

AFLCMC

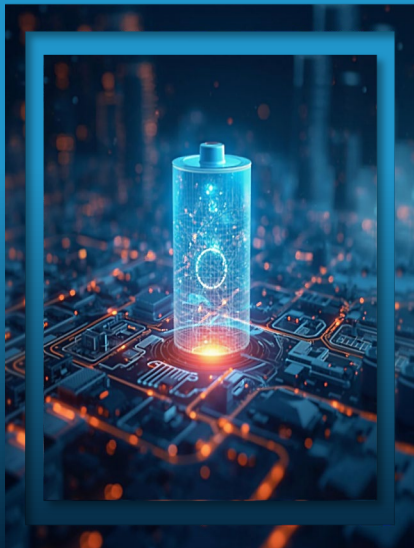
Dr. Sean Raymen



Why Batteries Now and What We Need

Sean Rayman, PhD

**AFLCMC Battery Subject Matter Expert
24 March 2026**



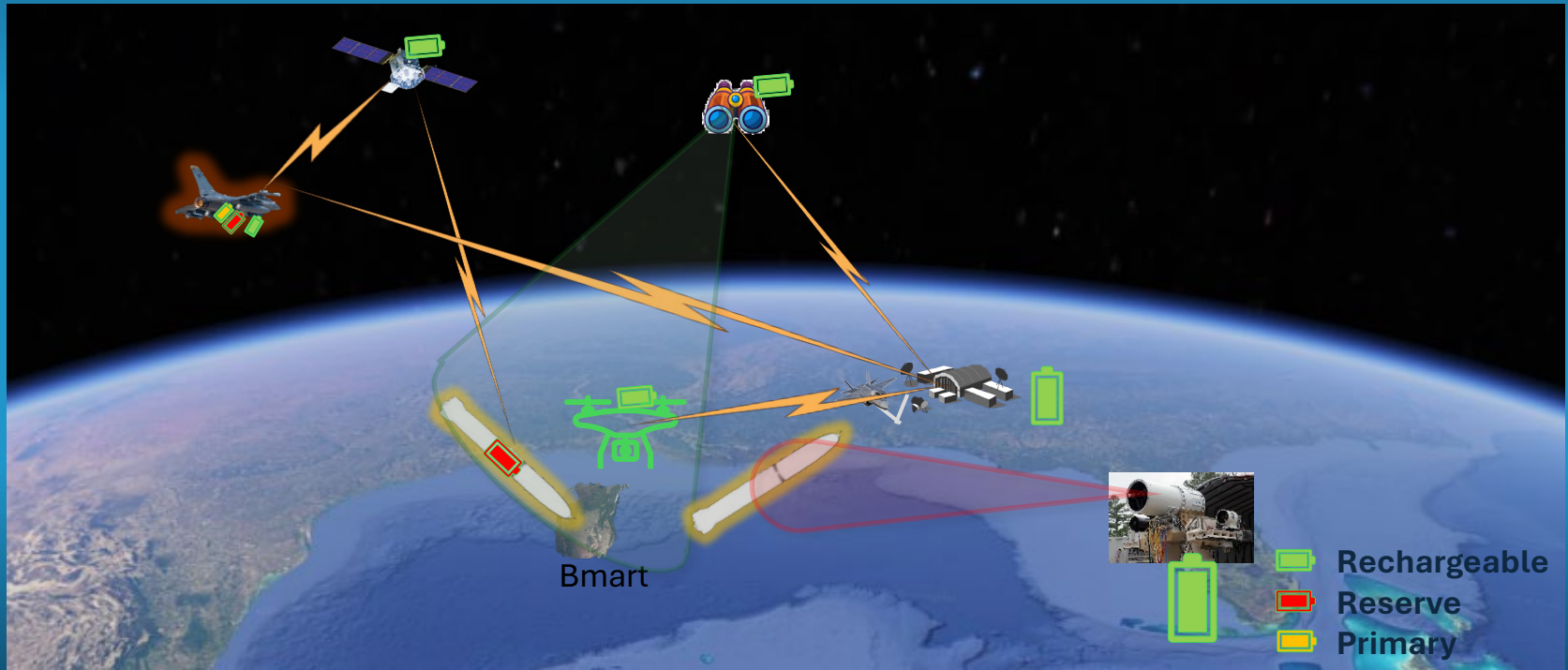


Agenda

- Battery Applications in the AF
- A Case for DAF Battery Strategy
- S&T Investment



Battery Applications (1 of 2)



Batteries are present at every link of the kill chain...

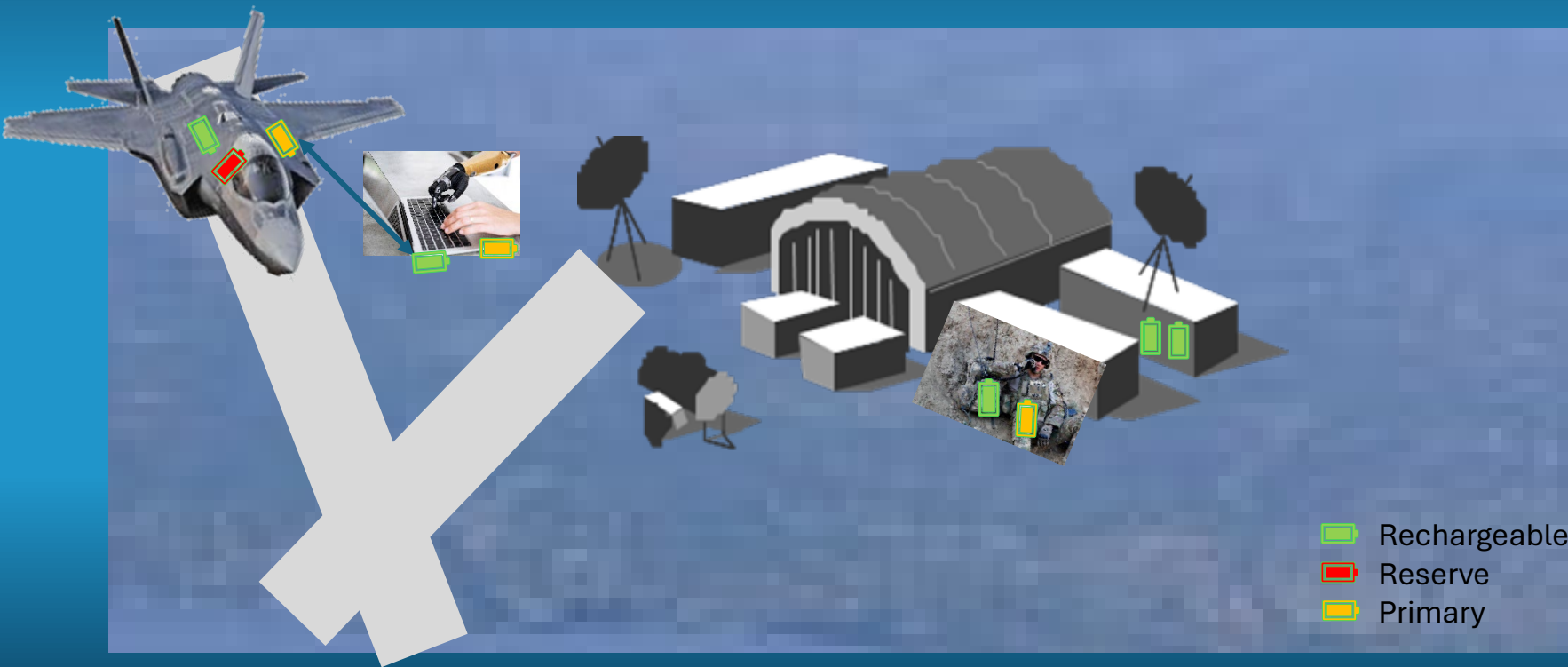
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Battery Applications (2 of 2)

