# Cooperative and distributed systems for integrated logistics services:

## *the benefits of the European Satellite Navigation*

IEEE
SOSE
2012

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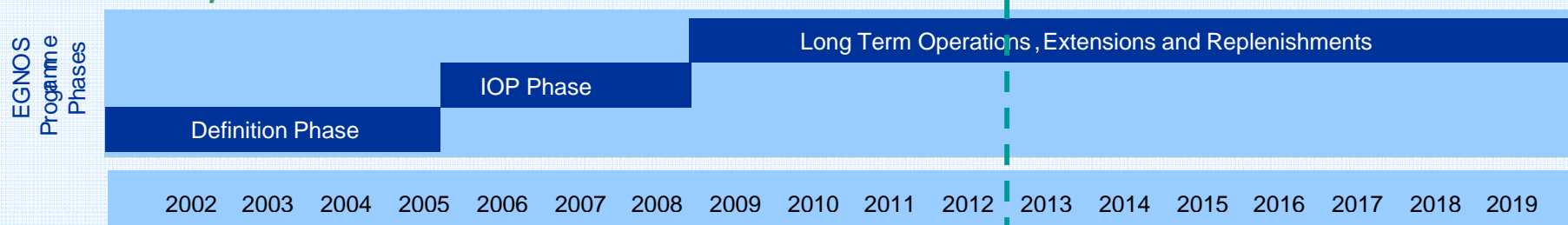
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# The European GNSS: EGNOS and Galileo
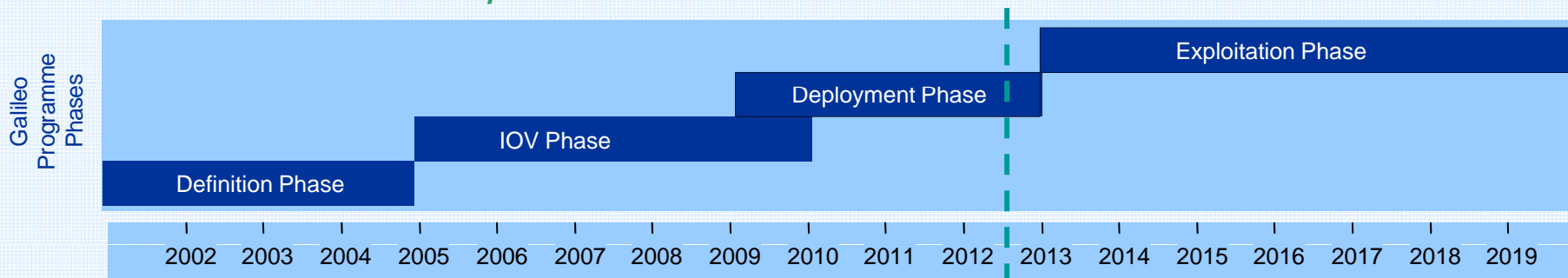
## 1) EGNOS

### Regional Infrastructure & Services

*EGNOS is operational*

**EGNOS Programme Phases**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Definition Phase | | | IOP Phase | | | Long Term Operations , Extensions and Replenishments | | | | | | | | | | | |
| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |

## 2) Galileo

### Global Infrastructure & Services

*Galileo is under implementation satellites are in orbit and planned*

**Galileo Programme Phases**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Definition Phase | | | IOV Phase | | | Deployment Phase | | | Exploitation Phase | | | | | | | | |
| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |

# EGNOS services

| Services | | | |
|---|---|---|---|
| | Open | Free to air; mass market; better than GPS | operational |
| | Commercial | High accuracy; encrypted; professional market | pre-operational |
| | Safety of Life | Integrity and authentication of the signal | operational |

*EGNOS augments the GPS signal:*

*–Higher accuracy*

*–Integrity information*

*over Europe and the Mediterranean area*

# EGNOS and Galileo applications

*Applications requiring robust, precise and reliable positioning and localization, e.g.:*



*Including freight transports and logistics*

| Services | | | |
|---|---|---|---|
| | Open | Free to air; mass market; better than GPS | **operational** |
| | Commercial | High accuracy; encrypted; professional market | **pre-operational** |
| | Safety of Life | Integrity and authentication of the signal | **operational** |

*EGNOS services for land and mobility applications:*

- ✓ *EGNOS OS (corrections and integrity info from SiS)*
- ✓ *EGNOS CS (corrections and integrity info from EDAS via ground communication means)*

*The majority of the receivers available on the market (mass-market and automotive chipsets) is EGNOS-ready*

