



NovAtel SPAN™ and Waypoint®

GNSS + INS Technology



SPAN Technology

SPAN provides real-time 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. Continual, 3D position, velocity and attitude are available 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

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 forwards and reverse in time
- backwards smoothing
- application of precise satellite clock and orbit information

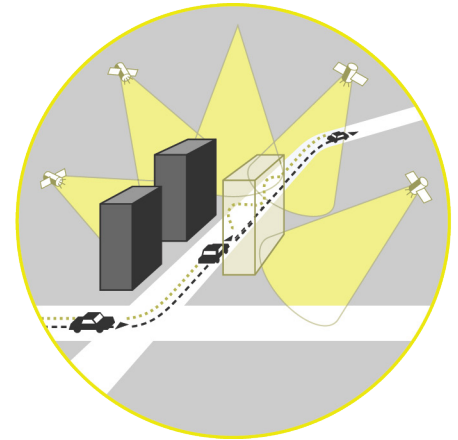
For comprehensive Inertial Explorer information, visit www.novatel.com/products/waypoint-software/waypoint-post-processing-software/inertial-explorer/

How SPAN Works

⋯ = GNSS Solution

--- = True Path

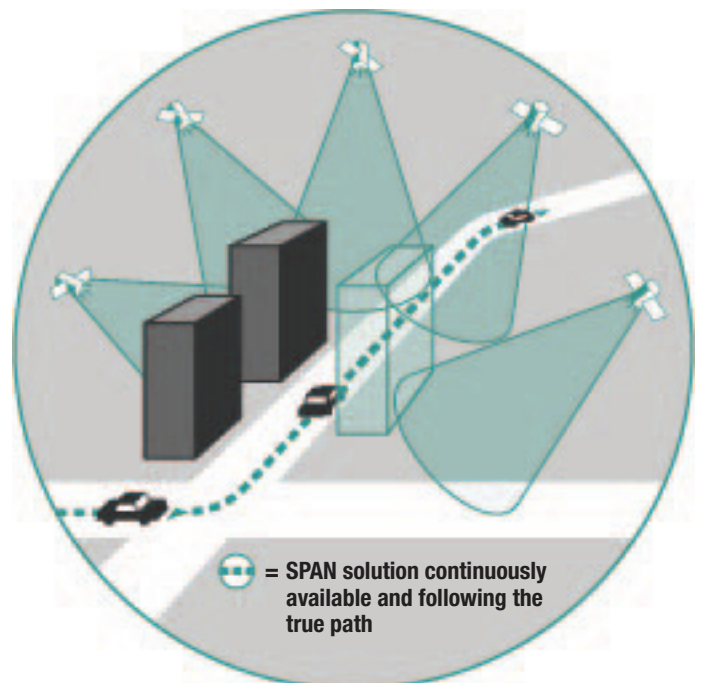
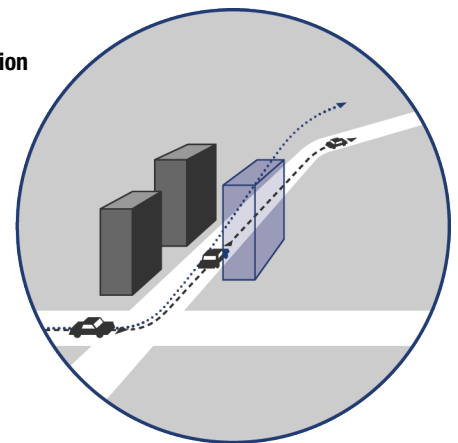
With GNSS-only positioning, navigating becomes unreliable or impossible when satellites are blocked by obstructions such as trees and buildings.



⋯ = 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.



⊕ = SPAN solution continuously available and following the true path

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™



- A complete GPS/INS system in one enclosure featuring the OEMV-3 receiver, fiber optic gyros and MEMS accelerometers.
- Made entirely of commercially available components, the SPAN-CPT reduces cross border difficulties when operating in multiple countries.

Dimension: 168 x 152 x 89 mm
Weight: 2.36 kg
Power Consumption: 15 W (max)
Operating Temp: -40°C to +65°C
Accuracy Range: 1.5 m to 1 cm + 1 ppm



SPAN Enclosures and Receivers:

SPAN-SE™

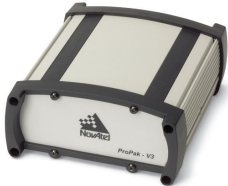


- Powerful GPS/GLONASS/INS engine for demanding mapping, survey or navigation applications.
- Optional ALIGN® configuration for precision attitude in low dynamic applications.
- Multiple communication options and onboard, removable data storage.

