MULTI-SENSOR-SYSTEMS COMBINING GNSS AND OTHER SENSOR TECHNIQUES

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ABSTRACT:

The different navigation applications require precise information of position, attitude and time. The requirements of this information vary with the character of the application. JAVAD Navigation Systems (JNS) offers a variety of navigation hardware for integration of different components and technologies for a variety of marine, airborne, terrestrial, time and space applications.

1. SENSOR COMBINATION

1.1 JNS Inertial Measurement Unit

JNS Inertial Measurement Unit (IMU) can be used either as sole navigation unit or integrated with multiple sensors as part of a more comprehensive navigation system. The JNS IMU combines a three degree-of-freedom gyro, three accelerometers with a processing/communication board in a water-resistant aluminium housing with mounting brackets and shock absorbers. For autonomous applications the IMU provides measurements of angular velocity and acceleration.

Figure 1. JNS Inertial Measurement Unit

1.2 JNSGyro-4

In combination with the JNSGyro-4 GNSS, this system also provides position in a stand-alone or in the carrier phase differentialmode. The JNSGyro-4 GNSS receiver is the first and the only dual frequency satellite-based attitude system. The effective 86 cm dual frequency wavelength (compared to 19 cm of single frequency) makes JNSGyro-4 the most reliable and the fastest-to-settle attitude system in the world.

Figure 2. JNSS Gyro 4

1.3 Navigation-Case

With the ALLSAT NAVCASE system for JNSGyro-4 users will be able to setup their JNSGyro-4 attitude system fast and easily. All navigation components like the GNSS receiver, the battery and the battery charger, and the ALLSAT COM4xUSB box are packed safely inside the case. All the necessary equipment to be mounted outside, like the GNSS antennas, line amplifiers and magnetic antenna brackets are packed inside a second case of the ALLSAT NAVCASE system.

Figure 3. Navigation-Case

While the case is closed, everything inside is water protected. The connectors to the GNSS receivers' data ports, external power as well as the antenna connectors for JNSGyro-4 and PPS signal are easily accessible via the front without opening the ALLSAT navigation-case. JNSGyro-4 can work autonomously inside the ALLSAT NAVCASE, powered by a rechargeable battery. A specially developed fan will keep constant temperature inside the NAVCASE during operation of JNSGyro-4.

1.4 Multi-Sensor-Systems

Today GNSS-technology is used more and more as an important element of complex Multi-Sensor-Systems.

JNS GNSS receivers can have up to two Pulse Per Second (PPS) TTL interfaces. With an accuracy of 25 nanoseconds, PPS of JNS receivers can be used for frequency synchronisation of other sensors.

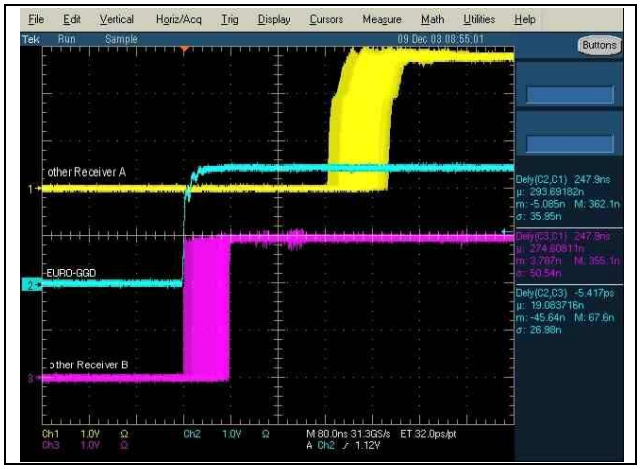

Figure 4. Acurate Puls Per Second

The picture shows the outstanding stability of JNSEuro-GGD PPS signal compared with other GPS receivers with significant PPS drift (up to 80 ns in 30 minutes).

Based on the accurate PPS signal, JNS100-GG receiver can output IRIG-B 200-95 standard. This signal can be used by other sensors for eg. amplitude synchronisation, absolute time synchronisation and frequency synchronisation.

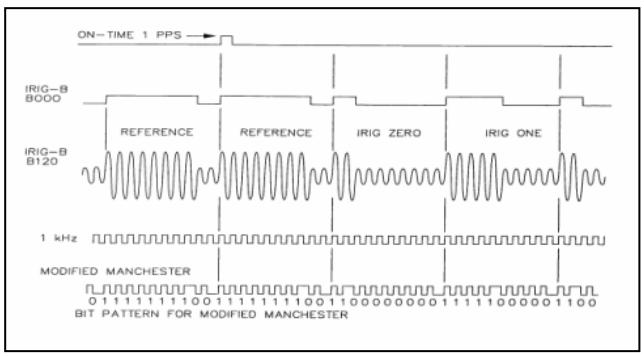

Figure 5. IRIG-B 200-95 standard

To calculate the offset of other sensors, JNS boards offer up to two separate Event Marker interfaces that can mark the time of an external event with an accuracy of 25 nanoseconds.

The Frecuency Input interface of JNSEuro-160GGDT accepts 5, 10 and 20 MHz frequencies from external sensors, also to be used as the main oscillator of the receiver. The other way round, the JNS board has a High Quality Reference Frecuency Generator. The JNS receivers' oscillator can optionally be locked to the GPS timing system which prevents drifts in the data generated by local frequency offsets. The locked frequency is also available as an output signal of 20 MHz that provides the long term stability of the cluster of cesium clocks maintained by the GPS Control Segment.

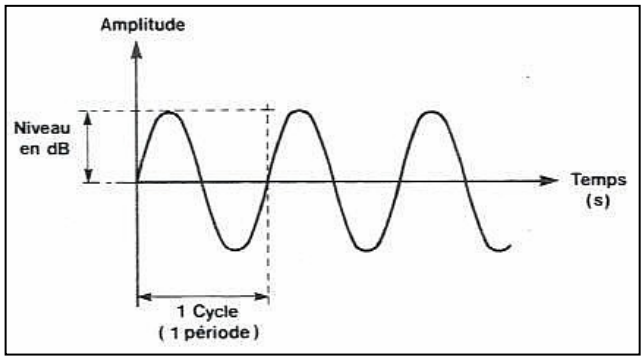

Figure 6. High Quality Reference Frequency Generator

JNS has achieved about 10 dB improvement in tracking high dynamics due to Common Tracking in which the dynamics of the receiver is tracked with the strength of all satellites combined in a third order tracking loop with a 20 Hz bandwidth. New hardware developments have been made available in order to improve JNS receiver operation in harsh environment for shock and vibration.

JNS receivers provide an excellent basis as a signal reference for the combination with other sensor techniques in a complex Multi-Sensor-System.