

Topic: N13A-T011

Spectral Sciences, Inc.

A Rapid Optical Approach to Quantitative Composite Bond Quality Assessment

Currently, detecting "kissing bond" failures, especially where primary airframe structures are joined, is elusive and unreliable. Spectral Sciences, nationally known for its expertise in spectroscopy, hyper-temporal imaging, remote sensing and imaging, is developing new non-destructive testing techniques that visualize and measure small vibrations in composite materials. Spectral's imager identifies defects in materials by mapping their vibration. These vibrations show where things are similar and where they are different (defects). These new techniques are important for composite airframes because tests developed for metal airframes cannot identify potential joint failures. The initial target for this technology is the Joint Strike Fighter program and ultimately integrating this nondestructive examination technology into Navy Fleet Readiness Centers.

### Technology Category Alignment:

Engineered Resilient Systems (ERS)

Maintainability/Sustainability

Propulsion and Extreme Environments

Electro-Optical/Infrared (EO/IR)

Modeling, Simulation & Test Infrastructure

### Contact:

Dr. Bridget Tannian

[btannian@spectral.com](mailto:btannian@spectral.com)

(781) 273-4770

<http://www.spectral.com/index.shtml>

**SYSCOM:** ONR

**Contract:** N00014-15-C-0082

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=N00014-15-C-0082](https://navystp.com/vtm/open_file?type=brochure&id=N00014-15-C-0082)

# Department of the Navy SBIR/STTR Transition Program

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ONR Approval # 43-2262-16

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A Rapid Optical Approach to Quantitative Composite Bond Quality Assessment  
Spectral Sciences, Inc.

## WHO

**SYSCOM:** ONR

**Sponsoring Program:** Code 35

**Transition Target:** V-22

**TPOC:**

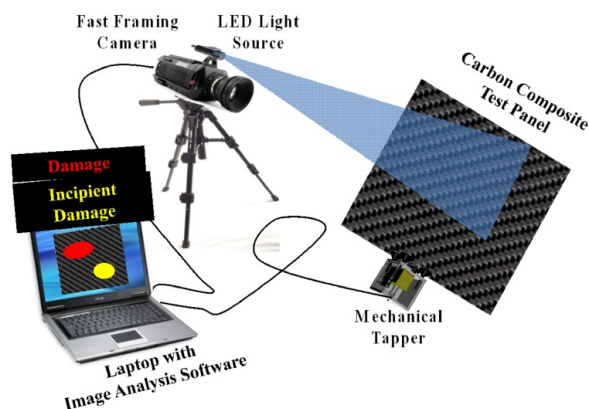
Mr. Bill Nickerson Junior  
[william.nickerson@navy.mil](mailto:william.nickerson@navy.mil)

**Other transition opportunities:**

F/A-18, F-35, Triton,  
UAS Prime contractors

**Notes:** Mechanical stimulation of the article under test induces vibrations. Ambient and reflected 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:** US Navy seeks to identify and demonstrate new methods for nondestructive evaluation of adhesive bond quality.

Specific interest are "kissing bonds" as initially fabricated (quality control check) and as a function of service (FLY/NO FLY) decisions.

**Specifications Required:** Novel approaches based on bulk or guided wave techniques which:

- provide semi-quantitative evaluation of bond shear strength
- detect defects ranging from fully to partially adhered bond line flaws
- measure the bond strength of joints of dissimilar materials (composites to aluminum or titanium)
- discern bond strengths in layered assemblies
- equipment must work in manufacturing environment and be field deployable

**Technology Developed:** By applying specialized computer video processing and using cameras along with spatio-temporally structured lighting SSI images how the materials vibrate. We are able to see the effects of how bad material defects scatter sound and vibration differently from surrounding good material

These new techniques are important because tests developed for metal airframes do not give an accurate picture for bonds utilized on composite aircraft.

**Warfighter Value:**

Manufacturers will have a definitized assessment of composite bond quality during manufacturing process

Operators will have definitized test of bond strength through nondestructive testing allowing for faster "FLY/NO FLY" decisions in a fast tempo operational environment.

## WHEN

**Contract Number:** N00014-15-C-0082 **Ending on:** March 17, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Visualization of vibration on aerospace grade material	N/A	Vibration pattern imaged	2	August 2016
Reliable laboratory detection of simulated defects	Low	Simulated defect located	3	January 2017
Calibration of detection thresholds	Low	Prediction of detection on a range of defects	4	October 2017
Assessments on damaged and undamaged aircraft parts	Med	Defects detected on aircraft components	4	July 2018
Field test	Med	Demonstrate performance at customer facility	5	February 2019

## HOW

**Projected Business Model:**

License our technology to a prime manufacturer

License our technology to a non-destructive testing company

Provide sales, advanced technical support, and application-specific development to increase sales

**Company Objectives:**

Maintain our R&D focus and license our research results to prime contractors

Assist prime contractors develop their innovative needs

**Potential Commercial Applications:**

Prime manufacturers that want to develop "non-destructive testing" as a quality control check on their "bond joints".

- Develop a quality of bond measurement capability to provide a "FLY/NO FLY" decision tool.
- Improve relationship with UAV prime manufacturers such as:

- \* Northrop Grumman
- \* Bell Helicopter
- \* Lockheed Martin

**Contact:** Dr. Bridget Tannian, Principal Scientist  
[btannian@spectral.com](mailto:btannian@spectral.com) 781.273.4770