

Topic: N152-107

OptiPro Systems LLC

Manufacturing of Visibly Transparent Large Conformal Windows

The sensors on unmanned aerial vehicles (UAVs), such as the MQ-25 Stingray require conformal windows for protection from the elements. With 35+ years of experience developing and manufacturing precision optical fabrication machines and metrology systems, OptiPro has developed OptiSonic ultrasonic machining that adds ultrasonic vibration while grinding. Coupled with UltraForm Finishing (UFF), a sub-aperture polishing process involving a moving belt of polishing material wrapped around a precision compressive wheel and UltraSmooth Finishing (USF), which smooths mid-spatial frequency content and corrects the figure error of a surface by polishing with a mid to large size aperture tool, companies can cost-effectively manufacture 24"x24" conformal windows and other large precision optical components to sub-micron accuracy. Prime Contractors have already integrated OptiSonic, UFF, and USF onto their manufacturing floors.

Technology Category Alignment:

EO/IR Components for sensing, transmission and communication

Electro-Optical/Infrared (EO/IR)

Radio Frequency Weapons (RFW)

Sensors, Electronics and Photonics

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SYSCOM: NSMA

Contract: N68936-17-C-0014

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68936-17-C-0014

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-665

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WHO

SYSCOM: NSMA

Sponsoring Program: PMA-268

Transition Target: MQ-25 Stingray

TPOC:

(760)939-1649

Other transition opportunities: Any military platform housing conformal sensor windows with a requirement for visible (not just infrared) optical tolerances.

Notes: Since receiving our first SBIR grant, OptiPro has grown from less than 15 employees to more than 80 today. Through the SBIR program, OptiPro has developed new machines and processes which are commercialized in sales to Prime contractors, small to medium sized optics manufacturers, and exported around the world. All profits earned since receiving our first SBIR grant have been reinvested in the company to increase technological improvement and commercialization of technologies.



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WHAT

Operational Need and Improvement: To manufacture conformal optical windows to protect aircraft electro-optical sensors, OptiPro developed three different solutions: OptiSonic ultrasonic machining technology, UltraForm Finishing (UFF) sub-aperture polishing process and UltraSmooth Finishing (USF) mid-to-large aperture polishing process. Refining these existing processes will allow Defense companies and prime contractors to manufacture optically precise conformal windows cost effectively.

Specifications Required: The objective for this project is to create methods to grind and polish freeform conformal sensor windows with dimensions up to 24x24 inches with a sag height of approximately 8 inches and an optical precision of 0.5 micron or better. It is expected that methods will be developed with glass or fused silica and that a full sized window will be made from glass or fused silica. It is also possible that a full sized spinel blank may be available from the government during this project.

Technology Developed: With a Phase II effort, OptiPro proposes to develop a cost-effective manufacturing process to produce large optical windows and corrector optical elements. We demonstrated this capability by making a 12" x 12" fused silica conformal window. The development effort will focus on taking advantage of OptiPro's ultrasonic grinding technology (OptiSonic), UltraForm Finishing (UFF), and UltraSmooth Finishing (USF). We will also take advantage of OptiPro's SXL 500 and Triumph XL grinding and polishing platforms to perform this work. Both of these machines can perform the tasks required to complete a Phase II effort. We plan to push the limits of the machine's working envelope to evaluate the likelihood of their use to complete the Phase II requirements. The overall goal of this project would be to develop a manufacturing system in Phase II that would ultimately be available as a product for OptiPro to sell.

Warfighter Value: UFF is capable of polishing the surface of conformal windows to precision levels with high removal rates while USF tools proved to be effective in rapidly polishing conformal windows with minimal grain decoration; the UFF and USF processes have been integrated into our newly developed freeform optics manufacturing software, PROSurf. These technologies, along with OptiPro's OptiSonic ultrasonic machining centers, which involves adding ultrasonic vibration to the grinding tool to achieve efficient material removal, will allow companies to efficiently produce conformal windows.

WHEN

Contract Number: N68936-17-C-0014 **Ending on:** December 18, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Incorporate on-machine metrology	Low	The integration of surface probing using touch probes onto the SXL 500 grinding platform; this has allowed for on-machine grind corrections which significantly reduces process time	5	May 2018
Change axis configuration	Med	New design that accommodates more shapes and complex geometry on the 500 class polisher	6	December 2018
Fixture development	Low	Grind & polish a thin conformal window without inducing error/cracks from processing & deblocking	5	February 2018
Tool path development work	Med	Create more efficient tool paths for grinding and polishing utilizing different tooling in PROSurf; enhance computer memory to optimize PROSurf	6	December 2018
Glass conformal window	High	Successfully ground and polished both sides of 12 inch x 12 inch glass conformal window; deblock using new fixturing techniques	7	May 2018
Spinel teardrop shape	Med	Successfully ground and polished both sides of the spinel teardrop; deblock using new fixturing techniques	7	May 2019

HOW

Projected Business Model: OptiPro Systems has more than 35 years of experience developing and manufacturing precision optical fabrication machines and metrology systems. We are a global leader in designing and building computer controlled grinding, polishing, and measuring equipment for the precision optics and advanced ceramics industries. Our Advanced Process Development (APD) department focuses on fabrication solutions for precision optics. These solutions are designed to yield parts that can be manufactured from a variety of commercially available materials including optical glasses, ceramics, crystals, and alloys.

OptiPro will be manufacturing and selling OptiSonic, UFF, and USF platforms at our facility in Ontario, NY. Because of the investment required to manufacture each unit, we will begin building each system immediately after the purchase order is received. Typical lead time to build the eSX, UFF and USF platforms is 16-20 weeks, while UltraSurf is currently 24-32 weeks.

Company Objectives: OptiPro will be looking to provide insight on the latest developments with OptiSonic, UFF, and USF technologies, as well as other technology advancements being driven by the SBIR program. By continuously advancing our technology, OptiPro will be the leader in providing solutions for Defense companies and prime contractors that will enable cost-effective production of components with defense applications.

Potential Commercial Applications: Companies in the precision optics and advanced hard ceramics industries can benefit from OptiPro's manufacturing and metrology equipment. Components that are able to be produced with OptiPro technology serve a variety of applications, including aerospace, automotive, medical, and consumer electronics; processes developed for conformal window manufacturing have potential to reduce the cost and widen the scope of manufacturing precision aspheric optics.

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