph.D.
Nexceris: Neil Kidner, Ph.D, Amanda Gibson, M.S.

- **Relevant experience:** Materials design, discovery and development across advanced energy storage and power generation platforms.
    - Lithium and Sodium Ion Batteries
    - Sodium-Metal Chloride Batteries
    - High and Low-Temperature Electrochemical Cells
- **MIC:** 25+ years' experience in materials and process design for hydrothermal, sol-gel, precipitation and solid-state synthesis.
- **Nexceris:** Extensive lab, pilot, and scaled manufacturing up to 10 tpy, with physical, and electrochemical characterization, and cell fabrication and testing capabilities.

Teaming Needs

Key Teaming Interests:
- Collaborative relationships with cell developers with unique materials synthesis challenges.
- *Lab to Launch* materials scaling opportunities, translating experimental materials to pilot scale.

Additional Teaming Interests :
- Opportunities to provide technoeconomic analysis and process scaling models for materials production.
- Teaming opportunities to develop commercialization and go-to-market strategies for ExPEDitions battery products.

Matthew M. Seabaugh mms@materialimpactconsulting.com (614)-783-2532

Bold North America

Project Overview

- **BOLD** merges a Formula 1 engineering mindset with defense-grade execution to build scalable energy platforms for mission-critical applications.
- **BOLD HP** is a modular high-performance battery platform designed for defense vehicles and heavy-duty mobility systems. It combines high energy density with extreme power capability, enabling both propulsion and onboard power delivery.
- **BOLD HP** is an off-the-shelf solution that can integrate into your program quickly and efficiently.
- Supported by **BOLD Energy OS**, a purpose-built operating system for defense energy management, designed to accelerate decisions, reduce risk and maximize fleet readiness.

Teaming Overview and Capabilities

- **Team:** BOLD North America (Michigan), supported by Bold Valuable Technology HQ (Spain)
- **Experience:** Supplying high-voltage battery systems to military ground vehicles, performance automotive applications, aerospace & eVTOL, and marine & off-highway applications. Supplying to General Dynamics Land Systems to electrify military vehicles.
- **Facilities:** Manufacturing center near Barcelona; U.S. operation have started in Michigan (SOP Q1 2027); in-house design, prototyping, abuse testing, small-series production. AS9100 in progress.

Teaming Needs

Key:
- We are looking to partner with platform integrators seeking energy modules.

Other:
- NDAA compliant cell manufacturers

Bold North America – Bruno Vanzieleghem – US Operations Manager - bruno.v@boldtechnology.com - boldtechnology.us

Daniel Sciro · Seionics LLC · with LBNL and UIC

SEIONICS

AI-Native Materials Qualification

~20 mS/cm

at 5.1 V ESW · -50 to 190 °C

predicted, no cathode coating required

10B+ formulations • 5 U.S. patents
r = 0.901 OBELiX validation

Project Overview

- **Goal:** compress electrolyte qualification from 18-36 months to weeks.
- **Approach:** dual-engine AI conditioned simultaneously on high conductivity and wide ESW. Lead compound eliminates the cathode-coating step.
- **Validation:** r = 0.901 on 129 OBELiX entries; VQE on IBM 156-qubit Heron r2.

Team & Capabilities

- **Team:** Daniel Sciro (PI, Seionics); LBNL co-PIs (synthesis, characterization); UIC co-PI (DFT/AIMD modeling).
- **Facilities:** LBNL Molecular Foundry, ALS, SSRL; Argonne LCRC and NREL Kestrel HPC via UIC; IBM Quantum.
- **Posture:** U.S. small business; ITAR-eligible; CUI-capable. DOE AMMTO proposal in review.

Teaming Needs

Seeking collaborators on:

- Cell-integration partners for pouch-cell prototyping.
- DoD operating-condition test partners.

Transition path:

- Two LOIs on file from U.S. industry partners (cell manufacturers).

Daniel Sciro · danielsciro@seionics.com · 860-460-1212 · Westerly, RI · UEI: VUC3R6WUP856