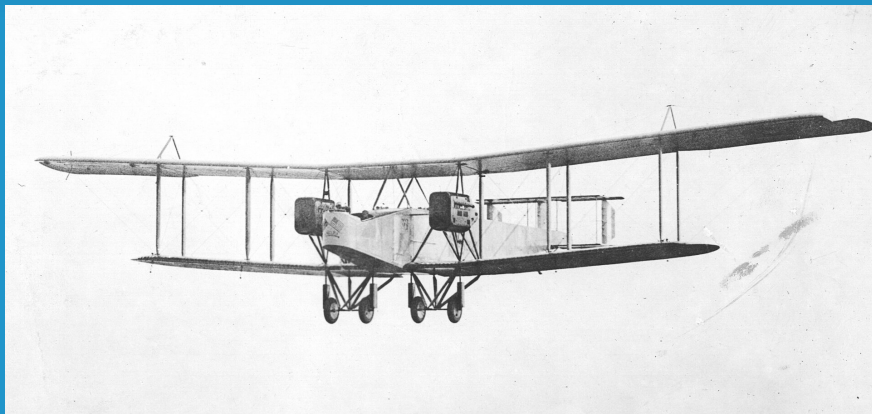


-  Rechargeable
-  Reserve
-  Primary

... even ground operations



The Air Force Without Batteries



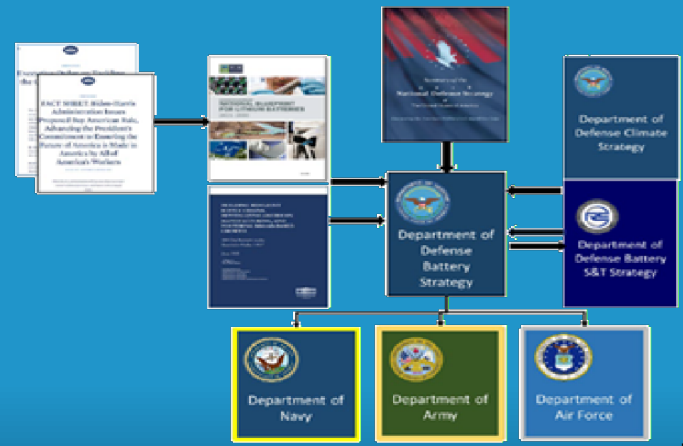
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Case for DAF Battery Strategy

- **The Challenge:** DAF ‘s federated approach to batteries resulted in systemic risks in our industrial base, acquisition pipelines, and R&D framework for this critical technology.
- **The National Security Risk:** Loss of DAF technical capabilities and a dependency on adversarial supply chains, creating a significant vulnerability impacting our military superiority and readiness.
- **The Strategic Solution:** A DAF Battery Strategy could provide the prescriptive actions necessary to solve these challenges. By regaining control, securing the industrial base, and driving battery development based on specific DAF warfighting needs.
- **Alignment with National Policy:** A DAF battery strategy would be complementary to established Department of War (DoW) directives, the National Defense Authorization Act (NDAA), and Executive Orders
- **Execution through a Centralized Team:** A DAF Battery Team, could serve as the single, centralized authority to implement the strategy and act as the focal point for all DAF battery-related activities.



*1

“The DAF is currently undertaking a comprehensive assessment ...to determine the need and scope for future development of a battery specific strategy.”¹

¹Department of Defense Battery Strategy 2023-2030



Strategic Opportunities

1. **Establish Unified Command & Control:** Create a comprehensive and unified approach to battery management, ensuring strategic advantage across the DAF
2. **Optimize Policy for Strategic Advantage:** Align policies and practices to prioritize supply chain security and battery performance, ensuring greater resilience and capability alongside per effect cost efficiency
3. **Enhance Buying Power Through Commonality:** Foster commonality in battery solutions, significantly enhancing the DAF's buying power and accelerating development and acquisition cycles
4. **Leverage Enterprise Data for Informed Investment:** Develop robust aggregate battery data capabilities, enabling the DAF to proactively manage risk and make informed investment decisions
5. **Accelerate Acquisition to Integrate Advanced Technology:** Streamline acquisition processes to rapidly integrate cutting-edge battery technology to field state-of-the-art solutions
6. **Develop Tailored Solutions for Unique DAF Needs:** Develop and leverage specialized battery solutions, meeting unique operational requirements such as extreme temperature tolerance, high-G environments, and high C-rate discharge
7. **Establish DAF-Specific Safety Certification Process:** Create and implement a DAF-specific battery safety certification process, enhancing operational security and autonomy from other services' processes
8. **Modernize for Sustainable and Resilient Battery Systems:** Modernize our battery portfolio and foster robust domestic production for long-term resilience
9. **Cultivate a Highly Skilled Battery Workforce:** Establish institutional training and development programs, creating a highly skilled and knowledgeable battery workforce within the acquisition community and beyond
10. **Strengthen Foundational Structures for Maximized Capabilities:** Strengthen our underlying structural, infrastructure, and workforce elements, amplifying our ability to address all battery-related challenges and maximize DAF capabilities

Opportunities are beyond “Advanced Batteries”



Strategic Benefits

- 1. Champion our destiny:** Establish DAF Battery Team with authority and responsibility
- 2. Drive the science:** Invest in technology to present a credible deterrent, counter emerging threats, create asymmetric capabilities, secure the industrial base, and be a smart buyer even in technologies driven largely by commercial investments
- 3. Secure the supply chain:** Facilitate technology transfers, provide understanding of DAF's current and likely demand signal, and to invest in domestic/ allied battery development and manufacturing
- 4. Streamline acquisition:** Address challenges associated with battery safety, acquisition, sustainment processes
- 5. Own safety:** Develop a battery safety process and establish a battery safety authority
- 6. Empower workforce:** Invest in skilled and knowledgeable battery workforce
- 7. Know ourself:** Develop advanced analytics capabilities to optimize energy decisions and inform future investments



Holistic Battery Approach



Anticipated efforts beginning in FY 27



<p>LOE 1: Advanced Chemistries & High-Energy Density</p>	<p>Next-Generation Power. Funds AFRL, academic, and industry R&D into post-lithium-ion chemistries (e.g., solid-state, lithium-sulfur) to increase range and time-on-station for future platforms (UAS, space).</p>
<p>LOE 2: Defense-Specific Performance & Resiliency</p>	<p>Mission-Ready Batteries. Funds development of batteries optimized for military needs not met by commercial markets: extreme temperature tolerance (-40°C to +80°C), high-G survivability, fast-charge/high-power for directed energy, and long-life reserve batteries.</p>
<p>LOE 3: Safety, Containment & Certification</p>	<p>Ensuring Warfighter Safety. Funds R&D into early failure detection, thermal runaway mitigation/containment, and development of DAF-specific, criteria-based safety certification standards.</p>
<p>LOE 4: Industrial Base & Advanced Manufacturing</p>	<p>Securing the Supply Chain. Funds AF ManTech projects, SBIR/STTRs, and industry partnerships to mature domestic manufacturing processes, secure the supply chain for critical materials, and develop cyber-secure battery management systems.</p>
<p>LOE 5: T&E and Digital Engineering Infrastructure</p>	<p>Accelerating Transition to the Field. Funds establishment of dedicated DAF T&E facilities (cell/battery level) to reduce reliance on other services. Develops validated Modeling & Simulation (M&S) tools to reduce physical testing costs and speed up acquisition timelines.</p>

“To support the development of domestic sources of next generation batteries”



Rationale and Justification

- Rationale

- Addresses critical dependency on adversarial battery supply chains, a key national security risk
- Fixes systemic programmatic challenges that prevent fielding of advanced capabilities and cause duplicated, inefficient spending
- A foundational approach to de-risk major programs, restore the industrial base, and ensure war-winning overmatch

- Justification

- Critical, DAF-specific R&D for battery technologies the commercial market cannot provide
- Develops higher-energy-density, safe batteries to extend UAV loiter time and combat radius
- Creates novel, high-g survivable power sources for next-generation, more lethal munitions
- Enables affordable mass for weapons by creating standardized, modular power source "kits-of-parts"
- Establishes DAF-owned T&E and safety certification to de-risk programs and accelerate fielding
- Breaks critical dependency on adversarial supply chains for a foundational warfighting commodity



Questions?



