

Topic: N152-107

Optimax Systems, Inc.

Manufacturing of Visibly Transparent Large Conformal Windows

Optimax, the largest privately-owned precision optics company in the U.S., specializing in short lead times on prototype optical components of all geometries and sizes between 3 – 500 mm has developed a large working-volume polishing and finishing platform for precision optical components. It's geared towards large extreme freeform optics that match the curvature of an airframe, such as those protecting sensor arrays on all aircraft including the MQ-25 Stingray and can serve as upgrades to traditional windows like the Electro-Optical Targeting System (EOTS) found on next generation aircraft. Optimax has produced a 550 x 500 mm square extreme freeform component with 170 mm of sag to <1 µm rms surface figure error from fused quartz; several other freeform optical components have also been polished on this platform.

Technology Category Alignment:

EO/IR Components for sensing, transmission and communication

Air Platforms

Broadband/Multispectral Components and Systems

Guidance, Navigation & Control (GN&C) and Data Links

Sensors, Electronics and Photonics

Contact:

Matthew Brunelle

mbrunelle@optimaxsi.com

(158) 526-51020

<https://www.optimaxsi.com/>

SYSCOM: NSMA

Contract: N68936-17-C-0013

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68936-17-C-0013

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2018-680

WHO

SYSCOM: NSMA

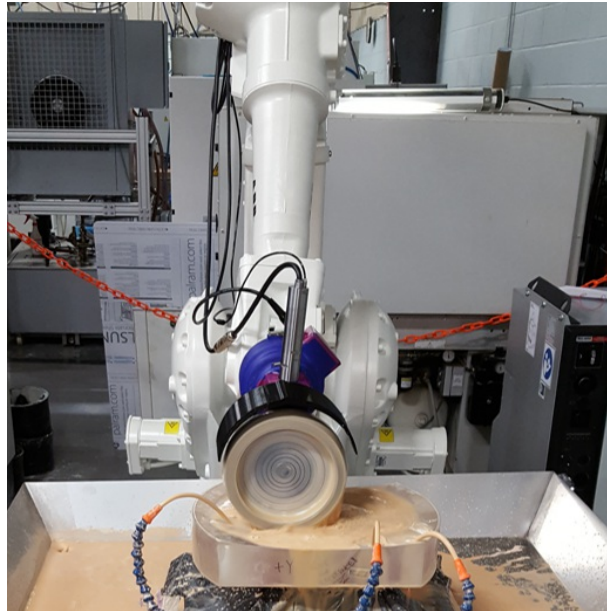
Sponsoring Program: Unmanned Carrier Aviation program office (PMA-268)

Transition Target: MQ-25 Stingray

TPOC:
(760)939-1649

Other transition opportunities: The applications of this technology include: conformal sensor windows, arbitrarily curved viewing windows for ballistic or high pressure applications, and large aspheric or freeform optics.

Notes: Optimax has commercialized several SBIR developed technologies since the completion of our first Phase II in 2009. \$8 million in SBIR funding has created over \$23 million in revenue and created 55 jobs through 2017. It is estimated that an additional \$9 million in revenue and 10 additional jobs will be created by the end of 2018.



Robotic polishing platform finishing a 375 mm (14.8 in) diameter truncated CC sphere (Copyright, Optimax, 2018)

Topic # N152-107

Manufacturing of Visibly Transparent Large Conformal Windows
Optimax Systems, Inc.

WHAT

Operational Need and Improvement: A need for freeform conformal sensor windows on military aircraft is increasing as more, and higher performing, sensors are incorporated into each aircraft. Conformal windows follow the curvature of an airframe to increase aerodynamic performance over traditional flat or spherical windows. Large aperture (<500 mm (<19.7 in)) transparent ballistic materials can be used to provide a large angle of regard for the sensor, as well as protection from impact for the warfighter inside the aircraft.

Specifications Required: There is a need for large diameter freeform optical components with strong curvature, specifically up to 610 mm x 610 mm (24 x 24 inches) with 203 mm (8 inches) of sag, made from hard transparent ceramic or polycrystalline materials. Currently these components are prohibitively expensive and have lead times that often exceed 8 months. An improvement on cost and lead time is needed to advance the state of the art from an optical design perspective.

Technology Developed: Optimax Systems has developed a polishing platform and process capable of finishing 700 mm (27.6 in) diameter optical components to <2 micron (3.2 waves) rms surface irregularity. This platform is highly customizable and can be programmed to polish rotationally symmetric and freeform geometries. Materials that can be polished on this platform include: glasses, crystals, and ceramics; including alon, spinel, and PCA.

Warfighter Value: Freeform optical components have the potential to drastically reduce the number of elements in an optical system, reducing weight and increasing output power through less transmission loss. The processes and platform designed in this project eases the manufacturing process for freeform optics; resulting in shorter lead times, better optical surfaces, and lower cost than the current state of the art.

WHEN

Contract Number: N68936-17-C-0013 **Ending on:** December 18, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase I freeform conformal window (330 mm square x 125 mm sag)	N/A	Both sides polished to better than 0.5 microns rms surface figure error over a 305 mm square aperture	7	August 2017
Applicable polishing of test part on scaled-up polishing platform	N/A	Successfully corrected form on a 375 mm diameter CC sphere to better than 2 microns P-V	6	March 2018
Complete polishing on CC side of 585 x 500 mm freeform conformal window with 170 mm of sag	Low	Surface figure error of <1 micron rms over a 90% aperture	6	October 2018
If Option is exercised: Complete the CX side of the 585 x 500 mm freeform conformal window	Low	Surface figure error of <1 micron rms over a 90% aperture of the CX side	6	June 2019
Begin utilizing polishing platform for production optical components	Low	Booking commercial/government work to the platform and polishing parts without damage or unexpected downtime occurring	7	September 2019

HOW

Projected Business Model: Since Optimax was founded in 1991, optics have been behind enormous progress in technologies as diverse as fiber optic telecommunications, solid-state lighting, digital photography, displays, and diagnostic medicine. We have worked key programs in aerospace, government research, and defense, and our customers' successes have fueled our growth. Optimax reliability has allowed us to become America's largest prototype optics manufacturer. Optimax specializes in Asphere, Cylinder, Sphere, Freeform, and Plano/Flat optics in sizes up to 400 mm. All parts are manufactured to customer-supplied specifications and include final inspection data.

Optimax is a service business providing custom precision optical components made to customer specifications. A core tenet of the business is short lead times while maintaining high quality and customer satisfaction. Optimax is an early adopter of novel technology and utilizes SBIR and internal research and development (R&D) projects to fill in technological gaps in existing manufacturing processes. These projects focus on processes to enable higher precision, more complex geometries, and the ability to work with novel materials. Optimax is set up to manufacture, test and deliver with the speed and performance your programs require -- prototype optics in one week.

Company Objectives: The technology developed under this project is applicable to manufacturing optical geometries from 10 mm to 700 mm (0.4 in - 27.6 in) in diameter; including both simple rotationally symmetric and extreme freeform shapes. Optimax seeks to build partnerships with prime contractors and system integrators that require precision optics and conformal sensor windows.

Potential Commercial Applications: Commercial service already in place to manufacture conformal sensor windows, large (<500 mm) telescope mirrors, freeform corrector optics, other freeform optics, laser grade optics, high energy laser optics, large (<500 mm) aspheric optics, and a variety of other optical products.

Contact: Matthew Brunelle, R&D Engineer
mbrunelle@optimaxsi.com 15852651020