ADVANCED NAVIGATION
POSITIONING EVERYWHERE

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COMPANY OVERVIEW

Advanced Navigation develops industry-leading navigation and robotics technologies for air, land, sea and space applications.

35,000
SOLUTIONS IN OPERATION

20%
OF TOTAL REVENUE INVESTED IN R&D

70+
COUNTRIES SOLD TO

1,000
CLIENTS TRUST OUR SOLUTIONS

Advanced Navigation's mission is to drive the autonomy revolution with high reliability AI powered systems delivering unparalleled capabilities and performance. Our customers choose us for our high performance, reliabilty and advanced design.

Many of the world's leading companies use Advanced Navigation

AEROSPACE:

AIRBUS   BAE SYSTEMS   BOEING   LEONARDO

DEFENCE:

LOCKHEED MARTIN   NASA JPL   Raytheon   THALES

AUTOMOTIVE:

Ford   GM General Motors   EMBARK   TESLA

TECHNOLOGY
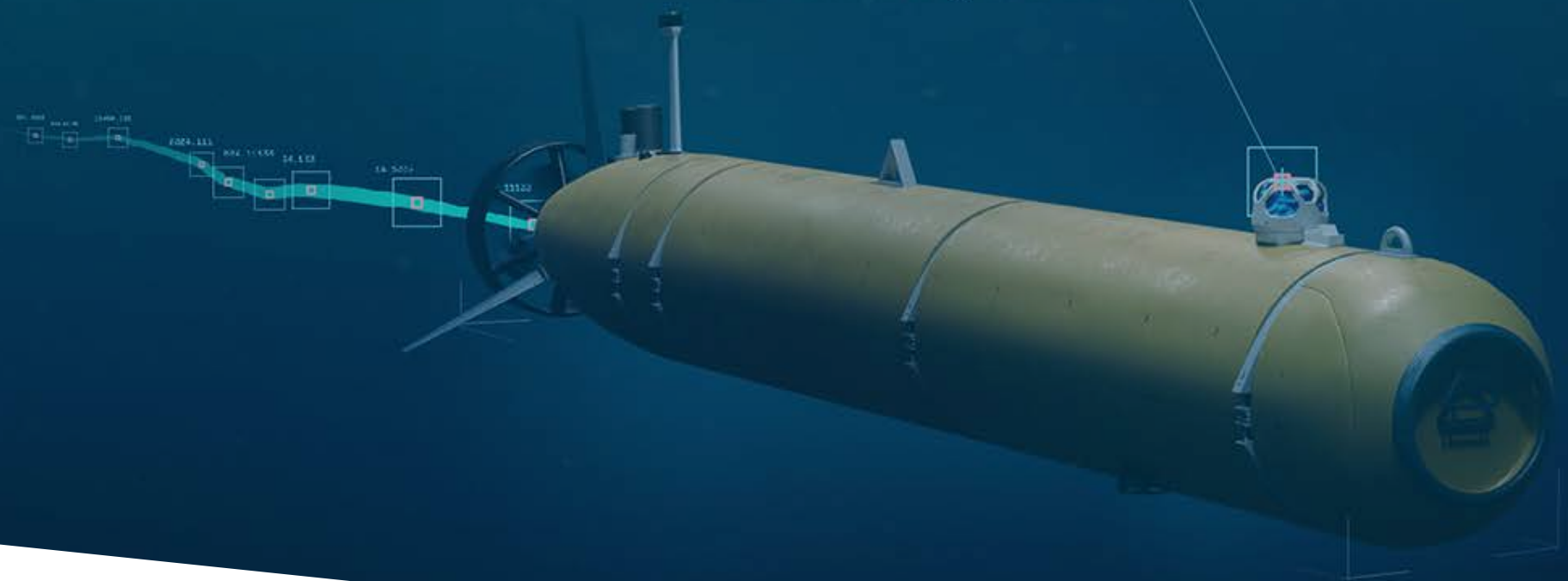
Apple   BOSCH   FACEBOOK   Google

ACCURATE POSITIONING UNDER
DEMANDING CONDITIONS

⊞ SUBSONUS – USBL & INS
Y: 183.78 °   P: 4.91 °   R: 0.12 °
Alt: -2 m
Lat: -33.862687 Long: 151.208860

01 | QUALITY

Our products are put through an intensive calibration process to optimise their performance and provide consistently accurate data over an extended temperature range of -40 °C to 85 °C.

Advanced Navigation's custom calibration process is the only full sensor calibration that can provide dynamic ranging, allowing the user to select a sensor range for high accuracy or high accelerations on the fly. As part of this calibration, every single product unit spends a minimum of 8 hours in our specially built rotating temperature chambers. Advanced Navigation's quality management system is ISO 9001 accredited.

02 | RELIABILITY

Our solutions are designed from the ground up for mission critical control applications where reliability is essential. They are built on top of a safety oriented real time operating system and all software is designed and tested to safety standards with fault tolerance in mind.

The hardware is protected from reverse polarity, overvoltage, surges, static and short circuits on all external interfaces. The GNSS contains RAIM (Receiver Autonomous Integrity Monitoring), which excludes both malfunctioning, and tampered satellite signals.

03 | ADVANCED FILTERS

All Advanced Navigation INSs feature a revolutionary sensor fusion filter. The filter is more intelligent than a typical extended Kalman filter and is able to extract significantly more information from the data by making use of human inspired artificial intelligence.

It was designed for control applications and has a high level of health monitoring and instability prevention to ensure stable and reliable data.

04 | CUSTOM SOLUTIONS

Advanced Navigation has a long-standing track record of developing bespoke hardware and software solutions ranging from the integration of encrypted military GNSS receiver to implementing motion analysis algorithms.

