ESA’s Approach for long Term GNSS Sensor Station Hosting with Partners around the World - ESA's GNSS Observation Network (EGON)

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ESA's General GNSS Sensor Station Hosting Approach

Initial contact of potential partner

- Head of Navigation Support Office or ESA's International Relation Department (in both cases fully coordinated)

Basic principles for the intended cooperation

- Hosting of Navigation Support Office GNSS equipment (geodetic, commercial of the shelf, multi-constellation, multi-frequency GNSS receivers, antennas, cables etc.).
- Use of on-site existing infrastructure (power, housing, communication etc.) from the hosting entity for the ESA/ESOC GNSS sensor station.
- ESA covers all costs related to equipment procurement and shipping, as well as necessary construction works at the site - if considered within acceptable margin of effort/costs
- International partner covers the running costs for keeping the equipment operational (electricity, comms, possible limited support if the receiver has to be reset)
- Objective is to enter in a **'no-exchange-of-funds'** agreement.
- In exchange for the hosting of ESA/ESOC GNSS sensor station equipment, the hosting entity would get full access to the non-public data (RINEX 3) that is generated at the hosted station(s).

ESA's General GNSS Sensor Station Hosting Approach

Technical Aspects

- A Hosting Requirements document serves as a guideline (not a strict go/no-go) for each site.
- ESA/ESOC ask the hosting entity to fill in the evaluation form with C, PC or NC, and to provide some comments where PC or NC has been identified.
- It is very common for sites to have several PCs or even NCs, ESA/ESOC just need to be aware of them to assess whether to leave them as-is or agree on an action if considered feasible

Agreement Approach

- Nominal approach is to start with a Letter of Intent (LoI)
- Letter of Agreement (LoA) once the technical evaluation mentioned above has been deemed satisfactory to move forward
- Following signature of the LoA by ESA and a short reply letter from the hosting entity acknowledging its content, shipment of the equipment and subsequent installation takes place
- Start of site operations

EGON International Partner cooperation agreement - Scope

ESA/ESOC (Navigation Support Office)

- **Provision of all GNSS equipment (antenna, receiver, RF cabling, EMPs..) and funding of monument construction**
- **Routine long term provision of geodetic-quality GNSS data (15min/Hourly/Daily RINEX3 files)**
  - Automated data retrieval, processing and generation for entire EGON network
  - Skilled team responsible for quick follow-up of any availability/performance anomalies
  - 10+ year close relationship with Septentrio support team to address non-trivial/new issues
- **Internal use of both public and non-public EGON data**
  - Contributing towards Precise Orbit Determination (ultra-rapid/rapid/final orbit and clock products)
  - Contributing towards realisation of Galileo Terrestrial Reference Frame (GTRF)

International Partner

- **Hosting of the EGON site(s)**
  - Installation as per provided manual with remote support from ESA/ESOC
  - Provision of receiver/antenna hosting locations, network connection, power and occasional (minimal) troubleshooting
- **Full access to RINEX3 files (15min/Hourly/Daily) of hosted EGON station(s)**
  - Data is non-public and can be provided to a designated data server in near-real time
  - LoA annex allows for specification of related entities that are also entitled to use the data for scientific non-commercial purposes
- **Possible exchange of additional non-public ESA (EGON) data/products (e.g. Galileo Orbits and Clocks, etc.)**