*(labelled "GPS/EGNOS-enabled" or "GPS/SBAS-enabled")*

# Galileo services

| | | |
|---|---|---|
| **Open Access** | Free to air; Mass market; Simple positioning |  |
| **Commercial** | Encrypted; High accuracy; Guaranteed service |  |
| **Safety of Life** | Open Service + Integrity and Authentication of signal |  |
| **Public Regulated** | Encrypted; Integrity; Continuous availability |  |

| | | |
|---|---|---|
| **Search and Rescue** | Near real-time; Precise; Return link feasible |  |

*Galileo will provide highly accurate, guaranteed positioning services.*

*Galileo will also give the ability to authenticate the origin of the signal.*

*The GNSS receiver market is providing new-generation chipsets capable to receive signals from different constellation, for example GLONASS and early Galileo satellites in addition to GPS and SBAS/WAAS.*

✓**Article 16:**

*"For ITS applications and services for which accurate and guaranteed timing and positioning services are required, satellite-based infrastructures or any technology providing an equivalent level of precisions should be used, such as those provided for in Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations ( 1 ) and Regulation (EC) No 683/2008 of the European Parliament and of the Council of 9 July 2008 on the further implementation of the European satellite navigation programmes (EGNOS and Galileo)"*

✓**Article 17:**

*"Innovative technologies such as Radio Frequency Identification Devices (RFID) or EGNOS/Galileo should be used for the realisation of ITS applications, notably for the tracking and tracing of freight along its journey and across modes of transport."*
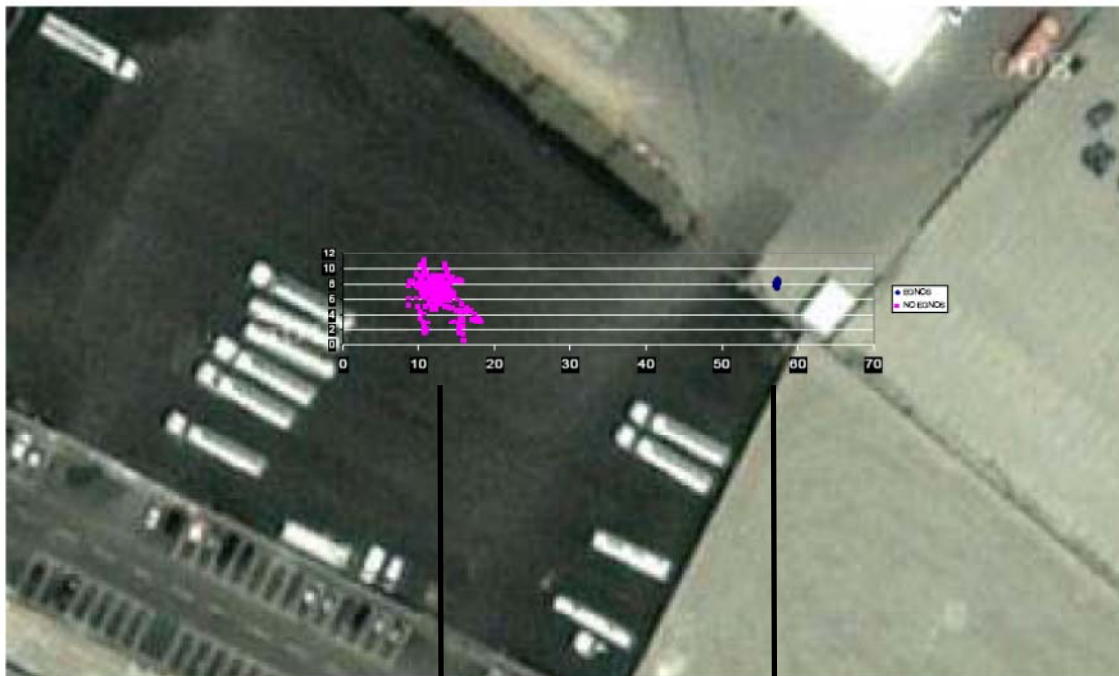
# The EU vision for mobility: the EWSP (2/2)

**European Wide Service Platform (EWSP) based on:**

✓ Intelligent combination of wireless communication technologies, network and transport communication protocols, security and control mechanisms

✓ Subsystems like service development, service offerings, service discovery and operations as well as of authorization/authentication, subscriptions/identification, payment/billing/charging and CRM

✓ For providing to users a large variety of energy efficiency, mobility, comfort and safety related services

✓ Interoperable and standardized innovative services to potentially fulfil the expectations and needs of all users in Europe, wherever they are geographically, whatever access terminal they are using, and whatever the transport mode