OUR RANGE OF **PRODUCTS**

INERTIAL NAVIGATION SYSTEMS

COMPASS

	IMU / AHRS		MEMS GNSS / INS			FOG GNSS / INS			SATELLITE COMPASS
	ORIENTUS	**MOTUS**	**SPATIAL**	**CERTUS**	**CERTUS EVO**	**SPATIAL FOG DUAL**	**BOREAS**		**GNSS COMPASS**
	Miniature IMU and AHRS	Ultra-high accuracy IMU and AHRS	Cost-effective single antenna INS	Market-leading dual antenna INS	Ultra-high accuracy INS	Field-proven FOG INS	Strategic-grade FOG with low SWaP-C		Cost-effective GNSS/INS navigation solution
							D70	**D90**	
PERFORMANCE									
Roll & Pitch	0.2 °	0.05 °	0.1 °	0.1 °	0.03 °	0.01 °	0.01 °	0.005 °	0.4 °
Heading	0.5 ° (magnetic)	0.8 ° (magnetic)	0.2 ° (GNSS)	0.1 ° (GNSS)	0.05 ° (GNSS)	0.01 ° (GNSS)	0.01 ° (GNSS)	0.006 ° (GNSS)	0.2 ° (GNSS)
Gyrocompass Heading	–	–	–	–	–	0.25 ° seclat	0.1 ° seclat	0.01 ° seclat	–
Positioning	–	–	20 mm (RTK)	10 mm (RTK)	10 mm (RTK)	10 mm (RTK)	10 mm (RTK)	10 mm (RTK)	0.01 m (RTK)
Gyro Bias	3 °/hr	0.2 °/hr	3 °/hr	3 °/hr	0.2 °/hr	0.1 °/hr	0.01 °/hr	0.001 °/hr	5 % or 0.05 m
SWaP									
Size	30 x 41 x 24 mm	42 x 67 x 30 mm	30 x 41 x 24 mm	78 x 115 x 34 mm	78 x 115 x 44 mm	94 x 94 x 98 mm	160 x 140 x 116 mm		672 x 190 x 73.9 mm
Weight	25 grams	98 grams	37 grams	280 grams	300 grams	740 grams	2,500 grams		1460 grams
Power	0.5 W	1.4 W	0.5 W	2.64 W	2.9 W	6.1 W	12 W		1.3 W

SUBSEA

UNDERWATER ACOUSTIC NAVIGATION	
SUBSONUS	**SUBSONUS TAG**

SOFTWARE

KINEMATICA POST-PROCESSING

ACCESSORIES

LOGGING UNIT	**AIR DATA UNIT**	**OBDII ODOMETER**	**SUBMERSIBLE ANTENNA**

ORIENTUS
MEMS AHRS

Orientus is a ruggedised miniature sensor and AHRS that provides accurate orientation under the most demanding conditions.

It combines temperature calibrated accelerometers, gyroscopes and magnetometers in a sophisticated fusion algorithm to deliver accurate and reliable orientation.

PERFORMANCE

- 0.2 ° Roll and Pitch
- 0.8 ° Heading (Magnetic)
- 3 °/hr Gyroscope Bias
- 1000 Hz Update Rate

KEY FEATURES

- Linear Acceleration Compensation
- Magnetic Interference Mitigation
- Low Weight : 25 Grams
- Small Size : 30 x 30 x 24 mm
- Low Power : 0.325 W

ITAR FREE

APPLICATIONS

AIR
- UAV Orientation
- Stabilisation & Pointing

LAND
- Robotic Control & Orientation
- Stabilisation & Pointing
- Human Movement

SEA
- AUV Orientation
- ROV Orientation

SPECIFICATIONS

ORIENTATION

Roll & Pitch Accuracy (Static)	0.2 °
Heading Accuracy (Static)	0.8 °
Roll & Pitch Accuracy (Dynamic)	0.6 °
Heading Accuracy (Dynamic)	1.0 °
Orientation Range	Unlimited
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz
Latency	0.3 ms

HARDWARE

Operating Voltage	4 to 36 V
Input Protection	± 60 V
Power Consumption	0.325 W
Operating Temperature	-40 °C to 85 °C
Environmental Protection (Enclosed)	IP67 MIL-STD-810G
MTBF	380,000 hrs
Shock Limit	2000 g
Dimensions (excluding tabs)	30 x 30 x 24 mm
Dimensions (including tabs)	30 x 40.6 x 24 mm
Weight	25 grams

COMMUNICATION

Interface	RS232
Speed	4800 to 1M baud
Protocol	AN Packet Protocol, NMEA or TSS
Peripheral Interfaces	2x GPIO and Auxiliary RS232
GPIO Level	5 V
GPIO Functions	NMEA input / output Novatel input AN Packet Protocol input / output Magnetometers disable Set zero orientation Packet trigger u-blox input TSS output Custom (contact us)

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS
Range (dynamic)	± 2 g ± 4 g ± 16 g	± 250 °/s ± 500 °/s ± 2000 °/s	± 2 G ± 4 G ± 8 G
Bias Instability	20 ug	3 °/hr	-
Initial Bias	< 5 mg	< 0.2 °/s	-
Initial Scaling Error	< 0.06 %	< 0.04 %	< 0.07 %
Scale Factor Stability	< 0.06 %	< 0.05 %	< 0.09 %
Non-linearity	< 0.05 %	< 0.05 %	< 0.08 %
Cross-axis Alignment Error	< 0.05 °	< 0.05 °	< 0.05 °
Noise Density	100 ug/√Hz	0.004 °/s/√Hz	210 uG/√Hz
Bandwidth	400 Hz	400 Hz	110 Hz

MOTUS
MEMS IMU

Motus is a miniature ultra high accuracy MEMS IMU. It features some of the highest accuracy MEMS accelerometers and gyroscopes currently available combined with magnetometers.

Motus is fully calibrated for all sensor errors over a wide temperature range and can be software upgraded to AHRS or INS functionality. It is available in both OEM and enclosed packages.

PERFORMANCE

- 0.05 ° Roll and Pitch
- 0.8 ° Heading (Magnetic)
- 0.2 °/hr MEMS Gyroscope
- 1000 Hz Update Rate
- 150 g 6 ms Shock Limit

KEY FEATURES

- IMU, AHRS and INS Options
- Rugged and OEM Versions
- 500 ms Hot Start

ITAR FREE

APPLICATIONS

AIR
- UAV Geopointing
- UAV Lidar
- Gimbal Stabilisation

LAND
- Gimbal Stabilisation
- Structural Monitoring
- Vehicle Navigation

SEA
- AUV Navigation
- ROV Navigation
- Hydrography

SPECIFICATIONS

NAVIGATION

Roll & Pitch Accuracy	0.05°
Heading Accuracy (magnetic)	0.8 °
Roll & Pitch Accuracy (external GNSS aided)	0.03 °
Heading Accuracy (external GNSS aided)	0.05 °
Horizontal Position Accuracy (external GNSS aided)	0.8 m
Vertical Position Accuracy (external GNSS aided)	1.5 m
Velocity Accuracy (external GNSS aided)	0.007 m/s
Orientation Range	Unlimited
Hot Start Time	500 ms
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz

HARDWARE

Operating Voltage (OEM)	4.5 to 5.5 V
Operating Voltage (Enclosed)	5 to 36 V
Input Protection (Enclosed only)	± 60 V
Power Consumption (Typical)	1.4 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 85 °C
Environmental Protection (Enclosed)	IP67 MIL-STD-810G
MTBF	200,000 hrs
Shock Limit	150 g, 6 ms, half sine
Vibration Limit	8 g RMS
Dimensions (OEM)	34 x 39 x 24 mm
Dimensions (Enclosed)	42 x 67 x 30 mm
Weight (OEM)	26 grams
Weight (Enclosed)	98 grams

