

Department of the Navy SBIR/STTR Transition Program

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Topic # N193-A01

(3) Condition-Based Predictive Maintenance for Mission Critical Systems with Probabilistic Knowledge Graph and Deep Learning
Intelligent Fusion Technology, Inc

WHO

SYSCOM: NAVAIR

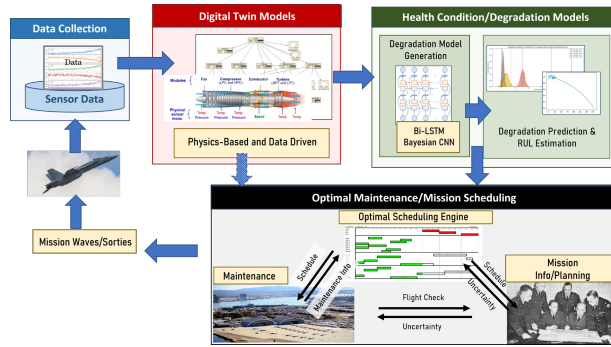
Sponsoring Program: Air Systems Group, Propulsion and Power

Transition Target: PMA-265

TPOC:

(301)757-2504

Other transition opportunities: Navy programs such as the NAVAIR Air Warfare Center Aircraft Division (NAWCAD) and Naval Surface Warfare Center, Carderock Division-Ship Systems Engineering Station (NSWCCD-SSES). Within the Machinery Control Systems (MCS) & Networks Department in NSWCCD, IFT directly supports the division's objective in their focus areas of MCS, CBM, shipboard instrumentation, sensors, and navigation systems. The second customer segment to pivot would be the Information Operations Science & Technology Battlespace Awareness and Information Operations (PMW-120) NAVWAR. I-SEER can perform CBPM on any equipment upkeep, e.g. aircraft, vehicles, trains, or construction-based infrastructure, with the condition it has physical sensors and contextual information. Due to the flexible web-based or application service architecture, I-SEER can be deployed anywhere aircraft maintenance is performed such as the Naval Depot-Level, Field-Level, or vendor customer providers, e.g., Lockheed Martin's Sikorsky 360.



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WHAT

Operational Need and Improvement: Modern US Navy surface and aviation systems are designed with an ever-increasing level of automation and advanced machinery that include state-of-the-art sensors that monitor vital aircraft, ship, and auxiliary system functions. The Navy seeks new tools and technologies to augment current onboard condition monitoring and maintenance processes and to improve mission-critical system availability, increase operational readiness, and reduce life cycle costs. These tools must communicate status to the monitoring system, provide options for solutions to machinery alignment, repair, and maintenance, and present the appropriate alarms and information in a manner complementary to the machine intelligence that does not overload the human operator

Specifications Required: Remaining Useful Life (RUL) prediction performance, aircraft availability, and maintenance costs.

Technology Developed: IFT's-Service Enhanced Recommender (I-SEER) is a data analysis and maintenance scheduling web application, that employs deep learning techniques for advanced analytics of onboard sensory data to draw meaningful insights to predict machine states and proactively schedule maintenance by dynamic optimization approach to minimize costs and unplanned downtime.

Warfighter Value: The proposed technology features in the aircraft components health status modeling, degradation modeling, and RUL prediction, which benefits the condition based predictive maintenance and further reduce the costs of routine maintenance and unit failure. Further, the proposed technology performs optimal maintenance and mission scheduling, which minimizes the maintenance costs and improves the efficiency of the repair personnel and aircraft fleet readiness.

WHEN

Contract Number: N68335-20-F-0562 **Ending on:** November 1, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Concept Design	N/A	Design Documentation	TRL 2	April 2020
Develop and evaluate full-scope prototype in simulated environment	Low	Performance evaluation of real time I-SEER prediction and Optimization	TRL 5	November 2021
Field test prototype on Navy platform in an operational scenario	Med	Performance requirements met in an operational scenario	TRL 6	August 2022
Transition technology into PMA-256 program and/or integrate with commercial platform	Med	Operational requirements met in a developmental test platform or equivalent real world system	TRL 7	April 2023

HOW

Projected Business Model: Intelligent Fusion Technology has over 10 years of steady growth providing innovative, cost-effective solutions through R&D. Over 50 IFT projects have produced a wealth of advanced-technology prototype software that can facilitate the rapid integration of critical technology into operational systems. IFT will license the I-SEER technology to large system integrators and integrate it into Navy platforms, such as PMA-265 and PMW-120. Once integrated, IFT will provide users with full documentation on how to use the features of I-SEER.

Company Objectives: Condition-based predictive maintenance, digital twin, and AI/machine learning are core business areas for IFT, making the success of this effort fall squarely within our corporate interests and competencies. IFT expertise will ensure the success of the innovations developed under the I-SEER program beyond the SBIR contract. In particular, IFT plans to pursue a multi-part plan to transition this technology to the U.S. Navy and other U.S. Government customers, as well as provide benefits to commercial markets and customers seeking to improve the operational readiness of equipment maintenance systems and increase up-time during critical operating conditions.

Potential Commercial Applications: We expect the full-scope I-SEER to have immediate and tangible benefits for a number of commercial systems that require regular maintenance and repair, such as the automotive, transportation, and biomedical sectors. We will develop a broad commercial product for diagnostics and prognostics of industrial machinery systems.

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