



# NovAtel SPAN<sup>®</sup> and Waypoint<sup>®</sup>

GNSS + INS Technology



# SPAN Technology

SPAN provides continual 3D positioning, velocity and attitude determination anywhere satellite reception may be compromised. SPAN uses NovAtel's industry leading GNSS (Global Navigation Satellite System) technology and Inertial Measurement Units (IMU) to create a tightly coupled GNSS/INS solution at data rates up to 200 Hz. A range of receiver, IMU and antenna options are available to meet accuracy and size requirements for nearly any application.

For comprehensive SPAN information, visit [www.novatel.com/products/span-gnss-inertial-systems](http://www.novatel.com/products/span-gnss-inertial-systems)

# Inertial Explorer® Software



In many applications, absolute solution accuracy is critical but not required in real-time. SPAN products allow for the collection of raw GNSS and IMU measurement data for later use. Inertial Explorer uses the stored measurement data, post-mission, to generate a much more accurate solution than is possible in real-time. SPAN also uses the following features to increase accuracy:

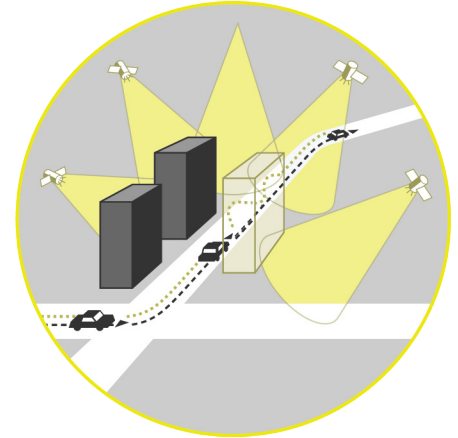
- local base station differential processing
- processing forward and reverse in time
- backward smoothing
- application of precise satellite clock and orbit information

For comprehensive Inertial Explorer information, visit [www.novatel.com/products/waypoint-software/waypoint-post-processing-software/inertial-explorer/](http://www.novatel.com/products/waypoint-software/waypoint-post-processing-software/inertial-explorer/)

# How SPAN Works

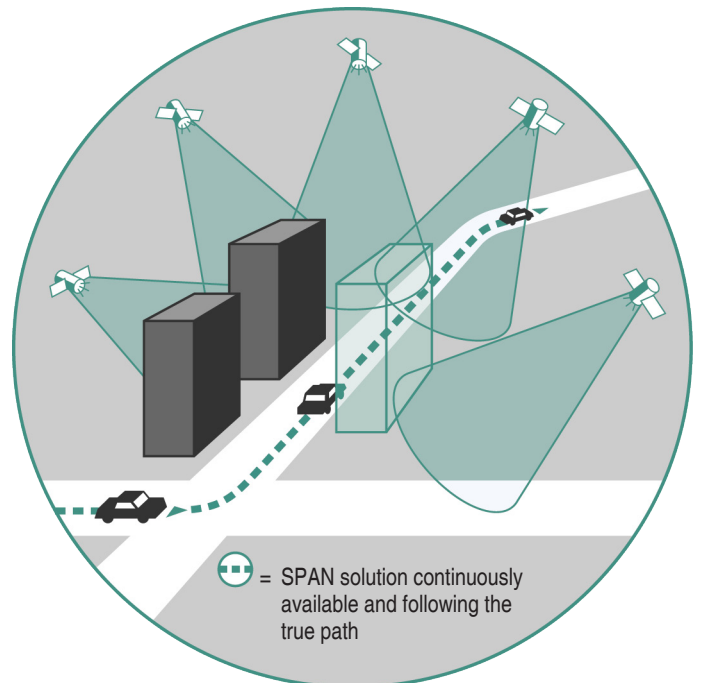
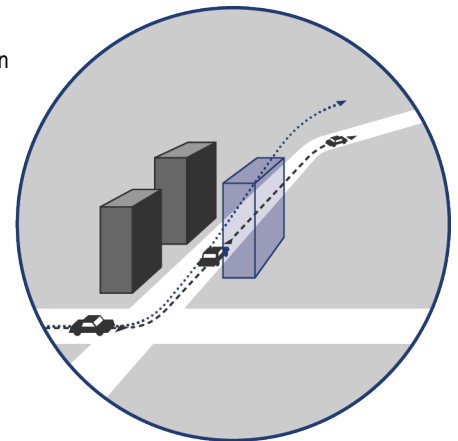
- ⊙ = GNSS Solution
- ⊖ = True Path

With GNSS only positioning, navigating becomes unreliable or impossible when satellites are blocked by obstructions such as trees and buildings.