RA-Air Warfare

Dr. Levi Elston



AFRL

POWERING THE FUTURE OF AIR DOMINANCE: THE CRITICAL NEED FOR ADVANCED ENERGY STORAGE

DR. LEVI ELSTON, HIGH-SPEED POWER-THERMAL LEAD
DR. JOE FELLNER, ELECTRICAL SYSTEMS BATTERY SME
AFRL/RQ-AEROSPACE SYSTEMS DIRECTORATE, 24 MAR 2026



The Power Dilemma...

Future Air Force capabilities—from autonomous platforms to weapons and high-speed systems—are fundamentally limited by access to electrical power. Advanced energy storage is no longer just a component; it is a critical enabling technology for maintaining air dominance.



Proven Performance: Powering Today's Most Critical Assets

Air Force-led S&T has successfully integrated high-performance Li-ion batteries into DoW premier platforms:

- **F-35 Lightning II**
 - The **first military aircraft** to use Li-ion for mission-critical functions, including emergency power to flight controls.
- **B-2 Spirit:**
 - Developed and deployed robust Li-ion main batteries, resulting in **significant weight savings** and increased operational readiness.
- **RQ-4 Global Hawk:**
 - AFRL supported the deployment of the first Li-ion battery systems for this high-altitude long-endurance platform, directly enabling **longer mission endurance and enhanced ISR capabilities.**

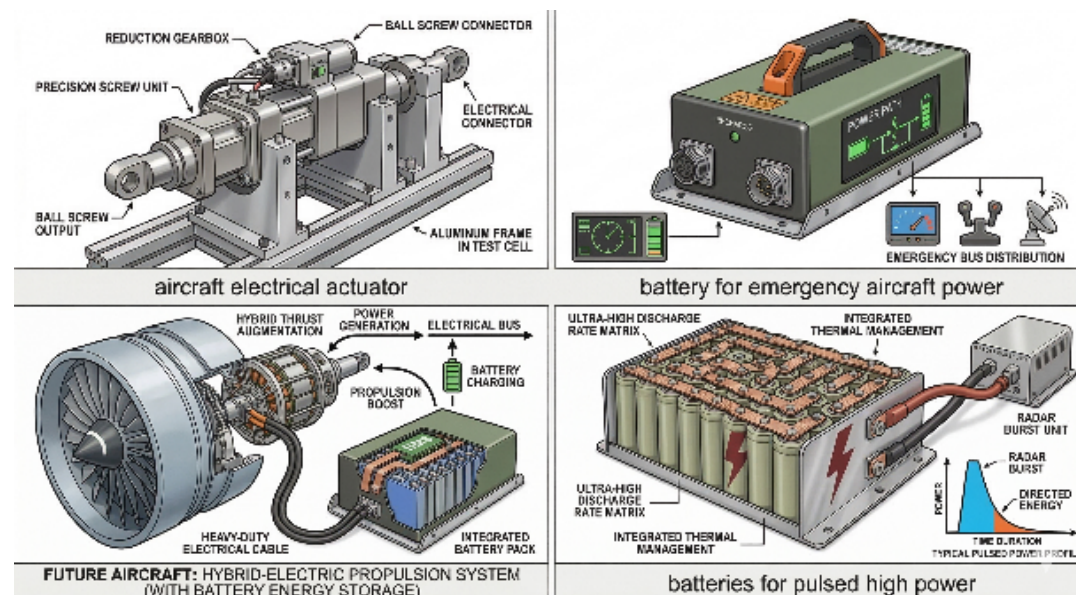


Images courtesy of Defense Visual Information Distribution Service

Batteries: Needed for Integrated Power

Advanced batteries are an enabler for a vast range of aerospace functions. Their role is expanding across a variety of critical subsystems:

- **Actuation:**
 - Providing the high-power bursts needed to **deploy landing gear and operate flight control surfaces.**
- **Mission-Critical & Backup:**
 - Ensuring uninterrupted power for **avionics, emergency power, and "return-to-base"** functions in the event of primary power failure.
- **Hybridized Electric:**
 - Forming the core of hybrid-electric power systems that **increase range, endurance, and on-board electrified propulsion/power generation** for next-generation platforms.
- **Pulsed High Power:**
 - Enabling the next generation of high-power **sensors, radar, and self-protection** capabilities that demand significant, short-duration energy.



Images generated by Gemini, 11Mar2026, Google



The Foundation: Our Core Battery Research Pillars

Our current success is built on a foundation of persistent, forward-looking research.

- Advanced Battery Chemistry/Materials:
 - Our legacy includes investment in “**Beyond Li-ion**” research, exploring **solid-state electrolytes** and **high-capacity materials** to develop inherently safer batteries with 2-3x the energy density.
- Advanced Component and System-Level Modeling & Simulation (M&S) and Hardware/Software-in-the-loop (HIL/SIL):
 - Our “**fly-it-before-you-build-it**” digital strategy simulates the fully integrated electrical and thermal system. This allows us to predict and validate performance within the complete power architecture, ensuring system-level reliability before hardware is built.
- Unwavering Focus on Safety:
 - AFRL has long been a leader in battery safety, pioneering new methods for **thermal runaway mitigation** and developing advanced battery health predictive capability to ensure mission reliability.



Advanced Battery Chemistry/Materials



Modeling & Simulation (HIL/SIL)



Unwavering Focus on Safety

Images generated by Gemini, 11Mar2026, Google



Powering the Next Generation: Energy for the Future Fight (AFRL/RQ Focus)

Future warfighting concepts will demand specialized power system technologies. We are focused on defining the requirements and developing the integrated technologies needed to enable disruptive warfighter capabilities.

- **Autonomous Collaborative Platforms (ACPs):**
 - **The Challenge:** Powering networks of “drone wingmen” that require a difficult balance of **long endurance, high-power payloads, and affordability.**
 - **The Need:** High-energy-density batteries, hybrid-electric systems, and innovative thermal management to make these platforms a reality.
- **High-Speed Systems (Weapons & Platforms):**
 - **The Challenge:** Creating batteries that can survive and deliver immense, **continuous power under the extreme heat, vibration, and g-forces** of high-speed flight.
 - **The Need:** Robust, high-power-density and/or high-energy-density battery systems with integrated thermal solutions designed specifically for the high-speed environment.



Images generated by Gemini, 11Mar2026, Google



The Way Forward: A Call for Engagement

- Our mission is to **ensure the USAF maintains its technological edge** through superior energy and power.
 - We Have a Proven Track Record: From lab to launch, AFRL has consistently delivered the battery technology that powers the mission.
 - The Challenges are Complex: Securing the supply chain and accelerating next-generation technology requires a dedicated, collaborative effort.
- We are seeking **industry** engagement to help:
 - Innovate in materials, cell design, and manufacturing.
 - Accelerate technology maturation and transition.
 - Scale production to meet future demand.
 - Focus on cost/affordability.