COMMUNICATION

Interface (OEM)	UART
Interface (Enclosed)	RS232 (RS422 version available)
Speed	4800 to 2M baud
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO and Auxiliary RS232
GPIO Level	5 to 20 V
GPIO Functions	1PPS Input Sensor sync input Sensor sync output Odometer Stationary Air Data Input NMEA input/output Novatel GNSS input Trimble GNSS input AN Packet Protocol

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS
Range	± 10 g	± 475 °/s	± 8 G
Bias Instability	8 ug	0.2 °/hr	-
Initial Bias	< 0.45 mg	< 3 °/hr	-
Initial Scaling Error	< 0.03 %	< 0.02 %	< 0.07 %
Scale Factor Stability	< 0.04 %	< 0.03 %	< 0.09 %
Non-linearity	< 0.05 %	< 0.03 %	< 0.08 %
Cross-axis Alignment Error	< 0.05 °	< 0.05 °	< 0.05 °
Noise Density	2 ug/√Hz	6 °/hr/√Hz	210 uG/√Hz
Bandwidth	250 Hz	200 Hz	110 Hz

SPATIAL
MEMS GNSS/INS

Spatial is a ruggedised miniature GPS aided inertial navigation system and AHRS that provides accurate position, velocity, acceleration and orientation under the most demanding conditions.

It combines temperature calibrated accelerometers, gyroscopes, magnetometers and a pressure sensor with an advanced GNSS receiver. These are coupled in a sophisticated fusion algorithm to deliver accurate and reliable navigation and orientation.

PERFORMANCE

- 0.1 ° Roll and Pitch
- 0.2 ° Heading (GNSS)
- 20 mm RTK Positioning
- 3 °/hr MEMS Gyroscope
- 1000 Hz Update Rate

KEY FEATURES

- Multi-Constellation RTK
- Hot Start Time : 500 ms
- Low Weight : 37 grams
- Small Size : 30 x 30 x 24 mm
- Low Power : 0.5 W

ITAR FREE

APPLICATIONS

AIR
- UAV Navigation
- Georeferencing
- Stabilisation & Pointing

LAND
- Ground Vehicle Navigation
- Georeferencing
- Robotics Control

SEA
- AUV Navigation
- ROV Navigation
- Hydrography

SPECIFICATIONS

NAVIGATION

Horizontal Position Accuracy	2.0 m
Vertical Position Accuracy	3.0 m
Horizontal Position Accuracy (with RTK)	0.02 m
Vertical Position Accuracy (with RTK)	0.03 m
Horizontal Position Accuracy (Kinematica post processing)	0.01 m
Vertical Position Accuracy (Kinematica post processing)	0.02 m
Velocity Accuracy	0.05 m/s
Roll & Pitch Accuracy	0.1 °
Heading Accuracy (Dynamic with GNSS)	0.2 °
Heading Accuracy (Magnetic Only)	0.8 °
Roll & Pitch Accuracy (Kinematica post processing)	0.04 °
Heading Accuracy (Kinematica post processing)	0.08 °
Heave Accuracy (whichever is greater)	5 % or 0.05 m
Orientation Range	Unlimited
Hot Start Time	500 ms
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz
Latency	0.4 ms

GNSS

Model	u-blox M8P
Supported Navigation Systems	GPS L1 GLONASS L1 GALILEO E1 BeiDou L1
Update Rate	10 Hz
Cold Start Sensitivity	-148 dBm
Tracking Sensitivity	-160 dBm
Hot Start First Fix	1 s
Cold Start First Fix	26 s
Horizontal Position Accuracy	2.5 m
Horizontal Position Accuracy (with L1 RTK)	0.02 m
Velocity Accuracy	0.05 m/s
Timing Accuracy	30 ns
Acceleration Limit	4 g

HARDWARE

Operating Voltage	5 to 36 V
Input Protection	± 60 V
Power Consumption (typical)	0.5 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 85 °C
Environmental Protection	IP67 MIL-STD-810G
MTBF	310,000 hrs
Shock Limit	2000 g
Dimensions (excluding tabs)	30 x 30 x 24 mm
Dimensions (including tabs)	30 x 40.6 x 24mm
Weight (Rugged)	37 grams
Weight (OEM)	26 grams

COMMUNICATION

Interface	RS232
Speed	4800 to 2M baud
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO and 2x Auxiliary RS232
GPIO Level	5 V or RS232
GPIO Functions	1PPS Odometer Stationary Pitot Tube NMEA input / output Novatel GNSS input Trimble GNSS input Packet Trigger Input Event Input

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS
Range (dynamic)	± 2 g ± 4 g ± 16 g	± 250 °/s ± 500 °/s ± 2000 °/s	± 2 G ± 4 G ± 8 G
Bias Instability	20 ug	3 °/hr	-
Initial Bias	< 5 mg	< 0.2°/s	-
Initial Scaling Error	< 0.06 %	< 0.04 %	< 0.07 %
Scale Factor Stability	< 0.06 %	< 0.05 %	< 0.09 %
Non-linearity	< 0.05 %	< 0.05 %	< 0.08 %
Cross-axis Alignment Error	< 0.05 °	< 0.05 °	< 0.05 °
Noise Density	100 ug/√Hz	0.004 °/s/√Hz	210 uG/√Hz
Bandwidth	400 Hz	400 Hz	110 Hz

CERTUS
MEMS GNSS/INS

Certus combines temperature calibrated accelerometers, gyroscopes, magnetometers and a pressure sensor with a dual antenna GNSS receiver.

These are coupled in an AI based fusion algorithm to deliver accurate and reliable navigation data. It features low SWaP-C (Size, Weight, Power and Cost), internal data logging and multiple communication interfaces for easy integration.

Certus is available in both OEM and rugged packages, and comes standard with license free 10 mm RTK position accuracy.

