

Topic: N103-207

PC Krause and Associates, Inc.

High Density, High Efficiency Electrical Power Generation

Increased power demands with limited cooling availability have stressed traditional generation systems resulting in reliability and maintenance challenges. PCKA's AC-field Electrical Synchronous Generator (ACESG) is specifically designed for such stressing applications enabling sustained power in harsh extended temperature environments. As a design, analysis, and development company of advanced power and thermal systems, PCKA developed a rapid machine design technique that was used to design, construct, test, and successfully meet requirements for a full-scale ACESG hardware unit. PCKA is seeking funding to mature the technology. Furthermore, PCKA is looking for a manufacturing partner that would either license or produce the technology for the end customer.

Technology Category Alignment:

Electronics Integration

Aircraft Propulsion, Power and Thermal

Power Generation/Energy Conversion

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SYSCOM: NAVAIR

Contract: N68335-18-C-0186

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0186

Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF18-946

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WHO

SYSCOM: NAVAIR

Sponsoring Program: JPO

Transition Target: F-35, gas turbine power

TPOC:
(301)342-0804

Other transition opportunities: MQ-4C Triton, Global Hawk, tactical aircraft, future vertical lift, tanks

Notes: Many systems encounter temperature constraints with respect to electrical power generation. The technology developed in this effort addresses this limitation by allowing for much higher temperature operation while providing reliable and sustainable electrical power. The prototype generator shown is rated for operation at ambient temperatures up to 300 degrees Celsius. This technology is ideally suited for direct integration with prime movers such as turbine engines, eliminating mechanical equipment and the associated weight, loss, and maintenance.



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WHAT

Operational Need and Improvement: Improve efficiency and power density for electrical power generation systems that provide reliable and sustainable electrical power to meet the increased loading of modern aerospace platforms and terrestrial systems.

Specifications Required: 270 Vdc / 100 kW continuous / 250 kW peak power electrical starter / generator.

Technology Developed: The AC-field Electrical Starter Generator (ACESG) was designed for high-temperature operation with a simplified cooling system for improved efficiency, power density, and reliability while operating in harsh, extended temperature environments. This was achieved by eliminating high failure-rate parts and components with limited temperature range commonly used in traditional generators. PCKA designed, constructed, tested, and successfully met requirements for a full-scale ACESG hardware unit rated 25% above the continuous and peak power rating of the baseline system with a maximum operating temperature of 500 degrees Celsius.

Warfighter Value: Sensors, radars, and electronic attack/defense systems are essential for the modern warfighter to successfully complete their missions. These systems require reliable, sustained electrical power at ever increasing levels. To meet this challenge, traditional generator manufacturers have traded reliability to meet the weight and volume constraints. The ACESG is a new generator technology specifically designed to provide sustainable, reliable power in harsher environments found in many defense systems. In addition, enabling much higher temperature operation allows for alternative integration options (e.g., direct integration with a turbine engine) that will provide further system weight and volume savings and enhance mission capabilities.

WHEN

Contract Number: N68335-18-C-0186 **Ending on:** October 22, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Full-Scale Hardware Prototype	Low	Demonstrate high-temperature operation	4	December 2017
Refined Design - Simplified Manufacturing	Low	Verified Operation with Reduced Weight	5	October 2019
Full-Scale Pre-Qual Hardware Prototype	Med	Meet all design requirements (weight, efficiency, volume, power, temperature)	6	June 2020
Controls / Converter Pre-Qual Hardware Prototype	Med	Meet all design requirements (weight, efficiency, volume, power)	6	June 2020
LRIP / Qualification Testing	Med	Qualified generation system	7	June 2022

HOW

Projected Business Model: PCKA's business model is to license this technology to a manufacturing partner to produce the technology for the end customer. The licensing revenue will enable PCKA to fund continued research and development efforts focusing on improvements and derivative high-performance power and thermal applications.

Company Objectives: Meet with weapon systems contractors that have a need for reliable power generation systems operating in harsh environments. PCKA has established a rapid design and development technique that will allow PCKA to quickly customize the ACESG technology to meet different requirements. PCKA is also looking to meet with potential licensing manufacturing partners interested in constructing and testing future production units.

Potential Commercial Applications: The ACESG technology provides the capability to embed a reliable, high-power electrical starter / generator within a turbine engine, resulting in opportunities to significantly reduce weight, improve efficiency, and reduce operational and maintenance costs for commercial aircraft.

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