- ⊙ = Drifting INS Solution
- ⊖ = True Path

In the absence of an external reference, the Inertial Navigation System (INS) solution will drift over time due to accumulated errors in the IMU data.



When combined, the two navigation techniques augment and enhance each other to create a powerful positioning system. The absolute position and velocity accuracy of the GNSS is used to compensate for the errors in the IMU measurements. The stable relative position of the INS can be used as a bridge to span times when the GNSS solution is degraded or unavailable. Data is available in real-time or can be post-processed for workflows requiring the most robust solution possible and additional quality control.

## Combined System:

### SPAN-CPT™



- Featuring the OEMV-3 receiver, fiber optic gyros and Micro Electromechanical Systems (MEMS) accelerometers in one enclosure.
  - All commercially available components reduce cross border difficulties when operating in multiple countries.
- Dimension:** 152 x 168 x 89 mm  
**Weight:** 2.36 kg  
**Power Consumption:** 15 W (max)  
**Operating Temp:** -40°C to +65°C  
**Accuracy Range<sup>3</sup>:** 1.5 m to 1 cm + 1 ppm

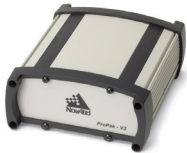
## SPAN Enclosures and Receivers:

### SPAN-SE™



- Powerful GPS/GLONASS/INS engine for demanding mapping, survey or navigation applications.
  - Optional ALIGN® configuration for precision attitude in low dynamic applications.
  - Multiple communication options and onboard, removable data storage.
- Dimension:** 200 x 248 x 76 mm  
**Weight:** 3.4 kg  
**Power Consumption:** 10 W (SE-S) / 12 W (SE-D)  
**Operating Temp:** -40°C to +65°C  
**Accuracy Range<sup>3</sup>:** 1.5 m to 1 cm + 1 ppm

### ProPak-V3™



- Offers the tightly coupled GPS/INS in a compact, rugged enclosure for less demanding applications.
  - Real-time solution and raw data output via USB or serial ports.
- Dimension:** 160 x 185 x 71 mm  
**Weight:** 1.0 kg  
**Power Consumption:** 2.8 W  
**Operating Temp:** -40°C to +75°C  
**Accuracy Range<sup>3</sup>:** 1.5 m to 1 cm + 1 ppm

### FlexPak6™



- Houses the OEM628 GNSS receiver board. Tracks all current and upcoming GPS, GLONASS, Galileo and Compass signals and provides multiple communication options including Ethernet, USB and CAN bus.
- Dimension:** 113 x 147 x 45 mm  
**Weight:** 337 g  
**Power Consumption:** 1.8 W<sup>1</sup>  
**Operating Temp:** -40°C to +75°C  
**Accuracy Range<sup>3</sup>:** 1.5 m to 1 cm + 1 ppm

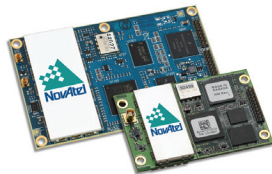
## OEM Boards:

### SPAN-MPPC™



- Connects directly to NovAtel's OEMV-3 receiver, creating a powerful GPS/GLONASS/INS receiver board stack.
  - Multiple communication options and onboard API for easy integration into larger systems.
- Dimension<sup>1</sup>:** 85 x 125 x 27 mm  
**Weight<sup>1</sup>:** 75 g  
**Power Consumption<sup>1</sup>:** 8 W  
**Operating Temp<sup>2</sup>:** -40°C to +75°C  
**Accuracy Range<sup>3</sup>:** 1.5 m to 1 cm + 1 ppm

## OEM6™ Series OEM615™



- Smaller than the size of a business card, the OEM615 features high performance GNSS positioning with low power consumption.
- GPS L1/L2 + GLONASS L1/L2 + SBAS Galileo + Compass**  
**Size:** 46 x 71 x 11 mm  
**Weight:** 24 g

## OEM628™

- Features 100 Hz data rate for high dynamic positioning applications. Drop in replacement for NovAtel's OEMV-2 GNSS receiver.
- GPS L1/L2/L5 + GLONASS L1/L2 + SBAS + L-Band + Galileo + Compass**  
**Size:** 60 x 100 x 9.1 mm  
**Weight:** 37 g

## OEMV-3™



- Multi frequency receiver with integrated L-Band and enhanced power management features. The OEMV-3 high performance series utilizes a common platform across all products. The OEMV-3 GNSS receiver also offer scalable, field upgradeable firmware options, including NovAtel's AdVance™ RTK for centimetre-level positioning accuracy.
- GPS L1/L2 + SBAS + L-Band**  
**Size:** 85 x 125 x 13 mm  
**Weight:** 75 g

## SPAN Features

In addition to the core functionality, SPAN products come with multiple options to enhance performance on the ground, in the air and for marine applications.