PERFORMANCE

- 0.1 ° Roll and Pitch
- 0.1 ° Heading
- 10 mm RTK Positioning
- 3 °/hr MEMS Gyroscope
- 1000 Hz Update Rate

KEY FEATURES

- Dual Antenna Heading
- Free Multi-Constellation RTK
- Ethernet, CAN, RS232, etc.
- Internal Data Logging
- OEM or Rugged Options

ITAR FREE

APPLICATIONS

AIR
- UAV Navigation
- Georeferencing
- Camera Pointing

LAND
- Vehicle Navigation
- Georeferencing
- Antenna Targeting

SEA
- Hydrography
- Marine Navigation

SPECIFICATIONS

NAVIGATION

Horizontal Position Accuracy	1.2 m
Vertical Position Accuracy	2.0 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Vertical Position Accuracy (with SBAS)	0.8 m
Horizontal Position Accuracy (with RTK or Kinematica PPK)	0.01 m
Vertical Position Accuracy (with RTK or Kinematica PPK)	0.015 m
Velocity Accuracy	0.05 m/s
Roll & Pitch Accuracy	0.1 °
Heading Accuracy (1m Antenna Separation)	0.1 °
Roll & Pitch Accuracy (Kinematica post processing)	0.03 °
Heading Accuracy (Kinematica post processing)	0.06 °
Slip Accuracy	0.1 °
Heave Accuracy	5 % or 0.05 m
Range	Unlimited
Hot Start Time	500 ms
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000Hz

HARDWARE

Operating Voltage (Rugged)	9 to 36 V
Operating Voltage (OEM)	9 to 30 V (or 5 V)
Input Protection (Rugged only)	-40 to 100 V
Power Consumption (typical)	2.64 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 85 °C
Environmental Protection (Rugged only)	IP67 MIL-STD-810G
MTBF	140,000 hrs
Shock Limit	2000 g
Dimensions (Rugged)	78 x 115 x 34 mm
Dimensions (OEM)	75 x 101.5 x 24 mm
Weight (Rugged)	280 grams
Weight (OEM)	110 grams

GNSS

Model	Advanced Navigation Aries
Supported Navigation Systems	GPS L1, L2 GLONASS L1, L2 GALILEO E1, E5b BeiDou B1, B2
Supported SBAS Systems	WAAS EGNOS MSAS GAGAN QZSS
Update Rate	Up to 20 Hz
Hot Start First Fix	3 s
Cold Start First Fix	30 s
Horizontal Position Accuracy	1.2 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Horizontal Position Accuracy (with RTK)	0.01 m
Velocity Accuracy	0.05 m/s
Timing Accuracy	20 ns
Acceleration Limit	4 g

COMMUNICATION

Interfaces (Rugged)	Ethernet, RS232 / RS422, CAN
Interfaces (OEM)	Ethernet, UART, CAN
Speed	100 Mbit 4800 to 4M baud serial
Protocol	AN Packet Protocol NMEA0183 NMEA2000
Peripheral Interface	2x GPIO 1x Auxiliary RS232
GPIO Level	5 V or RS232
GPIO Functions	1PPS input / output Odometer Stationary Air data input NMEA input / output Novatel GNSS input Trimble GNSS input AN Packet Protocol CAN / CANopen Event trigger

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS	PRESSURE
Range (dynamic)	± 2 g ± 4 g ± 16 g	± 250 °/s ± 500 °/s ± 2000 °/s	± 2 G ± 4 G ± 8 G	10 to 120 KPa
Bias Instability	20 µg	3 °/hr	-	10 Pa
Initial Bias	< 5 mg	< 0.2 °/s	-	< 100 Pa
Initial Scaling Error	< 0.06 %	< 0.04 %	< 0.07 %	-
Scale Factor Stability	< 0.06 %	< 0.05 %	< 0.09 %	-
Non-linearity	< 0.05 %	< 0.05 %	< 0.08 %	-
Cross-axis Alignment Error	< 0.05 °	< 0.05 °	< 0.05 °	-
Noise Density	100 ug/√Hz	0.004 °/s/√Hz	210 uG/√Hz	0.56 Pa/√Hz
Bandwidth	400 Hz	400 Hz	110 Hz	50 Hz

CERTUS EVO
MEMS GNSS/INS

Certus Evo is an AI based GNSS-aided INS that provides extremely accurate position, velocity, acceleration and orientation under the most demanding conditions.

It offers FOG-like performance combined with the reliability and affordability of MEMS sensors. It features low SWaP-C (Size, Weight, Power and Cost), internal data logging and multiple communication interfaces for easy integration.

Certus Evo is available in both OEM and rugged packages, and comes standard with license free 10 mm RTK position accuracy.

PERFORMANCE

- 0.03 ° Roll and Pitch
- 0.05 ° Heading
- 10 mm RTK Positioning
- 0.2 °/hr MEMS Gyroscope
- 1000 Hz Update Rate

KEY FEATURES

- Dual Antenna Heading
- Free Multi-Constellation RTK
- Ethernet, CAN, RS232, etc.
- Internal Data Logging
- OEM or Rugged Options

ITAR FREE

APPLICATIONS

AIR
- UAV Geopointing
- UAV Lidar
- Stabilisation & Pointing

LAND
- Gimbal Stabilisation
- Structural Monitoring
- Vehicle Navigation

SEA
- AUV Navigation
- ROV Navigation
- Hydrography

SPECIFICATIONS

NAVIGATION

Horizontal Position Accuracy	1.2 m
Vertical Position Accuracy	2.0 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Vertical Position Accuracy (with SBAS)	0.8 m
Horizontal Position Accuracy (with RTK or Kinematica PPK)	0.01 m
Vertical Position Accuracy (with RTK or Kinematica PPK)	0.015 m
Velocity Accuracy	0.05 m/s
Roll & Pitch Accuracy	0.03 °
Heading Accuracy (1m Antenna Separation)	0.05 °
Roll & Pitch Accuracy (Kinematica post processing)	0.01 °
Heading Accuracy (Kinematica post processing)	0.01 °
Slip Accuracy	0.1 °
Heave Accuracy (whichever is greater)	5 % or 0.05 m
Range	Unlimited
Hot Start Time	500 ms
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz

HARDWARE

Operating Voltage (Rugged)	9 to 36 V
Operating Voltage (OEM)	9 to 30 V (or 5 V)
Input Protection (Rugged only)	-40 to 100 V
Power Consumption (typical)	2.9 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 85 °C
Environmental Protection (Rugged only)	IP67 MIL-STD-810G
MTBF	140,000 hrs
Shock Limit	2000 g
Vibration Limit	8 g
Dimensions (Rugged)	78 x 115 x 44 mm
Dimensions (OEM)	75 x 101.5 x 40.2 mm
Weight (Rugged)	300 grams
Weight (OEM)	125 grams

GNSS

Model	Advanced Navigation Aries
Supported Navigation Systems	GPS L1, L2 GLONASS L1, L2 GALILEO E1, E5b BeiDou B1, B2
Supported SBAS Systems	WAAS EGNOS MSAS GAGAN QZSS
Update Rate	Up to 20 Hz
Hot Start First Fix	3 s
Cold Start First Fix	30 s
Horizontal Position Accuracy	1.2 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Horizontal Position Accuracy (with RTK)	0.01 m
Velocity Accuracy	0.05 m/s
Timing Accuracy	20 ns
Acceleration Limit	4 g

