

# Department of the Navy SBIR/STTR Transition Program

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NAVWAR (14 JANUARY 2022)

Topic # AF191-D001

Low Cost Laser Communication Ground Terminal Network

Vision Engineering Solutions, LLC

## WHO

**SYSCOM:** NAVWAR

**Sponsoring Program:** PEO C4I

**Transition Target:** TBD

**TPOC:**

(619)553-5379

**Other transition opportunities:** 1.

Fixed-site optical communication ground stations (OGS) for other services and agencies; 2. Transportable OGSs for deploying units; 3. Shipboard OGSs for naval and commercial ships.

**Notes:** Vision Engineering Solutions, LLC specializes in electro-optical tracking systems for long-range applications. The decades of experience our personnel have in tracking mortars, hypervelocity projectiles, satellites, and more, have prepared and positioned us well to help make space-to-ground optical communication networks a reality.

Vision was awarded an initial Phase II SBIR by AFRL, and a Sequential Phase II SBIR by NAVWAR to build OGSs. The OGS we describe here includes attributes of both systems. Several Vision products are included in our OGS, including our Precision Mount Control System (PMCS), a feature-rich, universal gimbal control system. Clear2Fire, our laser deconfliction and safety system, was an option selected by NAVWAR. The image shows an OGS in the early stages of integration (July 2021)



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## WHAT

**Operational Need and Improvement:** Laser communications (lasercom) are emerging as a means of meeting the projected bandwidth requirements of future space systems and alleviating the congestion in the radio frequency spectrum. Filtering and processing required to meet space-to-ground bandwidth restrictions leave unknown amounts of valuable information "on the cutting room floor" of the space terminal, while using precious size, weight, and power. In addition to increased bandwidth, many end users of satellite-generated data are looking for ways to increase the security of the data coming from space. Proven capabilities in optical communications already promise an order of magnitude increase in bandwidth over RF networks, while the reduced probabilities of detection, interception, and interference, inherent to optical communication make it much more secure than RF. Encryption technologies, such as quantum key distribution, will make it even more so.

**Specifications Required:** OGS capable of tracking LEO and GEO satellites, and satellites in transition between LEO and GEO. Communication wavelength: 1550nm band. Uplink data rate: 100 Mbps to LEO. Downlink data rate: Up to 1Gbps from LEO. Provide intensity modulation schemes, such as on-off keying (OOK) and pulse position modulation (PPM). Provide a laser beacon in either the 1060 nm or 1550 nm band. Incorporate a fast-steering mirror for point-ahead/behind errors and ability to correct tilt errors caused by atmospheric turbulence. Capable of daytime and nighttime operations. Design the system for at least 2 years of operational life. The OGS will connect to a network for data input and output via common networking protocols.

**Technology Developed:** Our OGS is designed to transmit and receive signals across the entire C Band of lasercom (1530 nm - 1565nm), accommodate all signal polarization states, integrate a single or multiple C Band optical modems, and be incorporated into existing and future communication networks.

**Warfighter Value:** Lasercom offers warfighters the potential to receive up to ten times the information, imagery, and intelligence from space they currently receive via RF, and to receive it more securely.

## WHEN

**Contract Number:** N68335-21-C-0067 **Ending on:** May 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Preliminary test of optical tracking subsystem (gimbal, optics, sensors, control software)	Low	Manual tracking accuracy of 10 microradians or better	TRL 4	March 2022
Preliminary test of optical receiver	Med	Receiver and receiving optical fiber are aligned; alignment laser enters receiver and impacts the center of the receiving fiber	TRL 4	April 2022
Software integration and local system test	Med	System searches, locates, and tracks satellites; satellite tracking accuracy of 1 microradian or better; laser signals of required wavelengths are received by the system	TRL 5	May 2022
System Demonstration at Customer Site	Med	System is fully integrated into customer's infrastructure; System searches, locates, tracks, and receives optical signals from required satellite(s); System tracking accuracy of 1 microradian or better	TRL 6	May 2022

## HOW

**Projected Business Model:** Our goal is to produce and sell the systems directly to network integrators. Vision Engineering Solutions, LLC can begin low rate initial production (8 systems per year) in March of 2022, with a plan to begin full rate production (24 systems per year) in March of 2023. If requirements outpace our growth capability, we will obtain production support from a larger business through subcontracting or licensing. Additionally, teaming with an optical modem provider, could enhance the attractiveness of our product.

**Company Objectives:** Our objectives at Sea-Air-Space will be: 1) communicate with constellation operators about communication links, ground network operators about integration; 2) communicate with NAVSEA about shipboard OGSs, and with MARCORSSYSCOM about transportable OGSs; 3) communicate with Space Development Agency regarding integration with the National Defense Space Architecture; 4) identify candidate companies for production support.

Short-term company objective: build a reputation of excellence as a supplier of OGSs to DoD.

Long-term company objective: become a trusted advisor and supplier to US Government and commercial customers in optical communications and tracking applications

**Potential Commercial Applications:** Like the government's demand for greater bandwidth, the commercial demand is outpacing current capabilities. There are multiple efforts underway by commercial entities to establish optical communication ground networks- Empower Space, and BridgeComm, for examples. We are making contacts with these entities to pursue opportunities to help them succeed. Additionally, contacts will be made with satellite network providers. Teaming with them directly provides a more complete solution for space-to-ground lasercom.

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