SPIRENT SimINERTIAL

INTEGRATED GPS/INERTIAL TEST

Introduction

The testing of an Inertial navigation sensor presents a major challenge in its own right, even before considering GPS integration. The linear and angular sensors are usually characterised separately using centrifuges and angular rate tables respectively. Some limited integrated navigation testing can be performed using rate tables equipped with a lever arm but establishing full operational performance usually requires expensive and time-consuming field test on an appropriate moving vehicle platform.

To reduce the need for field trials, operational performance of an Integrated GPS/Inertial (IGI) system can be established in the laboratory using a GPS RF Constellation simulator, such as Spirent's GSS9000 product, along with a real-time emulation of the inertial sensor outputs that are coherently generated to exactly match the simulated GPS vehicle trajectory. Typical Inertial sensor performance regarding bias and drift, for example, can be established using traditional techniques, and then represented by a sensor error model driven by the simulated motion with appropriate coefficients entered by the user. It is often necessary to provide an altitude reference for Inertial-only navigation, such as a pressure altitude input.

The key benefit of this approach is that the stimuli to the navigation algorithms, in the form of GPS pseudorange measurements made by the GPS receiver under test and the emulated linear delta-velocity and angular delta-theta inertial sensor outputs, are under user control in the lab and are extremely repeatable. This allows fine-tuning and debugging of the navigation algorithms across a range of operational test scenarios.

For hybrid navigation sensors that are fully integrated into a single unit, (such as Northrop Grumman's LN100 and Honeywell's H-764G) the manufacturer will often provide a suitable test input port to accept the emulated sensor data streams, bypassing the physical sensors in the unit under test.

For GPS/Inertial systems that have the Inertial Measurement Unit (IMU) and GPS in physically separate units, all that is required is to substitute the IMU with an inertial sensor stream conforming to the IMU's defined data output interface, typically RS422 serial.

Spirent SimINERTIAL Inertial Test Systems

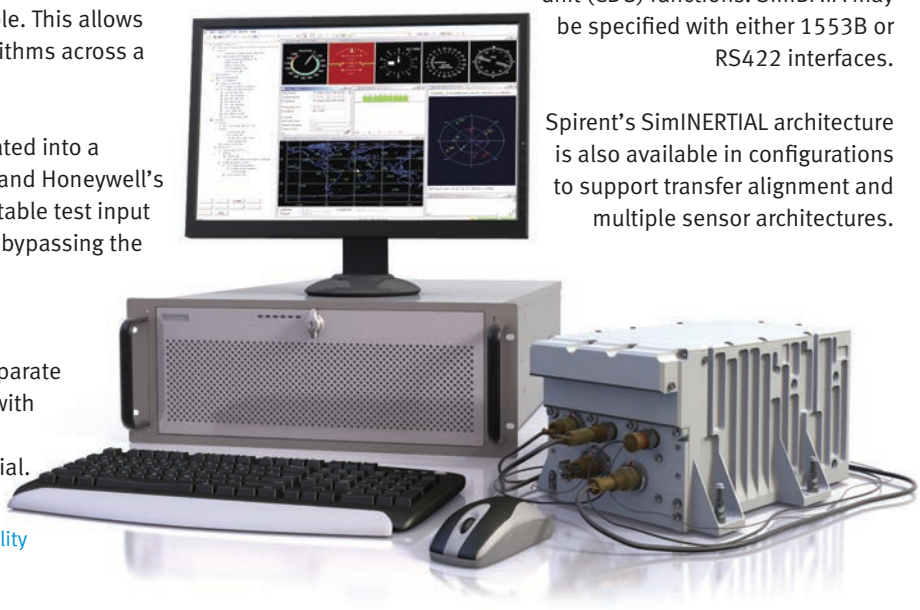
The GSS9000 GPS simulator range uses Spirent's state-of-the-art SimGEN™ application and modelling software to define and control the test environment. This fully flexible tool is easy to use and is equipped with a comprehensive range of trajectory generators as well as supporting true hardware-in-the-loop applications via acceptance of external vehicle motion data in real time. SimINERTIAL is housed in a PC platform equipped with the appropriate data interface card. The simulated motion data is streamed from SimGEN™ via Ethernet to SimINERTIAL, which translates this simulated motion data into representative real-time data streams at the data rate and with the data format appropriate to the unit being tested.