# EGNOS OS for freight transport and logistics applications

**EGNOS OS added value wrt GPS alone**

– free to users from the satellites' open signal
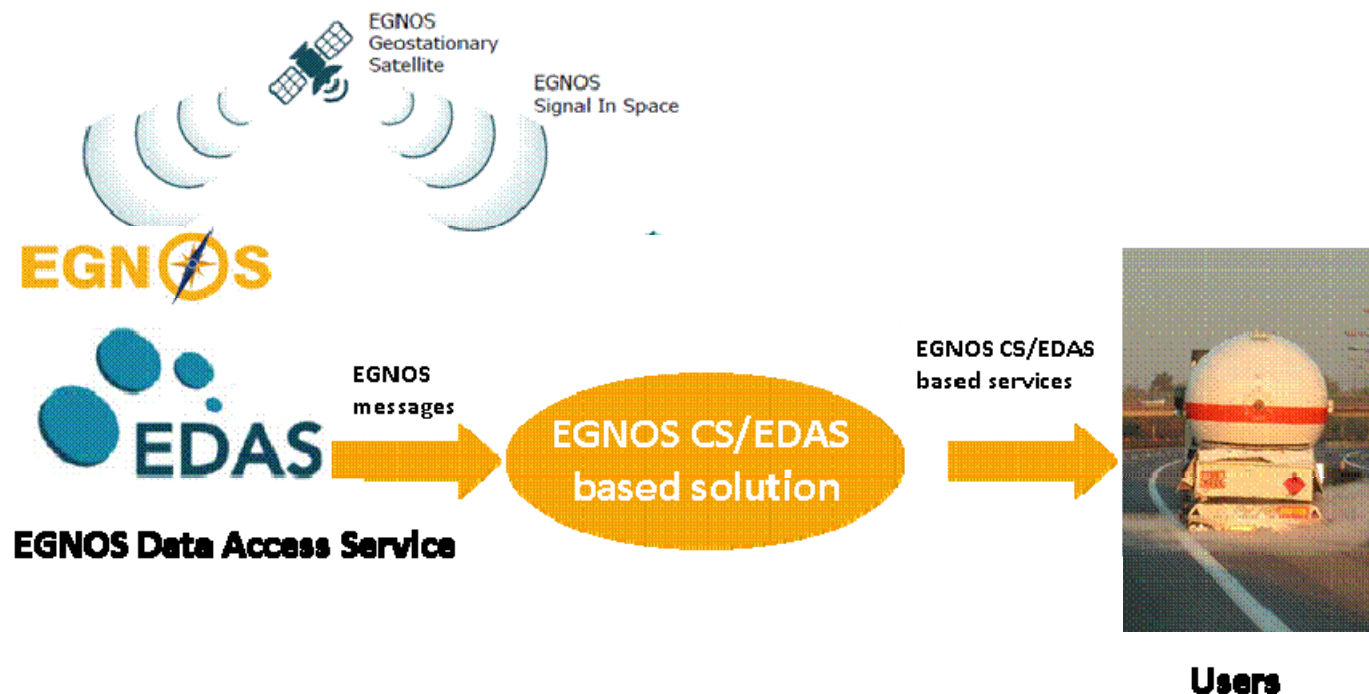
– enhanced GPS position accuracy *by approx. 3 metres*

static tests conducted by `eni`

**GPS**  **GPS + EGNOS**

# EGNOS CS (via EDAS)

**EGNOS CS added value**

– controlled access, distributed by EDAS via terrestrial networks

– enabling to augment the performances of the EGNOS OS through EGNOS CS/EDAS based solutions ("processing algorithm", e.g. LCS)



– **EDAS distributes EGNOS raw data to "solutions" connected to it, in real-time, within controlled access**