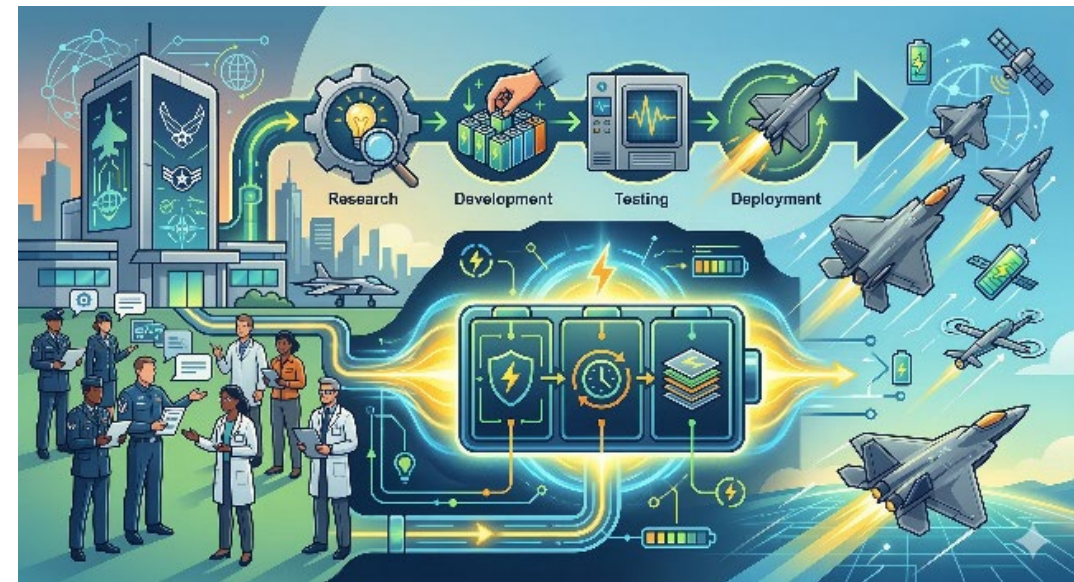


Image generated by Gemini, 11Mar2026, Google

*Let's work together to power the future
of the United States Air Force!*



Thank you!

RJ-Space Warfare

Mr. David Arvidson



Advanced Space Power: DAF & USSF Battery Needs

David Arvidson

Space Vehicles Directorate, Air Force Research Laboratory

As of 03 March 2026



DAF & USSF Battery Needs

- Increased fidelity of fundamental device electrochemical physics to inform research and development
- Improved confidence in accelerated testing to shorten development and productization timelines

Solutions are needed for the space environment that can meet performance metrics with a bias towards higher energy density (Wh/kg). Aspects to consider for space:

- Thermal cycling stress tolerance
- Radiation tolerance (MIL-STD-750, MIL-STD-883)
- 1000s of duty cycles for a 96-minute LEO orbit (35-minute discharge up to 60% DoD)

USSF has a need for a robust domestic supply chain supporting vendors capable of manufacturing high energy density solutions for the space operational environment

Questions or Comments?

David.arvidson.1@spaceforce.mil

AFOSR=Air Force Office Scientific Research

Dr. Justin Koo



AFRL

A BASIC RESEARCH PERSPECTIVE: *WEAPONS ELECTRICAL POWER & BATTERY S&T* *INDUSTRY DAY*

JUSTIN KOO, PROGRAM OFFICER, PROPULSION AND POWER
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)
JUSTIN.KOO@US.AF.MIL



Overview

- Introduction to AFOSR
- Historical AFOSR battery investments
- Future of AFOSR battery basic research
- Process for AFOSR engagement



Introduction to AFOSR



AFOSR's Mission is to Discover, Shape, Champion, and Transition High Payoff Basic Research to profoundly impact the future Air and Space Forces

We build bridges to the world's most prestigious universities and talented researchers to enhance partnerships and provide revolutionary science and technology discoveries to the Warfighter.

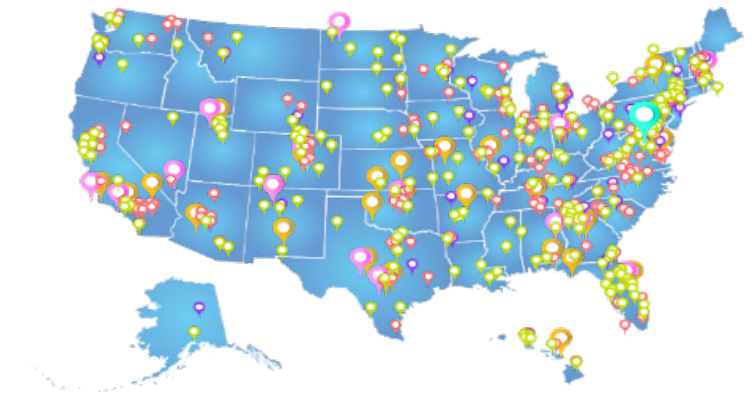
Scientific Reach - 60+ World-class Subject Matter Experts manage 1,600+ grants at over 300 leading academic institutions across 50 states and 65 countries, 150 industry-based contracts, and more than 230 internal AFRL research efforts.

Global Footprint and Reach

DAF Link to Academia



STEM Outreach Impact





AFOSR's Mission is to Discover, Shape, Champion, and Transition High Payoff Basic Research to profoundly impact the future Air and Space Forces

We build
partner

Scientific
academic
internal

DAF Link



What is Basic Research?

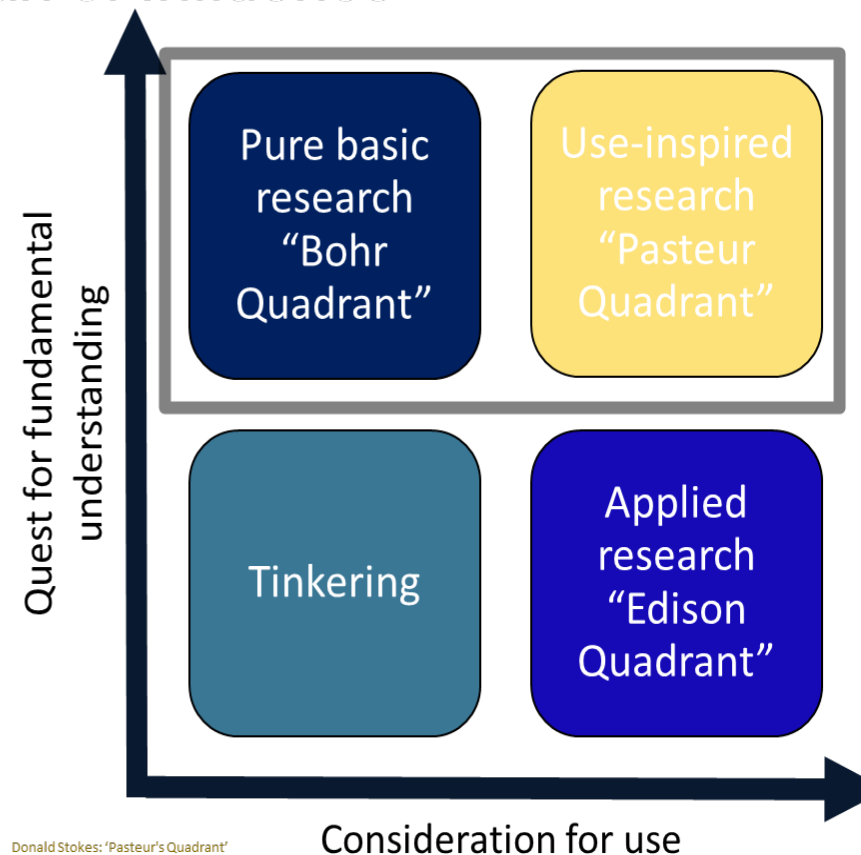
Basic research is systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind.

Office of The Secretary of Defense
§ 272.3 Definition.