COMMUNICATION

Interface (Rugged)	Ethernet, RS232 / RS422, CAN
Interface (OEM)	Ethernet, UART, CAN
Speed	100Mbit 4800 to 4M baud serial
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO 1x Auxiliary RS232
GPIO Level	5 V or RS232
GPIO Functions	1PPS input / output Odometer Stationary Air data input NMEA input / output Novatel GNSS input Trimble GNSS input AN Packet Protocol CAN / CANopen Event trigger

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS
Range	± 10 g	± 475 °/s	± 8 G
Bias Instability	8 µg	0.2 °/hr	-
Initial Bias	< 0.45 mg	< 3 °/Hr	-
Initial Scaling Error	< 0.03 %	< 0.02 %	< 0.07 %
Scale Factor Stability	< 0.04 %	< 0.03 %	< 0.09 %
Non-linearity	< 0.05 %	< 0.03 %	< 0.08 %
Cross-axis Alignment Error	< 0.05 °	< 0.05 °	< 0.05 %
Noise Density	2 ug/√Hz	6 °/hr/√Hz	210 uG/√Hz
Bandwidth	250 Hz	200 Hz	110 Hz

SPATIAL FOG DUAL
FOG GNSS/INS

Spatial FOG Dual is an industry-proven GNSS/INS and AHRS.

It combines high accuracy fibre optic gyroscopes, accelerometers, magnetometers and a pressure sensor with a dual antenna RTK GNSS receiver.

These are coupled in an AI based fusion algorithm to deliver accurate and reliable navigation data.

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PERFORMANCE

- 0.01 ° Roll and Pitch
- 0.01 ° Heading (GNSS)
- 10 mm RTK Positioning
- 0.1 °/hr FOG Gyroscope
- Heave: 2 % or 0.02 m (whichever is great)

KEY FEATURES

- Dual Antenna Heading
- Multi-constellation L1/L2 GNSS
- Hot Start Time : 2 Seconds
- Low Size, Weight and Power

APPLICATIONS

AIR
- Georeferencing
- UAV Navigation
- Stabilisation & Pointing

LAND
- Georeferencing
- Underground Navigation
- Ground Vehicle Navigation

SEA
- Hydrography
- Oil Rig Monitoring
- Marine Navigation

SPECIFICATIONS

NAVIGATION

Horizontal Position Accuracy	0.8 m
Vertical Position Accuracy	1.5 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Vertical Position Accuracy (with SBAS)	0.8 m
Horizontal Position Accuracy (with RTK or Kinematica PPK)	0.008 m
Vertical Position Accuracy (with RTK or Kinematica PPK)	0.015 m
Velocity Accuracy	0.005 m/s
Roll & Pitch Accuracy	0.01 °
Heading Accuracy	0.01 °
Roll & Pitch Accuracy (Kinematica post-processing)	0.005 °
Heading Accuracy (Kinematica post-processing)	0.007 °
Slip Accuracy	0.01 °
Heave Accuracy (whichever is greater)	2 % or 0.02 m
Orientation Range	Unlimited
Hot Start Time	2 s
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000 Hz

GNSS

Model	Trimble MB-Two
Supported Navigation Systems	GPS L1, L2 GLONASS L1, L2 GALILEO E1 BeiDou B1
Supported SBAS Systems	WAAS EGNOS MSAS GAGAN QZSS Trimble RTX
Update Rate	20 Hz
Hot Start First Fix	3 s
Cold Start First Fix	30 s
Horizontal Position Accuracy	1.2 m
Horizontal Position Accuracy (with SBAS)	0.5 m
Horizontal Position Accuracy (with RTK)	0.008 m
Velocity Accuracy	0.05 m/s
Timing Accuracy	20 ns
Acceleration Limit	11 g

HARDWARE

Operating Voltage	9 to 36 V
Input Protection	-40 to 100 V
Power Consumption (typical)	6.1 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 85 °C
Environmental Protection	IP67 MIL-STD-810G
MTBF	> 36,000 hrs
Shock Limit	40 g 11 ms
Vibration Limit	12 g
Dimensions	94 x 94 x 95 mm
Weight	740 grams

COMMUNICATION

Interface	RS422 (RS232 optional)
Speed	4800 to 10M baud
Protocol	AN Packet Protocol or NMEA
Peripheral Interface	2x GPIO and 2x Auxiliary RS232
GPIO Level	5 V or RS232
GPIO Functions	1PPS Odometer Stationary Pitot Tube NMEA input / output Novatel GNSS input Trimble GNSS input AN Packet Protocol input/output Packet Trigger Input Event Input

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	MAGNETOMETERS	PRESSURE
Range	± 10 g	± 490 °/s	± 8 G	10 to 120 KPa
Bias Instability	15 ug	0.1 °/hr	-	10 Pa
Initial Bias	< 1 mg	< 2 °/hr	-	< 100 Pa
Initial Scaling Error	< 0.03 %	< 0.01 %	< 0.07 %	-
Scale Factor Stability	< 0.04 %	< 0.02 %	< 0.09 %	-
Non-linearity	< 0.03 %	< 0.005 %	< 0.08 %	-
Cross-axis Alignment Error	< 0.04 °	< 0.02 °	< 0.05 °	-
Noise Density	120 ug/√Hz	0.7 °/hr/√Hz	210 uG/√Hz	0.56 Pa/√Hz
Bandwidth	200 Hz	440 Hz	110 Hz	50 Hz

BOREAS D90
GNSS/INS

Boreas combines ground-breaking Digital Fibre Optic Gyroscope (DFOG) and closed-loop accelerometer technologies, with a dual antenna RTK GNSS receiver.

These are coupled in an AI based fusion algorithm to deliver accurate and reliable navigation data.

The system features ultra-fast gyrocompassing, acquiring and maintaining an accurate heading under all conditions with no reliance on GNSS.