– **"solutions" use EGNOS data (from EDAS) and offer EGNOS CS/EDAS services**

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**LCS**

EGNOS CS/EDAS solution:
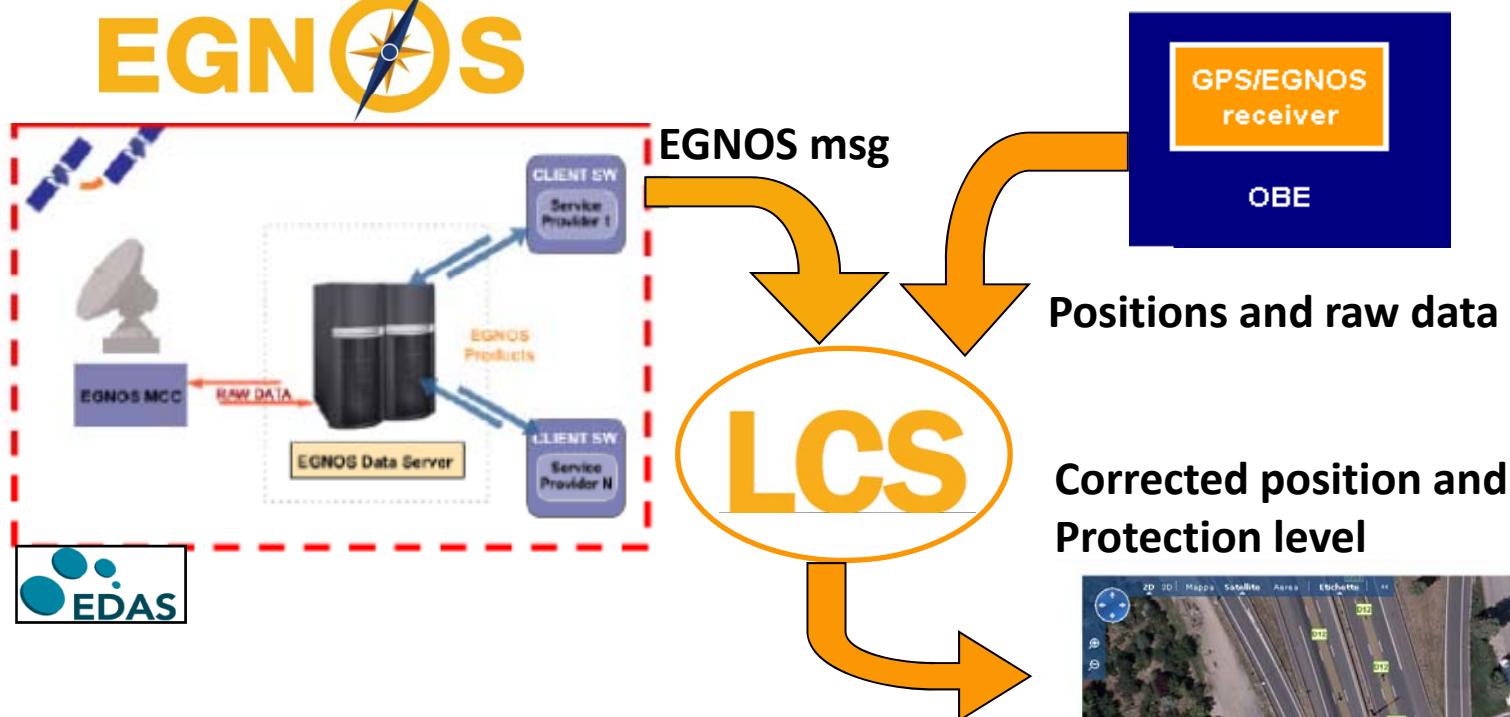
✓ Uses **EGNOS CS/EDAS**

✓ **Retrofits existing GPS tracking & tracing systems**

✓ Consists of several software modules, connecting to EDAS to get EGNOS data and implementing a **Telespazio proprietary navigation solution**

✓ Processes raw data from GPS/EGNOS receivers (mass-market automotive)

