

Topic: N131-013

Spectral Sciences, Inc.

A Lightweight Optical Approach to Detect Incipient Heat Damage

This nationally known resource with expertise in spectroscopy and hypertemporal imaging is developing a new vibration-sensing imager that displays the location and extent of heat damaged composite aircraft skin. Using commercially available hardware and custom software, the FINDIT instrument images vibration patterns and infers spatial variation in the material state and airframe structure. Utilizing advanced physics-based algorithms and having a simple set-up, FINDIT can survey a square meter of material in minutes identifying any anomalies allowing for further localized nondestructive inspection of composite material. Early testing on spot damaged carbon composite panels has shown contrast in portions of the vibration spectrum. The initial target for this technology is the F-35 Lightning II program and integrating the technology into Navy Fleet Readiness Centers along with prime contractor aircraft inspection workflow.

Technology Category Alignment:

None

None

None

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SYSCOM: NAVAIR

Contract: N68335-15-C-0016

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-15-C-0016

Department of the Navy SBIR/STTR Transition Program

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WHO

SYSCOM: NAVAIR

Sponsoring Program: PEO JSF

Transition Target: F35

TPOC:

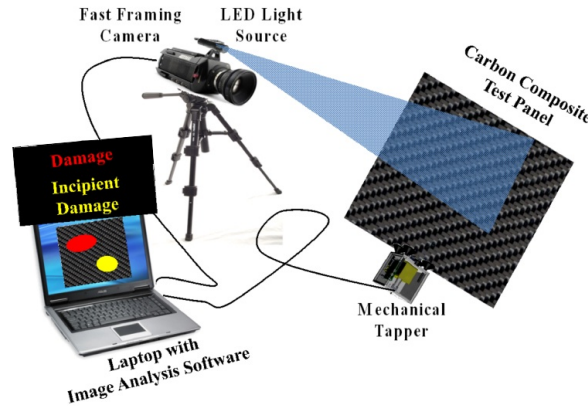
(301)342-8084

Other transition opportunities:

F/A-18, Triton, Osprey

Notes: Mechanical stimulation of the article under test induces vibrations. Ambient and projected light are acquired by a camera and processed using custom software to produce vibration maps that are then correlated to damage centers.

Concept drawing shows representative components of the FINDIT system.



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WHAT

Operational Need and Improvement: The Navy seeks a novel inspection technology that can demonstrate correlation between non-visible heat damage, material property degradation and airframe structural response. The long-term goal includes the ability to provide on-aircraft evaluation. The target technology should be easily calibrated and robust enough for Fleet Readiness Centers or shipboard systems.

Specifications Required: NAVAIR needs to assess the integrity of airframe structure to ensure safety-of-flight and performance over the life of the aircraft. The increased use of advanced composites in the design of naval aircraft such as F-35 or F-18 which operate under extreme environments has increased the demand to be able to inspect for potential overheating of those materials and components. The need to detect and evaluate incipient composite heat damage and to understand its effect on airframe structure is critical to both weapon system sustainment costs and mission safety.

Technology Developed: Spectral Sciences, Inc. (SSI) uses cameras and spatio-temporally structured lighting to infer the state and structure of materials by imaging how they vibrate. Mechanical structure and material state affect how sound travels in materials. When one looks for studs in a wall by tapping, it is the vibration and damping that signal the stud location. Similarly, material defects scatter sound and vibration differently than the surrounding good material. SSI applies specialized computer video processing originally developed to see dim signals in remote sensing applications with portable hardware to see the vibration and show the defects. These new techniques are important for composite airframes because tests developed for metal airframes do not give an accurate picture for composites. By using a remote-imaging approach SSI's technology simplifies set-up time and reduces costs.

Warfighter Value: Fast, portable, convenient survey assessment of aircraft components will allow for more frequent, lower cost inspections. This in turn will bolster confidence in condition-based maintenance, and reduce costs associated with part replacement or repair where the damaged state cannot be adequately assessed.

WHEN

Contract Number: N68335-15-C-0016 **Ending on:** November 9, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Visualization of vibration on flat surfaces	N/A	Vibration pattern imaged.	2	October 2014
Visualization of simulated defects	N/A	Simulated defect imaged, located.	2	July 2015
Assessments on damaged and undamaged aerospace grade material	Low	Successfully applied on realistic materials.	3	December 2015
Assessments on damaged and undamaged aircraft parts	Med	Defects detected on aircraft components (curved and structured).	4	March 2016
Field test	Med	Demonstrate performance at customer facility.	5	August 2016

HOW

Projected Business Model: The product will be licensed to another company, such as a nondestructive testing equipment vendor, for marketing and sales, and may possibly be licensed to a third party for manufacturing. The product consists mainly of commercial off the shelf (COTS) parts integrated and packaged in an enclosure with power systems and customized software. We intend to have a design-for-manufacturability phase followed by manufacture by licensees. Initial technical support will be provided directly by Spectral Sciences so that product deficiencies can be addressed in a tight feedback loop, but would be assumed by the seller when the product reaches a certain level of field maturity. Licensed sales, advanced technical support, and application-specific development are all potential revenue sources.

Company Objectives: Spectral Sciences is a nationally known resource for its expertise in a variety of fields related to spectroscopy, remote sensing and imaging, combustion and propulsion technology and radiative transfer processes. Our scientists and engineers consult with clients from government, prime contractors and industry leaders to address their technology needs and help them develop innovative solutions. Projects are guided from concept through various stages of development resulting in a sound prototype. By licensing our developed technology at a prototype stage, Spectral Sciences can maintain its R&D focus while engaging companies with commercial expertise to produce, market and sell the resulting products.

Potential Commercial Applications: The FINDIT product may apply to several composite material systems, including those used in UAVs and other military aircraft. Our partner Aurora Aerospace has interest in the product for manufacturing purposes. Tentative interest in this and related applications of this technology has also been expressed by Northrup Grumman, Bell Helicopter, and Lockheed Martin.

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