Dimension: 248 x 200 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: 1.5 m to 1 cm + 1 ppm



ProPak-V3™



- For less demanding applications, the ProPak-V3 offers the tightly coupled GPS/INS in a compact, rugged enclosure.
- Real-time solution and raw data output via USB or serial ports.

Dimension: 185 x 160 x 71 mm
Weight: 1.0 kg
Power Consumption: 2.8 W
Operating Temp: -40°C to +75°C
Accuracy Range: 1.5 m to 1 cm + 1 ppm

OEM Boards:

SPAN-MPPC™

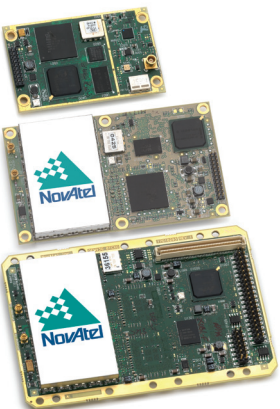


- Designed to connect directly to NovAtel's OEMV-3 receiver, creating a powerful GPS/GLONASS/INS receiver board stack.
- Multiple communication options and onboard Application Programming Interface (API) for easy integration into larger systems.

Dimension¹: 125 x 85 x 27 mm
Weight¹: 75 g
Power Consumption¹: 8 W
Operating Temp¹: -40°C to +75°C
Accuracy Range²: 1.5 m to 1 cm + 1 ppm



OEMV® Series



OEMV-1DF™

Dual frequency, Real-Time Kinematic (RTK) positioning and low power consumption all in a compact form for applications with space constraints.

GPS L1/L2 + SBAS

V1 Size: 71 x 46 x 13 mm **Weight:** 21.5 g

OEMV-2™

Dual constellation, dual frequency receiver equipped with all of NovAtel's high performance positioning modes.

GPS L1/L2 + GLONASS L1/L2 + SBAS

V2 Size: 100 x 60 x 13 mm **Weight:** 56 g

OEMV-3™

Multi frequency receiver with integrated L-band and enhanced power management features.

GPS L1/L2/L5 + GLONASS L1/L2 + SBAS + L-band

V3 Size: 125 x 85 x 13 mm **Weight:** 75 g

SPAN Features

SPAN products are based on NovAtel's core GNSS technology. Each platform offers output of time tagged GNSS and inertial measurement data, along with a full 3D position and attitude solution, up to the native data rate of the IMU (100 or 200 Hz typical).

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.

Features:

- NovAtel's ALIGN Dual antenna support²
- API – Application Programming Interface²
- Generic wheel sensor input for velocity aiding into the SPAN filter
- Onboard data logging²

API ▲

NovAtel's Application Programming Interface (API) is a rich environment, allowing system customization to meet specific application requirements. API within SPAN offers system integrators the flexibility to quickly address new opportunities requiring customization.

Developers can make use of the processing power of the SPAN platform by running a custom developed, embedded application onboard the hardware.

Applications have access to any of the 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 so you can control licensing and usage of your features.

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 ●

Dual antenna GNSS heading simplifies initial alignment procedures in non-stationary applications and improves heading accuracy in low dynamic applications like mining, marine and rail monitoring. NovAtel's ALIGN heading technology utilizes dual antenna GNSS to enhance SPAN position and attitude performance in all these challenging environments. ALIGN is easy to configure on SPAN products but may require additional hardware (refer to the ALIGN Product Sheet for details).

Variable Lever Arm Support ■

NovAtel developed 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 ◆

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

Notes:

¹ When in a stacked configuration with the OEMV-3 receiver.

² Only available on specific hardware models.

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 NovAtel SPAN enabled GNSS/INS 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: 195 x 168 x 146 mm **Weight:** 4.25 kg

UIMU-LN200/ UIMU-LN200-L

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

Dimension: 195 x 168 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: 195 x 168 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