### API<sup>3</sup> ▲

The Application Programming Interface (API) within SPAN offers system integrators the flexibility to quickly address new opportunities and customize for unique opportunities.

Developers use the processing power of the SPAN platform to run custom developed, embedded application onboard the hardware. Applications have access to any system peripherals and interact with the main application using C/C++ function calls and the standard NovAtel command/log interface. Your IP is protected with an optional security wrapper that ties usage of an application to a specific system to control licensing and feature usage.

Examples of custom application include:

- Application to control a stabilized camera mount
- Application to operate a flight control system
- Application to interface with CAN networks

### Dual Antenna Support<sup>3</sup> ●

Dual antenna GNSS heading simplifies initial alignment procedures in non-stationary applications and improves heading accuracy in low dynamic applications. NovAtel's ALIGN heading technology utilizes dual antenna GNSS to enhance SPAN position and attitude performance in challenging environments. With the exception of the SPAN-SE-D, a secondary ALIGN capable remote receiver is required. ALIGN is easy to configure on SPAN products (see the ALIGN Product Sheet for additional hardware requirements).

### Variable Lever Arm Support<sup>3</sup> ■

A generic input, for gimbaled applications, where the IMU rotates with respect to the GNSS antenna. The variable lever arm function is designed to support a stabilized mount for an airborne camera system. Generic functionality is available to allow input of rotation angles, from any stabilized platform, into SPAN so a stable navigation solution is maintained while the IMU moves freely with respect to the antenna.

### Heave<sup>3</sup> ◆

The rise and fall of a vessel correlates directly to the returning sonar data in marine mapping applications, leading to errors in depth measurement. Select SPAN receivers feature the robust heave output option to compensate for these errors.

### Additional features:

- Generic wheel sensor input for velocity aiding into the SPAN filter
- Onboard data logging<sup>3</sup>

### Notes:

<sup>1</sup>Power Consumption for GPS L1/L2 at 6 VDC with Ethernet disabled. May increase with other configurations.

<sup>2</sup>When in a stacked configuration with the OEMV-3

<sup>3</sup>Only available on specific hardware modes and IMU types.



# SPAN Inertial Measurement Units (IMUs)

## UIMU Series



### UIMU-LCI

A tactical grade IMU from Northrop-Grumman Litef GmbH. The custom NovAtel mechanical enclosure and software interface of the IMU integrates easily into a SPAN enabled receiver such as the SPAN-SE. The low noise and stable biases of the accelerometer and gyro sensors mean the IMU is well suited for ground or airborne survey applications. Manufactured in Germany the UIMU-LCI offers LN200 performance.

**Dimension:** 168 x 195 x 146 mm **Weight:** 4.25 kg

### UIMU-LN200/ UIMU-LN200-L

The low noise, tactical grade UIMU-LN200 is a proven sensor for airborne survey and mobile mapping applications. The UIMU-LN200-L features closed-loop fiber optic gyros and solid state accelerometers.

**Dimension:** 168 x 195 x 146 mm **Weight:** 4.5 kg

### UIMU-HG

The UIMU-HG is a tactical grade IMU from Honeywell containing ring-laser gyros and servo accelerometers. Available in a range of performance levels, from 1 to 5 degrees per hour, the economical UIMU-HG offers excellent performance.

**Dimension:** 168 x 195 x 146 mm **Weight:** 4.5 kg

## IMU-FSAS



Small, tactical grade IMU consisting of three closed-loop fiber optic gyros and three servo accelerometers. Manufactured in Germany, the IMU-FSAS is a good option for customers looking for a product without International Traffic in Arms Regulations (ITAR) restrictions.