PERFORMANCE

- 0.005 ° Roll and Pitch
- 0.001 °/hr FOG Gyroscope
- 0.01 ° Gyrocompass Heading
- 2 min Gyrocompassing
- 3 Year Warranty

KEY FEATURES

- Ultra-Fast North Seeking
- AI-Based Algorithm
- Industry Leading SWAP-C
- Multiple Protocols & Interfaces

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APPLICATIONS

AIR
- Aerial Surveying
- Stabilisation & Pointing

LAND
- Land Surveying
- Antenna Targeting

SEA
- AUV Navigation
- ROV Navigation
- Hydrography

SPECIFICATIONS

NAVIGATION

Roll and Pitch Accuracy	0.005 °
Heading Accuracy (Dual GNSS 1m separation)	0.006 °
Heading Accuracy (without GNSS)	0.01 ° secant latitude
Gyrocompassing Alignment	2 minutes (typical) 10 minutes (maximum)
Accuracy with Odometer (no GNSS)	0.01 % distance travelled
Horizontal Position Accuracy (RTK or PPK)	0.01 m
Vertical Position Accuracy (RTK or PPK)	0.015 m
Horizontal Position Accuracy (SBAS)	0.5 m
Vertical Position Accuracy (SBAS)	0.8 m
Velocity Accuracy	0.005 m/s
Heave Accuracy	2 % or 0.02 m (whichever is greater)
Output Data Rate	1000 Hz

GNSS

Model	Advanced Navigation Aries
Supported Navigation Systems	GPS L1, L2 GLONASS L1, L2 GALILEO E1, E5b BeiDou B1, B2
Supported SBAS Systems	WAAS EGNOS MSAS GAGAN QZSS
Update Rate	Up to 20 Hz
Hot Start First Fix	2 s
Cold Start First Fix	30 s
Horizontal Position Accuracy	1.2 m
Horizontal Position Accuracy (SBAS)	0.5 m
Horizontal Position Accuracy (RTK)	0.01 m
Velocity Accuracy	0.05 m/s
Timing Accuracy	20 ns
Acceleration Limit	4 g

HARDWARE

Operating Voltage	9 to 36 V
Input Protection	-200 to 200 V
Power Consumption (Typical)	12 W
Hot Start Battery Capacity	> 48 hrs
Hot Start Battery Charge Time	30 mins
Hot Start Battery Endurance	> 10 years
Operating Temperature	-40 °C to 65 °C (v1.0) -40 °C to 75 °C (v1.1 & later)
Environmental Protection	IP67 MIL-STD-810H
MTBF	> 70,000 hrs
Shock Limit	50 g 11 ms
Vibration	8g rms (20-2000 Hz random)
Dimensions	160x140x115.5 mm
Weight	2.5 kg

COMMUNICATION

Interface	Ethernet RS232/RS422 CAN 1PPS
Speed	100Mbit 4800 to 4M baud serial
Protocol	AN Packet Protocol NMEA CANopen
Peripheral Interface	2x GPIO 1x Auxiliary RS232
GPIO Level	5 V (RS232) 3.3 V
GPIO Functions	1PPS input/output Odometer input DVL/USBL input Air Data input Zero Velocity input MEA input/output Novatel GNSS input Trimble GNSS input AN Packet Protocol CAN/CANopen

SENSORS

SENSOR	ACCELEROMETERS	GYROSCOPES	PRESSURE
Range	± 15 g	± 490 °/s	10 to 130 kPa
Bias Instability	7 µg	0.001 °/hr	8 Pa
Initial Bias	< 100 ug	< 0.01 °/hr	< 50 Pa
Initial Scaling Error	340 ppm	80 ppm	-
Scale Factor Stability	100 ppm	10 ppm	-
Non-linearity	150 ppm	10 ppm	-
Cross-axis Alignment Error	< 0.001 °	< 0.001 °	-
Noise Density	< 30 ug/√Hz	0.06 °/hr/√Hz	0.4 Pa/√Hz
Random Walk	17 mm/s/√hr VRW	0.001 °/√h ARW	-
Bandwidth	300 Hz	400 Hz	50 Hz

SATELLITE COMPASS
GNSS COMPASS

GNSS Compass is a low-cost all-in-one GNSS/INS navigation and heading solution.

It provides accurate dual-antenna GPS-based heading that is not subject to magnetic interference and can maintain accurate heading during GNSS outages of up to 20 minutes.

It features high accuracy RTK positioning and is plug and play with NMEA 0183, NMEA 2000, and Ethernet interfaces.

PERFORMANCE

- 0.4 ° Roll and Pitch
- 0.2 ° Heading
- 0.01 m RTK Positioning
- Heave: 5 % or 0.05 m (whichever is great)

KEY FEATURES

- Dual Antenna Heading
- GPS, GLONASS, Galileo & BeiDou
- Ethernet & Serial Options
- Easy to Interface With Hydrographic Packages

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APPLICATIONS

SEA
- Marine Navigation
- Hydrography

LAND
- Ground Vehicle Navigation
- Surveying

SPECIFICATIONS

NAVIGATION

Horizontal Position Accuracy	1.5 m
Vertical Position Accuracy	2.0 m
Horizontal Position Accuracy (with RTK)	0.01 m
Vertical Position Accuracy (with RTK)	0.015 m
Velocity Accuracy	0.05 m/s
Roll & Pitch Accuracy	0.4 °
Heading Accuracy	0.2 °
Heave Accuracy (whichever is greater)	5 % or 0.05 m
Range	Unlimited
Hot Start Time (orientation)	500 ms
Output Data Rate	Up to 200 Hz

GNSS

Supported Navigation Systems	GPS L1, L2 GLONASS G1, G2 GALILEO E1, E5b BeiDou B1, B2
Supported SBAS Systems	WAAS / EGNOS / MSAS / GAGAN / QZSS
Acceleration Limit	4 g
Hot Start First Fix	6 s
Cold Start First Fix	30 s
Heading Fix (after valid position)	10 s

COMMUNICATION (Ethernet)

Interface	Ethernet
Speed	10 / 100
Protocol	NMEA 0183 AN Packet Protocol TSS1 Simrad RTCM
Ports	Up to 4 TCP or UDP ports
Timing	PTP Server NTP Server
Timing Accuracy (PTP)	50 ns
Timing Accuracy (NTP)	1 ms

COMMUNICATION (Serial)

Interface	RS422 or RS232 CAN bus
Speed	2400 to 1M baud
Protocol	NMEA 0183 NMEA 2000 AN Packet Protocol TSS1 Simrad RTCM
Timing	1PPS Output
Timing Accuracy	20 ns

HARDWARE (Ethernet)

Power Input	Power over Ethernet (PoE) 802.3af or 802.3at
Power Consumption	1.3 W
Hot Start Battery Capacity	> 24 hrs
Operating Temperature	-40 °C to 85 °C
Environmental Protection	IP67 MIL-STD-810G
Shock Limit	75 g 11 ms
Dimensions	672 x 190 x 73.9 mm
Weight	1450 grams

HARDWARE (Serial)

Operating Voltage	9 to 36 V
Power Consumption	1.4 W
Operating Temperature	-40 °C to 85 °C
Environmental Protection	IP67 MIL-STD-810G
Shock Limit	75 g 11 ms
Dimensions	672 x 190 x 73.9 mm
Weight	1450 grams

SUBSONUS
USBL/INS

Subsonus is a miniature underwater acoustic positioning system that provides high accuracy position, velocity and heading at ranges of up to 1000 metres.

