Advanced GPS Hybrid Simulation (AGHS)

The Advanced GPS Hybrid Simulator (AGHS) is a hybrid software, digital and radio frequency (RF) GPS simulator design. The AGHS architecture leverages the NAVSYS Digital Storage Receiver (DSR) data recorder and remodulator capability to allow recording and playback of real-world GPS signals from field tests. The hybrid simulator can also be used to generate simulated digital signal sets using profiles generated by NAVSYS' MATLAB Signal Simulation capability. The recorded signals can either be played back as a RF signal into GPS receivers under test or can be directly played back as a digital signal into a compatible digital GPS receiver such as the NAVSYS HAGR product. Data can be recorded and played back from a single antenna element or form an array of antenna elements. This allows both the signal characteristics and the signal wavefront to be preserved in a test environment. The AGHS architecture is illustrated below with a description of its key components and features.

KEY COMPONENTS

Digital Storage Receiver DSR-220

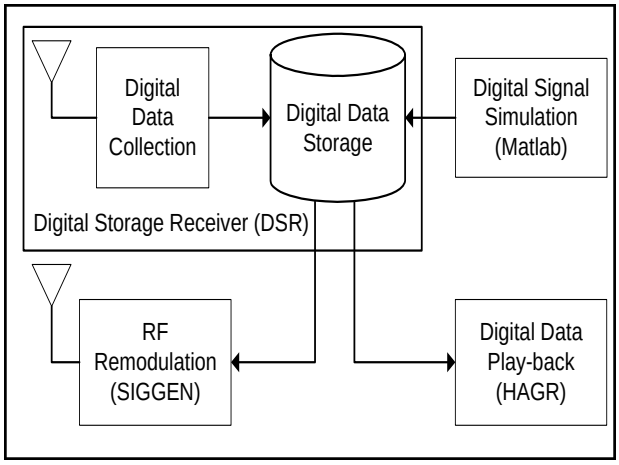
A key component of the AGHS is the Digital Storage Receiver. NAVSYS latest generation DSR product has the capability of storing the complete GPS spectrum (20 MHz) with up to 12 bit resolution. The DRS-220 in one of its configurations can record up to 3 hours of 8-bit L1 and 8-bit L2 at 56 Msps input data. Up to 3 hours of single bit data from 16 L1 antenna elements at 56 Msps can be recorded. The block diagram shows the way the DSR is utilized for system development and test.

RF Remodulator

The RF remodulator card provides the capability to remodulate the digital GPS data onto an RF carrier for playback into a conventional GPS receiver. The remodulator card includes eight channels to allow simultaneous playback into multiple antenna elements. By configuring the AGHS with two cards, both L1 and L2 remodulation can be performed. The RF remodulation capability allows the AGHS to operate as a wavefront simulator playing back either pre-recorded GPS signals or digitally simulated signal profiles.

MATLAB Signal Simulation Generation

The AGHS uses MATLAB as a primary generator of simulated GPS profiles to drive AGHS. The inputs for the GPS profiles can be entered either as a sequence of waypoints from which a trajectory is interpolated and satellite range and Doppler is computed using the specified satellite ephemeris or as an option, the raw satellite measurements recorded by the DSR can be provided instead. User inputs spreading code, signal strength, jamming, etc. are input. The satellites to be simulated can be specified by loading an almanac or ephemeris GPS file. The AGHS Matlab tools will compute the visible satellites throughout the trajectory, generate the estimated range, carrier phase and Doppler observations, and generate a navigation data file for modulation on the simulated signals. The AGHS will also compute the spatial offsets for an antenna array (if specified) based on the user trajectory and the simulated satellite locations. The simulation files that are used by the AGHS can also be generated from recorded DSR flights or from a flight simulator such as the Microsoft flight program that uses a joystick as an input.



