

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2019-0569

Topic # N161-036

Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres for Submarine Masts

Adolf Meller Company d.b.a Meller Optics Inc.

## WHO

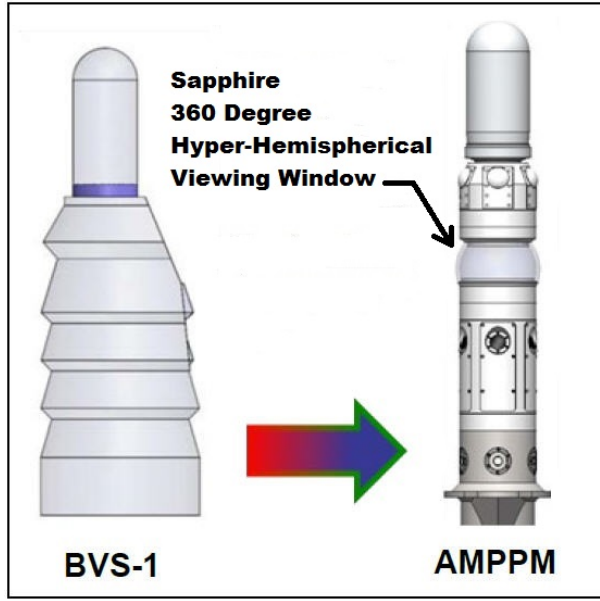
**SYSCOM:** NAVSEA

**Sponsoring Program:** PMS-435

**Transition Target:** TOTIM

**TPOC:**

**Other transition opportunities:**  
 Surface Mounted Photonics Mast / Platform  
 Autonomous Submersible Vehicles  
 Photonics Masts  
 Hyper-Sonics



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## WHAT

**Operational Need and Improvement:** Future Submarine Imaging Systems featuring a 360 Degree viewing window will eliminate the need for housing to rotate, ultimately minimizing mast exposure time. Sapphire's high material hardness exhibits greater survivability and increased damage resistance making it the ideal window material. Additionally, the window is transmissive from visible to mid-wave infrared wavelengths. However, sapphire is expensive and time consuming to machine.

**Specifications Required:** Development of Technology to Achieve Greater Than 50% Cost Reduction in the Fabrication of Sapphire Hyper-Hemispherical Windows

**Technology Developed:** Incorporate ultrasonic technology with a full 5-Axis CNC machining platform. Merging these two technologies demonstrated a very substantial increase in stock removal rates with corresponding reduction in process time. Increased throughput allows for scaling up production.

**Warfighter Value:** These once expensive "unique" optical components will become a viable option for integration into optical systems due to a 4x reduction in manufacturing cost and time. The cost reduction will now make sapphire windows attractive for EO/IR windows providing increased sensor survivability.

## WHEN

**Contract Number:** N00178-18-C-8019 **Ending on:** February 21, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I - Proof of Concept - Initial Grinding Studies	High	Proved Machining With Ultrasonics Successful	3	November 2016
Phase I Option - Produced 1/2 Size Sapphire Hyper-Hemispherical Window	Low	Produced Two Parts - Showed Dramatic Grinding Time Reduction	3	October 2017
Phase II (Year 1) - Start Full Size Sapphire & Spinel Hyper-Hemispherical Windows	Med	Partially Completed Grinding Sapphire & Spinel. Showing 4x Time Reduction	4	February 2018
Phase II (Year 2) - Complete Full Size Sapphire & Spinel Hyper-Hemispherical Windows	Low	Complete Both Sapphire and Spinel Parts & Develop Enhancements to Metrology	5	February 2019

## HOW

**Projected Business Model:** Meller Optics Will Need to Partner With the Navy's Prime Supplier L3 Technologies - KEO Development Center  
 Looking to Partner With Other Prime Contractors Supplying Other Navy Program Offices or Other System Commands

**Company Objectives:** Meller Optics is Looking to Become a Supplier of High Precision Sapphire Optical Components at an Extremely Competitive Price for Any Optical System  
 This includes Possible uses in Any Undersea, Sea, Air, or Space Platforms  
 Currently Producing Two Sapphire Hyper-Hemispherical Windows for Battelle to be used on the Proteus Underwater Vehicle

**Potential Commercial Applications:** This Technology is Transferable to a Wide Base of Commercial Applications Where Extremely Hard and Durable Materials are Required

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