The USBL provides highly reliable tracking, even in high multipath, challenging acoustic environments, thanks to its advanced signal processing and unique hydrophone design.

Subsonus also seamlessly operates as a modem capable of transmitting user data underwater.

SPECIFICATIONS

NAVIGATION

Position Accuracy (5 m range)	0.1 m
Position Accuracy (100 m range)	0.5 m
Position Accuracy (1000 m range)	5.0 m
Velocity Accuracy	0.01 m/s
Roll and Pitch Accuracy	0.1 °
Heading Accuracy	0.3 °
Heave Accuracy (whichever is greater)	5 % or 0.05 m
Internal Filter Rate	1000 Hz
Output Data Rate	Up to 1000Hz
Latency	0.6 ms

ACOUSTICS

Hydrophones	8
Frequency	30 kHz (broadband)
Range	1000 m
Acoustic Coverage	300 ° hemispherical
Range Accuracy	0.1 % of slant range
Angular Accuracy	0.1 °
Update Rate	Up to 10 Hz
Data Transfer Rate	Up to 10 kbit

SENSORS

Integrated GNSS/INS	Yes
Integrated GNSS Antenna	In top of hydrophone array
Pressure Sensor Range	1000 m
Pressure Sensor Accuracy	1.5 m

HARDWARE

Operating Voltage	9 to 60 V or Power over Ethernet
Power Consumption (Average)	10 W
Power Consumption (Peak)	25 W
Interface	Ethernet (RS232 / RS422 through ILU)
Timing Synchronisation	PTP and NTP support
Depth Rating	1000 m
Operating Temperature	-20 °C to 40 °C
Storage Temperature	-40 °C to 85 °C
Shock Limit	25 g
Dimensions	106 x 106 x 93 mm
Weight in Air	1170 g
Weight in Water	650 g

PERFORMANCE

- 0.1 m Positioning Accuracy
- 0.1 ° Roll and Pitch
- 0.3 ° Acoustic Heading
- 1000 m Range and Depth

KEY FEATURES

- Integrated INS
- Multipath Rejection
- Acoustic Modem
- Very Low Size, Weight and Power
- Speed of Sound Sensor

APPLICATIONS

AUV & ROV NAVIGATION	DIVER TRACKING	SUBSEA SURVEYING

SUBSONUS TAG
TRANSPONDER

Subsonus Tag is a low cost acoustic positioning transponder that operates with the Subsonus USBL.

It features an integrated battery, wireless charging and a pressure tolerant display.

Ultra low-power consumption allows operation for up to 18 months on one charge.

Up to 65,000 Tag underwater transponders can be tracked by one surface Subsonus unit.

PERFORMANCE

- ⦿ 0.25 m Positioning Accuracy
- ⊖ 1000 m Range
- ⚓ 2000 m Depth Rating

KEY FEATURES

- • 18 Months Battery Life
- • Very Low Size, Weight and Power
- • No Maintenance
- • Cost Effective
- • Integrated Display

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APPLICATIONS

SUBSEA ASSET TRACKING	AUV & ROV NAVIGATION	DIVER TRACKING	MOORING IDENTIFICATION

SPECIFICATIONS

POSITIONING (with Subsonus USBL)

Position Accuracy (5 m range)	0.25 m
Position Accuracy (100 m range)	1.5 m
Position Accuracy (1000 m range)	15.0 m

SENSORS

Roll & Pitch Accuracy	1.0 °
Heading Accuracy	2.0 °
Heading Source	Magnetic
Water Temperature Accuracy	0.5 °C

BATTERY

Battery Capacity	28 Wh
Battery Life (5 second ping rate)	48 hours
Battery Life (1 ping/hour)	30 days
Battery Life (listening)	18 months
Charging	Qi Wireless Charging v1.2
Battery recharge time	6 hours

DISPLAY

Display Type	Pressure Tolerant Electronic Paper Display (EPD)
Display Size	54 mm
Display Resolution	122 x 250 Pixels
Display Daylight Visibility	Direct Sunlight
Display Backlight	Yes (Configurable)

ACOUSTICS

Frequency	30 kHz (broadband)
Range	1000 m
Beam pattern	Omnidirectional
Range Timing Accuracy	0.01 m
Maximum Update Rate	1.3 Hz
Transmit Power	Dynamic
Data Transfer	Yes
Remote Acoustic Configuration	Yes

HARDWARE

Interface	Bluetooth Low Energy v4.1
Material	Polymer Composite
Depth Rating	2000 m
Operating Temperature	-5 °C to 50 °C
Storage Temperature	-20 °C to 60 °C
Shock Limit	40 g
Dimensions	52 x 52 x 125 mm
Weight in Air	550 g
Weight in Water	250 g

KINEMATICA
POST-PROCESSING

Kinematica is web based GNSS/INS post-processing software that allows users to process raw GNSS and inertial data after collection and achieve higher accuracy results than is possible in real time.

Kinematica supports all of Advanced Navigation's GNSS/INS products, is packed with features and provides market leading performance.

MAXIMUM INS ACCURACY

Kinematica processes data backward and forward in time with advanced algorithms. This allows it to significantly reduce errors and extract the very best performance possible from an inertial navigation system.

KINEMATIC GNSS POSITIONING

Kinematica features kinematic GNSS post processing which provides a 200x increase in position accuracy over standard GNSS.

Kinematica automatically downloads the closest RINEX base station data and outputs position to an accuracy of 8 mm.

FORWARD & REVERSE PROCESSING

Kinematica's PPK algorithm parses data forwards and backwards to fill satellite outages and ignore errors that would normally affect a real time solution.

Data is processed in both diurections multiple times in order to obtain the highest accuracy results.

PRECISE POINT POSITIONING (PPP)

The Precise point positioning (PPP) algorithm models GNSS errors to provide decimetre-level positioning accuracy.

PPP can be used anywhere in the world, for example at sea or in remote areas, where real-time kinematic (RTK) accuracy in unavailable.

DUAL ANTENNA HEADING

For dual antenna systems, Kinematica supports tightly coupled dual antenna heading processing which significantly increases heading accuracy.

ACCESSORIES

LOGGING UNIT

The ILU (Interface and Logging Unit) is a device server that interfaces to any of Advanced Navigation's systems and provides data logging, a web interface, a time synchronisation server and a wide variety of different industry standard data input/output options.

OBDII ODOMETER

The OBDII Odometer is a plug & play interface cable that communicates with a vehicle's on-board computer to determine the current vehicle speed.

It outputs real time vehicle speed over an RS232 serial data interface. When connected to one of Advanced Navigation's Spatial series of GNSS/INS products it allows for outstanding navigation accuracy when GNSS is not available.