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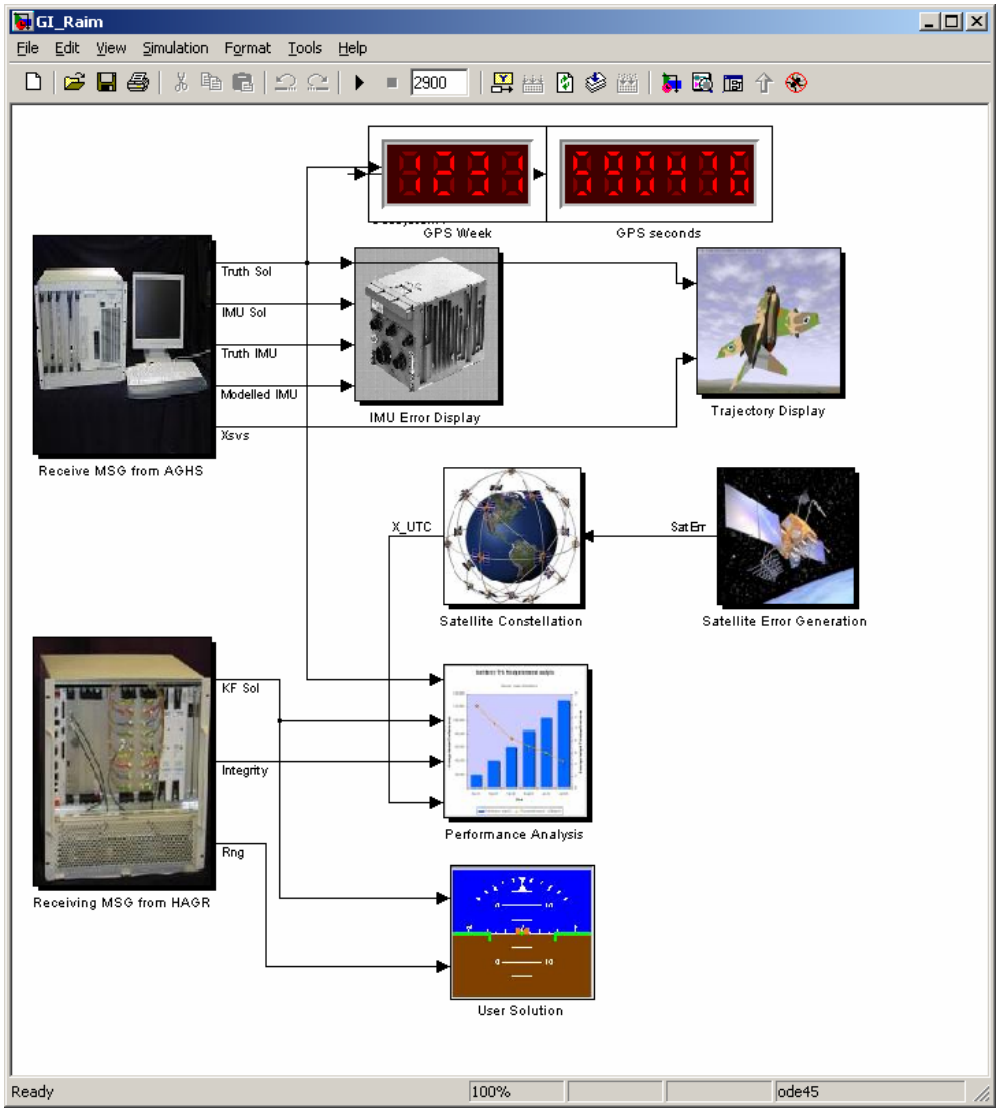
MathWorks Simulink® Control

The primary interface to the AGHS is the MathWorks Simulink. The graphical interface of Simulink has proven to be of great value in the control of the simulation being performed. NAVSYS is developing a user interface for our Advanced GPS Hybrid Simulator (AGHS) and High-gain Advanced GPS Receiver (HAGR) products with the MathWorks Simulink tool. Simulink is a platform for multidomain simulation and model-based design of dynamic systems. It provides an interactive graphical environment and a customizable set of block libraries that let you accurately design, simulate, implement, and test control, signal processing, communications, and other time-varying systems. We are using the Simulink® interface to control and set up our AGHS products and to control the GPS receiver under test.

Advanced Features

These features include

- INS and IMU simulation
- GPS Wavefront simulation
- Jammer Wavefront simulation,
- Integrity failure simulation
- RAIM failure simulation
- Satellite failure simulation
- Digital outputs to support software GPS receivers
- Open architecture to allow user access for low level simulation customization
- Software interface for insertion of future GPS signals or simulated jammer waveforms onto composite digital satellite signal profile.
- The AGHS is flexible and is designed for research into new GPS innovations



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