**Dimension:** 128 x 128 x 104 mm **Weight:** 2.1 kg

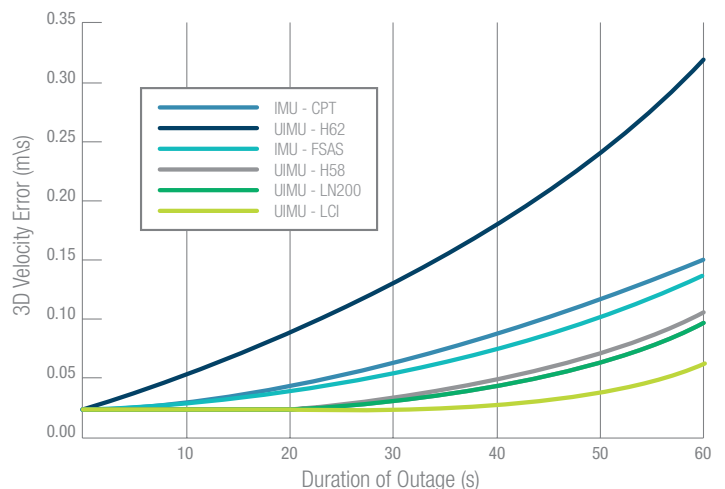
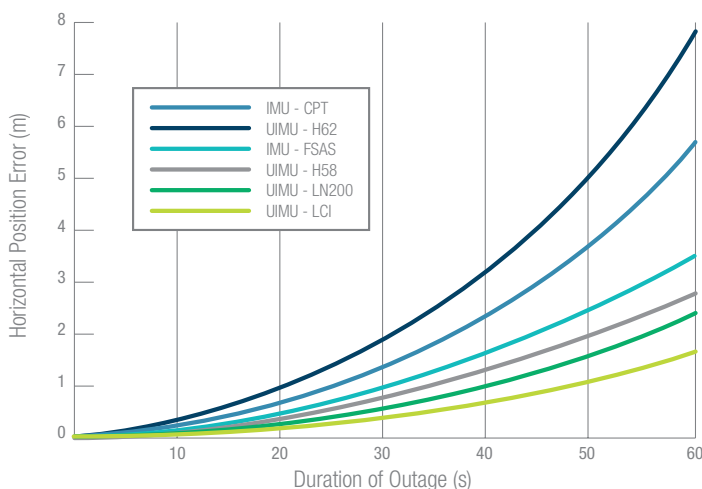
## IMU-CPT



The IMU-CPT is a stand alone IMU based on our SPAN-CPT, containing fiber optic gyros and MEMS accelerometers. Made entirely of commercially available components, the IMU-CPT reduces cross border difficulties when operating in multiple countries.

**Dimension:** 152 x 168 x 89 mm **Weight:** 2.29 kg

## SPAN Performance

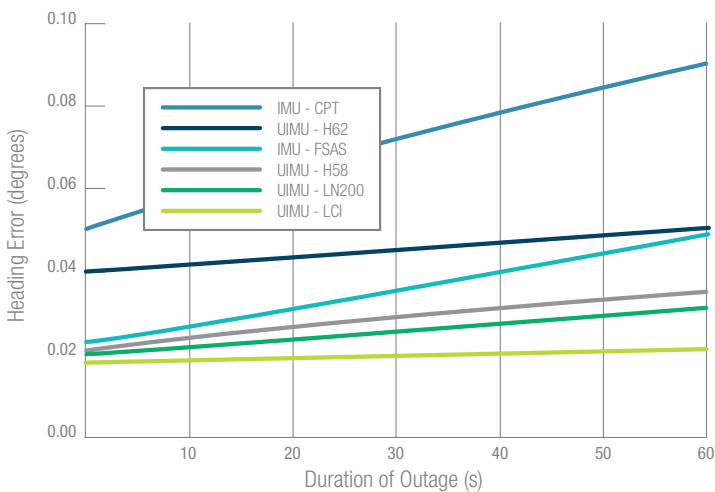


## GNSS Receivers

## IMU Specs

## SPAN System Attitude Accuracy (degrees)<sup>4</sup> RMS

GPS ONLY		GPS+GLONASS					Power Consumption	Export Control	Data Rate	Gyro Bias	Gyro Technical	Available as OEM	RTK <sup>5</sup>			PP <sup>6</sup>		
OEMV-3	ProPak-V3	SPAN-MPPC	FlexPak6	OEM615	OEM628	SPAN-SE							Roll	Pitch	Heading	Roll	Pitch	Heading
		●	●	●	●	●	16 W	Varies	200 Hz	<1.0 deg/hr	FOG		0.007	0.007	0.018	0.005	0.005	0.008
●	●	●	●	●	●	●	16 W	ITAR	200 Hz	1.0 deg/hr	FOG	●	0.010	0.010	0.020	0.005	0.005	0.008
●	●	●	●	●	●	●	8 W	ITAR	100 Hz	1.0 or 5.0 deg/hr	RLG	●	0.010 <sup>7</sup>	0.010 <sup>7</sup>	0.021 <sup>7</sup>	0.007 <sup>7</sup>	0.007 <sup>7</sup>	0.010 <sup>7</sup>
●	●	●	●	●	●	●	16 W	Varies	200 Hz	<0.75 deg/hr	FOG		0.008	0.008	0.023	0.008	0.008	0.012
		●	●	●	●	●	13 W (max)	Commercial	100 Hz	20.0 deg/hr	FOG		0.015	0.015	0.050	0.015	0.015	0.030



