

TOPIC NUMBER:
N102-135

TOPIC TITLE:
Durable Rain-
Repellent Coatings
for Aircraft
Transparencies

**CONTRACT
NUMBER:**
N68335-12-C-0117

**SBIR
COMPANY
NAME:**
Luna Innovations
Roanoke, VA

**TECHNICAL
PROJECT
OFFICE:**
Air Force
Sustainment Center
Hill AFB, UT

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A Luna Innovations employee applies a coating developed under the SBIR program to an aircraft canopy. (Courtesy photo)

COATING DEVELOPED FOR MILITARY USE SHOWS COMMERCIAL PROMISE

A Virginia-based company is better positioned for long-term growth because of its work on a coating technology for the Department of Defense.

Luna Innovations has filed for patents for the general coating formulation and signed a licensing agreement with partner UltraTech International for production and marketing. Under the trade name Gentoo, the coating is providing royalties to Luna while being evaluated for wider global use by dozens of companies in various industries such as glass, automotive and biomedical.

Originally developed for pilots who faced a hazard with water pooling on aircraft canopies and windshields, the coating is designed to quickly shed water off transparent surfaces for improved visibility during inclement weather.

Through the Air Force Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program, Luna has been part of an ongoing development program at Hill Air Force Base in Utah for F-16 canopy coatings and currently is going through qualification testing in collaboration with the canopy manufacturer.

Initial SBIR funding through the Navy was used to develop a formulation that combines fluid repellency and abrasion resistance. Follow-on funding through the Air Force Commercialization Readiness Program is allowing Luna's team to optimize the formulation for improved adhesion during severe environmental conditions on jet aircraft, such as sand abrasion and impact damage from rain erosion at more than 500 knots.

An additional benefit that may emerge from this SBIR effort is a new process to estimate performance on a rain erosion test, according to Tim Lucas, a mechanical engineer for the 416th Supply Chain Management Squadron, which supports the F-16.

The ability to perform rain erosion testing – required to certify a coating like Luna's – is limited by the availability of an expensive testing facility. Lucas said Luna is working toward a way that readily-available equipment could be used to provide an estimate, which would allow future coating developers to determine if they are heading in the right direction before going through the trouble of scheduling an official test at one of those facilities.

BEHIND THE TECHNOLOGY

There have been many academic and commercial efforts focused on the development of coatings – known as hydrophobic and superhydrophobic – that quickly

shed water off surfaces. A large number of those have demonstrated the primary goal of achieving water shedding properties, but lacked durability or have been too difficult or too expensive to apply.

Luna's chemists used their expertise in polymeric structures to modify a sol-gel (silica-based polymer) to incorporate very hydrophobic structures. This provides for the hydrophobic nature of the coating's surface which causes water to bead and roll off.

Luna's rain-repellent coating is a simple treatment solution that can be applied by the manufacturer to polycarbonate or acrylic-based canopies, polyurethane, metals and glass. This thin, hard coating is more than 99 percent transparent across the visible spectrum with less than 0.5 percent haze.

SBIR SUPPORT WAS CRITICAL

"Selling the product commercially provided (Luna with) additional funding to work in parallel to support the SBIR programs, thus providing the technology to the government economically and mitigating the risk that is inherent in a new product development," said Bryan Koene, director of advanced materials for Luna. "We have also transitioned the coating to other government agencies by demonstrating improved corrosion resistance on metal substrates."

Luna currently has five separate SBIR programs focused on the development of the base chemistry of this coating for different Department of Defense applications.



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