

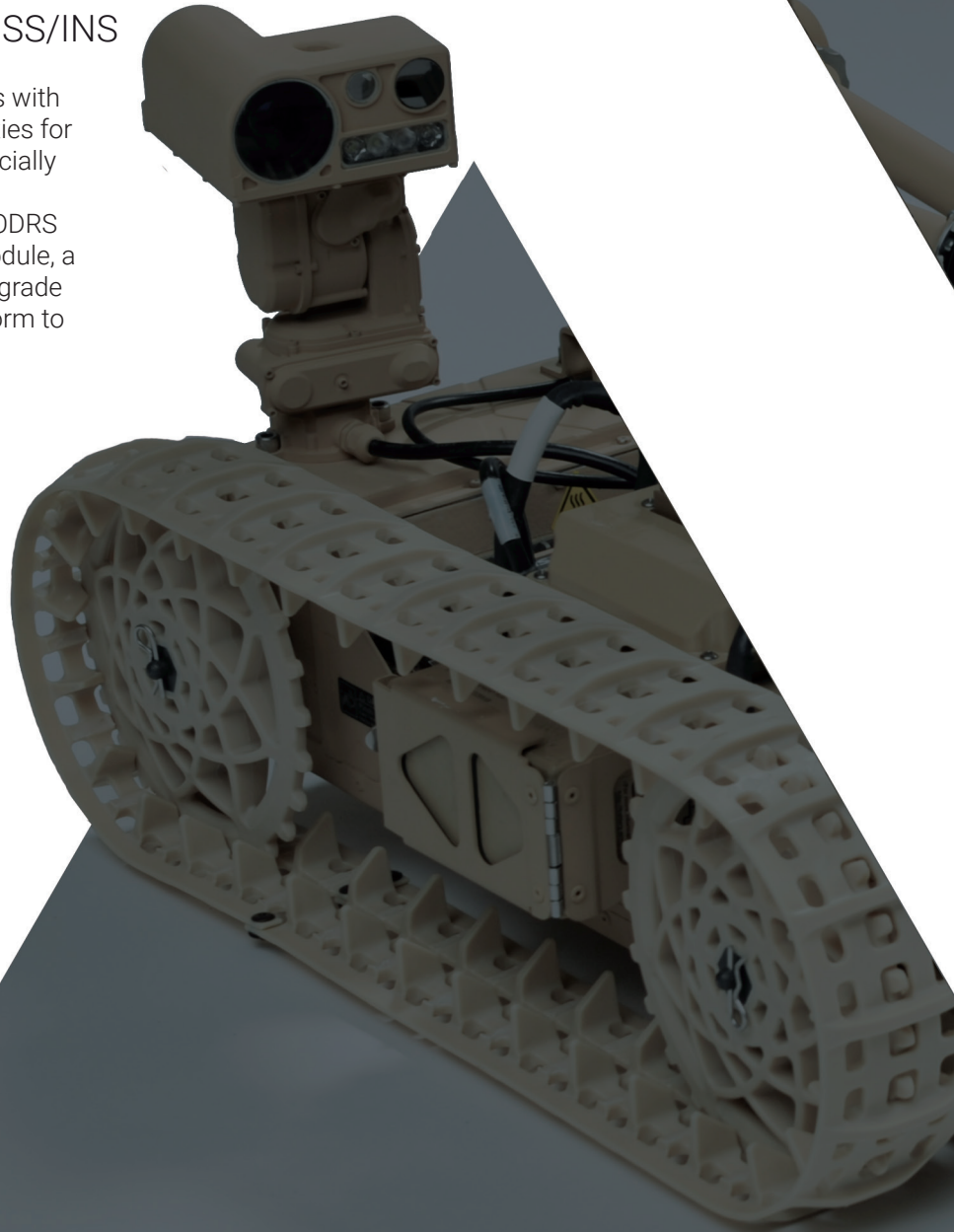


## CASE STUDY

# NEYA SYSTEMS NAVIGATES TO SUCCESS

VN-100 IMU/AHRS and VN-200 GNSS/INS

Neya Systems' UxAB module provides integrators with a turnkey platform that offers autonomy capabilities for navigation and manipulator control. The commercially available UxAB integrates a VN-200 GPS/INS for navigation and attitude data. Selected for the AEODRS Increment 1 Autonomous Behavior Capability Module, a custom version of the UxAB integrates a military grade GPS receiver and the VN-100 IMU/AHRS to conform to program requirements.



