

GNSS Applications **EC-ESA initiatives**

OOSA Training Course

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Franco Emma

Galileo Programme Representative in China

email: francesco.emma@esa.int



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Presentation Outline

- Applications what for and why?
- The range of GNSS services
- Projects sponsored by ESA
- Conclusions

Applications what for and why ?

*You can be as imaginative as you
want !*

Can be this: an instrumented sheep...



Specimen used for scientific applications: collection of grass samples in remote access areas.

..... or a handy parking locator.



you can park here



Already an important reality GPS on Cell Phone



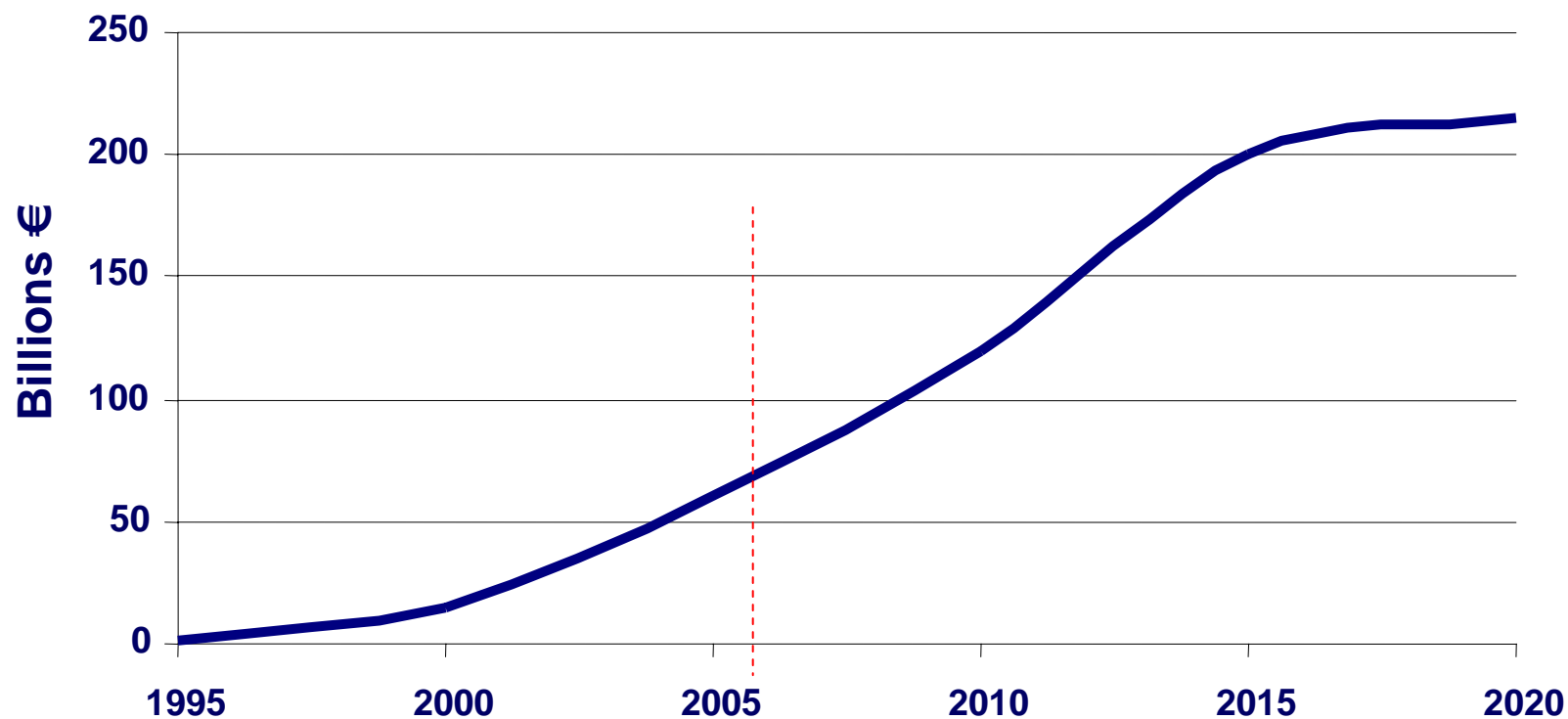
- 5 millions already in Japan -

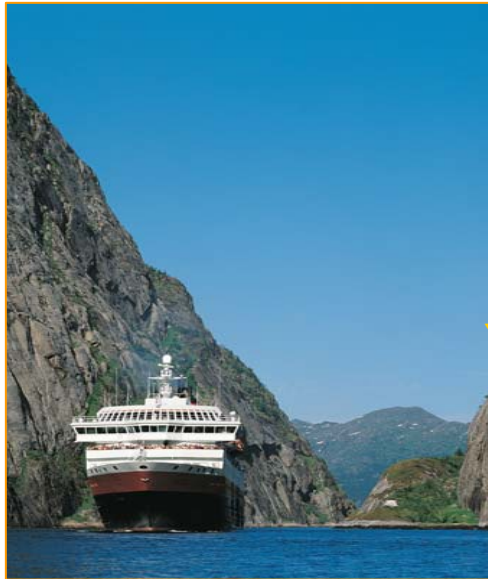


...and a business opportunity !