### Notes:

<sup>4</sup> When SPAN is in RTK mode.

<sup>5</sup> 0 seconds outage on land vehicle application.

<sup>6</sup> RMS, incremental error growth from steady state accuracy. Computed with respect to full GPS, RTK trajectory.

<sup>7</sup> UIMU-H58 performance.

# SPAN Micro Electromechanical Systems (MEMS)

## OEM-HG1900

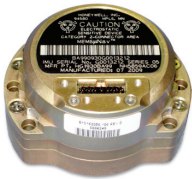


The HG1900 is a gyro based MEMS IMU manufactured by Honeywell. Economical, robust and small in size, the low power HG1900 provides high end tactical grade performance for commercial and military guidance and navigation applications.

**Dimension:** 92.7 mm dia max x 79.1 mm h

**Weight:** <460 g

## OEM-HG1930



The HG1930 is a small, economical MEMS IMU manufactured by Honeywell. It provides tactical grade performance for unmanned vehicles and other commercial and/or military guidance applications.

**Dimension:** 64.8 mm dia max x 35.7 mm h max

**Weight:** 200 g

## OEM-Landmark™ 20

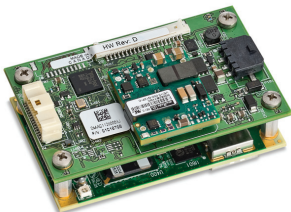


The Landmark 20 is the mid-performance model of Gladiator Technologies Landmark 20 series of MEMS IMU. It features low noise gyros and accelerometers in a small, lightweight and ruggedized environmentally sealed enclosure. The Landmark 20 enables precision measurements for applications that require both low cost, high performance and rugged durability in a very small form factor.

**Dimension:** 50 x 45 x 32 mm

**Weight:** approx 110 g

## MEMS Interface Card<sup>8</sup>



SPAN supported MEMS sensors are coupled with SPAN receivers using a compact, lightweight MEMS Interface Card (MIC) designed to support both power and communication. The MIC is our smallest receiver form factor, providing integrators an extremely compact, powerful GPS/INS engine. Designed as a board stack configuration for ease of integration, the interface card can be directly interfaced to our OEM615 receiver.

**Dimensions:** 75.1 x 45.7 x 19.5 mm

**Weight:** 31 g

**Input Voltage:** 10 VDC – 30 VDC

**Operating Temperature:** -40°C to +75°C

For IMU dependant data, refer to the applicable NovAtel product sheets for details or go to [www.novatel.com](http://www.novatel.com).

GNSS Receivers							IMU Specs					SPAN System Attitude Accuracy (degrees) <sup>9</sup> RMS					
GPS ONLY		GPS+GLONASS					Power Consumption	Export Control	Data Rate	Gyro Bias <sup>12</sup>	Gyro Technical	RTK <sup>10</sup>			PP <sup>11</sup>		
OEMV-3	ProPak-V3	SPAN-MPPC	FlexPak6	OEM615	OEM628	SPAN-SE						Roll	Pitch	Heading	Roll	Pitch	Heading
●	●	●	●	●	●	●	<3 W	ITAR	100 Hz	1.0 deg/hr	MEMS	0.011	0.011	0.035	0.008	0.008	0.020
●	●	●	●	●	●	●	<3 W	ITAR	100 Hz	2.0 deg/hr	MEMS	0.060	0.060	0.100	0.045	0.045	0.090
●	●		●	●	●		approx 430 mW typical	Commercial	100 Hz	15.0 deg/hr	MEMS	0.246	0.246	0.936	0.045	0.045	0.250

