

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2021-861

Topic # N12A-T007

Ultrasonic Measurement Tools and Models for Gearbox Components - Converted to an SBIR - PII Discretionary for Base Effort

Metis Design Corporation

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-299

Transition Target: H-60 Seahawk

TPOC:
(301)995-4147

Other transition opportunities: CH-53E, CH-53K, H-1, V-22

Notes: Sensors primary use is for preload verification of the inboard retention plate of the TGB after a maintenance event to eliminate manual torque verification checks that require disassembly of the rotor head. Sensor will assess structural integrity of the spline in combination with preload verification. The novel hardware & sensor integrates within the tail gearbox such that it can be ultrasonically inspected without disassembly. The embedded piezoelectric array maps changes to torque down to individual bolts and integrity down to the location on the spline tooth.

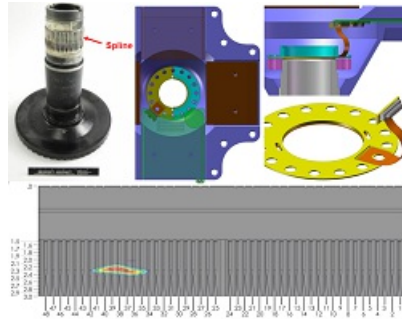


Image courtesy of Metis Design Corporation

WHAT

Operational Need and Improvement: The Navy has a need for fully-integrated and automated approaches to accurate non-destructive assessment of structural health for rotorcraft gearboxes. Current inspection practices can require significant down-time, breaking of factory seals, specialized equipment and trained personnel to evaluate structural integrity, and is prone to operator error. Structural health monitoring (SHM) sensors and hardware are permanently integrated into an asset to provide real-time detection capabilities without disassembly.

Specifications Required: SHM systems need to maintain as good or better damage detection capabilities as current baseline practices, described by probability of detection (POD). Further, as SHM systems are permanently integrated, they must endure the environmental and loading requirements of the target platform.

Technology Developed: Piezoelectric (PZT) beamforming sensors are incorporated into the gearbox assembly, fully-integrated with all necessary hardware to facilitate testing. Power and data are transferred wirelessly through the tail rotor, eliminating the need for connectors or complex wiring. The system can resolve crack initiation to individual spline elements and indicate bolt-torque while the vehicle is at rest on the ground.

Warfighter Value: Structural health monitoring (SHM) provides reliable mapping of damage within structural components without manual tear-down inspection. This approach increases asset readiness and reliability, while reducing costs associated with preventative maintenance and inspection.

WHEN

Contract Number: N68335-20-C-0858 **Ending on:** January 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Bolt-Torque Prediction Characterization	Med	Demonstrate ability to reliably measure torque +/-5%	5	August 2021
Fatigue Crack Prediction Characterization	Med	Demonstrate ability to reliably detect 0.050" crack	5	September 2021
Full-scale Hardware Production	Med	Fabrication of proposed production hardware	5	December 2021
CIVA Model Validation	Med	Good comparison of model data to demonstrated results	5	December 2021

HOW

Projected Business Model: Presently Metis Design Corporation (MDC) sells hardware components directly through a low rate initial production (LRIP) partner. Once demand suffices, the system design and intellectual property (IP) would be licensed to an appropriate Tier II integrator to provide the hardware, installation and support. Funds would be derived through royalties, system customization and future upgrades.

Company Objectives: The company is looking for lead customers willing to facilitate advanced development testing through higher TRL, Tier I OEM customers as well as Tier II licensing partners.

Potential Commercial Applications: The demonstrated technology is suited towards fault detection for any rotating equipment. The SBIR focused on the tail gear box for MH-60 R/S Seahawk, but the system would provide benefits for any type of gearbox for any rotorcraft.

Contact: Seth S. Kessler, Ph.D., President/CEO
skessler@metisdesign.com 6176615616