

Inertial Explorer

GPS-IMU Post-Processing Software by **Waypoint Consulting Inc.**

Inertial Explorer (GPS/IMU) post-processing software suite is aimed at user's who wish to integrate rate data from six degrees of freedom IMU sensor arrays with GPS information processed via GrafNav which is included. Inertial Explorer is designed to utilize strapdown accelerometer (Δv) and angular rate ($\Delta\theta$) information to produce high rate coordinate and attitude information from a wide variety of IMU's including high accuracy navigation grade to inexpensive MEMS (Micro Electro-Mechanical Systems) sensor types.



The initial version of the GPS/IMU processor implements a loose coupling of the GPS and inertial data. Users must collect and process GPS data in a separate stream from the raw IMU delta v and delta theta measurements. It is the user's responsibility to time tag each set of inertial measurements to the GPS time frame during the data collection process. Some units like NovAtel's BDS do this already.

The GPS component of Inertial Explorer must be run first in order to process and store optimal position, velocity and quality information in the standard GrafNav fwd/rev/cmb files. Following this, the IMU component of Inertial Explorer can be invoked to perform alignment, mechanization of measurements and filtering. GPS coordinate and velocity updates are implemented by time matching and interpolating the inertial rate data with the closest GPS measurement epoch. Sensor bias calibration is also performed during the filtering process.

Inertial Explorer runs within the familiar GrafNav processing environment and data analysis is performed with the same plotting tools as providing. This provides all of the features available to GrafNav to Inertial Explorer.

Inertial Explorer is aimed principally at users who wish to OEM their own GPS / inertial hardware platforms and process that data in a production level software environment. It is not designed to replace the very fine commercial level GPS/Inertial systems which are available. Users should be aware that Waypoint provides software only and does not provide hardware related features such as IMU data logging / time-tagging or off-line IMU calibration on devices such as rate tables. Users are responsible for these important system issues. With regard to IMU data formats for custom systems, Waypoint is willing to work with users on incorporating their data formats into our software system. Please contact us to discuss this particular feature.

Features:

- Embedded IMU processor based on University of Calgary's KINGSPAD technology
- 15 state IMU Kalman filter solving for Position, Velocity, Attitude, Accelerometer Bias and Gyro Drift (3 states each)
- Support for a variety of IMU data input formats
- IMUs supported include Litton LN200, Honeywell HG1700, NovAtel BDS and MotionPak. Call about custom units
- Supplied with a number of built-in error models. Users can modify and create their own too.
- Forward and reverse IMU processing. Attitude separation can be plotted.
- Very fast processing
- Alignment possible via static-coarse+fine, static-coarse only or kinematic alignment. Alignment can also be seeded with known attitude values.
- Support for a non-leveled IMU platforms
- Precise control of GPS updates including: covariance scale factor and quality/fix integer status tolerances.
- Fully integrated into GrafNav environment
- Extensive IMU graphing capabilities including plots for:
 - Attitude values including roll, pitch, heading and GPS course-over-ground
 - Attitude separation between forward and reverse directions (see Figure 1)
 - Estimated attitude accuracy
 - Gyro drift rate and its estimated accuracy
 - Accelerometer bias and estimated its accuracy
 - Attitude rate values with drift subtracted
 - Acceleration values with bias subtracted
 - GPS/IMU pre-filter position and velocity residuals (see Figure 2)
 - Difference between GPS course-over-ground and IMU heading
- Event markers can be precisely interpolated using high frequency IMU processing output
- Trajectory exporting can be output on a user-specified interval. Interpolation (if necessary) will be performed using high-frequency output

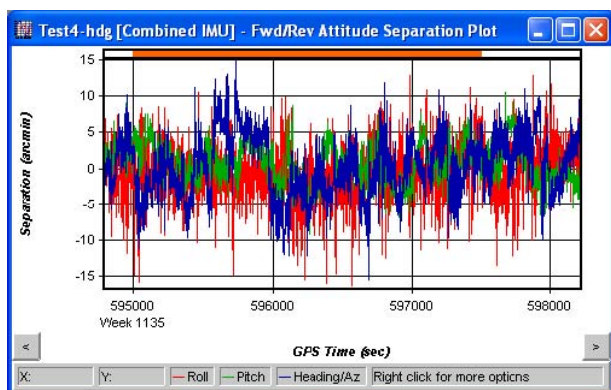


Figure 1 Forward/Reverse attitude separation (LN200)

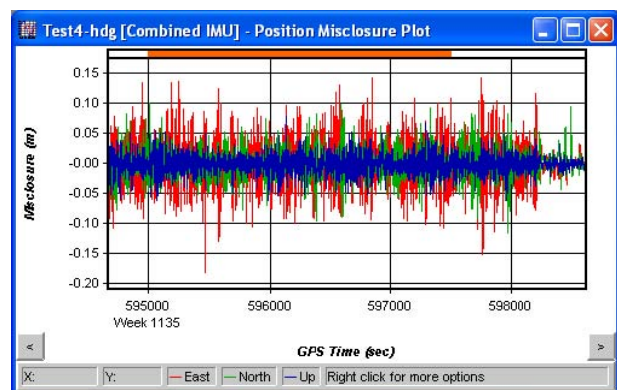


Figure 2 GPS-IMU position difference (LN200)