## Introduction

Neya Systems LLC is a leading developer of advanced unmanned systems technologies, providing innovative solutions to some of the most challenging unmanned systems and computer vision problems. One of the core products in Neya's portfolio is the UxAB, a fully self-contained, semi-autonomy and autonomy capable module that features GPS waypoint navigation, multi-joint manipulator control, retrotraverse, return-to-comms and optional obstacle avoidance behaviors. The UxAB is designed to be uniquely suited to small backpackable unmanned ground vehicles (UGV), with its small size, low weight and low power consumption (SWAP). Development of the UxAB required critical component selection in order to keep SWAP as low as possible while maintaining flexibility/adaptability and high performance of the system.

## Challenge

A foundational component to the UxAB is the Inertial Navigation System (INS) that fuses attitude data from an Inertial Measurement Unit (IMU) and position and velocity data from a GPS receiver using a specialized Kalman Filter. Faced with the challenge of finding a suitable solution, Neya selected a number of solutions from different manufacturers and evaluated against the following criteria:

- ▶ Small size, low weight, and low power
- ▶ Industrial grade performance IMU
- ▶ High shock and vibration survivability
- ▶ Easy to integrate
- ▶ Interchangeable IMU and GPS/INS designs

The only solution that met all the criteria was the VectorNav VN-200 GNSS/INS. "The VN-200 is a very impressive device. VectorNav have done an excellent job packing this level of performance into such a small package" said Parag Batavia, President of NeyaSystems. After successful testing and evaluation of the VN-200 Rugged, Neya integrated the Surface Mount Device (SMD) into a custom printed circuit board (PCB) for the UxAB. According to Ted Kuhn, Electronics Engineer at Neya, "The great thing about the VectorNav Industrial Series SMD products is that they all share the same footprint and interface, making it simple to provide customers with different levels of functionality based on their requirements without modifying our design/housing."



## COMPANY PROFILE

Neya Systems is a leading developer of advanced unmanned systems technologies in the United States. Neya works with defense, homeland security, and commercial customers to deliver novel solutions to some of the hardest problems related to autonomy, computer vision, and general unmanned systems development and deployment. Both government- and commercial-sector engineering managers consistently turn to Neya's team when seeking expertise related to perception in difficult visual conditions.

