

GALILEO overview



European Commission

**International GNSS Committee, Vienna,
1 December 2006**



Presentation Structure

- Galileo key features
- Program overview
- International cooperation
- Future perspectives





Galileo

Key features

1. **Higher quality services globally available**
2. **Market oriented, designed for civil users**
3. **Autonomy → security**
4. **Public private partnership**
5. **Accountability**

→ full service and performance monitoring and real-time “integrity”



Galileo Constellation








- **30 satellites in orbit (only 27 active)**
- **3 planes**
- **Orbit altitude: 23222 km (above GPS and GLONASS).**
- **Each satellites makes 17 orbits in 10 days.**
- **12 satellites visible from any ground location, in average.**



Galileo

Services

Navigation	Open Access	Free to air; Mass market; Simple positioning and timing	
	Commercial	Encrypted; High accuracy; Guaranteed service	
	Safety of Life	Open Service + Integrity and Authentication of signal	
	Public Regulated	Encrypted; Integrity; Continuous availability	
SAR	Search and Rescue	Near real-time; Precise; Return link feasible	



Galileo Project Status



*The GIOVE-A satellite under test at the ESA
Technical Facilities in the Netherlands*

- **Definition Phase started in 2000 and was completed in 2003.**
- **Currently in the Development and Validation phase to be completed in 2008.**
- **Critical technology developments completed (i.e. atomic clocks).**
- **First Experimental satellite GIOVE-A launched 28 December 2005.**



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GIOVE A



- GIOVE-A is the first Galileo In-Orbit Validation Element.
- Named in tribute to Galileo Galilei who discovered the first four satellites of Jupiter (*Giove* in Galilei's native language). Tables describing the motion of these four Jovian satellites were used to determine longitude at sea and on land.
- built by Surrey Satellite Technology Limited, Lift-off mass: 600 Kg, Power demand: 700 Watts, Stowed Dimensions: 1.3 m, 1.8 m x 1.6 m
- “bringing into use” of Galileo frequency filing assignments March 2006



Galileo

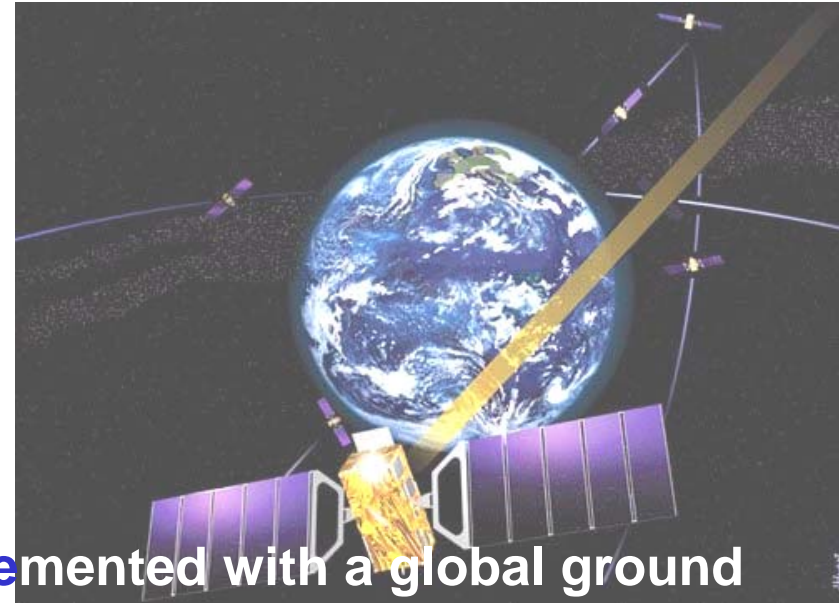
GIOVE B

- GIOVE-B is built by Galileo Industries.
- Back-Up of GIOVE-A.
- Launch planned for 2007.
- Incorporates additional key technologies such as the H-maser atomic clock (the more precise clock ever flown yet in space).





Galileo In-Orbit Validation and Full Deployment



- Constellation of four satellites to be deployed by 2008 complemented with a global ground segment of reference and up-link stations to communicate with the satellites.
- Four satellites is the minimum to guarantee exact position and time at test locations.
- The In-Orbit Validation will be followed by the deployment of the complete system (remaining 26 satellites) by 2010.