✓ **Compliant to CWA 16390**

✓ **Provides *"EGNOS CS/EDAS based services"*:**

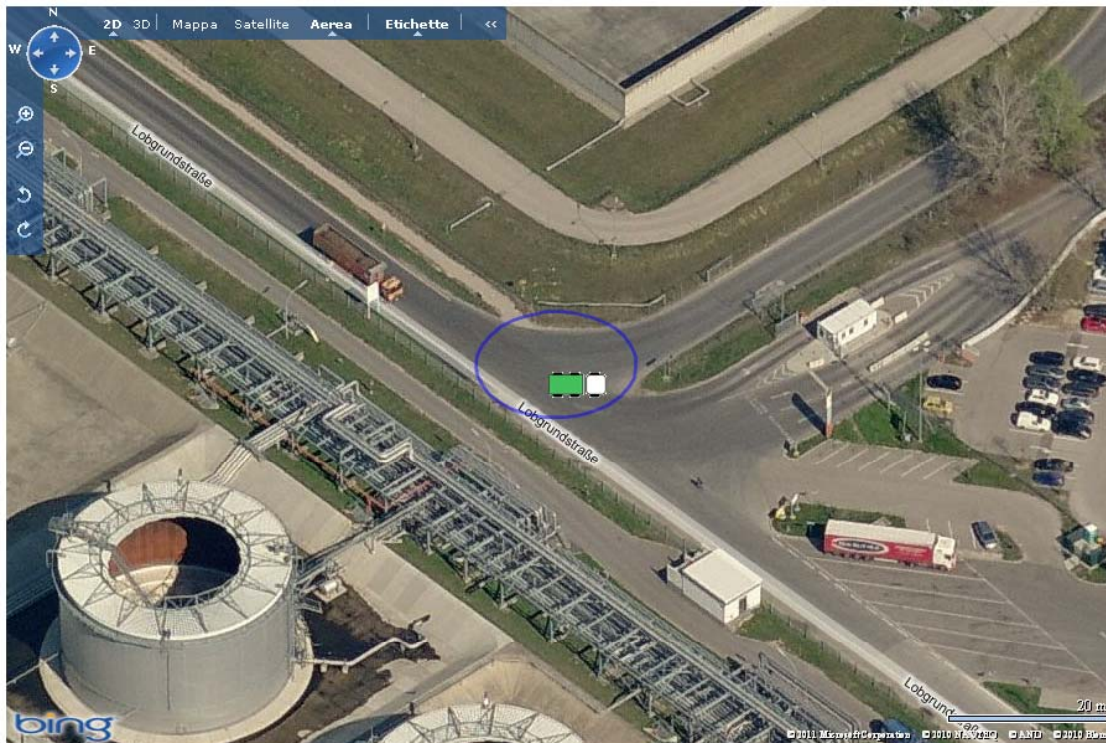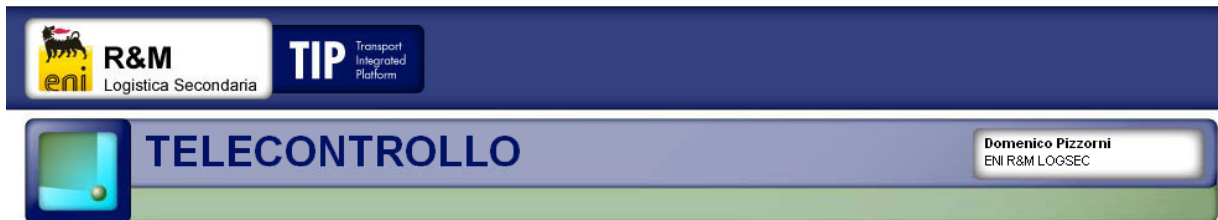    *Improves the availability of the EGNOS OS*

    *Enhances GPS position accuracy by approx. 4 metres*

    *Processes the EGNOS integrity into the "protection level", providing the qualification/ confidence in the position information*

# EGNOS CS for freight transport and logistics applications (2/8)

**EGNOS**

**EGNOS msg**

**GPS/EGNOS receiver**

**OBE**

**Positions and raw data**

**LCS**

**Corrected position and Protection level**

**EDAS**

## Use of GPS + EGNOS OS + EGNOS CS/EDAS & LCS



*Accurate latitude and longitude*

*Horizontal Protection Level (HPL)/ position guarantee*

`eni` benefits are for risk management, safety and commercial purposes

# EGNOS CS for freight transport and logistics applications (4/8)

**EGNOS OS and EGNOS CS/EDAS key performance values (average) for horizontal accuracy and protection level**

| GPS (m) | EGNOS OS (m) | EGNOS CS (m) | EGNOS CS HPL (m) |
|---------|--------------|--------------|------------------|
| 2,0 | 1,4 | 1,1 | 9,1 |

**EGNOS OS →higher accuracy wrt GPS**

| GPS (m) | EGNOS OS (m) |
|---------|--------------|
| 1,4 | 1,0 |

**Extra-urban environments**

| GPS (m) | EGNOS OS (m) |
|---------|--------------|
| 7,4 | 3,4 |

**Urban environments**

**EGNOS CS/EDAS via LCS → higher accuracy wrt GPS + qualification/ confidence on the position**

| EGNOS CS (m) | EGNOS CS HPL (m) |
|--------------|------------------|
| 0,9 | 8,8 |

**Extra-urban environments**

| EGNOS CS (m) | EGNOS CS HPL (m) |
|--------------|------------------|
| 1,8 | 10,9 |

**Urban environments**

| Availability |
|--------------|
| 96,91% |

**Number of positions for EGNOS CS/EDAS processing**

Genoa, 17 July 2012

# EGNOS CS for freight transport and logistics applications (5/8)

**Higher independence from the GPS/EGNOS receiver technology**

| GPS/EGNOS receiver 1 | GPS (m) | EGNOS OS (m) | EGNOS CS (m) | EGNOS CS HPL (m) |
|---|---|---|---|---|
| | 2,0 | 1,4 | 1,1 | 9,1 |

| GPS/EGNOS receiver 2 | GPS (m) | EGNOS OS (m) | EGNOS CS (m) | EGNOS CS HPL (m) |
|---|---|---|---|---|
| | 3,0 | 1,9 | 0,8 | 8,8 |



| | GPS | | EGNOS CS/EDAS | | EGNOS OS | | True Position |
|---|---|---|---|---|---|---|---|

| GPS HNSE (m) | EGNOS OS HNSE (m) | EGNOS CS/EDAS HNSE (m) | EGNOS CS/EDAS HPL (m) |
|---|---|---|---|
| 7.4 | 3.4 | 0.9 | 8.8 |