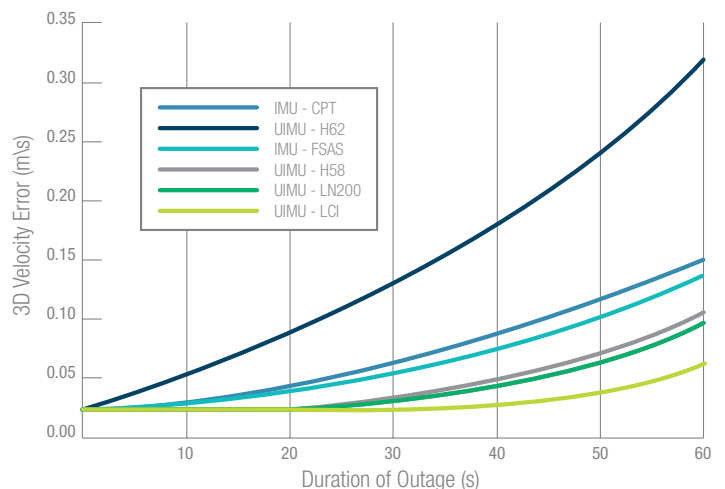
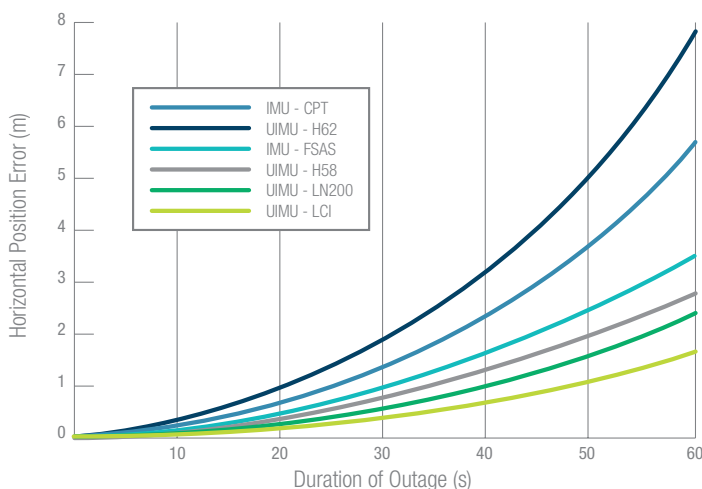
IMU-CPT



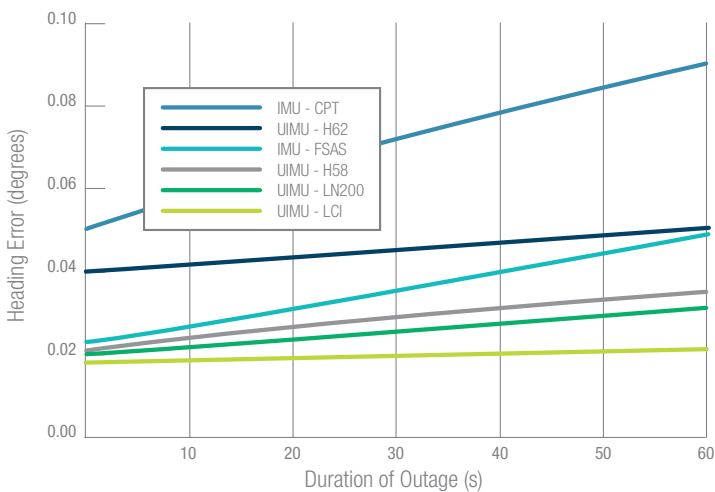
The IMU-CPT is a stand alone IMU based on NovAtel's SPAN-CPT, containing fiber optic gyros and MEMS accelerometers. Made entirely of commercially available components, the IMU-CPT reduces cross border difficulties when operating in multiple countries.

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

SPAN Performance



GNSS Receivers						IMU Specs						SPAN System Attitude Accuracy (degrees) ³ RMS					
GPS ONLY				GPS+GLONASS		Power Consumption	Export Control	Data Rate	Gyro Bias	Gyro Technical	Available as OEM	RTK ⁴			PP ⁵		
OEMV-1DF	OEMV-2	OEMV-3	ProPak-V3	SPAN-MPPC	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 ⁶	0.010 ⁶	0.021 ⁶	0.007 ⁶	0.007 ⁶	0.010 ⁶
	●	●	●	●	●	16 W	Varies	200 Hz	<0.75 deg/hr	FOG		0.008	0.008	0.023	0.008	0.008	0.012
				●	●	15 W (max)	Commercial	100 Hz	20.0 deg/hr	FOG		0.015	0.015	0.050	0.015	0.015	0.030



Notes:

³When SPAN is in RTK mode.

⁴0 seconds outage on land vehicle application.

⁵RMS, incremental error growth from steady state accuracy. Computed with respect to full GPS, RTK trajectory.

⁶UIMU-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

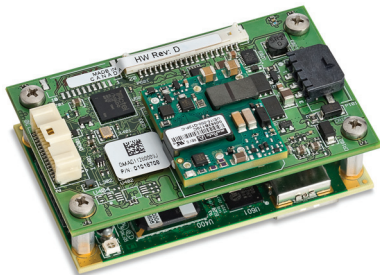


The Landmark™20 is the mid-performance model of Gladiator Technologies Landmark™20 series of MEMS IMU. It features low noise gyros and accelerometers in a small, lightweight and ruggedized environmentally sealed enclosure. The Landmark™20 enables precision measurements for applications that require both 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 Card⁷



The new SPAN supported MEMS sensors are coupled with NovAtel's SPAN receivers using a new compact, lightweight MEMS Interface Card (MIC) designed to support both power and communication. The MIC is NovAtel's 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 NovAtel's small OEMV-1DF SPAN 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.