Ref: DoDI 3210.1, September 15, 2005, Section 3

Ref: CFR-2012-title32-vol2-sec272-3

Ref: <https://basicresearch.defense.gov/About>



enhance
center.

leading
than 230

Impact





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Global Footprint and Reach

DAF Link to Academia



STEM Outreach Impact





AFRL/AFOSR Science & Engineering Portfolio Areas

Engineering and Complex Systems	Information and Networks	Physical Sciences	Chemistry and Biological Sciences	International Office
Energetic Solid-State Physics and Mechanochemistry	Computational Cognition and Machine Intelligence	Aerospace Materials for Extreme Environments	Biophysics	Asian Office of Aerospace R&D Tokyo, Melbourne
GHz-THz Electronics	Computational Mathematics	Atomic and Molecular Physics	Human Performance and Biosystems	European Office of Aerospace R&D London
Energy, Combustion, and Non-Equilibrium Thermodynamics	Dynamical Systems and Control Theory	Electromagnetics	Symbiotic Systems	Southern Office of Aerospace R&D Santiago, São Paulo
Aerodynamic Sciences	Dynamic Data and Information Processing	Condensed Matter Physics	Molecular Dynamics and Theoretical Chemistry	North America - Arlington
High-Speed Aerodynamics	Information Assurance and Cybersecurity	Optoelectronics and Photonics	Natural Materials and Systems	
Aerospace Composite Materials	Mathematical Optimization	High Energy Radiation-Matter Systems (HERMeS)	Organic Materials Chemistry	
Multiscale Multifunctional Structures & Systems	Science of Information, Computation, Learning, and Fusion	Quantum Information Sciences	Space Biosciences	
Propulsion and Power	Trust and Influence	Physics of Sensing		
Agile Science for Test and Evaluation (T&E)	Complex Networks	Space Physics		
	Cognitive and Computational Neurosciences	Ultrashort Pulse Laser-Matter Interactions		
		Astrodynamics		





Historical AFOSR battery investments



Li_xCoO_2 ($0 < x \leq 1$): A NEW CATHODE MATERIAL FOR BATTERIES OF HIGH ENERGY DENSITY

K. Mizushima, P.C. Jones, P.J. Wiseman and J.B. Goodenough
Inorganic Chemistry Laboratory, South Parks Road, Oxford, OX1 3QR

(Received April 3, 1980; Communicated by J. B. Goodenough)

ABSTRACT

A new system Li_xCoO_2 ($0 < x \leq 1$) has been prepared by electrochemical extraction of lithium from the parent LiCoO_2 ordered rock-salt structure. Measured open-circuit voltages with respect to lithium metal are approximately twice those of Li_xTiS_2 ($0 < x \leq 1$), and a theoretical energy density of 1.11 kWh kg^{-1} is calculated for $\text{Li}_x\text{CoO}_2/\text{Li}$. Preliminary voltage-composition curves show low overvoltages and good reversibility for current densities up to 4 mA cm^{-2} over a large range of x .

Introduction

The feasibility of insertion-compound electrodes for nonaqueous secondary batteries of high specific energy and power was first demonstrated with the $\text{Li}_x\text{TiS}_2/\text{Li}$ cell in 1976 (1). Lithium was reversibly inserted into and extracted



Acknowledgments

This work has been sponsored by the United States Air Force under Contract No. AFOSR-77-3493, and by the European Energy Commission under Contact No. 316-78-1 EE UK.

Nobel Prize in Chemistry 2019



© Nobel Prize Outreach. Photo:
A. Mahmoud

John B. Goodenough

Prize share: 1/3



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A. Mahmoud

M. Stanley
Whittingham

Prize share: 1/3



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A. Mahmoud

Akira Yoshino

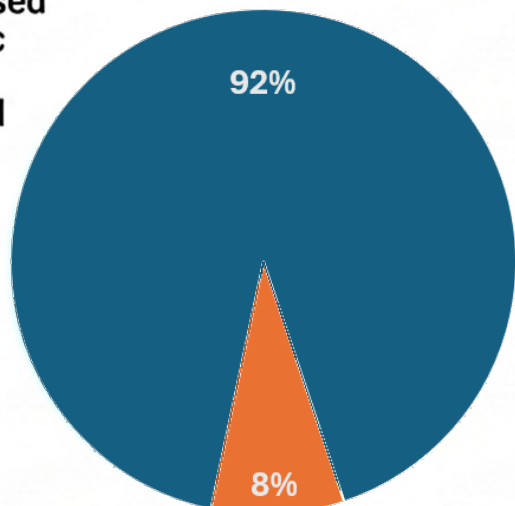
Prize share: 1/3

The Nobel Prize in Chemistry 2019 was awarded jointly to John B. Goodenough, M. Stanley Whittingham and Akira Yoshino "for the development of lithium-ion batteries"



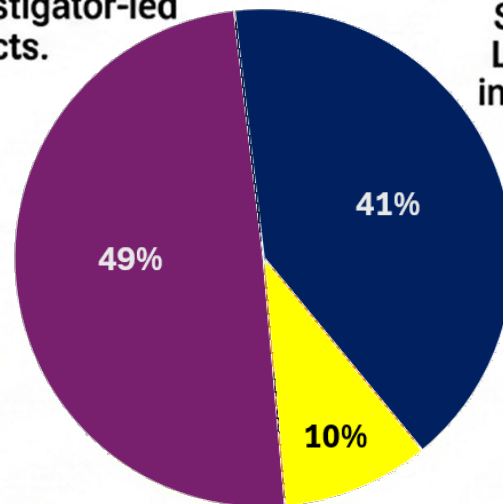
AFOSR Battery Investments over the last decade

US Programs (\$24.44M)
- Funding primarily focused on domestic research initiatives and academic institutions.



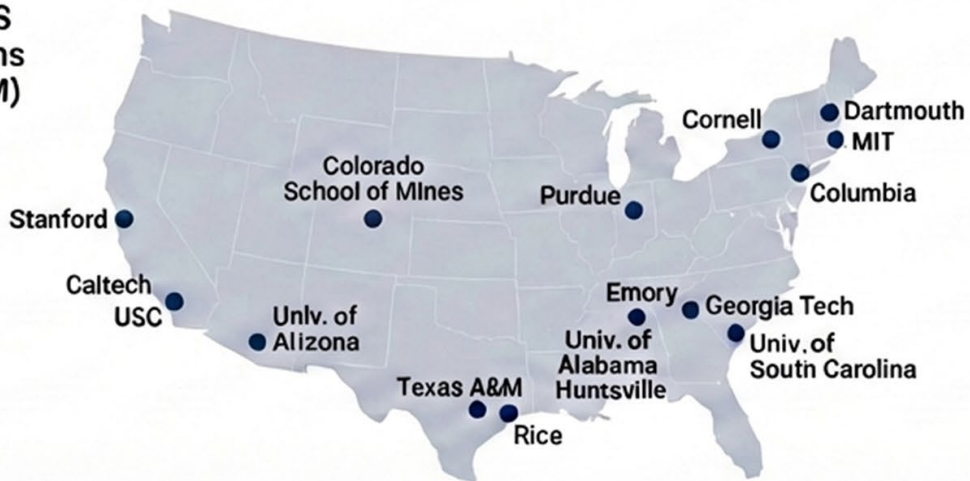
Non-US Programs (\$2.27M)

Traditional Grants (\$12.10M)
- Standard funding for individual investigator-led research projects.



MURI (\$10.0M) - Molecular Level Studies of Solid-Liquid Interfaces in Electrochemical Processes (2018-2024)

DURIP (\$2.34M) - Defense University Research Instrumentation Program for acquiring major equipment.





Structural Energy Storage & Novel Chemistries

Structural Batteries

- Chalmers Univ., KTH Royal Institute, Imperial College London, AIT Austrian Institute (2021–2025): Developing carbon-fiber and polymer composites that simultaneously store electrical energy and carry mechanical loads.
- Columbia Univ. (2020–2025): Created a bio-inspired, tree-root-like interfacial lamination technique to enhance the flexural modulus of battery pouch cells.
- Texas A&M Univ. (2022–2025): Designing structural organic batteries using redox-active polymers capable of extremely fast charging and sub-zero operation.