# EGNOS CS for freight transport and logistics applications (6/8)

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OBU **BO**
latitude: 44.5008466667 (degree)
longitude: 11.3461956667 (degree)
hpl/vpl: 8.67061710358, 11.5773525238 (meter)
gpstime: 2008-10-30 14:45:50
scalar velocity: 1.731 (km/h)

OBU Metis001
latitude: 36.7641798333 (degree)
longitude: 3.0627885 (degree)
hpl/vpl: 7.27910041809, 10.8360500336 (meter)
gpstime: 2008-05-17 13:40:07
scalar velocity: 0.025 (km/h)

*Also with mass market devices and in all environments*

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*Such as in Rome:*
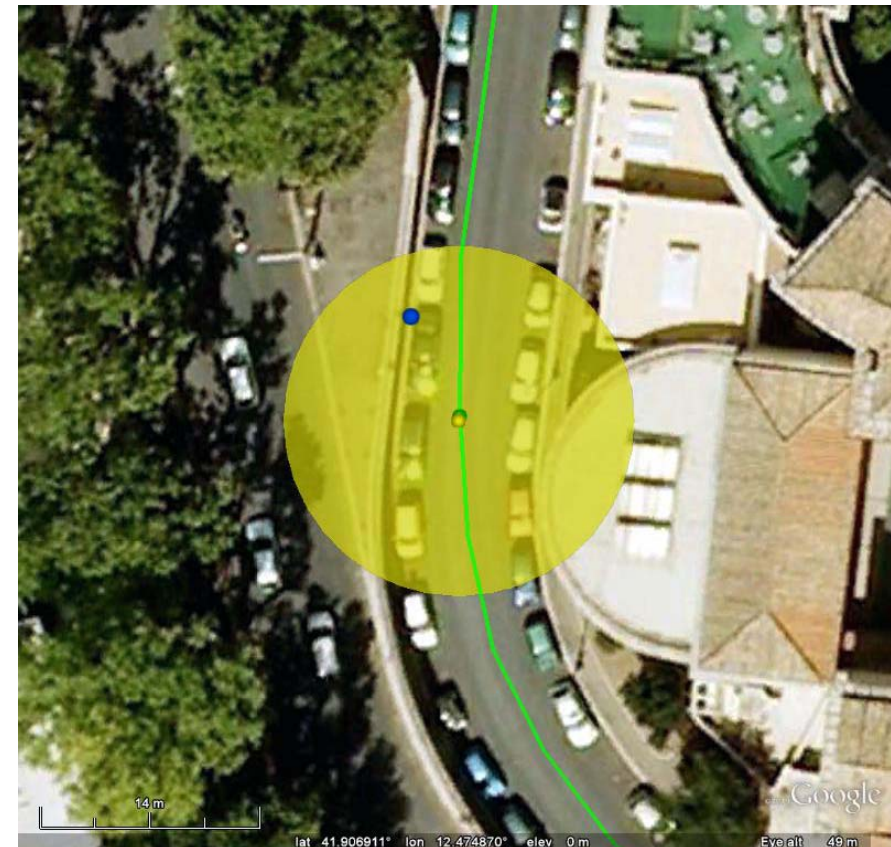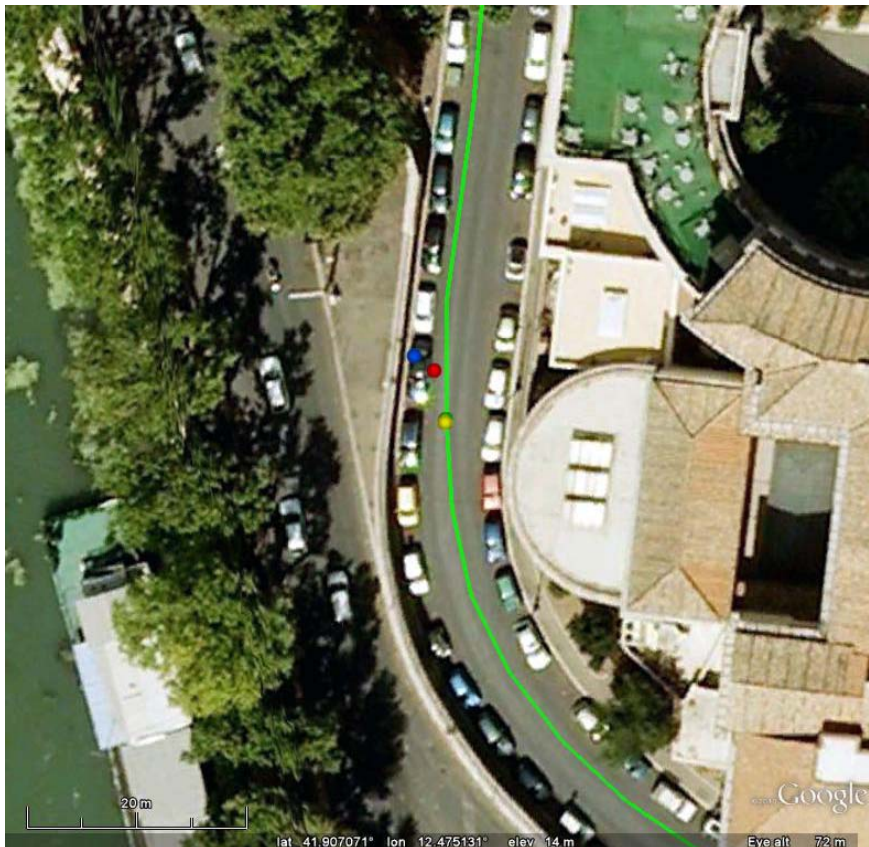


