Topic: N132-125

Technology Assessment & Transfer, Inc.

Scalable High Strength Spinel Reconnaissance Window Manufacturing

The company is developing strengthened Magnesium Aluminate Spinel (MgAl2O4) for transparent optical sensor windows. The two primary objectives in this project are scaling up size and strength of Spinel windows. This enables use of advanced sensor systems operating from the UV through the mid-wave infrared (MWIR). It improves situational awareness, enhances targeting and intelligence, surveillance and reconnaissance (ISR) operations, and enables multiple sensor systems to operate behind a single protective window. Spinel reduces the total cost of ownership through improving erosion resistance, increasing protection against runway debris, reducing replacement, and improving preventative maintenance operations. Spinel has other applications in transparent armor, missile domes, viewports, and potentially as solid state laser gain media and scintillators for medical, high energy physics, and detection of special nuclear materials.

Technology Category Alignment:

None
None
None

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SYSCOM: NSMA
Contract: N68936-15-C-0020

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68936-15-C-0020

Department of the Navy SBIR/STTR Transition Program

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Scalable High Strength Spinel Reconnaissance Window Manufacturing

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WHO

SYSCOM: NSMA

Sponsoring Program: Program Executive Office for Unmanned Aviation and Strike Weapons [PEO(U&W)] under NAVAIR

Transition Target: Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) program within the Unmanned Combat Air System Program Office (PMA-268)

TPOC:
(760)939-1649

Other transition opportunities: The DDG-1000 Zumwalt-class destroyers require large area, planar (flat) windows to protect an advanced camera system, and is a near-term opportunity for Spinel windows.

WHAT

Operational Need and Improvement: Sophisticated airborne sensor systems require long-term protective shielding in order to avoid damage from runway debris, sand and rain erosion, in-flight impact events, corrosion, and other unforeseen contacts, without sacrificing sensor efficiency. A large-area Spinel window protecting an array of various sensors (optical through mid-wave IR) provides increased situational awareness for drone operators through the larger usable aperture space available to the multiple sensor systems, while providing the long-term protective shielding needed.

Specifications Required: At this time, UCLASS system specifications have not been finalized. However, under this SBIR effort, TA&T is targeting a strength increase of 100% in large area Spinel, while maintaining the high optical properties from the visible into midwave-IR wavelengths. The size required is on the same order of magnitude needed for the DDG-1000 Destroyer Sensor Suite windows.

Technology Developed: Spinel has been under research and development by TA&T and others for many years, and has been commercialized in small and medium-scale sizes (up to 300 square inches in area). The two primary objectives in this project are scaling up Spinel windows to sizes suitable for the UCLASS application and increasing the strength of full-sized windows so they're good.

Warfighter Value: The use of strengthened Magnesium Aluminate Spinel as transparent optical sensor windows enables use of the most advanced sensor systems operating out to the mid-wave infrared (MWIR). This will improve situational awareness, enhance targeting and ISR operations, and enable multiple sensor systems to operate behind one protective window. Strengthened Spinel reduces the total cost of ownership of the UCLASS system through improved erosion resistance of the window, increased protection against runway debris, and a reduction in preventative maintenance operations.

WHEN

Contract Number: N68936-15-C-0020 **Ending on:** May 18, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate strength increase in 38 mm (~1.5 in) Spinel samples	N/A	Biaxial flexure strength measurements meeting target	4	August 2015
Demonstrate strength increase in 101 mm (~4 in) Spinel samples	Med	Biaxial flexure strength measurements meeting target	4	February 2016
Demonstrate strength increase in representative thick Spinel samples	Med	Biaxial flexure strength measurements meeting target	4	August 2016
Demonstrate strength increase in full size Spinel plate	Med	Biaxial flexure strength measurements meeting target; full size window fabrication	5	April 2017

HOW

Projected Business Model: Currently, TA&T intends to control manufacturing of the large area, conformal sensor windows for UCLASS applications. TA&T has experience in manufacturing and selling high-quality sensor windows for government, military, and commercial applications, and is fully prepared for further orders. TA&T has experience licensing technologies, and is willing to undertake this business model as well.

Company Objectives: TA&T is seeking improved coordination with DoD decision-makers and stakeholders and early coordination with prime contractors or system integrators to develop requirements for sensor or armor applications for which Spinel would be an ideal candidate material. TA&T is also seeking new applications for Spinel and its other technologies (notably, in 3D Ceramic Printing technology)

Potential Commercial Applications: Magnesium Aluminate Spinel has other current applications in transparent armor, missile domes, viewports, and experimental applications as solid state laser gain media and scintillators. A strengthened, large area Spinel plate will enable scale up of transparent armor into larger windows (e.g. windshields, building architectures) and drive cost reduction for smaller components and complex shapes.

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