European GNSS Evolution

EU Global Navigation Satellite System (GNSS) Research and Technology
Horizon 2020 Stakeholder Consultation Workshop

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4 GNSS systems and almost global SBAS L1/L5 coverage

**GNSS situation**
- GPS and GLONASS systems are fully operational and modernizing their infrastructure
- Beidou and Galileo are in the deployment phase

**SBAS situation**
- USA provides LPV-200/ L2 augmentation services;
  Europe, Russia, Japan, India (currently in final acceptance phase) provide L1 augmentation services

**GNSS situation**
- In 2020, the GNSS environment will consist of modernized GPS, modernized GLONASS and fully operational Galileo and Beidou systems

**SBAS situation**
- SBAS infrastructures evolve towards the provision of dual frequency augmentation services.
- By 2020, USA, Europe, Russia, India, China and Japan will all provide GPS L1/L5 satellite-based augmentation services over their region
Galileo needs to offer added value and excellent signal in space in order to be sustainable ...

Insights

More than 2 ½ GNSS:
- no benefit to the user
- may cause serious difficulties for the user when processing all GNSS signals

A GNSS systems can only be sustainable with:
- **excellent signals-in-space** superior to others;
- and/or **unique features** or unique product delivery;
- and/or as dual use system (civil + governmental services)
The increased SBAS coverage will require harmonisation …
The major challenges for shaping the next generation of EGNSS systems …

★ To tailor the next generation of EGNSS systems to meet future user needs and market trends

★ To find broad user acceptance of EGNSS in the future global multi-system environment

★ To find the right balance in the repartition of functions between the future EGNSS systems and future user terminals

★ To preserve full backward compatibility with EGNSS legacy services

★ To maximize the benefits of targeted mission & service enhancements vs. life-cycle costs of the 2nd Gen EGNSS infrastructures
EGNSS Mission Evolution Drivers

★ User requirements evolution & market trends:
★ Users will demand greater levels of performance
★ Emergence of cooperative navigation
★ Generalization of hybridization
★ Interoperability is a highly desirable feature for users
★ PNT information to be used as evidence of compliance: increased need for authentication in many sectors

★ Technology evolution:
★ Multi-constellation / multi frequency
★ Hybridization @ receiver level (WiFi, MEMS, RF-ID, cellular positioning…)
★ Assistance for better TTFF (communication channel)

★ Evolution of GNSS international environment:
★ Modernization plans for GPS and Glonass are being implemented + China
★ Several trends affecting the system design: use of alternative orbits to improve coverage in some areas, transfer of functionality from the ground control segment to the satellites, increase robustness of signals…
The European Commission has established a process for the development of the next generation of European GNSS Systems in consistency with article 12§3-d of GNSS Regulation 1285/2013

 [...] the Commission shall lay down, where necessary, the measures, required to [...] implement systems evolutions. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 36(3).

The main objective is to define the new Mission Requirement Baseline for the Galileo 2nd Generation (G2G)

The development process is set up in close cooperation with the European Space Agency (ESA) and the European GNSS Agency (GSA)
Starting point: Galileo MRD 7.1 and EGNOS V3

- Remark: For schedule reasons, the Mission Evolution process is focussing on Galileo for the moment; process currently in place remains valid for EGNOS when EGNOS mission evolution post-V3 will start. The reason why EGMER V1 content is Galileo only.

Truly Top-down, considering EU strategic objectives and anticipating user needs evolution

- Classical approach to strategic forecasting,
- Based on the analysis of the PNT environment and its expected changes.
- Establishes Mission Evolution Directions and Scenarios

Structures a process on Mission Evolution, yet without pre-empting any technical solution

- Bespoke system implementation options and architectural solutions shall be defined and analysed by ESA in response to the Mission Evolution Directions
Improved interoperability with other GNSS systems

Enhancement of Galileo Mission Performance

Galileo Mission Evolution Directions
(EGMER V1)

Expansion of Galileo Service Portfolio

Improved EGNSS Service Capabilities over Europe
Link with EGNSS R&D Activities

EGNSS 2nd Gen Development

EGNSS Programmatic Framework

1. Upstream R&D activities (ESA)
2. Mission & Service Evolution R&D (COM)
3. Fundamental Elements (GSA)

EGNSS Mission evolution drivers

Link with GNSS R&D Activities
A top-down structured process, starting from the EU policy objectives and a thorough analysis of the potential evolution of user needs and market trends is in place for the definition of potential G2G mission evolution directions and scenarios.

The mission level work will be complemented by comprehensive system definition and analysis work for the final selection of the "best" G2G system implementation options.

The described G2G definition process relies on enabling technologies and focussed GNSS R&D activities on mission, system and receiver level.

This is the very subject of this Stakeholder Consultation Workshop …
Thank you for your attention

http://ec.europa.eu/galileo
http://ec.europa.eu/egnos