GNSS Applications

Satellite navigation products and services turnover





Applications



Let's have a look !

- Roads
- Aviation
- Agriculture and fisheries
- Civil engineering
- Energy

Applications Examples

Roads



- Route guidance
 - Traffic management
 - Fleet management
 - Road Tolling
 - Advanced Driving Assistance Systems
-
- Reduced travel time
 - Increase confidence in tracking of goods
 - Improvements in driving by the use of ADAS

Roads Transport cont.

- The combination of GNSS positioning and cellular communications opens the way to the introduction of road tolling with minimum deployment of road-side equipment and widespread socio-economic benefits:
 - Elimination of queues at highway tolling booths,
 - Pay-per-use of the road infrastructure
 - The vehicle on-board units can be used to support safety-related applications, traffic management, ...
- ESA is exploring these aspects in support of a recently approved European Directive on Interoperability of Road Electronic Fee Collections systems across Europe.

**Needs a certified system !
Galileo is going in this direction.**

Applications Examples cont.

Aviation



- En-route guidance
- Landing and take-off
- Traffic monitoring in areas with limited radar services
- Assistance to S&R operations under bad weather conditions

- **high performance to complement ground infrastructure**
- **increased safety of navigation in all flight phases**
- **increased efficiency in flight operations management, improving exploitation of airspace**
- **safer navigation of rescue helicopters under all weather conditions**

Applications Examples cont.

Agriculture and Fisheries



- Precise chemical spraying
- Crop yield monitoring
- Navigation and monitoring of fishing vessels
- Aids to nets laying
- Improved distribution of chemicals
- Improved parcel yield from customised treatment
- More efficient property management
- Improved fishing capabilities
- Improved navigation aids for fishermen

Applications Examples cont.

Civil Engineering



- Structures monitoring
- Machinery guidance
- Road and Rail management (i.e alignment, inclination control)

- Improved logistics
- Increased safety
- Increased efficiency

Applications Examples cont.

Energy



- Network Synchronisation
 - Perturbation measurements
 - Electronic mapping of users
 - Outage management
 - Rig anchoring and marine seismic operations
-
- Improved control of energy infrastructures
 - Time synchronisation
 - Increased safety and efficiency in drilling facility

Applications Examples cont.

.....and many others.....

The World of Applications

(GJU source)

Safety of Life

- Aviation
- Rail
- Maritime
- Inland waterways
- Ambulance
- Police / Fire
- Search and Rescue
- Personal Protection
- Traffic surveillance
- Dangerous goods trans.
- ADAS

Mass Market

- Personal communication and navigation
- Cars / motorcycles
- Trucks & buses
- Light Commercial Vehicles
- Personal outdoor recreation
- Others...

Professional

- Oil and Gas
- Mining
- Timing
- Environment
- Fleet Management
- Asset Management
- Geodesy
- Meteorological forecasting
- Land Survey
- Precision survey
- Precision Agriculture
- Fisheries
- Vehicle control and robotics
- Construction / Civil Engineering
- Space

Integrity
(error-free),
Standards,
Regulation,
Continuity,
Availability,
Accuracy

Low costs,
Low power cons.,
Small size,
Friendly use,
Best perf.
accordingly

High precision,
High accuracy,
High reliability



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ESA complements the work of the EC: focus on Safety-critical GNSS applications.

Those applications require

development ↻ demonstration ↻
validation ↻ certification ↻ operation

... commercial exploitation only after
certification / validation of safety cases



ESA Experimental Applications



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Harbour Trials

- Trials carried out in the Hamburg harbour in 2002
- EGNOS proved to be a reliable service even under unfavourable conditions, compared to Radar
- Positioning, True Heading, Angular Velocity and Acceleration and radius of turn were measured
 - specific set-up (two antennas on each side of the vessel)