## APPLICATION

Ground Robotics

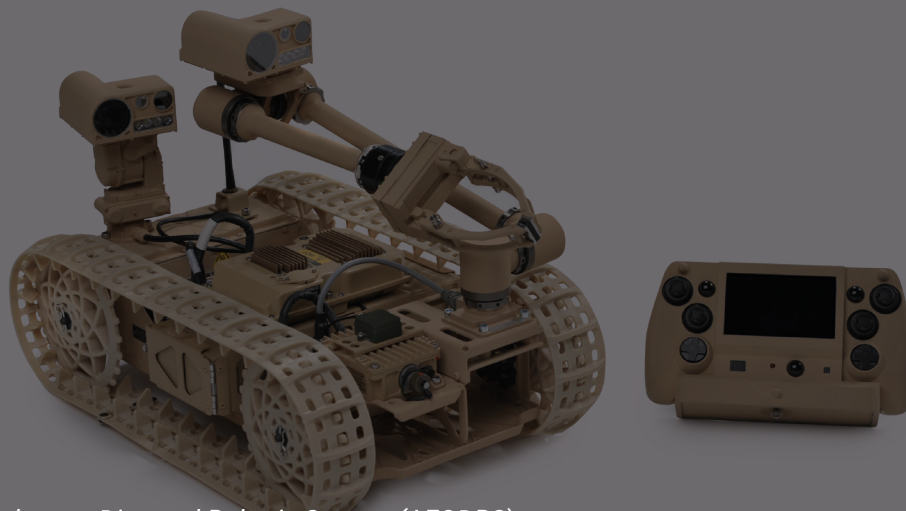
## VECTORNAV PRODUCT

VN-100 IMU/AHRS and VN-200 GNSS/INS

## NEYA SYSTEMS PRODUCT

UxAB





*Advanced Explosive Ordnance Disposal Robotic System (AEODRS)*

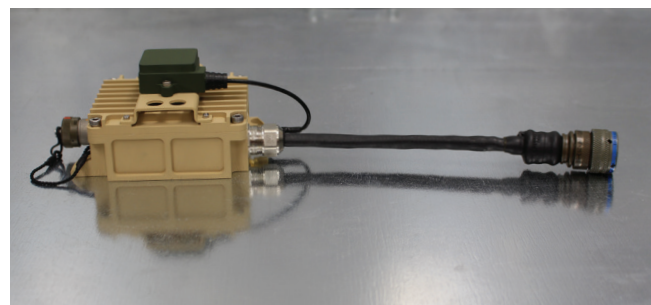
## How VectorNav Helped

The proven in-market performance and success of the commercially available UxAB platform contributed to Neya Systems, part of the Northrop Grumman team, being selected as a supplier of the Advanced Ordnance Disposal Robotic System (AEODRS) Increment 1 Autonomous Behavior Capability Module. AEODRS is the next generation of Explosive Ordnance Disposal robotic systems, designed as a continuation and capability upgrade to existing platforms for the U.S. Navy.

In order to adhere to AEODRS Capability Module requirements the UxAB needed to be modified to integrate an external, military grade GPS receiver into the UxAB enclosure. This allowed Neya Systems to integrate the VN-100 IMU/AHRS and design a custom INS Kalman filter to combine the position, velocity and attitude data between the two systems. Dave Martin, Senior Robotics Software Engineer at Neya says "It was pretty straightforward to switch from the VN-200 to VN-100 because they share the same register mapping. It was almost as easy as cut and paste."

## Results, Return on Investment and Future Plans

The ease of implementation and modularity of the VectorNav Industrial Series has enabled Neya Systems to focus on their core strength of developing new and innovative control methodologies to further the capabilities of the UxAB platform including mission planning and management, active and passive perception, navigation in structured and unstructured terrain, and human-robot interaction.



*Neya Systems' UxAB Module*

### VN-100 IMU/AHRS & VN-200 GNSS/INS



**VN-100 SMD**



**VN-200 SMD**

## KEY SPECIFICATIONS

### NAVIGATION & IMU

Heading (Magnetic).....	2.0° RMS
Heading (INS; VN-200) <sup>1</sup> .....	0.2°, 1σ
Pitch/Roll (Static).....	0.5° RMS
Pitch/Roll (INS; VN-200) <sup>1</sup> .....	0.03°, 1σ
Gyro In-Run Bias Stability.....	5-7°/hr typical
Output Rate (IMU).....	800 Hz
Output Rate (Navigation).....	400 Hz

### PHYSICAL & ELECTRICAL

Dimensions.....	24 x 22 x 3 mm
Weight.....	4 g
Max Power Consumption (VN-100).....	185 mW
Max Power Consumption (VN-200).....	445 mW

<sup>1</sup>. With sufficient motion for dynamic alignment.



## About

VectorNav Technologies is a leading developer and manufacturer of high performance inertial navigation systems using the latest inertial sensor and GPS/GNSS technology. Since its founding in 2008, VectorNav has provided systems integrators in the Military, Aerospace, Marine, and Robotics industries with inertial navigation solutions with best-in-class price to performance ratios.

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