

# Precise Timing with the Galileo Early Open Service

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Following the successful launch of the first four satellites of the European navigation system Galileo, the subsequent Galileo In-Orbit Validation test campaign demonstrated excellent system performance. The European navigation system Galileo will start delivering Early Services at the end of 2014. These services will include:

- Early Open Service interoperable with GPS and providing free access to positioning and timing,
- Search-And-Rescue contribution to COSPAS-SARSAT Service for locating people in distress,
- Early Public Regulated Service with controlled access and increased robustness, and
- Commercial Service Demonstrator.

The performance of the Early Services will be continuously monitored by ESA/EC through evaluation of dedicated Key Performance Indicators (KPIs).

Precise timing dissemination capability is a part of the Early Open Service. This Service will guarantee the visibility, with a high level of availability, of at least one Galileo satellite in every location of the world, making the precise timing dissemination capability practically available to fixed users, such as timing laboratories.

The key elements of the Galileo infrastructure to enable UTC dissemination are:

- the Precise Time Facility (PTF), which is in charge of generating and distributing a stable and reliable Galileo System Time (GST), the internal timing reference in Galileo used to synchronize the system infrastructure and predict the satellite clocks;
- the Time Validation Facility (TVF) in charge of predicting GST-UTC offset based on time transfer between PTF and European Timing Laboratories.

The performance of time dissemination via Galileo was comprehensively evaluated during the IOV campaign in 2013 and will be validated in 2014 prior to declaration of the Early Service readiness.

The paper describes the context of Galileo Early Services, introduces the Galileo time dissemination concepts, provides an overview of the In-Orbit Validation results and discusses implementation of the Key Performance Indicators applicable to timing and organization of the overall service validation phase.