

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2017-706

Topic # N10A-T042

Probability of Detection (PoD) Toolbox for Guided Wave based Structural Health Monitoring (SHM)

Metis Design Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: Heavy Lift Helicopters Program (PMA-261)

Transition Target: CH-53K

TPOC:

(301)342-9428

Other transition opportunities: Rotorcraft & Fixed-wing airframe fatigue, corrosion, and impact detection; Aircraft & shipboard cargo deck monitoring; several commercial aircraft opportunities through United Technologies Corporation (UTC) technology license agreement.

Notes: Metis Design Corporation (MDC or Metis) has partnered with UTC Aerospace Systems (UTAS) for vehicle applications of Structural Health Monitoring. Metis and UTAS team members are active in leading efforts to earn military and commercial regulatory acceptance and validation.



http://www.navair.navy.mil/img/uploads/610_31701.jpg

WHAT

Operational Need and Improvement: There has been a twenty-year effort to improve vehicle health monitoring and assessments across commercial and military assets through condition based maintenance (CBM or CBM+). This technology has progressed, leaving a gap in structural (airframe) monitoring and operations. As emerging technologies improved feasibility of a robust and reliable design and many new metallic and composites were introduced, advancements in SHM capability and procedures have become a priority for many military and commercial air-framers. The implementation of a robust, reliable, and automated monitoring technology will lower maintenance costs and extend aircraft maintenance intervals and life expectancy.

Specifications Required: There are three high level system requirements: (1) The system must survive a high-altitude rotorcraft operational environment. (2) The system shall detect specified structural changes, of which could include corrosion, micro-cracks and fatigue precursors, and physical impacts. (3) Low system mass and integration difficulty.

Technology Developed: Metis has developed a SHM technique that utilizes a network of digital sensors to monitor physical changes in critical structural components. The patented technique utilizes passive and active ultrasonic monitoring techniques to detect fatigue crack initiation and growth, corrosion, and/or impact events. The MD7-Pro SHM system utilizes piezoelectric elements for transmitting and receiving ultrasonic waves across a material, and a microprocessor that controls the scanning routines and manages the collected data. A central data accumulator controls the synchronization and structural health assessment by collecting these datum and comparing the structural characterization from each scan routine to the baseline of the "healthy" structure.

Warfighter Value: The implementation of a robust, reliable, and automated monitoring technology will improve safety, lower maintenance costs, and extend aircraft maintenance intervals and life expectancy. The MD7-Pro SHM technology is more mature, lighter weight, more easily integrated, and can monitor for more damage conditions than any competing SHM technology.

WHEN

Contract Number: N68335-17-C-0184 **Ending on:** August 10, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
3D APL Prediction for Single Sensor in metallic structures	Low	Probability of Detection (POD) compare to Navy test case	5-6	July 2017
3D APL Prediction for Multiple Sensors	Low	PoD compare to Navy test case	5-6	December 2017
3D APL Prediction for Multiple Structural Layers	Med	PoD compare to Navy test case	5-6	June 2018
Final Reporting & Documentation	Low	Technology progression, quality of work, and value to future programs	5-6	August 2018

HOW

Projected Business Model: Metis is soliciting retrofit and production programs that aim to lower maintenance costs, and increase safety and fleet readiness. Defense customers with HUMS-equipped aircraft are prime targets, as there are existing CBM operations and ease of SHM integration; however, the MD7 system can be installed as a stand-alone system as well. The UTAS partnership will provide certification and manufacturing support, as well as a distribution outlet for all vehicle applications.

Company Objectives: Metis is a technology development company with primary locations in Boston, MA and San Francisco, CA. Metis has been successful in development, maturation, and securing commercial licensing agreements for our patented SHM and Anti-Ice technologies. Metis' size and agility have been critical attributes in our ability to convert funding opportunities to technology while compelling thought leaders across industries to become supporters and early adopters. Primary goals for 2017 are to identify and secure funded development programs for Metis Power Generation technology, and advanced demonstrations of Metis SHM and Anti-icing technologies on additional platforms.

Potential Commercial Applications: Metis and UTC Aerospace Systems have engaged with a number of commercial aircraft manufacturers and fleet owners to understand entry requirements and feasible implementation plans for commercial fixed wing and rotorcraft programs. The demand for this technology on commercial aircraft relies heavily on regulatory acceptance.

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