GALILEO High Accuracy Service

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GALILEO providing excellent performance

- **Galileo Services are a reality**
  - Initial Services provided since 15th December 2016
  - Open Service and SAR/Galileo Forward Link Service

- **Galileo offers excellent overall performance**
  - High "Per satellite" availability 99.42%
  - **Continuous SISE improvement due to ongoing deployment;** Currently observed SISE value <**0.50m 95% Global Average** (constellation average)
  - **UTC(SIS) dissemination** accuracy is below **8.4ns (95%)**
  - **GGTO dissemination** accuracy is below **6.9ns (95%)**

- **Galileo provides Dual Frequency** capability to users

Galileo High Accuracy Service

- Galileo has been designed to allow for provision of a **Commercial Service (CS)** intended for broadcast of value added data, such as **high accuracy** and **authentication**.

- In March 2018, the European Commission adopted an implementing decision whereby the **High Accuracy** feature of the Galileo CS shall be provided **free of charge to Galileo users**.

- The European Commission's goal with offering a free High Accuracy signal is to allow **innovation** to flourish in both consolidated and emerging **markets**, while **minimising** as far as possible any **disruption** to the current business models of established providers.

- While high accuracy services are already widespread in professional sectors, providing them on a worldwide basis is a novel service that Galileo will begin to offer as of 2020/21.
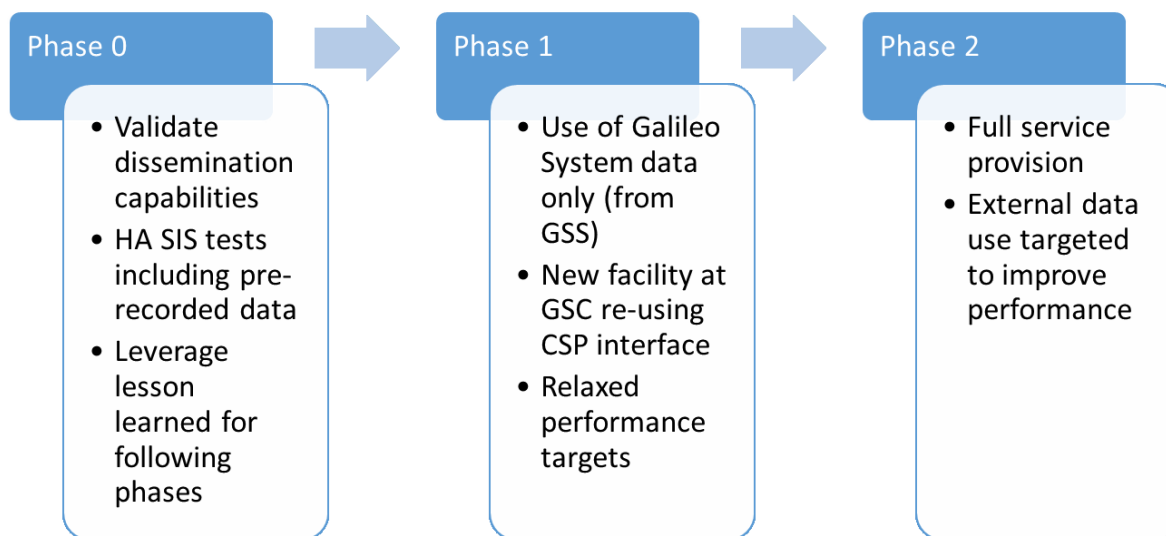
Galileo High Accuracy - continued

- **Galileo** will be the first constellation able to provide such **High Accuracy service globally**.

- **Galileo High Accuracy Service** will be based based on the provision of accurate satellite data (clocks, orbits and biases) and atmospheric data (mainly ionospheric corrections) to enable **PPP**

- Galileo **High Accuracy Data** will be transmitted through an **open format** in the **Galileo E6B signal**, using **448 bits** per satellite per second.

- The format of HA corrections, considering the available bandwidth and Galileo uplink capability, are critical for maximising user performance. The format has commonalities with the RTCM-CSSR, including adaptations to the Galileo E6B channel.

Galileo High Accuracy Service Key Features

- Galileo HAS will provide 2 Service Levels:
  - **Global Service Area** (SL1) and
  - **Regional Service Area** (SL2)
- Enabling Positioning with Accuracies **< 20 cm (H)/ 40 cm (V)**
- **Improved Convergence** for the Regional Service
- **Multi** Constellation (at least Galileo + GPS)
- **Multi** Frequency
- Correction Data broadcast though **Galileo E6B Signal in Space** at 448 bps
- Correction Data also planned to be available through auxiliary channels
- Corrections provided in **Galileo Terrestrial Reference Frame** and **Galileo System Time**

High Accuracy Service Plan

Phase 0
- Validate dissemination capabilities
- HA SIS tests including pre-recorded data
- Leverage lesson learned for following phases

Phase 1
- Use of Galileo System data only (from GSS)
- New facility at GSC re-using CSP interface
- Relaxed performance targets

Phase 2
- Full service provision
- External data use targeted to improve performance

- **HAS Phase 0:** Tests started by mid Feb'19 and continued.
- **HAS Phase 1:** under procurement. Based on existing infrastructure.
  - Will provide HAS by 2020 (signal)/2021 (service).
  - Not global - relaxed performances.
- **HAS Phase 2:** under design. Global (SL1), full accuracy service, possibly including ionospheric information to improve convergence regionally (SL2).

Galileo HAS Signal In Space ICD

Draft HAS SIS ICD for Phase 1 is available but not yet in public domain.
Commonalities with RTCM-CSSR but adapted to the Galileo E6B channel.
Some parameters and messages are still under consolidation.

The following parameters are envisaged:

Parameter	HAS Global Service Level 1	HAS Regional Service Level 2
Satellite Orbit Corrections	X	X
Satellite Clock Corrections	X	X
Code Biases	X	X
Phase Biases	(X) TBC	(X) TBC
Ionospheric delay corrections		X

Considerations on Interoperability

Interoperability of products

- Interesting feature for users using several different correction origins

- Not deemed to be of critical importance as long as the broadcast correction parameters are well defined in User Interface documents

- Likewise for the Atmospheric corrections a clear description of the provided corrections and the applied model is important

Interoperability could be ensured **by sharing a common terminology** when describing the services

High Accuracy Service – Take away

- Galileo High Accuracy Service:
  - will be **free of charge** to Galileo Users
  - will enable **20 cm PPP** positioning on a **global scale,** with regionally improved convergence

- The Galileo HAS data will be **transmitted openly, for free**, and through an **open standard format**.

- The Galileo High Accuracy Service will be **gradually rolled** out as of 2020

- **Interoperability** could be ensured **by sharing a common terminology** when describing the services

THANK YOU

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