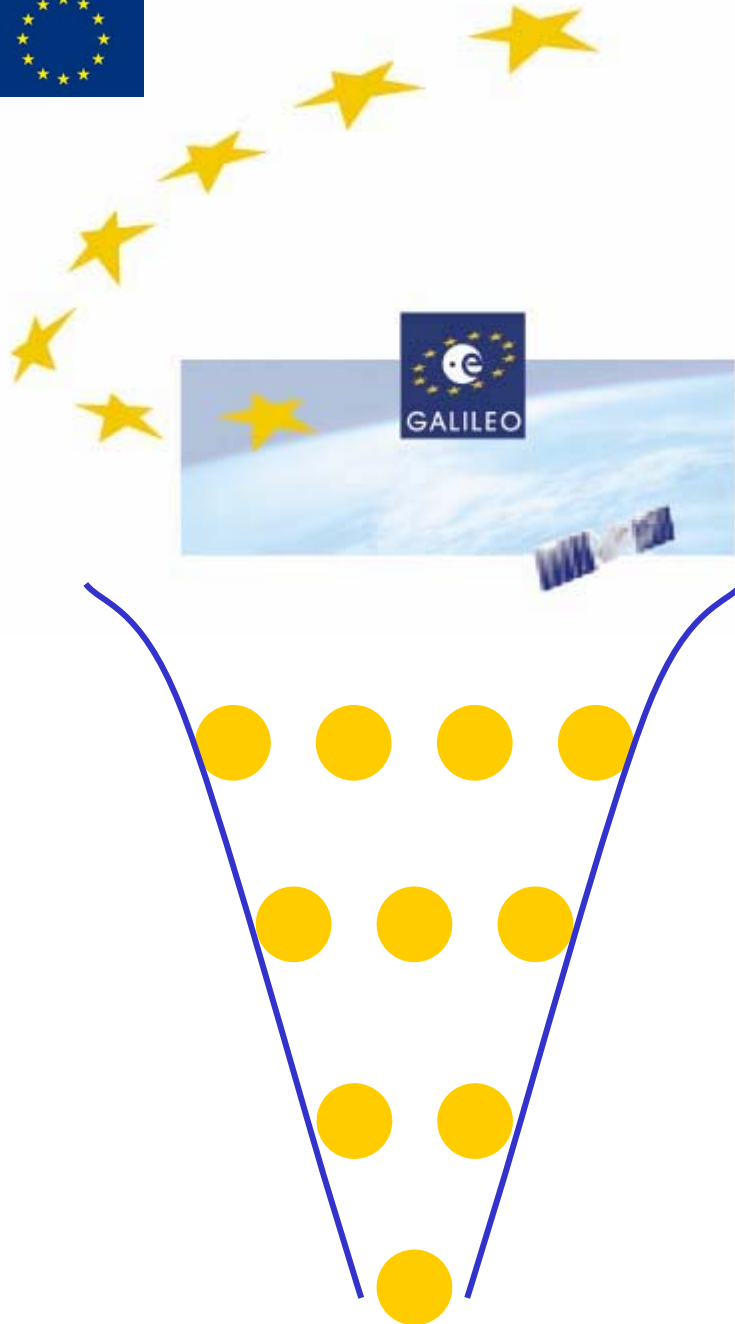


EGNOS

Update



- **EGNOS operations started in July 2005.**
- **Declaration of Open Service availability planned for early 2006.**
- **Coverage extensions taking place:**
 - **South Mediterranean and North Africa: 4 additional stations.**
 - **Whole of Africa: Workshop of potential investors, Cairo, 14-15 February 2006, Steering Committee set up.**
 - **Several demonstrations in Africa during 2005 using test-bed signals.**



Galileo

concession status

- **Oct. 2003: Concession Call**
- **Dec. 2003: 4 candidates**
- **Feb. 2004: 3 short listed**
- **Competitive negotiation**
- **Sept. 2004: 2 bids**
- **June 2005: 1 merged bid**
- **Dec. 2006: Heads of Terms**



PPP

Risk sharing



risk



cost





Objectives

international co-operation

- **Seek interoperability with existing systems**
- **Reduce risks (technical, market, regulatory..)**
- **Raise awareness**
- **Promote access to GNSS/Galileo**
 - ➔ **Make Galileo inclusive from outset**



Activities

international co-operation

- **Bilateral agreements**
- **Research and technological development**
- **Training, information days, Galileo centres**
- **Industrial co-operation, EGNOS South**
- **Certification, standardisation**
- **Co-operation in international forums** ➔ **IGC**



Interoperability Galileo - GPS

- *Agreement signed on June 26th 2004 on the provision and promotion of Galileo and GPS services*
- Full interoperability and compatibility Galileo and GPS
- Common baseline signals + optimisation under study
- Joint broadcasting of GPS/Galileo time offsets
- Galileo and GPS will share some frequency bands
- Galileo + GPS = world standard for civil GNSS free of charge to end users



Galileo - GPS

Next steps

Expert groups on:

- a) **Frequency compatibility and interoperability**
- b) **Trade and civil applications**
- c) **Design and development of next generation civil satellite navigation systems**
- d) **Security issues**



Interoperability Galileo-GLONASS

- **Contacts underway**
(ex: ESA - Roscosmos on EGNOS and GLONASS augmentations)
- **Different challenges (technical standards etc)**

-
- **Opportunities: bridge GPS, GLONASS, GALILEO**

➔ **ICG as forum**



Galileo

International

Perspective:

- Worldwide Markets
- Local-Regional Infrastructures
- Global Standards
- Products Certification
- Financing

	Signed	Draft	Nego.	Talks
U.S.A.	✓			
China	✓			
Israel	✓			
India		✓		
Ukraine	✓			
S. Korea	✓			
Morocco	✓			
Norway			✓	
Argentina			✓	
Russia			✓	
Canada				✓
Brazil, Chile, Mexico				✓
Malaysia, KSA				✓



Galileo Cooperation Centres

- **Asia Region: Beijing, 2003**
- **Africa Region: Cairo, 2004**
- **Latin American Region: Sao Jose dos Campos, 2005**
(hosted by UN CRECTEALC center)
- **Centers: a useful tool for the ICG**
(e.g. training course in Beijing Dec. 2006)



Future perspectives

- **Moore's law (computing devices)**
 - cost decrease
 - capacity increase
- **Synergy with other technologies**
 - telecommunication
 - earth observation
- **Interoperability needs increase**
- **Internationalisation and democratisation**
- **Liability questions**