EGON 3rd party cooperation agreement - Schedule

Indicative schedule of activities and milestones

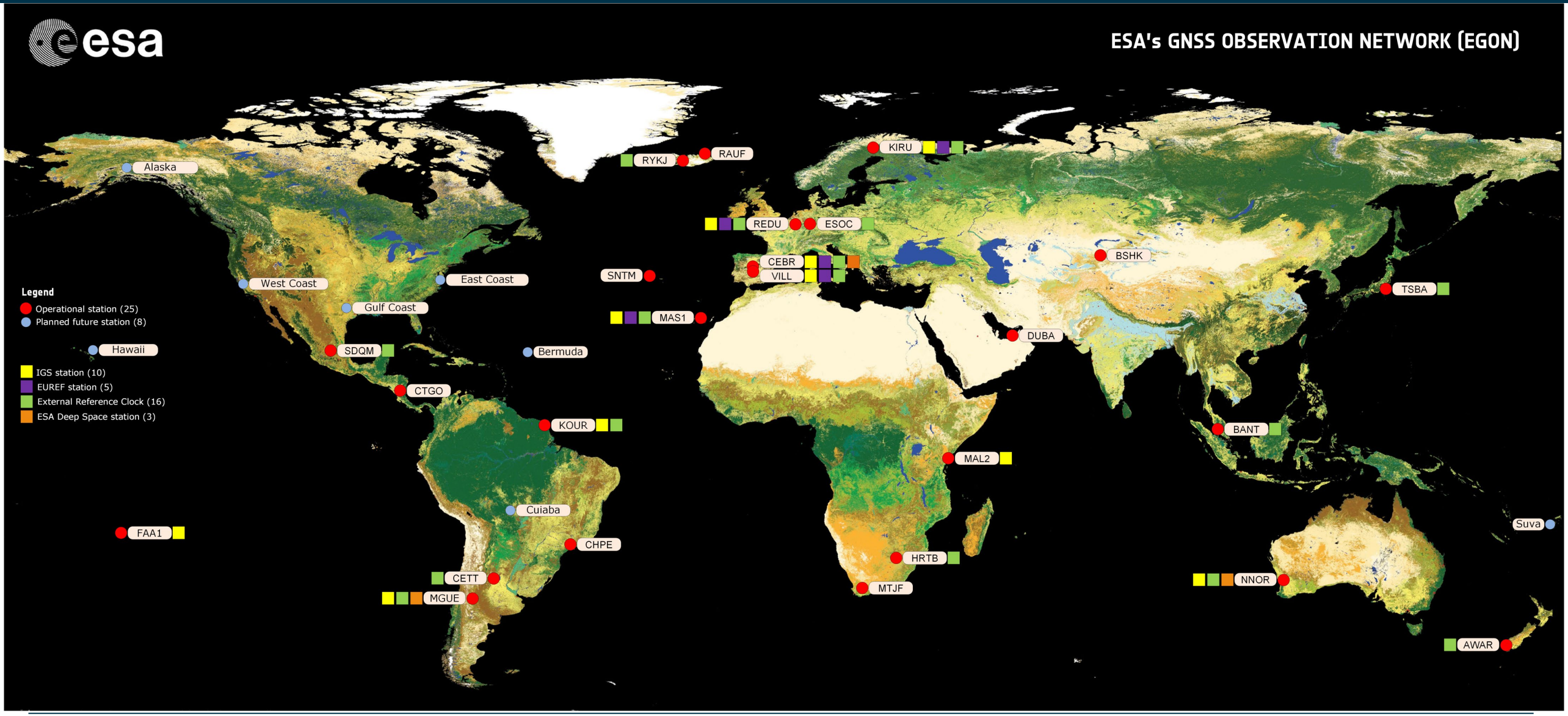
ID	Activity	Indicative Schedule
1	Exchange of hosting requirement documents and identification of suitable sites	T_0
2	Finalisation of Letter of Intent	T_0 + 1 month
3	Management confirmation to proceed with cooperation	T_0 + 2 months
4	Drafting, approval and signature of the legal arrangements (Letter of Agreement)	T_0 + 3 months
5	Shipment of GNSS sensor station equipment (prepared in parallel, shipped when LoA is signed)	T_0 + 3 months
6	Deployment of GNSS equipment to site(s)	T_0 + 4 months
7	Testing of deployed GNSS equipment (check connection and data quality, and mm-level antenna phase center determination with PPP)	T_0 + 5 months
8	Start nominal operations	T_0 + 6 months

EGON station hosting requirements

Document: DOPS-SYS-SS-0001-OPS-GN

- **Contains guidelines** (not a strict go/no-go) **for hosting sites**
- **Areas covered:**
  - Long term site availability
  - Site security/safety
  - Environmental conditions for equipment room
  - Electrical compatibility
  - Network connection/security
  - Antenna monument/cabling
  - Antenna clear horizon + MP/RF environment
- **Evaluation Form to be provided to ESA for candidate sites**
- **Partial/Non-compliances:** either accepted “as is” or minor re-work on site (if effort is considered acceptable by both parties)

EGON – Status 2024



EGON GNSS equipment for all new deployments

The PolaRx5 and its variant the PolaRx5e are versatile and robust multi-frequency GNSS reference receivers. They provide measurements with the lowest noise and cycle slip rate on the market while continuously monitoring and protecting against interference, multipath and other environmental effects.

KEY FEATURES

- **Tracks all visible signals (GPS, GLONASS, Galileo, BeiDou, NAVIC, QZSS and SBAS)**
- **High precision, low noise measurements**
- **AIM+ interference monitoring and mitigation system**
- **Low and scalable power consumption**

Septentrio PolaRx5

Scientific

Reference Network Stations

Septentrio's PolaNt Choke Ring B3/E6 is a high precision geodetic multi-frequency, multi-constellation choke ring antenna for use with Septentrio's PolaRx family of high performance multiple-frequency GNSS reference receivers. It supports current and planned GNSS signals including BeiDou B3 and Galileo E6.

The PolaNt Choke Ring antenna incorporates low-noise amplifiers, powerful filters for out-of-band interference rejection combined with superior multipath rejection and a high phase centre stability.

It is a competitive alternative for Dorne & Margolin based antennas and is designed for high-end applications and reference station operations. The sealed radome allows reliable signal reception even in harsh conditions.

KEY FEATURES

- **Support current and planned GNSS signals from GPS, GLONASS, Galileo, BeiDou, IRNSS, QZSS and SBAS**
- **BeiDou B3 and Galileo E6 capable**
- **High phase center stability**
- **IGS calibration available with or without radome**

Septentrio PolaNt Choke Ring E3/B6

Current EGON network (25)

GNSS receivers
- PolaRx5 (18)
- PolaRx5TR (3)
- PolaRx4 (2)
- PolaRx4TR (2)

GNSS antennas
- PolaNt Choke Ring E3/B6 (17)
- Choke Ring MC (4)
- AR25.R4 (4)

All receivers are Septentrio, to ensure homogenous operations, processing and maintenance

Majority of the antennas are also Septentrio, whereas remaining 4 antennas are Leica

EGON antenna monument examples

SNTM - Azores

AWAR - New Zealand

HRTB - South Africa

EGON – Further Information

Information about ESA/ESOC's EGON is available under:

http://navigation-office.esa.int/ESA%27s_GNSS_Observation_Network_%28EGON%29.html

Point of Contact for potential Cooperation:

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