

Topic: N181-013

Precision Combustion, Inc.

Compact, Lightweight, Power-Dense, Integrated Fuel Cell System

This technology is a power-dense, JP-5 fueled Unmanned Aerial Systems (UAS) power plant/Integrated Fuel Cell System (IFCS). The system consists of a novel integration of PCI's JP-5 fuel reforming technology to convert JP-5 into a hydrogen containing gas, and a solid oxide fuel cell (SOFC) stack with proven performance in UAS applications. Implementation on Group 1-3 UAS will increase range and mission duration and support One Fuel Forward policy. Precision Combustion, Inc. (PCI) develops, manufactures, and markets components and systems for clean and efficient power generation and has extensive experience developing and integrating fuel reformers and SOFC stacks for DoD applications. Our goal is to provide the JP-5 fueling system to power and propulsion contractors for integration and supply to UAS prime contractors.

Technology Category Alignment:

Energy & Power Technologies

Air Platforms

Ground and Sea Platforms

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SYSCOM: NAVAIR

Contract: N68335-20-C-0098

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-20-C-0098

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-869

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Precision Combustion, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-263

Transition Target: Stalker XE UAS which currently uses a propane-fueled solid oxide fuel cell (SOFC) as its power and propulsion module.

TPOC:

Other transition opportunities: Power and propulsion module of additional Group I-III UAS platforms such as ScanEagle and RQ-21A Blackjack.

Other markets of interest are UGV, USV, vehicle APU and tactical generators for military applications where quiet and longer duration operation and efficient propulsion are valued.

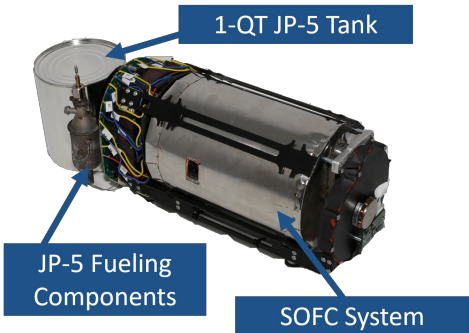


Image Courtesy of Precision Combustion, Inc. & Adaptive Energy, LLC

WHAT

Operational Need and Improvement: An Integrated Fuel cell system (IFCS) consisting of a JP-5 fueled solid oxide fuel cell (SOFC) version of the power and propulsion module would have improved logistics and support the One Fuel Forward policy. Transitioning to JP-5 would also allow for a higher energy density system, thereby increasing mission range. Moreover, due to the compactness of the technology, it can be utilized in current Group 1-3 UAS fuselage designs.

Specifications Required: - SOFC operation with JP-5/JP-8

- JP-5 fueled SOFC system weight essentially same as propane fueled version
- Multi-fuel capability: JP-5, JP-8, diesel, gasoline, kerosene, biojet, and gaseous fuels
- Power output of 500-1000 watts
- JP-5 to Electric Efficiency of 30 (T) - 40(O)%
- Start-up time: 17 minutes
- Powerplant weight 7.5 lbs (versus Objective of 19 lbs)
- Mission Duration of 15+ hours (versus 8 hours with existing propane fueled SOFC) using 1.3 lbs of fuel

Technology Developed: A Reformer converting logistic fuel (i.e., JP-5/JP-8) into fuel for fuel cells integrated with a fuel cell stack and appropriate Balance-of-Plant (BOP) pump/burner etc. for flow and thermal management and integrated with system controls.

Warfighter Value: Implementation on Group 1-3 UAS will increase range and mission duration and support One Fuel Forward policy.

This technology doubles mission length as compared to baseline system

WHEN

Contract Number: N68335-20-C-0098 **Ending on:** October 25, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete validation of individual components performance	Med	Test Report that includes test matrix and results from evaluation	4	July 2020
Complete CHEMCAD model; develop CAD, BOM, P&ID	Med	P&ID, BOM, packaging draft completed	4	July 2020
Complete assembly of IFCS prototype	Med	Generate assembly report; IFCS hardware packaged, ready for test	4	April 2021
Complete IFCS testing in preparation for ground demo	Med	Ground demonstration at NAS Patuxent River	5	October 2021

HOW

Projected Business Model: Our goal is to provide, in serial production, the JP-5 fueling system and license appropriate patents and system designs to the current power and propulsion contractor, Adaptive Energy, LLC for integration with their SOFC stack and supply to the Stalker UAS prime contractor, Lockheed Martin. Building upon this, we would seek to scale and engineer the system for use in the power and propulsion module of additional UAS platforms such as Boeing Insitu's ScanEagle and RQ-21A Blackjack platforms.

Company Objectives: - Commercialize our technology within the Navy specifically:

- * PMA 263
- * PEO U&W
- Expand the technology to Army and Marine Corps applications for the same Navy platforms, and potentially for Air Force, Coast Guard, SOCOM, CIA and Department of Homeland Security and small power generation applications

Potential Commercial Applications: Small power generation applications where the use of liquid fuels, high efficiency, low emissions and low noise are valued. Examples include diesel fueled truck auxiliary power units (APUs), marine APUs and electric vehicle range extenders.