# TACTICAL SERIES EXTENDED CAPABILITY BROCHURE

EXTERNAL IMUs
EXTERNAL SAASM & M-CODE GPS RECEIVERS

# SMALLER. SMARTER. PROVEN.

# NAVIGATION WITHOUT COMPROMISE.

The most demanding defense and aerospace applications require the most robust and capable navigation solutions. VectorNav's Tactical Series is designed to provide unprecedented modularity with support for a range of external inertial and positioning technologies. Complete your objective and gain the competitive edge over emerging Navigation Warfare (NAVWAR) threats and contested environments with VectorNav.

## VECTORNAV TACTICAL SERIES



**VN-110/110E**
**IMU/AHRS**

**VN-210/210E**
**GNSS/INS**

**VN-310/310E**
**DUAL GNSS/INS**

VectorNav's Tactical Series features auxiliary ports to connect to external Inertial Measurement Units and SAASM or M-Code GPS receivers. The extended capabilities of the Tactical Series enable users to take advantage of VectorNav's superior navigation algorithms while incorporating other technologies to enhance capabilities, security and performance in contested environments.

# EXTERNAL IMU SUPPORT

| IMU SPECIFICATIONS | KVH 1775 | EMCORE/SYSTRON DONNER SDI500 | NORTHROP GRUMMAN LITEF LCI-100 |
|---|---|---|---|
| **GYRO** | | | |
| Range | ± 490°/s | ± 1,000°/s | ± 610°/s |
| In-Run Bias | | | |
|    Instability - Allan Variance | 0.5°/hr, 1σ | 1.0°/hr, 1σ | 0.05°/hr, 1σ |
|    Over Temperature Range | 0.7°/hr, 1σ | 1.0°/hr, 1σ | 0.15°/hr, 1σ |
| Noise Density (ARW) | 0.012°/√hr | 0.02°/√hr | ≤ 0.012°/√hr |
| Scale Factor Error (Non-Linearity) | 50 ppm | 200 ppm | ≤ 100 ppm |
| | | | |
| **ACCELEROMETER** | | | |
| Range | ± 30 g | ± 50 g | ± 20 g |
| In-Run Bias | | | |
|    Instability - Allan Variance | 45 µg, 1σ | 100 µg, 1σ | ≤ 100 µg, 1σ |
|    Over Temperature Range | 1125 µg, 1σ | 1 mg, 1σ | ≤ 300 µg, 1σ |
| Accel Noise Density (VRW) | 102 µg/√Hz | 100 µg/√Hz | ≤ 100 µg /√Hz |
| Scale Factor Error (Non-Linearity) | 300 ppm | 200 ppm | ≤ 100 µg |
| | | | |
| **ATTITUDE PERFORMANCE** | | | |
| Heading (Magnetic)[1] | 2.0° RMS | 2.0° RMS | 2.0° RMS |
| Heading (Static, Gyrocompass)[2] | - | - | 0.35° sec-lat |
| Heading (Dynamic, INS)[3] | 0.05°-0.1°, 1σ [4] | 0.03°, 1σ | 0.015°, 1σ |
| Pitch/Roll (Static) | 0.5° RMS | 0.05°, 1σ | 0.02°, 1σ |
| Pitch/Roll (Dynamic, INS)[3] | 0.015°, 1σ | 0.01°, 1σ | 0.01°, 1σ |

**1.** With proper magnetic declination, suitable magnetic environment and valid hard/soft iron calibration.
**2.** Alignment time ≤ 5 minutes.
**3.** With sufficient motion for dynamic alignment.
**4.** Dependant on a number of factors, contact VectorNav to discuss expected performance in your application.

# SAASM AND M-CODE RECEIVER SUPPORT

Applications that require precise positioning when operating in contested environments require the latest developments in modernized GPS with anti-jamming/anti-spoofing capabilities and increased security.

Legacy SAASM (Selective Availability Anit-Spoofing Module) GPS receivers are being updated to M-Code receivers that feature greater anti-jamming and security. VectorNav's Tactical Series supports any GPS/ GNSS receiver that is configured to output GPS-ICD-153 protocol. Simple connection of power, ground, serial communication lines and 1PPS to the auxiliary port on the Tactical Series device will enable the sensor to utilize the external PVT data for its INS solution.

