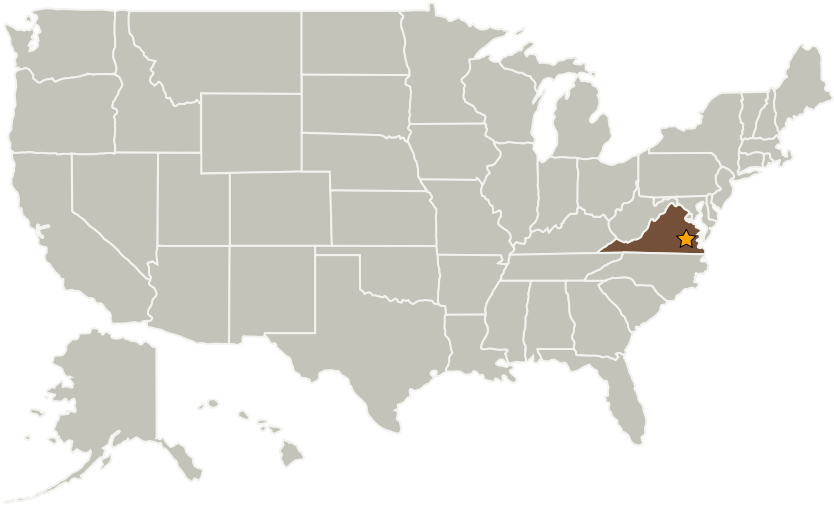
All-Fiber-Optic Ultrasonic Health Management System, Phase I

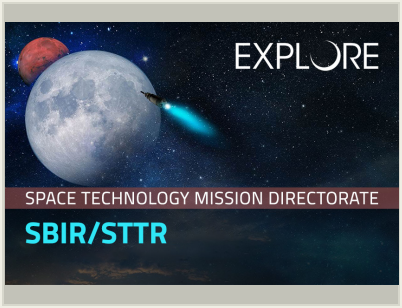
Completed Technology Project (2009 - 2009)

Project Introduction

Health management of composite airframe components is essential for safety and reliability of future aircrafts. It reduces the risk of catastrophic failures and reduces operating costs. Luna Innovations proposes to develop a revolutionary airframe health management system on the basis of an all-fiber optic ultrasonic structural health monitoring system (SHM) and accurate prognostics algorithms. The key component of SHM system is a highly multiplexible transducer generating ultrasonic waves in the predefined locations of the optical fiber. Using such a technique, 10s of transducers and 1000s of sensors can be placed on the optical fiber embedded or surface-mounted to the airframe component thereby providing unmatched multiplexing capability. Origination and propagation of defects will be retrieved with high spatial resolution thus providing a basis for an accurate estimation of a component's Remaining Useful Life. During the Phase I, efforts will focus on demonstrating feasibility of an efficient ultrasound generation with the proposed fiber optic transducer and selecting appropriate prognostics algorithms. In Phase II, sensors, transducers will continue to be refined and will undergo extensive testing and validation. By the end of Phase II, the proposed health management system will reach TRL 5. In Phase III, Luna will commercialize the developed system.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Luna Innovations, Inc.	Supporting Organization	Industry	Roanoke, Virginia

Primary U.S. Work Locations
Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.2 Structures
    └ TX12.2.3 Reliability and Sustainment