**Notes:**

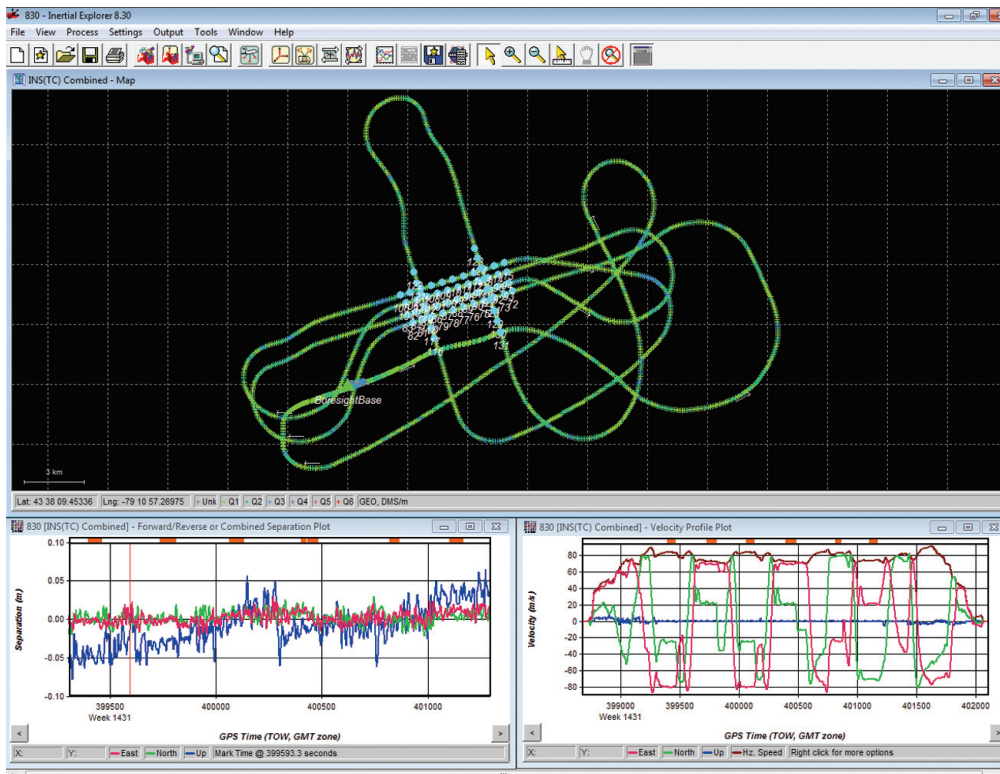
- <sup>8</sup> Shown in board stack configuration with OEM615 receiver.
- <sup>9</sup> When SPAN is in RTK mode. Based on 0 seconds outage duration.
- <sup>10</sup> 0 seconds outage on land vehicle application.
- <sup>11</sup> RMS, incremental error growth from steady state accuracy. Computed with GPS, RTK trajectory.
- <sup>12</sup> Values are in-run bias stability figures.

# Inertial Explorer Software



Inertial Explorer (IE), from NovAtel's Waypoint Product Group, is a Windows based GNSS/INS post-processing software suite that delivers highly accurate position, velocity and attitude information in a wide range of operating environments.

Depending on application needs and preferences, loosely and tightly coupled processing modes are supported in both differential and Precise Point Positioning (PPP) mode. IE features a New Project Wizard and a download service data utility for easy access to thousands of permanently operating reference stations. Automated alignment, fast and reliable ambiguity resolution, Multi-Base processing, backward smoothing and Multi-Pass processing for low dynamic surveys provide all the tools for success.



IE provides quality control plots for quality control of your data. A variety of export formats are available from our flexible Export Wizard, which also allows customized ASCII output. IE is fully compatible with NovAtel's SPAN product line.

For power users or system integrators, a Software Developer Kit (SDK) version of IE is available. The SDK allows developers to integrate the powerful Inertial Explorer processing engine into their applications. This enables companies with high data volumes to customize their workflow and automate their data processing. System Integrators can embed IE functionality into their software packages to improve workflow for their customers and enhance their software offering.

## PRECISE THINKING MAKES IT POSSIBLE

NovAtel is an original equipment manufacturer (OEM) that designs, manufactures and sells high precision Global Navigation Satellite System (GNSS) positioning technology.

Our receivers, antennas and subsystems are at the heart of many of the world's most exciting precise positioning applications.

The markets we serve are wide and varied, including aviation, survey, geomatics, machine control, mining, agriculture, marine and defense.

Whatever your application, NovAtel technology will ensure your success.

For more information, contact [novatel.com sales@novatel.com](mailto:sales@novatel.com) or visit [www.novatel.com/products/span-gnss-inertial-systems](http://www.novatel.com/products/span-gnss-inertial-systems)



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