SimINERTIAL is equipped with fully user-configurable sensor error modelling and supports a range of popular Inertial formats via a number of separately priced variants. All variants adopt the same basic architecture as shown in Figure 1.

All SimINERTIAL solutions are also equipped to deliver a barometric altitude output via a MIL-STD-1553B card installed in the SimGEN™ controller PC.

Control and data monitoring of the unit-under-test would normally be via the user's own instrumentation interface. Spirent's optional SimDATA product can also be used to fulfil core control and display unit (CDU) functions. SimDATA may be specified with either 1553B or RS422 interfaces.

Spirent's SimINERTIAL architecture is also available in configurations to support transfer alignment and multiple sensor architectures.



SimINERTIAL testing at Spirent's facility

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Supported Variants

EGIs

- Honeywell H-764G, SIGI and NAV100™ IMU
  Interfacing is via Honeywell's proprietary Inertial Sensor Recorder Simulator ISRS2 card
- Northrop Grumman LN100G, LN250, LN251 and LN260 EGIs *Interfacing is via the supplied RS422 card*

IMU Emulation

- Honeywell HG-1700, HG-1900 and HG-9900 (as used in JDAM, for example)
- Northrop Grumman LN200
- AMRAAM-compliant
- NATO STANAG 4572
  Interfacing is via the supplied RS422 card
- AIS SilMUO2 and SiNAV02

Summary

Spirent supports Integrated GPS and Inertial performance testing by combining its powerful and flexible GPS simulation systems with coherently generated inertial sensor delta-theta and delta-velocity data.

The SimINERTIAL architecture is readily adapted to other inertial sensor simulations.

Please contact Spirent for more detailed information to meet your specified testing requirements.

Product Specifications MS3008, MS3030, MS3033 and MS3034 refer to the capabilities in this information sheet and are available on request.

Performance figures and data in this document are typical and must be specifically confirmed in writing by Spirent Communications plc. before they become applicable to any particu- lar order or contract.

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For current product data, visit the Spirent websites at www.spirent.com/positioning or www.spirentfederal.com

GPS + Inertial Testing Example

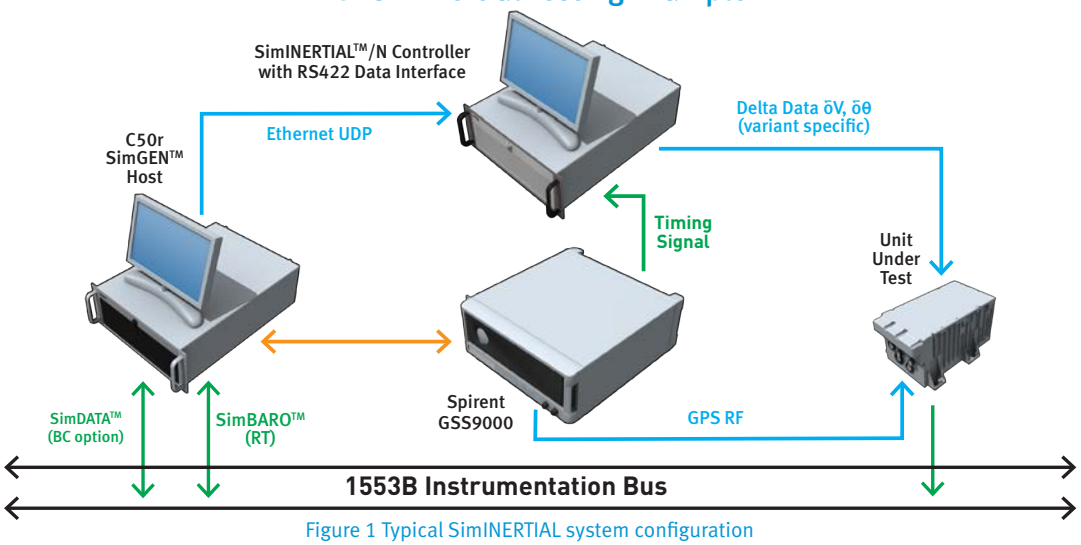

Figure 1 Typical SimINERTIAL system configuration

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