Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-697

Topic # N162-088

High Temperature, High Performance Wire Insulation (17-RD-964)

UES, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-299, H-60 Helicopter Program

Transition Target: H-60 Helicopter Program, MV-22

TPOC:
(301)342-2189

Other transition opportunities: About 15% of the DoD operational rotorcraft fleet is based on the H-60 platform. Therefore, potential transition opportunities exist for the UH-60, SH-60, HH-60, MH-60, and VH-60. Also, aircraft and other systems where high temperature (425C) environments are unavoidable.

http://www.navy.mil/management/photodb/webphoto/web_161020-N-WS581-081.JPG

Notes: UES is striving to accelerate development and testing to make this solution available as soon as materials and processes can be down-selected and validated to meet all Key Performance Parameters (KPPs) required for Phase II.

WHAT

Operational Need and Improvement: Unique operating environments and conditions expose Navy systems and their components to extreme temperatures, moisture/humidity, altitude, fluids, vibration, and various other challenges. Unlike a majority of electrical/wiring applications that require harnesses and cables able to withstand temperatures up to 260C, a small number of Navy applications require flexible engine wiring harnesses to operate in continuous, high-temperature conditions exceeding 425C. While many options exist for high-performance wire insulations that can withstand up to 260C temperatures, currently no suitable insulations exist that can withstand continuous temperatures up to 425C while still complying with all the Key Performance Parameters (KPPs).

Specifications Required: Key Performance Parameter (KPP) Testing required: Wiring insulation will need to pass a 50-hour temperature endurance test (at two temperature extremes of -55C and +425C), a 500-hour temperature endurance test (at two temperature extremes of -55C and +425C) and ultimately endure a 5000-hour temperature endurance test meeting all of the KPPs: Mandrel wrap bend test (MIL-DTL-25028J, para 4.6.4.a and para 4.6.5); Wet dielectric (MIL-DTL-25038J, para 4.6.4 and 4.6.6); Insulation resistance; meet minimum requirement of 100 Megohms at 500V DC, per SAE AS4373 Method 504 after high-temperature endurance (MIL-DTL-25038J, para 4.6.6); Needle abrasion of 1500 cycles at ambient temperature per SAE AS4373 Method 301 after high-temperature endurance at 425C (MIL-DTL-25038, para 4.6.4); Insulation outer diameter not to exceed MIL-DTL-25038/1 requirement of 0.125", ±25% (including conductor); Concentricity of wire insulation over the conductor, may be no less than 70% (MIL-DTL-25038J, para 3.4.2.2 and 4.6.2).

Technology Developed: UES Inc. in cooperation with University of Dayton Research Institute (UDRI), has developed insulation approaches to enable a high-temperature wire capability. These include unique overcoating procedures to enable current mil spec wires (M25038/1-20) rated for 260C to perform up to 425C, new wire insulation concepts and a combination of both. Test results from phase I using laboratory prepared wiring insulation met the KPPs after exposure to 425C for 50 hours.

Warfighter Value: Reduce maintenance costs; increased mission readiness; wire fits all current connectors, brackets, etc.; enables wire routing as currently designed; weight neutral

WHEN

Contract Number: N68335-18-C-0188 **Ending on:** March 3, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Finalize Wiring Insuation Design	High	Short sample wiring Passes Wet dielectric test (MIL-DTL-25038J, para 4.6.4 and 4.6.6) as a screening tool for up to 500 hours exposure at 425C	TRL 3	January 2019
Mid-Scale Wire Production, 250 hrs endurance.	Med	Production produces uniform wiring insulation according to specifications. Wire insulation passes all KPPs after 250 hours exposure at 425C and -55C	TRL 4	April 2019
Mid-Scale Wire Production, 500 hrs endurance.	Med	Production produces uniform wiring insulation according to specifications. Wire insulation passes all KPPs after 500 hours exposure at 425C and -55C	TRL 5	August 2019

HOW

Projected Business Model: UES marketing staff is in place to facilitate commercialization by identifying markets, understanding customer needs, etc.. Additional effort beyond Phase II will be required to advance the technology towards transition and application. UES intends to work with ASTRO Industries to convert and transition the reel to reel process understanding to a production environment. The wire insulation produced in this production environment will need to be tested according to the specifications after up to a 5,000 hour exposure at 425C and -55C. The UES Inc. approach to commercialization will be to license the insulation technology to multiple wiring suppliers which service targeted markets, allowing them an exclusive license for a specific market application. We will work with the suppliers to transition the technology to their production facility based on the documented process developed at ASTRO Industries.

Company Objectives: UES is a research and development company, developing advancements across a broad spectrum of specialties, including materials & processes, aerospace power & propulsion technologies, biological & nanoscale technologies, surface engineering, photonics & electronics, modeling & simulation, and integrated health and human performance. The maturity and value of each technology is tracked and periodically evaluated for potential product maturation. UES has successfully leveraged the Small Business Innovation Research (or SBIR) program to develop cutting edge technologies; we are a recent winner of a 2015 R&D 100 Award for a product developed through SBIR efforts. UES continues to invest its own funds to commercialize our products and services using in-house laboratories to mature and advance technologies for internal production or licensing. Our long-term goal is to generate 50% of revenues from commercial ventures.

Potential Commercial Applications: There is a potential need for this type of insulation within the commercial engine applications as well. This capability will allow for the use of high-temperature, flexible harnesses in current and future military and commercial engine applications in addition to foreign platforms such as the Mitsubishi H-60 and Sikorsky H-70.

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