| GPS (m) | EGNOS OS (m) | EGNOS CS (m) | EGNOS CS HPL (m) |
|---------|--------------|--------------|------------------|
| 6,0 | 4,2 | 0,3 | 11,3 |

# EGNOS CS for freight transport and logistics applications (8/8)

| GPS (m) | EGNOS OS (m) | EGNOS CS (m) | EGNOS CS HPL (m) |
|---------|--------------|--------------|------------------|
| 8,5 | 6,0 | 1,8 | 10,9 |

Genoa, 17 July 2012

# The role of R&D and
# the European project SCUTUM

**SCUTUM:**

✓**EGNOS service for the tracking & tracing of dangerous goods**

✓**24 months**

✓**Project team**:

 11 members, coordinated by Telespazio

 4 EU countries

 Covering the value chain of EGNOS/Galileo applications

 Representatives from user community, Authorities, Standardization bodies

# SCUTUM: Why EGNOS for dangerous goods transports

**Combination of:**

    **EGNOS OS (i.e. from SiS) and**

    **EGNOS CS (distributed via EDAS)**

**EGNOS benefits for dangerous goods transport:**

    EGNOS OS → Better accuracy

    EGNOS CS/EDAS → Higher confidence/guarantee on position

                 Enhanced availability

    Adding value to GPS now, and preparation to Galileo

**State of play** of EGNOS use for dangerous goods transport

    **Needs and interest** of end-users and institutions

    **GPS+EGNOS OS adopted** in nation operational best cases (eni + MIT)

# SCUTUM:
# EGNOS European best practice

**Upgrading of the eni operational system** to EGNOS CS/EDAS by means of **LCS**

Turning **large scale demonstration in EU into operation**

**Involving commercial users and authorities** in 3 EU countries (Italy, France and Austria) to:
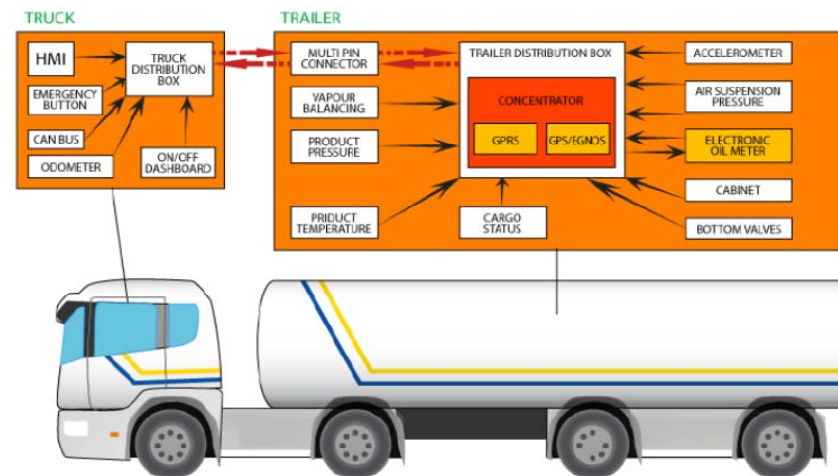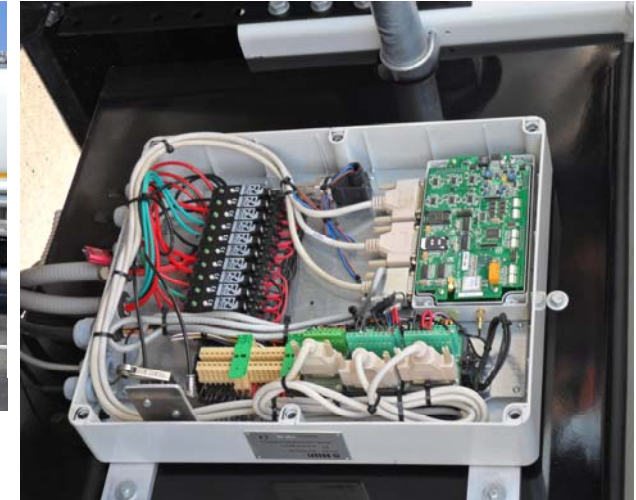
Validate EGNOS benefits for road applications

