

# GNOME

## GNSS Operative Monitoring Equipment

» The implementation of Performance-Based Navigation (PBN) is presently one of the global aviation community's highest priorities. GNSS is the primary means of navigation for PBN operations and allows guidance from departure to vertically guided final approach, providing safety, efficiency and capacity benefits. Nevertheless, GNSS signals are very weak at the receiver antenna, so they are vulnerable and susceptible to disruption for intentional and unintentional interference (spoofing or jamming). ICAO Annex 10 recommends that the State that approves GNSS-based operations should monitor and record relevant GNSS data to support investigations, performance assessment and provide timely warnings to operational staff.

The GNOME system developed by IDS Airnav, allows continuously monitor GNSS signals both in navigation and physical domains. It is conceived to fulfill GNSS Monitoring use cases defined in ICAO Doc 9849 GNSS Manual.

### Solution description

GNOME system consists of the following main elements:

a) GNSS monitoring sentinel composed by:

- Software-defined radio (SDR) Kernel, which ensure that the GNOME system has the flexibility and customizability to meet specific customer and user needs;
- GNSS COTS Receiver multi-constellation and multi-frequency;
- GNSS Multiband antenna (L1, L2, E5);
- Direction Finding antenna, to estimate interference source Direction of Arrival.

b) Central Monitoring Facility (CMF), a server which oversees collecting and processing data coming from sentinels to produce relevant output in terms of real-time monitoring and statistical performance assessment. Optionally, external GNSS monitoring network data can be included in the GNOME network to extend the geographical coverage. The GNOME Hardware is installed in standard rack-



» GNOME System deployment

mounted chassis, so that it can be easily deployed in a typical Equipment room.

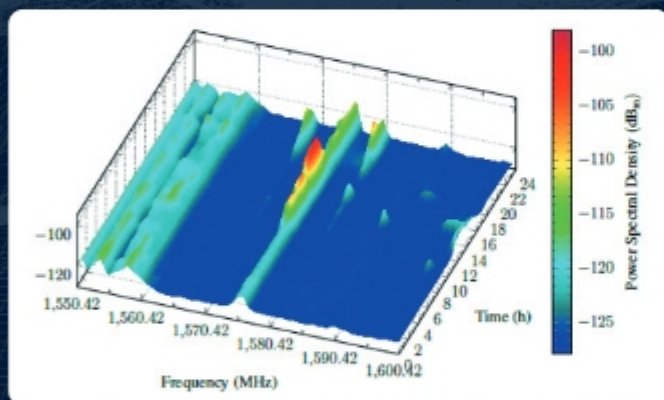


**Modes of operation**

- **RTI:** The Real-Time Inspector for continuous visualization of performance analyses and integrity alarms in live-mode
- **VTI:** The Virtual-Time Inspector Playback to browse the full GNSS Scenario to support “post incident/accident” investigations
- **StI:** The Statistical Inspector to process large observation data sets to generate long term statistical performance analyses
- **GOSP:** the GNSS Operational Panel support to operational personnel in determining GNSS procedures usability



» VTI with Interference source detection and localization



» Waterfall plot spectrum in L1 GNSS band

**Features**

The main applications and capabilities are:

- Monitoring of GNSS system performance for different constellations and augmentation: GPS, GLONASS, Galileo, BeiDou, EGNOS, WAAS, MSAS, GAGAN;
- Post-incident / post-accident investigations;
- Virtual-time playback of the full GNSS scenario
- Early warning of interference allowing rapid initiation of countermeasures;
- Interference source direction of arrival estimation;
- Anti-spoofing & anti-meaconing surveillance;
- Signal debugging for satellite constellations (Galileo, BeiDou);
- Deep signal investigations (e.g. residuals check, cross-correlation peak distortion,...);
- Real-time spectrogram & interference detection;
- Real-time waterfall plots (Time/Frequency domains);
- Multipath analysis;
- Stanford diagrams;
- Long-term statistical performance analyses

**ESSP work with ENAV for some specific project to support.**