## EXAMPLE SAASM & M-CODE GPS RECEIVERS

**BAE SYSTEMS***
MPE™-S
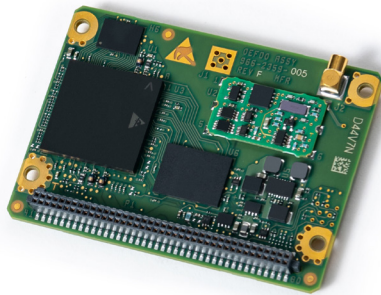


**BAE SYSTEMS***
MPE™-M
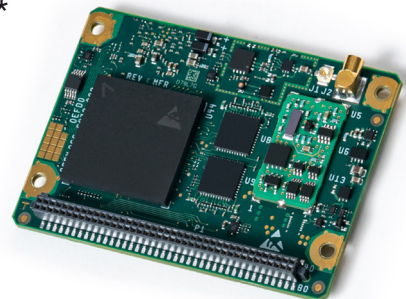


# ENABLING ADVANCED CAPABILITIES

Connecting external IMUs or SAASM/M-Code GPS receivers to the VectorNav sensor's auxiliary port enables users to retain existing drivers and interfaces to the sensor's main port. Simple configuration of the VectorNav sensor to accept external IMUs or GPS receivers can be done using VectorNav's Control Center GUI. This enables users to seamlessly increase operational performance and capabilities of their inertial solution. Please contact VectorNav support (support@vectornav.com) for information regarding cable purchase.

## Advanced Capabilities
► Gyrocompassing
► GPS Denied Navigation
► Anti-Jam/Anti-Spoof
► Assured PNT

## CONNECTION SCHEMATIC
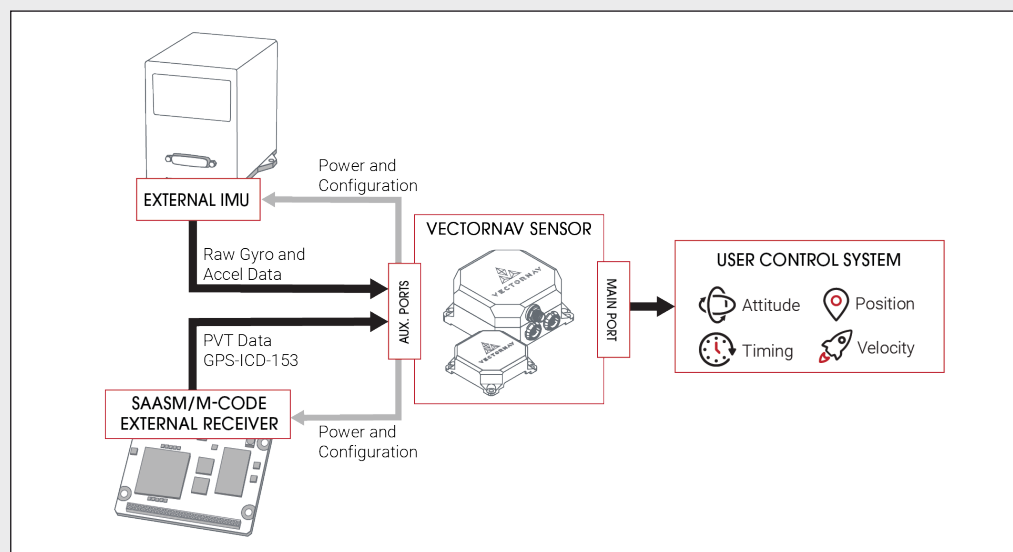


**\*** BAE Systems and VectorNav Technologies do not have an exclusive dealing agreement.

# TACTICAL SERIES SENSOR SUMMARY

- VectorNav proprietary Extended Kalman Filter INS delivers coupled position, velocity, and a continuous attitude solution over the complete 360° range of operation
- VectorNav Processing Engine (VPE) for disturbance rejection, adaptive filtering, dynamic filter tuning
- Hard/Soft Iron Compensation (Real-time and Manual 2D & 3D)
- Individually calibrated for bias, scale factor, misalignment, and temperature over full operating range (-40°C to +85 °C)
- RTK Capable: Support for External RTCM 3 Inputs
- Raw GNSS Data: Exportable RINEX Data for PPK; Raw Pseudorange, Doppler and Carrier Phase outputs
- Support for external RTK GNSS receivers (NovAtel, Septentrio) & SAASM & M-Code GPS receivers (ICD-GPS-153)
- Coning and sculling integrals ($\Delta V$'s, $\Delta \theta$'s)
- Data output format: ASCII (VectorNav), NMEA-0183, Binary (VectorNav), ARINC 429[1]
- VN-110E/210E/310E: 24-pin 1mm pitch board-to-board interface connector with U.FL for GNSS antenna connection

