

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-3252-17

Topic # N14A-T014

Durable Sol-Gel Surface Treatment to Control Cathodic Current Density

Luna Innovations Incorporated

WHO

SYSCOM: ONR

Sponsoring Program:

Transition Target: Aviation, ships, ground vehicles, and support hardware across the DoD where galvanic corrosion is a problem, especially in marine environments.

TPOC:

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Other transition opportunities:

The sol-gel treatment technology is suitable for protection against galvanic corrosion by reducing the current available from cathodic components (e.g. fasteners). Applications range from rotorcraft, aircraft, ships, ground vehicles and numerous auxiliary support equipment. Fastener and specialty coating suppliers are ideal transition partners for this technology for integration across wide-ranging DoD (and private) platforms.

Notes: The treatment can be applied direct to metal or over sacrificial plating like Cadmium or Zinc-Nickel to boost galvanic protection. The image shows the enhanced corrosion protection afforded by the use of the sol-gel treatment on fasteners.



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WHAT

Operational Need and Improvement: Galvanic corrosion on aircraft around mechanical fasteners represent a significant portion of total platform maintenance costs and contributes towards reduced operational readiness. Historical approaches to controlling galvanic corrosion involve protecting the anode (e.g. usually the aluminum airframe), but minimal efforts have been made at limiting the galvanic contribution at the cathode. There is a need to improve the galvanic corrosion control tool set across these platforms, and technologies that aid in controlling the available cathodic current density are a new approach.

Specifications Required: Suppress cathodic current density compared to untreated bare components without affecting the mechanical properties of the fastener materials.

Technology Developed: Luna has developed an advanced sol-gel based surface treatment that mitigates galvanic corrosion by providing excellent physical and electrical barrier protection to corrosive environments. Our application is designed for drop-in fastener batch processing for easy integration with common aircraft construction or repairs. This sol-gel treatment is inherently chrome-free and non-hazardous associated with a water/alcohol based chemistry that results in a highly cross-linked inorganic/polymer hybrid film with excellent impact resistance, flexibility, and toughness.

Warfighter Value: The U.S. Navy relies on critical weapon system readiness to fulfill mission objectives. A significant portion of the Navy's annual budget therefore goes toward solving corrosion-related problems. While the addition of the sol-gel treatment technology may increase initial costs of fasteners, the long term corrosion and maintenance costs will go down. Corrosion tests have indicated a reduction in observed galvanic corrosion by 2-3 times less compared to that of bare fasteners. This reduction in corrosion will directly translate to cost savings through decreased maintenance of aircraft components and improved operational readiness.

WHEN

Contract Number: N68335-16-C-0121 **Ending on:** June 19, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate corrosion protection capability in accelerated testing and outdoor exposure	Med	Improved corrosion resistance compared to common fastener corrosion control methods and tests	6	June 2018
Quantify torque/tension behavior and mechanical properties of treated fasteners	Med	Frictional and mechanical characteristics confirmed to be comparable to COTS aircraft fastener coatings	6	June 2018
Demonstrate batch fastener application in simulated production environment	Med	Successful application of treatment to 500+ fasteners with suitable thickness and coverage	6	June 2018
Platform dem/val testing	Med	Improved corrosion resistance around treated fasteners (relative to incumbents)	7	November 2019

HOW

Projected Business Model: Luna intends to license the technology to a specialty coating manufacturer or fastener supplier for distribution to DoD platform integrators. Luna will provide technical assistance and production scale-up support.

Company Objectives: We seek partnerships with DoD Prime integrators, specialty coating manufacturers, and fastener suppliers for dem/val assessment of the sol-gel technology as applied to fasteners for application to aircraft, ships, and/or ground vehicles.

Potential Commercial Applications: The treatment is highly versatile for a multitude of corrosion protection applications, both as a direct-to-metal treatment and as an overcoat to existing primer/topcoat systems for improved fluid shedding and barrier resistance. The most likely commercial applications include helicopters and aircraft in corrosion-prone environments (sea based). Example aircraft transition platforms include the Navy's F/A-18 Hornet and the T-45 Goshawk training aircraft, although numerous opportunities exist for the new technology across aerospace and other markets. The new surface treatment technology will enable rapid adoption across relevant Navy depots and at Prime production facilities. Other potential applications include commercial aviation, automotive, maritime/ships, and facility/infrastructure applications requiring improved galvanic corrosion resistance around dissimilar metallic attachment points.

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