

Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF17-821

Topic # N14A-T004

Active Combustion Control (ACC) of Augmentor Dynamics

Knite Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Joint Strike Fighter (JSF)

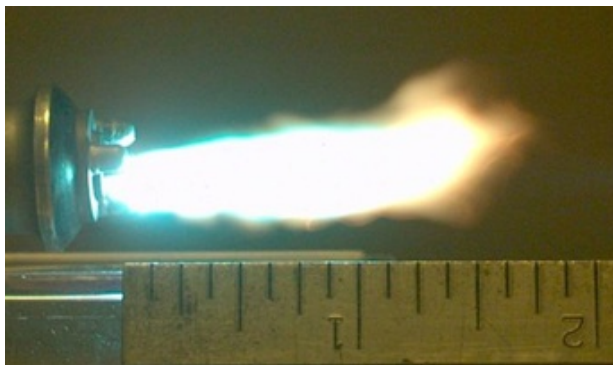
Transition Target: Ignition components for the F-35 Lightning II, F16 Fighting Falcon, F15 Eagle, Rockwell B1 Lancer, Boeing F/A-18E and F/A-18F Super Hornet; and Pratt & Whitney F135, Pratt & Whitney F100 turbofan, Pratt & Whitney F119, General Electric F101, F110, F404 and F412 afterburning turbofan aircraft engines

TPOC:

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Other transition opportunities:

Knite's Kinetic Spark Ignition™ system opens the door to solving engine performance problems that were once considered impractical or impossible with conventional ignition technologies. KSI™ enables engines to run better on a wide variety environments, fuels, and configurations. KSI has application across a broad spectrum of military and commercial aerospace and internal combustion applications.



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WHAT

Operational Need and Improvement: Advancements in active combustion control (ACC) technologies are required to develop an active screech suppression system for thrust augmentors in high-performance gas turbine engines. Combustion instability, or screech, occurs in many combustion systems. Combustion instability is due to the complex physical coupling of the acoustic resonances in the combustion chamber with fluctuations in the heat release of the combustion process. In modern gas turbine afterburners coupling can produce large pressure fluctuations that can be severe enough to damage engine hardware.

Specifications Required: New active control screech suppression technologies that target the physical processes in the afterburner. These new active control technologies should be developed such that they could easily be implemented in current gas turbine augmentors with little weight (less than 30-40 lbs) or cost consequence. These technologies should also address exhaust integration issues for next-generation systems without adversely impacting the proper functioning of the exhaust or the engine as a whole

Technology Developed: Knite Inc.'s Kinetic Spark Ignition (KSI) is a transformational ignition technology for combustion systems including turbine and augmentor applications achieving most of the desired benefits attributed to laser ignition.. KSI's technology is based upon an electromagnetic plasma railgun. KSI maintains much of the simplicity of conventional thermal plasma ignition while removing its limitations, making it an excellent candidate for a drop-in ignition upgrade. Within this program KSI has been successfully applied as a plasma injector for active combustion control.

Warfighter Value: Knite Inc.'s KSI components have the potential to enhance combustor and augmentor ignition performance. Some of the expected benefits would be an expanded main combustor relight capability within the flight envelope, enabling the use of alternate fuels or lean combustion thereby lowering fuel consumption; improved augmentor performance; and targeted lower maintenance costs (reduced igniter wear). KSI's demonstrated ability to actively manipulate and control combustion dynamics allows for a simple and light weight active combustion control system.

WHEN

Contract Number: N68335-16-C-0139 **Ending on:** February 19, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Detailed Characterization of Instability and Suppression	Low	System specification and test criteria established	4	October 2017
Enhance Suppression Design and Implementation	Med	Measurable increase effectiveness base on newly established test criteria	5	February 2018

HOW

Projected Business Model: KSI is design to be manufactured using current DoD approved manufacturing materials and methods. Knite is actively pursuing to become the foundational technology in next generation augmentor, and combustor for Pratt & Whitney's F135 propulsion system and other defense department OEM propulsion suppliers and is looking forward to forming collaborative partnerships with leading ignition component suppliers to test, evaluate, and manufacture KSI ignition systems. Knite's projected business model, provides limited licenses to its patented advanced ignition system to leading original equipment manufacturer (OEM) ignition subsystems and components manufacturers. Royalties from projected sales of the KSI technology will be leveraged to fund advanced research and development of advanced ignition capabilities for automotive, commercial, and aerospace applications.

Company Objectives: Knite Inc. has developed and is commercializing the Kinetic Spark Ignition™ System (KSI™). The KSI system uses a proprietary electronics module and igniter to generate a moving spark that is much shorter and 100 times more powerful than today's conventional spark plug system, without consuming more energy. KSI's powerful spark: improves positive firing, even with very lean mixtures; increases fuel efficiency; significantly reduces air pollution, possibly eliminating the need for catalytic converter; can be easily installed in current OEM engine configurations; and can be leveraged in new and improved engine designs that cannot realize their potential employing conventional ignition technologies.

Potential Commercial Applications: Knite's technology has potential for dual-use applications by suppressing combustion instabilities in both military and civil gas turbine and internal combustion engines.

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