**1.** Contact VectorNav for ARINC 429 option.
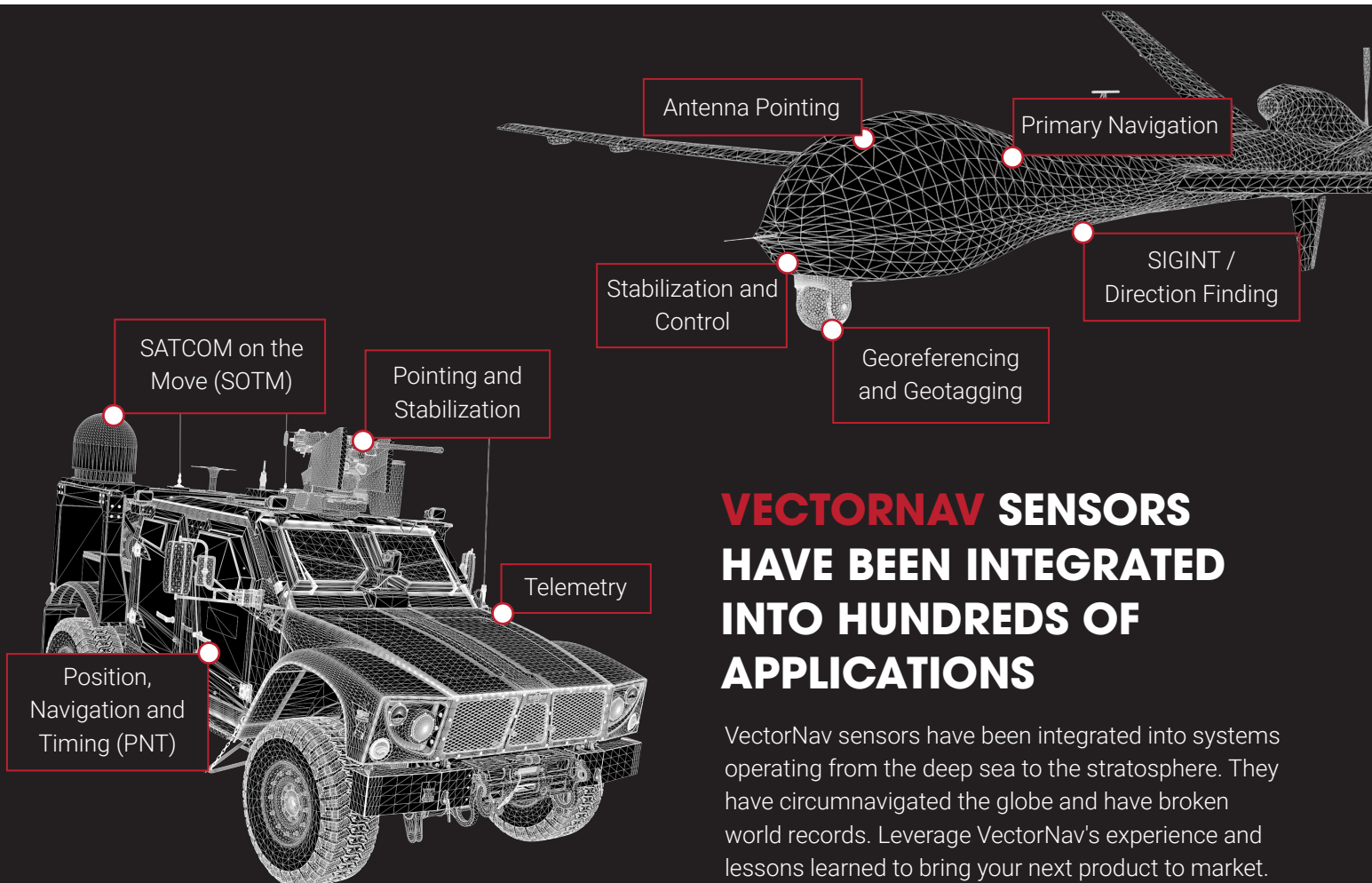**2.** Contact VectorNav for higher IMU data output rates.
**3.** VN-110, VN-210 and VN-310 only, does not apply to VN-110E, VN-210E or VN-310E.

## Interfacing

Output Data Rate (IMU)[2] ........................................................................... up to 800 Hz

Output Data Rate (Position, Velocity & Attitude) ..................................... up to 400 Hz

Primary Interface (VN-110, VN-210, VN-310) ................. RS-422 (Optional RS-232)

Auxiliary Interface (VN-110, VN-210, VN-310) ................................................. RS-422

Interface (VN-110E, VN-210E, VN-310E) ................................................ (2) Serial TTL

GNSS PPS .................................................................... 30 ns RMS, 60 ns 99%

Input ................................................................................................... Sync-in

Output ................................................................................................ Sync-out

## Environmental and Qualifications

Operating Temperature ............................................................... -40° to +85° C

Storage Temperature .................................................................. -40° to +85° C

Ingress[3] ......................................................................... IP 68 per IEC 60529

Temperature[3] ................................................................................ DO-160G

Electrical[3] ............................................................................ MIL-STD-1275E

Vibration and Shock[3] ............................................................... MIL-STD-810G

EMI & Radiation[3] ..................................................................... MIL-STD-461G

Antenna Pointing

Primary Navigation

Stabilization and Control

SIGINT / Direction Finding

Georeferencing and Geotagging

SATCOM on the Move (SOTM)

Pointing and Stabilization

Telemetry

Position, Navigation and Timing (PNT)

## VECTORNAV SENSORS HAVE BEEN INTEGRATED INTO HUNDREDS OF APPLICATIONS

VectorNav sensors have been integrated into systems operating from the deep sea to the stratosphere. They have circumnavigated the globe and have broken world records. Leverage VectorNav's experience and lessons learned to bring your next product to market.

HEADQUARTERS

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