Department of the Navy SBIR/STTR Transition Program

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Multi-Input Strength Loss Sensors for Webbing Structures

Luna Innovations Incorporated

WHO

SYSCOM: NAVAIR

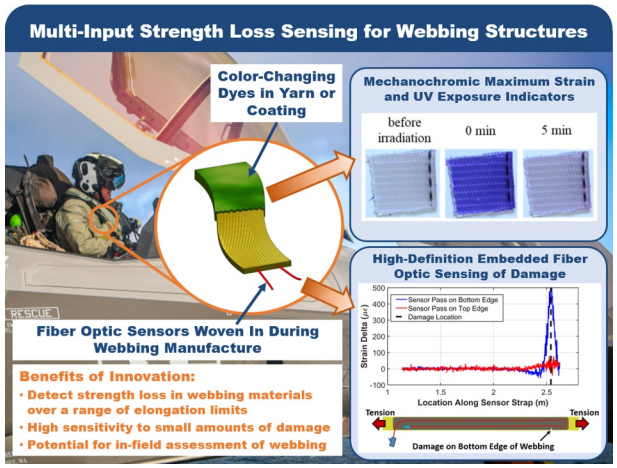
Sponsoring Program: PMA-202, PEO-JSF

Transition Target: F-35, F-18, V-22

TPOC:
(760)382-7321

Other transition opportunities: Torso harness, fall restraints, tethers, parachutes, seat belts, USAF, US Army, US Forest Service

Notes: The accompanying image depicts the smart webbing concept for an ejector seat application. Color-changing dyes and embedded fiber optic sensors are combined to provide a wholistic assessment of webbing strength and health. The end goal is to detect percentage loss of strength in webbing structures.



WHAT

Operational Need and Improvement: A non-destructive assessment of webbing strength is not currently available. Webbing is used in military applications to provide safety and load bearing capability with flexible materials. These structures must be periodically replaced due to degradation from wear, UV exposure, temperature, and harsh environments. This is currently performed without feedback data on remaining strength or health of the webbing. Adding a health monitoring capability to webbing structures that can be assessed in the field will increase safety, optimize maintenance, and increase long-term cost effectiveness.

Specifications Required: Detect strength loss of 25% or less
Assess strength loss due to high heat/humidity, UV exposure, chemical exposure, abrasion/wear
Survive harsh environment, flight qualification testing including 810G
Sensing capability must minimize size, weight, power, and not impact pilot operations

Technology Developed: Luna's combination of embedded fiber optic sensors and color-changing dyes will address this technology gap. This low-weight, low-profile sensor integration will add valuable functionality to military webbing structures to enable condition-based assessment of remaining strength. The technology can be used for pilot torso harnesses, tethers, seat belts, and cargo restraints. Coupon tests have successfully demonstrated the fiber optic and sensing dye approaches, which are being refined in Phase II for field deployment.

Warfighter Value: Increase safety, aircraft uptime, mission readiness, and reduce maintenance costs. U.S. Navy fixed wing and rotary wing aircraft subsystems will directly benefit from this innovation. Seat belts, restraint harnesses, fall arrest tethers, and parachute webbings will now have the capability to detect unsafe strength degradation with a technique that can be performed in the field or during depot maintenance.

WHEN

Contract Number: N68936-21-C-0021 **Ending on:** February 1, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Project Kickoff	N/A	Requirements established	4	February 2021
Design and Manufacturing Improvements Complete	Low	Rugged webbing and sensor integration verified	4	February 2022
Prototypes Fabricated for Field Testing	Med	Operational sensors in wearable webbing assemblies, pass 810G tests	5	August 2022
Field Testing	High	Sensors survive harsh environment and verify sensing performance	6	February 2023
Navy Test and Evaluation	Med	Navy performance requirements met	7	February 2024

HOW

Projected Business Model: Luna will partner with OEM manufacturers and prime contractors to bring smart webbing products to market. The patent-pending technology can be licensed or manufactured in-house for new product lines that would be disruptive in the market.

Company Objectives: To enhance the safety, security and connectivity of people by leveraging our expertise in fiber optic-based technology and the information it provides.

Potential Commercial Applications: The ability to detect the silent and invisible degradation of webbing will be a game changing technology that will address military and commercial markets. Beyond military applications, the technology could be adapted to the automotive and heavy equipment industries. Low-cost, low-weight sensors that can be incorporated during manufacturing and then interrogated throughout the webbing's lifetime to monitor structural health is a compelling value proposition with minimal risk associated.

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