

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0481

Topic # N171-045

Random Anti-Reflective Hydrophobic Textures on Semi-Hemispheric Domes  
TELAZTEC LLC

WHO

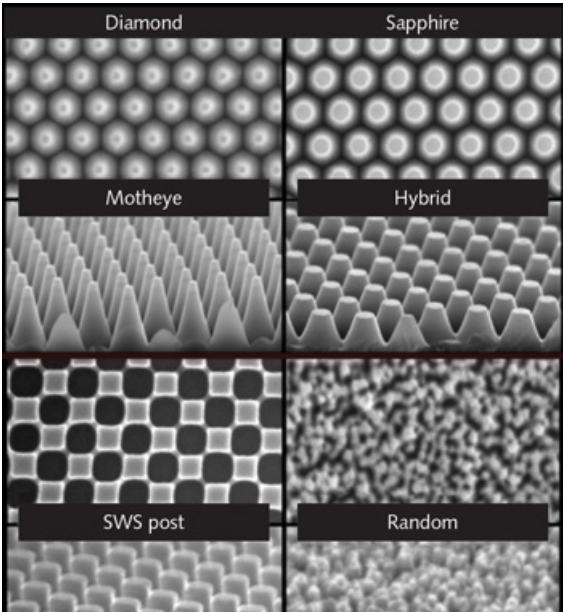
**SYSCOM:** NAVSEA

**Sponsoring Program:** Navy Integrated Submarine Imaging Systems (ISIS)

**Transition Target:**

**TPOC:**

**Other transition opportunities:** TelAztec would like to explore any and all other DoD, Navy, and commercial applications where RAR's extreme optical performance, hydrophobicity, and laser power handling can be utilized.



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WHAT

**Operational Need and Improvement:** Random AntiReflective (RAR) nano textures are an innovative and rugged solution and can be reliably deposited onto the surface of an optic and can meet mission specifications for bandwidth, durability, and hydrophobicity.

**Specifications Required:** TelAztec's AR nano structure technology can suppress light reflections over broad bandwidths and wide fields of regard, and can be applied to planar, domed, and hemispherical windows. A nano textured optic will be durable in extreme maritime environments and transmit over broad visible and infrared wavelength ranges. In addition, RAR nano textures can be made to have a durable and hydrophobic surface treatment that can repel salt water and provide a self-cleaning function.

**Technology Developed:** TelAztec has developed proprietary etch recipes for RAR etching many different types of glass and infrared materials. A texture consisting of sub-wavelength sized features etched in the surface of an optic, or fiber laser facet, produces a graded-index anti-reflection (AR) function. Some of the performance benefits of these high powered nano textured optics include: Extreme low levels of reflection loss, Anti-glare at Wide Incident Angles, Extreme Bandwidth, Non-scattering solution, Sea Water Durability, Super-hydrophobicity, Biofouling Resistance, and Self Cleaning Properties.

**Warfighter Value:** The optical performance of our nano textures has been shown to be far superior to commonly used thin film coatings with respect to transmission, bandwidth, and off axis performance; as well as exhibiting ultra-hydrophobic properties. Beyond optical performance, integrating AR function directly in an optical component has inherent benefits perhaps more important than the extreme optical properties. Typical thin film AR coating issues of adhesion, stress, wavefront distortion, and absorption seen in thin films do not exist with textures. In particular, optical absorption in AR coatings has been an Achilles heel for high power lasers and optics for years, causing localized heating, far-field distortion, beam instability, and laser damage that currently limits high laser power scaling. TelAztec's AR microstructures add no dissimilar material to an optic, so there is zero absorption thus no thermal lensing, shock or laser induced damage.

WHEN

**Contract Number:** N68335-19-C-0201 **Ending on:** December 1, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Mil-spec testing of full-scale nanotextured windows	Med	Pass Mil-spec test	6	TBD
Design and assemble a full-scale automated spray cleaning head	Low	Qualify window cleaning system	6	TBD
Long duration environmental durability	Low	Capacity to resist fouling	6	TBD
Shipboard re-application of the hydrophobic treatment	Low	Hydrophobic treatment process that can be utilized in port or at sea (above water) by naval personnel.	6	TBD
Repeat of Penn State Electro-Optics Center CW laser damage testing-long-duration sea water exposed fused silica samples.	Low	Withstanding previous LiDT of sea water exposed samples	6	TBD

HOW

**Projected Business Model:** Primary Business Model: supply finished optic with AR nano-texture. Customer provides drawing/specs; TelAztec sources optic.

Second Business Model: Provide AR nano-texture as Service Only using customer furnished material.

All production is done at TelAztec Cleanroom Mfg. Current facility is well equipped to handle volumes. Our Class 1000 cleanroom features two reactive ion etch tools (200mmØ; 300mmØ). TelAztec handles all front and back end processing: cleaning, inspection, quality control, packaging, etc.

**Company Objectives:** Our company goal includes efforts to advance our technology through refining manufacturing techniques, demonstrating greatly improved optical properties, and proving reliability through long term sea water testing. We have already done a great job in the commercialization of RAR nano textures, having shipped around 35,000 nano textured optics (windows, lenses, fiber facets) over the past three years. TelAztec would like to explore any and all other DoD, Navy, and commercial applications where RAR's extreme optical performance, hydrophobicity, and laser power handling can be utilized.

**Potential Commercial Applications:** We have already seen a lot of interest from many different laser OEMs, especially those working with high power systems who see a humongous benefit from the extreme laser induced damage threshold (LiDT) of our nano textured optics. We will continue to commercialize in this market. Other common applications that see a huge benefit from RAR are imaging systems who can strongly benefit from the high transmission and extreme low reflection loss of nano textured optics.

We believe that other commercial applications not yet fully tapped into by our commercialization efforts are medical and LiDAR applications who can possibly benefit from the hydrophobic properties of our nano textured optics and would like to further explore this.

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