Extreme Environments & Alternative Ions

- Dartmouth College (2022–2026): Pioneering cost-effective, non-flammable glassy sodium-ion conductors for solid-state sodium batteries.
- Univ. of South Carolina (2023–2026): Investigating aqueous zinc-ion batteries to mitigate zinc-anode corrosion and understand cation solvation.
- MIT (2022–2025): Developing ultrahigh-energy primary batteries using liquid fluorinated reactants to displace heavy, redox-inactive electrolytes.
- Columbia Univ. & Univ. of Notre Dame (2024–2027): Studying electrolyte concentration polarization to improve Li-ion performance at ultra-low temperatures.



Safety, Energetics & Fundamental Interfacial Science

Thermal Runaway Prediction & Health Monitoring

- Univ. of Arizona & Iowa State Univ. (2024–2025): Developing physics-informed machine learning models to forecast thermal runaway events using real-time sensor data.
- Stanford Univ. (2022–2025): Creating built-in ultrasonic sensors to monitor capacity fading and battery health for electric aerial vehicles.
- Seoul National Univ. (2024–2025): Developing single-frequency impedance sensors for early detection and testing phase change materials to block heat transfer.
- Univ. of Alabama Huntsville (2024–2027): Using multiscale X-ray and neutron imaging to map degradation pathways and lithium plating over varying temperatures.

Hybrid Battery-Propellant Systems

- Purdue Univ. (2024–2027): Creating dual-function batteries using energetic materials as cathodes to release energy on demand.
- Rice Univ. & Stanford Univ. (2023–2027): Investigating how the violent exothermic reactions of thermal runaway can be intentionally harnessed to generate spacecraft propulsion thrust.

Fundamental Interfacial Science

- Yale, MIT, Univ. of Pennsylvania [MURI] (2018–2024): Probing the molecular-level processes and thermal electron transfer at solid-liquid electrode interfaces.
- Caltech (2021–2025): Building ultrafast laser-driven impedance spectrometers to measure complex ion hopping and electron-phonon interactions on picosecond timescales.



Future of AFOSR Battery Basic Research



Operation in DAF-centric mission environments

Extreme Environments

Commercial cells are designed for mild, predictable conditions. DAF operations demand survival and high-power surges in the vacuum of space, across severe thermal gradients, and through extreme arctic and desert deployments.

Dynamic Degradation

Performance degradation is expected under unique, aggressive duty cycles; however, broad range of USAF/USSF requirements and limited asset volume preclude the use of commercial large-scale statistical monitoring.

High Consequence Failures

Catastrophic failure in mission-critical environments introduces unacceptable risk - thermal runaway, radiation-induced material degradation, and packing failures challenge the speed of development and deployment of new energy storage capabilities.

Underlying any successful operations are the *-ilities*
(manufacturability / affordability / availability / scalability / maintainability)



Snapshot of the scientific landscape

Fundamental Scientific Gaps

- **Dynamic Non-Equilibrium Behavior:** Current steady-state models struggle to predict battery behavior under robust, high-power DAF conditions.
- **Multi-Scale Dynamics:** Performance is bottlenecked by complex interactions spanning from atomic ion desolvation at the interface to mesoscale fluid migration.
- **Combinatorial Complexity:** Edisonian trial-and-error approach to discovering new materials is expensive and slow; even worse when trying to engineer for lifetime as operational history heavily dictates path-dependent failure.

Emerging Opportunities

- **Advanced Computational Modeling:** New quantum and classical molecular simulations allow us to study dynamic reactivity at scale.
- **Operando Diagnostics:** Synchrotron-based X-rays, neutron scattering, and high-speed imaging allow us to map solid-state evolution and interface breakdown in real-time.
- **AI & Data Assimilation:** Rapidly advancing algorithms can now filter massive experimental datasets through complex, nonlinear physics-based models.



Thrust 1: Foundations of Battery Degradation and Safety

Basic Research (Understanding Physics of Failure)

- Physics of Failure Initiation: Leveraging in-situ diagnostics (cryo-EM, synchrotron X-ray) to observe SEI/CEI formation/breakdown and model dendrite nucleation at the atomic scale.
- Chemomechanics of Abuse: Correlating kinetic abuse—high-G forces, vibration, and shock—with micro-fractures and the onset of internal short circuits.

Applied Results (Avoiding/Leveraging Failure)

- DAF-Specific Safety Certification: Defining exact Safety-of-Use protocols by subjecting high-energy formulations to combined mission stressors (e.g., thermal cycling under vibration and vacuum).
- Rapid Battery Foundry: Prototyping advanced form factors with integrated sensor fusion to detect subtle failure precursors at a realistic scale, providing hands-on research opportunities for advanced battery safety.
- Multifunctional energetic formulations

Understanding boundaries of stability expands current and future DAF application



Thrust 2: Nonequilibrium Multiphase Electrochemistry

Basic Research (Predictive Discovery)

- Far-from-Equilibrium Predictive Science: Developing validated molecular simulations to model complex electrolyte mixtures and aggressive duty cycles across extreme environments.
- Accelerated Materials Discovery: Building a materials-by-design framework to rapidly understand opportunities and limits of alternative paradigms like Sodium-Ion (Na⁺) and Dual-Ion Chemistries

Applied Results (Mission Optimization)

- DAF-Optimized Electrolytes: A rapid synthesis-and-test pipeline that translates AI-discovered candidates into custom formulations for arctic operations, space, or directed energy.
- Data-Driven SEI Control: Leveraging data assimilation to optimize initial manufacturing formation and operational duty cycles, dictating the path dependency to enable the creation of robust, stable battery

Deeper understanding of core processes accelerates new capability development



Process for AFOSR engagement



Who We Are



AFOSR program Officers (POs) operate with exceptional individual agency but limited financial resources. By design, we utilize a multiple search strategy for the scientific landscape.

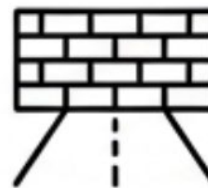


We build research portfolios to serve the nation. The AFOSR research community - research, researchers, and facilities – are a national asset.



We fund projects destined for an open publication environment and the workforce to exploit knowledge faster. Basic research is not well aligned with proprietary or limited distribution concepts.

What We Want



We want to understand the critical knowledge gaps that are actively blocking scientific progress.



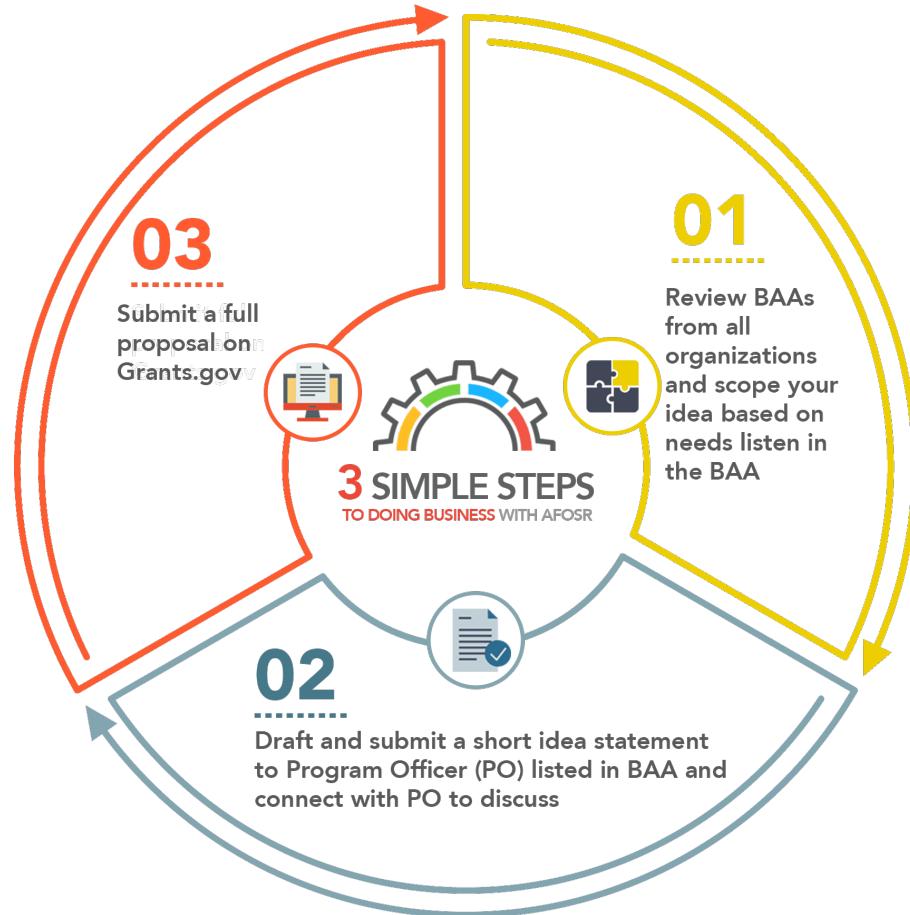
We want to make connections between you and our portfolios to heavily sharpen research relevance.



