

Topic: N162-103

TIPD, L.L.C.

Improved Volume Hologram Optical Elements

While thin film holographic lenses have replaced bulky refractive optics in many commercial applications, holographic optical elements such as spherical lenses and mirrors are not readily available for demanding imaging applications such as compact telescopes. TIPD's technology consists of thin film volume holographic elements integrated into a Cassegrain telescope to improve light collection efficiency and reduce weight and costs. The system has been prototyped and has demonstrated the high angular and wavelength sensitivity needed for lidar and ladar applications. TIPD specializes in developing novel and cost effective optical solutions to critical problems in the fields of laser, remote sensing and lidar. The ultimate goal is to integrate and transition this technology into the government's and prime contractor's imaging systems to improve performance and reduce costs.

Technology Category Alignment:

Electro-Optical/Infrared (EO/IR)

Sensors, Electronics and Photonics

EO/IR Components for sensing, transmission and communication

Contact:

Lloyd LaComb

lacomb@tipdllc.com

(520) 622-0804

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

SYSCOM: NAVAIR

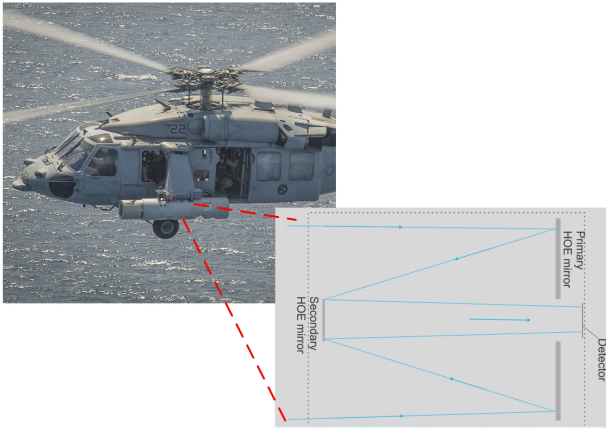
Contract: N68335-18-C-0228

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0228

WHO

SYSCOM: NAVAIR
Sponsoring Program: Air Anti-Submarine Warfare Systems Program Office (PMA-264)
Transition Target: H-60R
TPOC:
(301)342-2034

Other transition opportunities: TIPD's technology is of interest to unmanned autonomous helicopters and other small unmanned aerial vehicles to reduce the size and weight of the optical systems on their small platforms. The technology can be applied to lenses and mirrors in optical sensing subsystems to replace refractive optics on any other telescopes. The technology can be applicable to the other service branches' small aerial platforms to reduce the size and weight of the sensor payload.



U.S. Navy photo by Mass Communication Specialist 2nd Class Sean Furey/Released) 140804-N-WX059-219. Drawing courtesy of TIPD

WHAT

Operational Need and Improvement: There is a need to significantly enhance the performance and manufacturability of Volume Hologram Optical Elements (VHOE) by improving diffraction efficiency, increasing the uniformity and reducing aberrations of the element as a whole. The improvements include: size and weight reduction due to light weight of the VHOEs compared to refractive and reflective optics, integration of optical shaping and filtering functions into a single holographic element, and improved light collection. These advancements deliver improved system performance, increased signal-to-noise ratio, and enhanced target detection.

Specifications Required:
Operating wavelength: Customer specified
Acceptance Angle: Up to 30 mrad
Transmission efficiency: >50% @ selected wavelength
Transmission bandwidth: Customer specified
Environmentally stable during airborne operation and extended storage

Technology Developed: TIPD has successfully developed Volume Holographic Optical Elements (VHOEs) using low cost commercially available photopolymer materials. The team fabricated VHOEs for the following optical elements: lenses, mirrors (primary reflector of a Cassegrain telescope), three-color reflection lenses, and a notch filter to separate a certain portion of the spectrum. The team has developed software to design, test, and validate the VHOE's performance.

Warfighter Value: The VHOE components will collect more light, improving the signal to noise ratio and enhancing the system's target detection capability. The low cost material can be fabricated using simple optical substrates to reduce the cost, size and weight of the sensing system.

WHEN Contract Number: N68335-18-C-0228 Ending on: February 20, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate narrow band filter	Low	Meets bandwidth target at FWHM intensity	4	December 2018
Complete environmental testing	Med	Less than 5% degradation after accelerated testing equivalent to one year of operation	5	June 2019
Develop Ultranarrow integrated imaging system	Low	Narrow band system with total transmission > 50%	5	December 2019
Deliver complete telescope with holographic elements	High	Size > 100mm, narrow band operation, total transmission > 50%	6	December 2020

HOW

Projected Business Model: TIPD will work with the Navy's integration partner who will be responsible for building the sensor pod. TIPD's business model can support the Navy as either an original equipment manufacturer (OEM) for the optical subsystem or by licensing the technology to the system integrator.

TIPD's long-term business model is to develop the technology and secure the intellectual property for light weight high precision VHOEs for use in commercial and military imaging applications. TIPD will seed the market with internally produced VHOEs and seek to license the technology to multiple companies in various geographic and commercial markets.

Company Objectives: TIPD will continue to develop the VHOE technology for commercial and military applications. TIPD's technology has found applications in near-to-eye virtual reality displays and has been incorporated into the development program at a major technology company. TIPD's research efforts are focused on both improving the performance of VHOEs and expanding their applications. TIPD has developed custom VHOEs for the solar, near-to-eye display, 3D light field display, and optical filtering applications.

Potential Commercial Applications: Implementing VHOEs for commercial Light Detection and Ranging (LIDAR), imaging and drone cameras would provide a higher level of detail for surveillance, monitoring, infrastructure survey, and many other commercial and military applications. The ability of VHOEs to combine multiple optical functions into one light weight element enable applications in virtual reality, consumer camera, and cell phone displays.