Elaborate a common model for EGNOS adoption

**Launching a EU-wide technical standardization** for EGNOS CS/EDAS based services
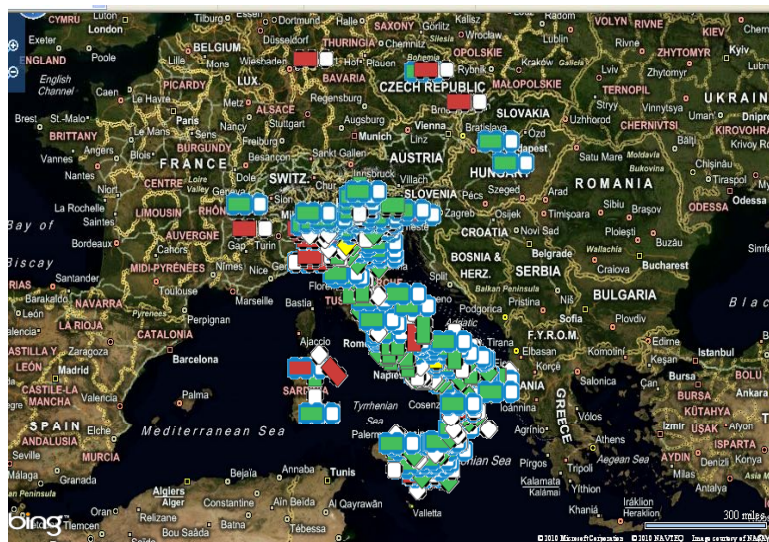
# SCUTUM system

# SCUTUM On-Board Unit



**Two typologies: Baseline and Slim**

# SCUTUM
## Transport Integrated Platform

# CEN Workshop Agreement CWA 16390:2012

✓ EU technical specification
http://www.cen.eu/cen/Sectors/Sectors/ISSS/Pages/SCUTUM.aspx

✓ Endorsed by EU stakeholders from industries, institutions and research sector

✓ Enabling the development of products and applications based on the **EGNOS CS/EDAS**

✓ Compliant with the guidelines of the UNECE/OTIF WG on telematics for dangerous goods

✓ Applicable to **Intelligent Transport Systems** and **mobility applications**

✓ **Validated by MEDDTL, MIT, `eni` and ERF**

# SCUTUM achievements

Adoption of EGNOS in an operational business case

Market readiness of a product based on EGNOS ( **LCS** )

Large consensus and applicability for the standardization

Cross-border cooperation initiated (between Italy, France and Austria as a first step, contacts with other countries already established)

Cross-fertilization with EU initiatives on-going (e.g. UNECE/OTIF WG on telematics for dangerous goods, eCall, HGV)

# SCUTUM lessons learnt

**Role of policies**

Alignment with *EU policies* (e.g. ITS Directive) as a key driver

**Role of institutions**

To support the implementation of *best practices* and *enablers*

**Role of users**

To dictate *technology development* and *validate benefits*

**Role of technology**

User-driven solution

To exploit *EGNOS added value in sustainable business case*

**Role of existing standards launching new developments when needed**

To ensure *interoperability and flexibility*

To enable turning *from R&D prototypes to products*

✓ Extension to rail

✓ CWA promotion for its use today (*already started in Italy/elaboration into an Italian PRASSI*)

✓ Galileo

      Multiconstellation environment/further robustness

      Signal authentication

✓ CWA GPS + Galileo + EGNOS to be considered in a further evolution of the CWA SCUTUM

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# Thank you

# www.scutumgnss.eu

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# LCS
# EGNOS CS/EDAS solution