We want groundbreaking basic research ideas and inspired approaches to address them.



Front door to AFOSR – grants.gov



Go to: <https://www.grants.gov/>

Search for keyword: “AFOSR”

Look for: Research Interests of the Air Force Office of Scientific Research

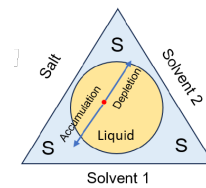
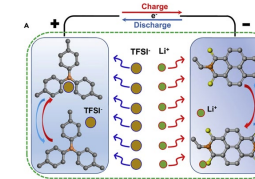
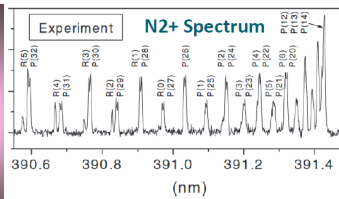
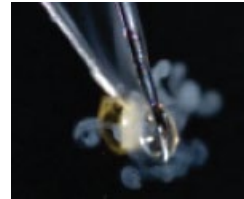
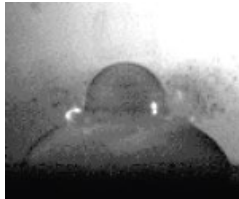
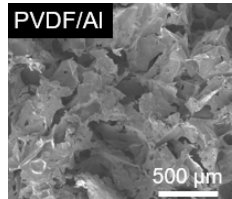




Backup Material

Propulsion and Power Portfolio Goals and Research Areas

Goals: Improve predictive accuracy of small-scale behavior through high fidelity, validated simulation and develop data assimilation/DT strategies to address coupled nonlinear dynamics at macroscopic scales



Reactive Multiphase Interfaces

Understand the interplay of the complex nonequilibrium processes driving solid and liquid combustion

- Initial focus on high fidelity physics modeling and detailed validation on select canonical experiments
- Provides rigorous theoretical basis for new reduced physics models to efficiently describe multiphase combustion
- Extreme multiphysics challenges are on the horizon

Low temperature Molecular Plasmas

Describe the detailed energy flows into and throughout partially ionized molecular plasmas

- Initial focus on improving predictive capability for RF molecular plasmas
- Leverages intersection of physics-based codes and experimental data through data assimilation
- Anticipates centrality of accurate nonlinear plasma dynamics models to enable model predictive control of next-generation plasma thrusters

Space Power and Electrochemistry

Improve core scientific knowledge underpinning power generation and storage in space environment

- Initial focus is on property prediction for multicomponent mixtures to better understand physics of extreme temperature battery operation
- Exploratory efforts to understand radiation / chemical / mechanical effects on space solar power generation



Review Broad Agency Announcements

- Researchers should visit www.grants.gov – the official source for finding and applying to Federal grants
- Find opportunities that match interests. Search by:
 - Keyword
 - Eligibility
 - Category
 - Agency etc.
- Study and keep current with BAAs
- [Attend program reviews](#) to understand the directions and needs of program

The screenshot shows the Grants.gov search results page. The search criteria include 'Keyword(s)', 'Opportunity Number', and 'CFDA'. The search results are sorted by 'Posted Date (Descending)' and show 2385 matching results. The table below lists several opportunities with their details.

Opportunity Number	Opportunity Title	Agency	Opportunity Status	Posted Date	Close Date
PAR-19-027	Basic Neurodevelopmental Biology of Circuits and Behavior (R01 Clinical Trial Not Allowed)	HHS-NIH11	Posted	10/17/2018	02/04/2019
PAR-19-028	Basic Neurodevelopmental Biology of Brain Circuits and Behavior (R21 Clinical Trial Not Allowed)	HHS-NIH11	Posted	10/17/2018	02/04/2019
PA-19-029	Innovation Corps (I-Corps) at NIH Program for NIH and CDC Translational Research (Admin Supp Clinical Trial Not Allowed)	HHS-NIH11	Posted	10/17/2018	01/28/2019
HHS-2019-ACF-OPRE-PD-1548	Human Services Interoperability Innovations	HHS-ACF-OPRE	Forecasted	10/16/2018	
HHS-2019-ACF-ACYF-EV-1547	Family Violence Prevention and Services Discretionary Grants, Capacity Building and Program Technical Assistance for Family Violence Prevention and Services Act Formula Grantees	HHS-ACF-FYSB	Forecasted	10/16/2018	
	Fish and Wildlife Management Assistance	DOI-FWS	Posted	10/16/2018	10/22/2018
	Lymphatics in Health and Disease in the Digestive System (R01 Clinical Trial Not Allowed)	HHS-NIH11	Posted	10/16/2018	02/21/2019
	US Mission to Viet Nam/Consulate General in HCMC: Annual Program Statement of Public Diplomacy Programs	DOS-VNM	Posted	10/16/2018	06/01/2019
	Family-to-Family Health Information Centers - Montana	HHS-HRSA	Posted	10/16/2018	01/15/2019
DOVAN-10162018	2018 Targeted Aished Grant Program	EPA	Posted	10/16/2018	01/04/2019
	Establishing a Family Justice Center in Moldova	DOS-INL	Posted	10/16/2018	12/17/2018
XLDVAN-10162018	Legal Socialization in Moldovan Schools	DOS-INL	Posted	10/16/2018	12/17/2018
	Coastal Wetlands Planning, Protection and Restoration	DOI-FWS	Posted	10/15/2018	12/13/2018
	U.S. Embassy Brussels FY2019 Annual Program Statement - Individuals	DOS-BEL	Posted	10/15/2018	07/19/2019
	U.S. Embassy Brussels FY2019 Annual Program Statement - Organizations	DOS-BEL	Posted	10/15/2018	07/19/2019
	U.S. Mission to South Africa: Ambassadors Fund for Cultural Preservation	DOS-ZAF	Posted	10/15/2018	11/30/2018
	U.S. Mission to South Africa: Ambassadors Fund for Cultural Preservation	DOS-ZAF	Posted	10/15/2018	11/30/2018
	ACFP 2019 Small Grants Competition	DOS-MDA	Posted	10/15/2018	12/13/2018
	Ryan White HIV/AIDS Program Part D - Women, Infants, Children, and Youth (WICY) Grants Supplemental Funding	HHS-HRSA	Posted	10/15/2018	01/29/2019
	Chesapeake Bay Program Office Fiscal	EDA	Posted	10/16/2018	12/07/2018





Connect with a Program Officer

- Some Program Officers will request a specifically formatted white paper
- Others will want to have a conversation
 - In person
 - Over the phone
 - Via email
- If the idea seems promising, a Program Officer will initiate an ongoing dialogue setting expectations and explaining the process for full proposal submission.