GNSS Receivers						IMU Specs					SPAN System Attitude Accuracy (degrees) ³ RMS					
GPS ONLY				GPS+GLONASS		Power Consumption	Export Control	Data Rate	Gyro Bias ⁸	Gyro Technical	RTK ⁴			PP ⁵		
OEMV-1DF	OEMV-2	OEMV-3	ProPak-V3	SPAN-MPPC	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:

³When SPAN is in RTK mode. Based on 0 seconds outage duration.

⁴0 seconds outage on land vehicle application.

⁵RMS, incremental error growth from steady state accuracy. Computed with respect to full GPS, RTK trajectory.

⁷Shown in board stack configuration with OEMV-1DF SPAN receiver.

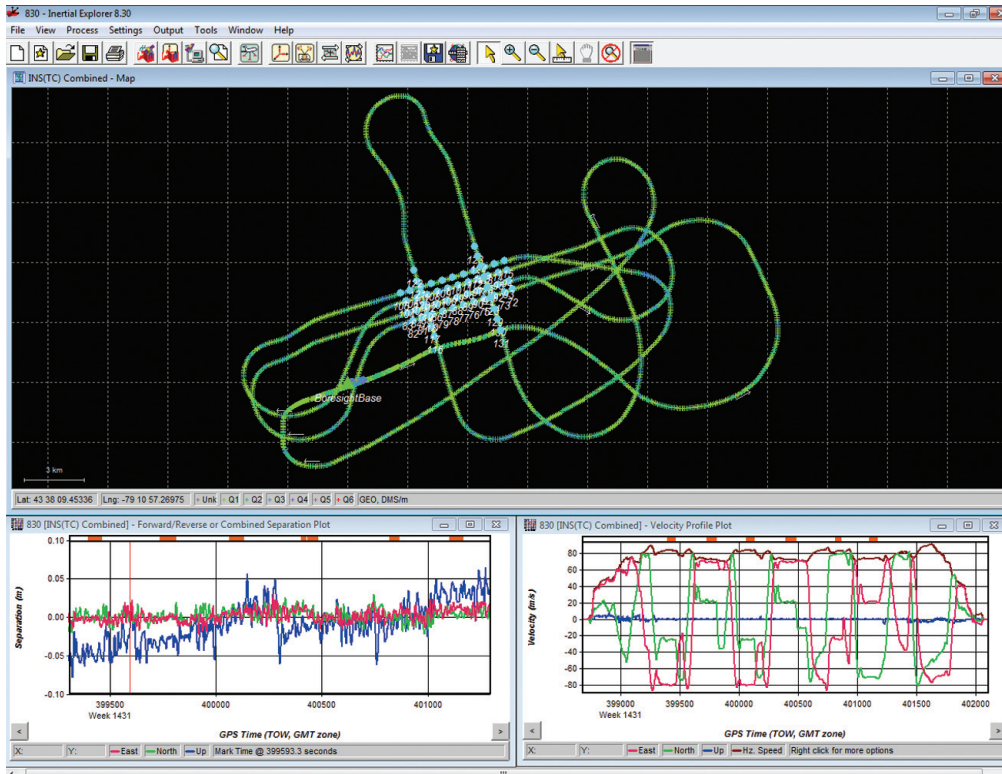
⁸Values are in-run bias stability figures.

Inertial Explorer Software



Inertial Explorer, from NovAtel's Waypoint Product Group, is a Windows based GNSS/INS post-processing software suite. It is trusted by marine applications, aerial survey as well as ground mapping companies to produce accurate position, velocity and attitude information in a wide range of operating environments.

Depending on the application, needs and preference, loosely and tightly-coupled processing modes are supported in both differential and Precise Point Positioning (PPP) mode. To get a project started quickly, Inertial Explorer features a New Project Wizard and a download service data utility for easy access to thousands of permanently operating reference stations. Further, features such as automated alignment, fast and reliable ambiguity resolution, Multi-Base processing, backwards smoothing and Multi-Pass processing for low dynamic surveys provides all the tools for success.



Inertial Explorer has effective quality control plots to confidently Q/C your data. A variety of export formats are available from our flexible Export Wizard, which also allows for customized ASCII output. Inertial Explorer is fully compatible with NovAtel's SPAN product line.

For power users or system integrators, a Software Developer Kit (SDK) version of Inertial Explorer is available. The SDK allows developers to integrate the powerful Inertial Explorer processing engine into their applications. This allows companies with high data volumes to customize their workflow and automate their data processing. System integrators can embed Inertial Explorer 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, components 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.

To learn more, visit www.novatel.com
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FM 92323

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