

WHO

**SYSCOM:** NAVAIR  
**Sponsoring Program:** NAVAIR

**Transition Target:** AETC is seeking to transition this technology into primes which use metallized fuels/propellants and establish a domestic supply chain for ablative carbon nozzle inserts.

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**Other Transition Opportunities:** AETC's Ablative nozzle technology is beneficial for metallized fuels/propellants and could be available for use by any manufacturer of rocket or ramjet powered weapons. In addition to the U.S. Navy, AETC's technology would be applicable to a range of rocket and solid-fueled ramjet weapons used by other services.

**Notes:** American Energy Technologies Company (AETC) is a small, woman-owned business located in Wheeling, Illinois. AETC operates a top-of-the-line R&D laboratory & pilot plant, dedicated to support sales of our products in the composite, battery, advanced carbon & graphite and advanced coatings industries. AETC has a manufacturing facility to produce industrial graphite and carbon for advanced energy and mechanical systems, and a pilot plant to produce form-factored parts. They have dedicated mechanical, chemical and electrical engineering departments, an excellent machine shop, in-house fabrication capabilities and a prototyping facility. AETC is a proud member of the domestic supply chain of EV batteries and an approved supplier of advanced materials to at least 10 battery manufacturers, including DOD primes and commercial clients. AETC works with the Government on contract R&D via SBIR, non SBIR initiatives, and via direct sales.



- Engineered Ablative Nozzle Insert:**
- DomesticRaw Material and all US-Production Capability
  - Graphite/Carbon Pitch Composite
  - Lightweight & Low Cost
  - Streamlined Supply Chain Logistics, including greatly reduced lead times
  - Engineered Graphite Grain orientation parallel to the direction of the thrust
  - Pale tint facilitates reduced energy absorption by the vehicle's casing and increased thrust
  - Ideally suited for handling metallized solid fuels
  - Works for liquid fuel vehicles as well
  - Technology is offered by Illinois Woman-Owned Small Business

WHAT

**Operational Need and Improvement:** Ramjet and rocket technology is undergoing innovation, and the industry is transitioning from traditional fuel to advanced metallized fuel which could dramatically improve the range and performance of rocket-powered munitions. AETC has developed an innovative carbon-based ablative rocket nozzle liner that will maximize the combustion performance of a new generation of metallized solid rocket fuels. The new nozzle is intended to improve a utilization of metallized fuels in air-breathing applications enabling a contribution of the after-the-throat energy release to the vehicle's thrust. That additional thrust contribution, which is not available while using traditional nozzle materials, will allow for increased performance and substantially longer range.

**Specifications Required:** The use of more potent, advanced metallized fuel could dramatically improve the range and performance of rocket and ramjet powered munitions. The downside of this fuel is that the substantial energy release occurs within the after-the-throat area leading to an extremely high thermal load to the nozzle. The use of this advanced fuel requires a more robust, higher-temperature material in the ablative nozzle insert that can also properly manage the energy contribution to the thrust. AETC's nozzle insert technology can enable the potential of the new advanced fuel.

**Technology Developed:** AETC's technology provides an alternative to current isostatically molded, ablative nozzle inserts for solid and liquid fuel rockets and munitions. The notable difference is that the new graphite nozzles will have a preferred orientation of graphite granules within the compression molded part to enable anisotropy properties in the direction of the vehicle's thrust. The improved thermal conductivity and increased reflectivity allows for higher temperatures and longer duration burns to be withstood. It has a particular utility in solid fuel ramjets.

**Warfighter Value:** The use of more potent, advanced metallized fuel enabled by AETC's carbon nozzle liners could dramatically improve the range and performance of rocket and ramjet powered munitions. The emerging metallized fuel has the potential of increasing a vehicles' thrust and extending mission duration by as much as 50%. Reduced cost and shorter lead times with increased transparency of the supply chain are added benefits of AETC's technology. Because there are currently no domestic suppliers of a critical component of solid rocket/ramjet powered weapons, there is no effective way for US rocket scientists and designers to transfer new requirements to foreign materials manufacturers. Gaining a domestic supplier would be a major opportunity to harmonize the development of advanced solid-fuel motors and tailor the design properties of the inserts to the properties of the fuel itself.

WHEN

**Contract Number:** N68936-22-C-0039      **Ending on:** Sep 30, 2024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Conduct experimental testwork and create flow sheet for making new nozzle material	Low	Experimental parts meet target density	5	1st QTR FY24
Produce initial prototype parts	Medium	Nozzles meet density and other key physical property requirement	5	3rd QTR FY24
Optimize formulation, produce nozzle blanks for qualification at government services organizations	Medium	Samples submitted for testing and feedback is positive	7	4th QTR FY24
Technology transitions to Tier 1 ramjet integrator	Medium	Pilot batches are produced and submitted to an integrator	8	4th QTR FY25

HOW

**Projected Business Model:** AETC will work with NAWCWD China Lake on quantifying the benefit of rocket nozzles produced through AETC's innovative technology. These benefits are expected to include longer range, reduced cost, and shorter lead times with increased transparency of the supply chain. The second step following testing at China Lake involves a technology scale up and product commercialization. AETC will work with its transition partners including U.S. Government Primes that manufacture rocket, missile and munition technology platforms in the capacity of a critical component vendor. Concurrently, AETC will commercialize products outside of the DOD sector which should enable a steady inflow of revenue to support government orders.

**Company Objectives:** AETC's objective is to further its mission as a domestic manufacturer of industrial graphite, carbon and the value added products which are made from these materials, in commercial and specialty markets. We will secure a successful transition through innovation, a premier level of customer service, reliability and cost leadership with the customer base we intend to serve.

**Potential Commercial Applications:** Potential commercial applications include hobby rocketry, NASA, furnace parts, ablative inserts in specialty applications beyond current DOD applications.

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