<https://www.afrl.af.mil/About-Us/Fact-Sheets/Fact-Sheet-Display/Article/4315393/afosr-workshops-reviews/>



Technology Transition

- Small Business Innovation Research (SBIR)
- Small Business Technology Transfer (STTR)
- **AFRL Regional Networks**

Strengthening Academic Research Capabilities (& Partnership Potential)

- Multidisciplinary University Research Initiative (MURI)
- **Laboratory-University Collaboration Initiative (LUCI)**
- **Space University Research Initiative (SURI)**
- Defense University Research Instrumentation Program (DURIP)
- Defense Established Program to Stimulate Competitive Research (DEPSCoR)
- Presidential Early Career Award for Scientists and Engineers (PECASE)
- **University Nanosat Program**

Workforce Development

- Awards to Stimulate and Support Undergraduate Research Experiences (ASSURE)
- **AFRL Scholars**
- **National Defense Science and Engineering Graduate Fellowship Program (NDSEG)**
- Pre K-12 STEM / Legacy

Basic Research Grants

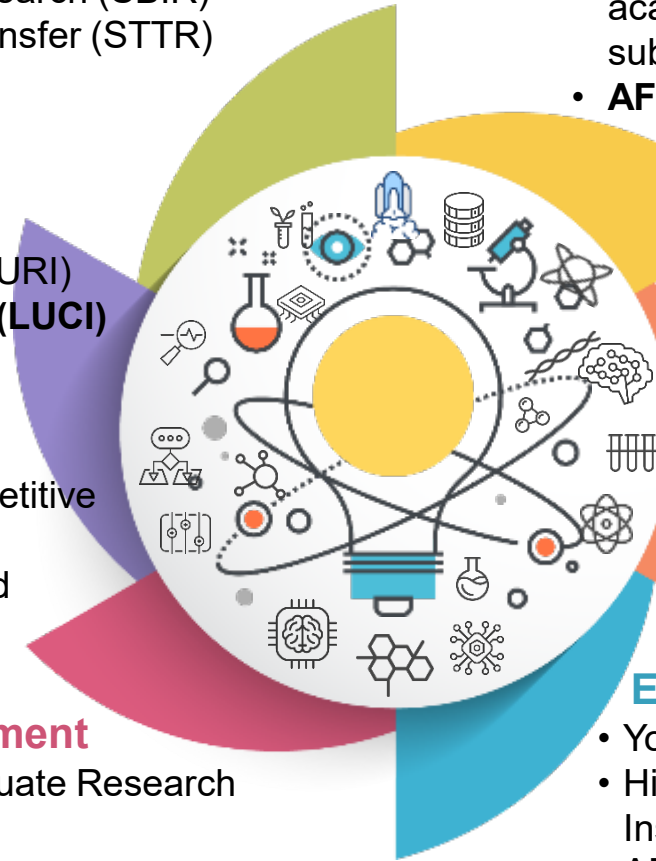
- All qualified, responsible organizational applicants from academia, the non-profit sector, and industry are eligible to submit research proposals. (Domestic/International)
- **AFRL Lab Task Program**

Strengthening Air & Space Force Research Capabilities

- **ProtoStar Program for Exceptional New Investigators**
- **Star Team Awards**
- **University Centers of Excellence**
- US Air Force Academy Partnership
- Air Force Institute of Technology Partnership
- **Summer Faculty Fellowship Program (SFFP)**
- **Science & Technology Fellowship Program (STFP)**

Expanding Air & Space Force Academic Reach

- Young Investigator Program (YIP)
- Historically Black Colleges & Universities/Minority Serving Institutions (HBCU/MSI) Program
- AFRL Basic Research National Science Portals (NSPs)
- Government-University-Industry-Philanthropy Research Roundtable (GUIPRR)



Diversified investment strategy for maximum discovery potential

Contracting

Mr. Vincent (Kelly) Pitts



AFRL

AIR FORCE RESEARCH LABORATORY Weapons Electrical Power and Battery S&T Industry Day

Vincent (Kelly) Pitts Contracting Officer

AFRL/RWK 24 MARCH 2026



Key Details of BAA FA8651-25-S-0001

Agency: Air Force Research Laboratory (AFRL), Munitions Directorate

Title: Air Dominance

Total Anticipated Value: Up to \$750,000,000 across multiple awards.

Period: Open for five years, allowing for submissions at any time, with specific "Calls" for proposals issued periodically. BAA closes 30 October 2029.

NAICS Code: 541715 - Research and Development in the Physical, Engineering, and Life Sciences

Thirteen Research Areas – technical POCs identified for each research area.

A link to the BAA on SAM.gov is provided on the back of my contact card.



Key Details of BAA FA8651-25-S-0001 (cont.)

Most BAAs, including this one, use a two-step process to save time and resources for both industry and the government.

Step 1: White Paper Submission

A brief, high-level summary of your technical idea and its estimated cost.

The government reviews the white paper to determine if there is an interest in pursuing the approach.

Step 2: Invitation for Full Proposal

If the government is interested in your white paper submission, you may receive a formal request to submit a detailed technical and cost proposal.

If the government issues a detailed request for proposal – you are encouraged to schedule a pre-proposal walk-through meeting to discuss the requirements of the request for proposal.



Evaluation Criteria: What We Look For (Step 2 Full Proposal)

Full Proposal Evaluation Criteria: If your white paper is assessed favorably, you may receive a request for proposal. Full proposals will be evaluated in accordance with the following evaluation criteria:

Technical (Highest Priority – not all inclusive)

Is the approach unique and innovative?

Does it convey the offeror's understanding of the scope of the technical effort?

Is the approach sound? Does it identify technical risks and provide feasible mitigation?

Does it indicate potential to transition the R&D effort to future government needs?

Cost/Price (Substantial factor, but lower priority than technical):

Is the proposed cost realistic and reasonable for the work described?



Evaluation Criteria: What We Look For (cont.)

Proposal Risk Assessment

Low: Little potential to cause disruption of schedule, increase in cost, or degrade desired performance.

Moderate: Can potentially cause some disruption of schedule, increase cost, or degrade desired performance. Special monitoring required to overcome issues.

High: Likely to cause significant disruption of schedule, increased cost, or fail to meet performance goals. Risk may be unacceptable even with special efforts.



Evaluation Criteria: What We Look For (cont.)

Review and Selection Process

High Recommended: Proposals are recommended for acceptance if sufficient funding is available and normally are displaced only by other Highly Recommended proposals.

Selectable: Proposals are recommended for acceptance if sufficient funding is available, but at a lower priority than Highly Recommended proposals. May require additional development.

Not Selectable: Even if sufficient funding existed, the proposal should not be funded.



Award Types

The government has flexibility and can award different types of arrangements based on the proposal.

FAR Based Contracts: Fixed-Price (FP), Cost Reimbursable (CP/CR). Must have DCAA approved accounting system for award of a cost reimbursable contract.

DoD Grant and Agreement Regulation Based Assistance Instruments: Grants, Cooperative Agreements may be used for efforts with a public purpose.

10 U.S.C. §§ 4021-22 Other Transaction Authority: Agreement under OTA statutory authority. Open to non-traditional defense contractors (small businesses qualify as non-traditional).



Summary

Become familiar with our BAA and periodically check for updates. Contact the Technical Point of Contact (TPOC) for your research area before submitting a white paper.

If requested to submit a full proposal, ensure it is thorough and compliant with proposal instructions.

Fee free to request a pre-proposal walk through with the contracting officer identified in the RFP letter.

QUESTIONS ??



U.S. AIR FORCE



USSF

AFRL

BACKUP SLIDES

Vincent (Kelly) Pitts Contracting Officer

AFRL/RWK 23 MARCH 2026