Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-3252-17

Topic # N121-099
Detecting Crack Nucleation/Damage Mechanisms In Sea-Based Aviation Environments
Technical Data Analysis, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: NAVAIR 4.3 Structures; PEO(A), (T) and (U&W); NAVSEA PEO(Ships)

Transition Target: P-8/P-3 (PMA-190), F/A-18 (PMA-265), H-60 (PMA-299), JSF

TPOC:
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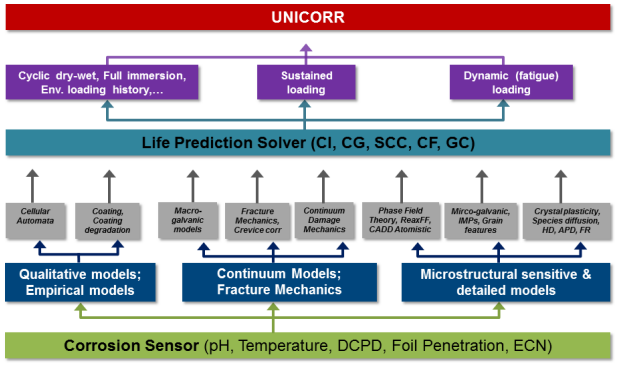
Other transition opportunities: Commercial aircraft market for the efficient design of airframe structures resulting in components life extension. Non-aerospace industry because corrosion degradation is a universal problem.



Notes: Provide predictive capabilities for environmentally assisted (EA) crack initiation in Navy specific material-environment and loading conditions by incorporating laboratory tests and service data via:
+ Development of the corrosion modeling and analysis tool - novel multi-scale methods to analyze corrosion fatigue and SCC
+ Development of corrosion sensor - engineer a miniature EA damage activity measurement instrument and manufacture a prototype sensor
+ Integration of sensor and software - sensor informed models

WHAT

Operational Need and Improvement: Corrosion is a persistent damaging phenomenon particularly for sea-based aviation, leading to localized attacks and sub-critical flaw progression, whose maintenance implications lead to high costs, reduced readiness and threatens flight safety. Most current methodologies used for lifing schemes are based on 'global' corrosion and corrosion fatigue behaviors and they fail to capture the 'local' variability of environmental conditions and concurrent mechanical loading variations, as well as material surface conditions, and material interactions.

Specifications Required: No specifications were required. Size, weight and Electromagnetic interference (EMI) will be reduced as much as possible to fit aircraft applications.

Technology Developed: A framework that uses both sensor data and advanced modeling for predicting corrosion damage initiation at a local level is therefore very much needed given the stochastic nature and uncertainty of various parameters affecting damage initiation under the influence of mechanical loads. The UniCorr framework being developed by TDA addresses this need by utilizing both sensor and advanced modeling for prognostics of structural corrosion damage initiation and growth.

Warfighter Value: The proposed sensor and framework are useful for all Navy aircraft platforms, fixed and rotary wing aircraft. All PMA's concerned with fixed and rotary wing aircraft will benefit from the proposed sensors and life prediction framework. The sensor and the associated software will be invaluable to maintainers and decision makers for determining component repairing and replacement actions, and for prognosticating platform availability, future readiness, and maintenance costs.

WHEN

Contract Number: N68335-16-C-0135 **Ending on:** March 7, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Critical tests for proof of concept	High	The technology detects Stress Corrosion Cracking in lab test for the material of interest	3	September 2014
Develop models to quantify corrosion degradation for galvanic, pitting and atmospheric corrosion	Med	The developed models accurately predicts corrosion phenomena when compared to literature data	4	December 2017
Complete sensing element industrial design	Med	The sensing element withstands the corrosive environment for the duration of the accelerated tests, and provides stable readings with minimal noise	5	January 2018

HOW

Projected Business Model: The global corrosion monitoring market is projected to see high growth because of increased awareness about corrosion, especially at times of limited budgets and fewer funds for new acquisitions. End users are investing in corrosion monitoring solutions, not only to protect against corrosion, but also to reduce operational expenditure. Within the corrosion monitoring market itself, non-intrusive corrosion monitoring will overtake intrusive corrosion monitoring by 2025. In light of this market situation, our product entry to the corrosion monitoring market is just at the right time. Our product will be focused on the sensor informed corrosion model as this is a potential high revenue generator since we can provide installation support, data analysis support and also risk and integrity analysis as part of a complete package. When TRL is close to 5, we will carry out the cost/benefit analysis and market research to position ourselves strongly in the growing corrosion monitoring market.

Company Objectives: Our company objective related to this project activity is to assess durability and structural integrity of components subjected to mechanical and environmental loading conditions. We strive to replace the widely used but largely semi-empirical / ad-hoc methods by sound physics based approaches to solve many service issues arising from mechanical and loading environment. We take the research in academia and give it a shape by developing quick, easy to use, insightful tools for practical applications to resolve many field problems. In alignment with this objective, our sensor informed corrosion modeling tool is built on sound physics based principles and thus the damage assessment and remaining life predictions will be more reliable than traditional methods.

Potential Commercial Applications: The product will be valuable to customers within the Aerospace & Defense industry. Additionally, TDA envisions that land based vehicle, ship, heavy machinery and oil and gas industries will also benefit from a similar device.

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