

# CAST-4000 GPS/INS Simulation System

## Complete GPS/INS Engineering Test System

The CAST-4000 GPS/INS simulation system produces GPS RF signals to stimulate tightly or loosely-coupled navigation systems. The system algorithms contain mature avionic sensor simulations for aiding. Available sensors include strapdown or gimballed Inertial Navigation System, Barometric Altimeter, Attitude Heading Reference System, Radar Altimeter and numerous auxiliary sensors, which are accessed over an optional 1553 interface.

The CAST-4000 has the ability to output raw IMU measurements to a receiver under test when equipped with an optional interface. This allows users to test GPS receivers that are tightly or loosely integrated with a strapdown or gimballed IMU. The form of the optional interface (bus, shared memory, etc) is customized to a user's particular requirements.

An IMU contains accelerometers that measure specific force in the form of  $\Delta V$ 's and gyros that provide angular velocity in the form of  $\Delta\theta$ 's. An INS uses these measurements to compute the user's position, velocity, and attitude. Inertial aided GPS receivers usually receive the INS outputs and not the IMU measurements. However, some receivers are tightly integrated with a strapdown or gimballed IMU and use the  $\Delta V$  and  $\Delta\theta$  measurements directly.

The CAST-4000 supports aided receivers by providing strapdown or gimballed IMU measurement data directly to the receiver under test via an optional interface.



### System Features

- Provides strapdown or gimballed IMU measurement data over optional interface synchronized with GPS RF data to the navigation system under test.
- Errors may be injected into the IMU measurements using high fidelity sensor error models.
- Contains mature avionic sensor simulation Barometric Altimeter, Attitude Heading Reference System, Radar Altimeter, and Doppler model.
- Optional interfaces include 1553/1394, SCRAMNet, ARINC 575, ARINC 572 and ARINC 429.
- Includes post-processing capability for determining system performance in accordance with ICD-GPS-215/150.
- Simulates sensors to provide the necessary fully coordinated, dynamic vertical channel aiding needed to maintain Kalman filter stability of the navigation system.
- Incorporates years of development, testing, and refinement of the precise GPS/INS synchronization capability needed for simulation of aircraft dynamics.
- Provides a dynamic, precisely coordinated simulation of numerous navigation signals to a GPS/INS navigation system, whether tightly or loosely coupled.
- Includes a complete 6-DOF motion generation capability.

**CAST Navigation, LLC** One Highwood Drive, Suite 100 Tewksbury, Massachusetts 01876  
Tel: 978 858-0130 Fax: 978 858-0170 Email: sales@castnav.com

## System Specifications

### Output Frequency

- GPS L1 1575.42 MHz
- GPS L2 1227.60 MHz

### Maximum Dynamics

- Velocity > 60,000 m/s
- Acceleration  $\pm 150,000$  m/s<sup>2</sup>
- Jerk  $\pm 150,000$  m/s<sup>3</sup>

### Signal Level

- GPS L1 C/A Code -160 dBW
- GPS L1 P Code -163 dBW
- GPS L2 P Code -166 dBW

### Signal Level Control

- Range  $\pm 30$  dB
- Resolution 0.1 dB

### L1/L2 Differential Delay

- Range  $\pm 0.3$  m
- Resolution < 1 mm

### Signal Accuracy

- Pseudorange 1 mm
- Pseudorange Rate 1.5 mm/s
- Delta Pseudorange 1.5 mm
- Interchannel Bias < 1 mm
- Uncontrolled Bias < 1 mm
- Bias Repeatability (initial) < 1 mm
- Bias Stability (operational) < 1 mm

### Signal Quality

- Spurious < -30 dBc
- Harmonics < -35 dBc
- Reference Oscillator 100 MHz OCXO
- Frequency Stability  $3 \times 10^{-8}$  per day

### System Configuration

- GPS Satellites Generated 12 to 16 L1 and L2
- Size (H x W x D) 55" x 24" x 32"
- Weight (approximate) 300 lbs
- Power Required 110/220 VAC  
50/60 Hz, 600 W
- Operating System Windows, Lynx

## System Options

- Multiple GPS/INS Configuration Testing
- Up to 8 Interference Generators
- Precision Guided Munitions Testing
- 1553 / 1394
- ARINC 575, 572 and 429
- External Precision Oscillator
- 6-DOF Real-Time Interface
- Y-Code
- SAASM
- OFP Loading – for GPS and INS
- Terrain Obscuration (TOP)
- TOP with Enhanced 3-D Visualization
- JDAM IMU Interface
- M-Code
- SBAS Simulation

## System Upgrade Path

- CAST-3000 for EGI Integration
- CAST EMT3500-3 for EGI Diagnostics
- CAST-5000 for CRPA System Testing



The CAST-4000 Strapdown IMU Interface

