



RESILIENCE

ROBUST ENERGY SOURCES FOR INTELLIGENCE LOGISTICS IN EXTREME NOVEL AND CHALLENGING ENVIRONMENTS

INTELLIGENCE VALUE

The RESILIENCE program seeks to develop reliable power solutions to enable increased mission run-times for electronics used by the Intelligence Community. RESILIENCE is designed to increase power solution energy densities by up to 2x and calendar life by up to 10x beyond the performance of commercial solutions. Potential applications include Unmanned Aerial Vehicles (UAVs) that need to operate without a runway, and leave-behind electronics that need to survive for years under extreme environmental conditions.

The Intelligence Community (IC) needs reliable power sources for missions in extreme and challenging environments. This includes power for unmanned robots, or vehicles that keep IC personnel

out of harm's way, and for electronic devices that must function unattended in extreme environments for long periods. IARPA's RESILIENCE program focuses on developing novel power solutions for these, and many other challenging applications.

Goals of the RESILIENCE program include power solutions with high-energy density, high-power density, long calendar life, and robustness to extreme environmental conditions, such as large temperature fluctuations, vibration, shock, overcharge and complete discharge.

Although the goals for RESILIENCE power solutions are broad, the program is divided into two research tracks with unique goals:

- Track 1: High-energy power sources with the ability to sustain very high-power bursts at the beginning and at the end of discharge, such as those needed by a UAV vertical take-off and landing event
- Track 2: High-energy power sources that can hold a charge for up to two years, without significant capacity loss due to chemical degradation

PERFORMERS

- Rutgers University, The Charles Stark Draper Laboratory, Inc. and Lockheed Martin Corporation
- Saft America, with subcontractors Northrup Grumman, the University of California San Diego, and the University of Maryland;

- Teledyne Scientific and Imaging, with subcontractors Navitas Systems and the University of Dayton Research Institute;
- Conamix, with subcontractors EaglePicher Technologies and Ionic Materials;
- SRI International, with subcontractors Precision Combustion, Inc. and the University of California, Los Angeles;
- II-VI Aerospace & Defense, with subcontractors EaglePicher Technologies;
- Solid Power, with subcontractor University of Maryland
- CAMX Corporation

TESTING AND EVALUATION PARTNERS

- U.S. Army Development Command
- Command Control Computers and Cyberdefense
- Intelligence
- Surveillance and Reconnaissance (C5ISR) Center

KEYWORDS

- Materials chemistry
- Energy storage (batteries)
- Stirling engines
- Power sources
- Electrochemistry

Customer Needs

100% Increase in Flight Times

VTOL Capability
(Vertical Takeoff and Landing)

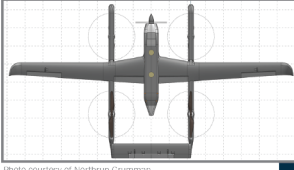


Photo courtesy of Northrup Grumman

HIGH ENERGY AND HIGH POWER STORAGE

- 380 Wh/kg Specific Energy
- High Power pulses are a challenge at the end of flight
- Startup time sometimes needed to function

Current Capability

TRACK 1 POWER SOLUTIONS

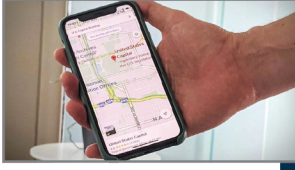
- 750 Wh/kg, max 5kg - 2.5L size
- High pulse power for 1 minute at any time
- No startup time required

Program Goals

Customer Needs

10x Longer Calendar Life

75% Higher Energy Density



LONG CALENDAR LIFE STORAGE

- 286 Wh/kg Specific Energy
- 5% Self Discharge at 25°C
- Power source depleted before deployment

Current Capability

TRACK 2 POWER SOLUTIONS

- 500 Wh/kg, max 50g - 30mL size
- 5 second power pulses available instantly
- 10 useful cycles
- Operates at -20° to 60°C

Program Goals



PROGRAM MANAGER

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