POSEIDON

Poseidon is a subsea GPS/GLONASS/GALILEO/BeiDou antenna that is designed for use on underwater vehicles that require the ability to obtain a GNSS fix when surfaced.

The antenna is also suitable for marine vessels that are exposed to harsh conditions that are too extreme for a normal GNSS antenna. The antenna is lightweight, compact, corrosion resistant and able to withstand depths of up to 3000 metres.

L-Band reception allows reception from services such as Marinestar and Atlas.

AIR DATA UNIT

The Air Data Unit is used to measure pitot airspeed and barometric altitude in fixed wing aircraft.

It features high accuracy temperature calibrated pitot and static air data sensors and outputs data over RS232.

It can be used standalone or connected to one of Advanced Navigation's Spatial series of GNSS/INS products for outstanding navigation accuracy in fixed wing aircraft when GNSS is not available.
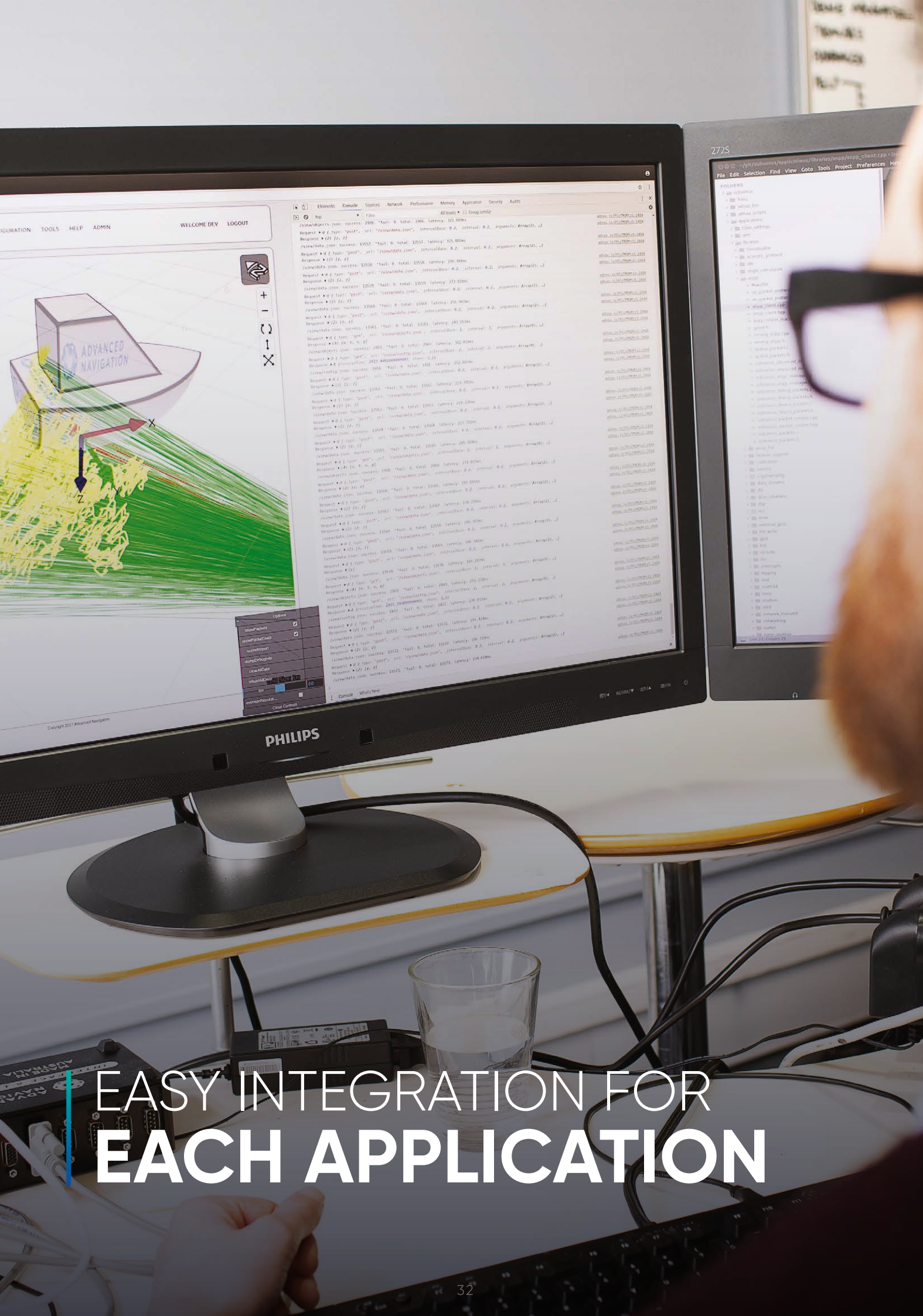
EASY INTEGRATION FOR
EACH APPLICATION

01 | GRAPHICAL USER INTERFACE

A comprehensive graphical user interface (GUI) that covers all applications is freely available for Windows and Android.

The GUI provides straightforward device configuration and an interface to data including real time position and attitude, raw sensor values, data logging and NTRIP Client functionality.
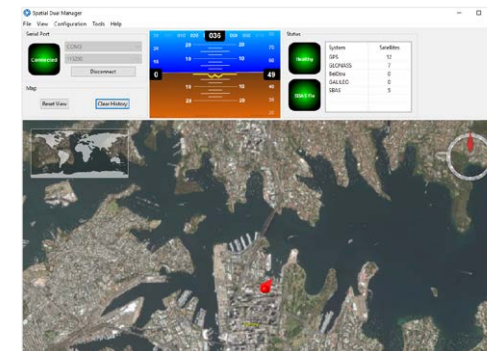
02 | INTEGRATION TOOLS

2.1. Hardware Evaluation Kit:
Contains a ruggedised device and the necessary cabling and accessories to facilitate rapid start-up for prototypes and one-off systems.

2.2. Hardware Development Kit:
Allow developers to quickly test and integrate our OEM devices into prototypes for high volume products. The included OEM development board provides the user with access to all the OEM device's interfaces with a number of convenient connection options.

2.3. Software Development Kit:
Provide comprehensive example source code for interfacing with our devices through the sophisticated Advanced Navigation Packet Protocol. Languages supported include C/C++, Java, .NET/C# and Matlab/Octave.
Full source code for a number of utilities such as NTRIP and ROS are also included.

03 | SUPPORT

Our qualified engineers are standing by to assist you in integrating and operating Advanced Navigation solutions. They provide free technical support by phone, email and website ticket.

ULTRONICS

ADVANCED NAVIGATION

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ADVANCED NAVIGATION