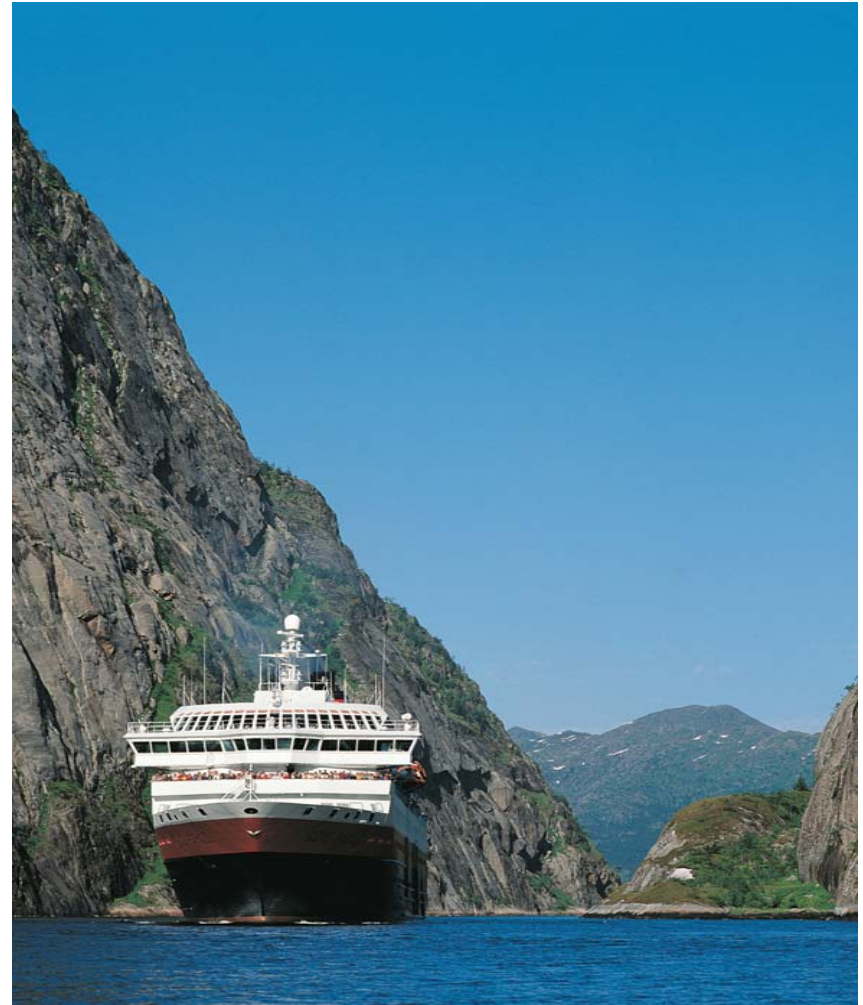
Automatic Identification System (AIS)

- AIS is a new international system used to enhance safety at sea, harbours and inland waterways.
- Main purpose:
 - Collision avoidance
 - Coastal surveillance
 - Improved efficiency
 - Search and Rescue
- Data is exchanged between vessels and ground base stations.
- A picture of the maritime traffic can be composed at the base stations
- AIS Data communication capability can be used to re-broadcast EGNOS data.



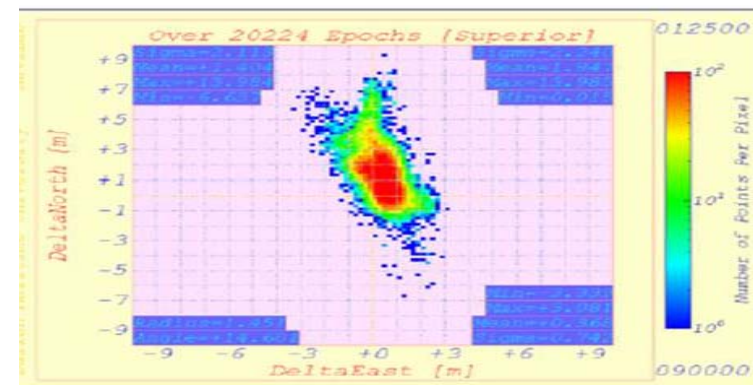
EGNOS-AIS Trials

- Tests done in Trondheim in 2003
- Accuracy of EGNOS after adaptation to AIS was comparable to IALA DGPS (1-2 m).
- EGNOS accuracy can support AIS alarming system to prevent ships collision.



Fluvial Test in China

- Demonstration done in China in 2003
- Local augmentation done with only three extra ESTB Stations
- Excellent result obtained with mean accuracy 1.8m



ECORAIL

Automatic level crossing system



- Simple fusion of EGNOS, odometer and map matching by interpolation
- Barrier activated by Radio
- Improvement road traffic control by adapting the activation of the barrier to actual speed of the train
- For use in scarcely populated areas

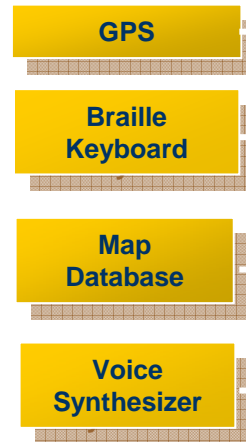
Urban Areas - SISNeT

- Dissemination of EGNOS messages via internet via **SISNeT** concept
- SISNeT makes EGNOS correction data easily available in urban environment.
- SISNET particularly well suited for Location Based Services (LBS)
- Several demonstrations done



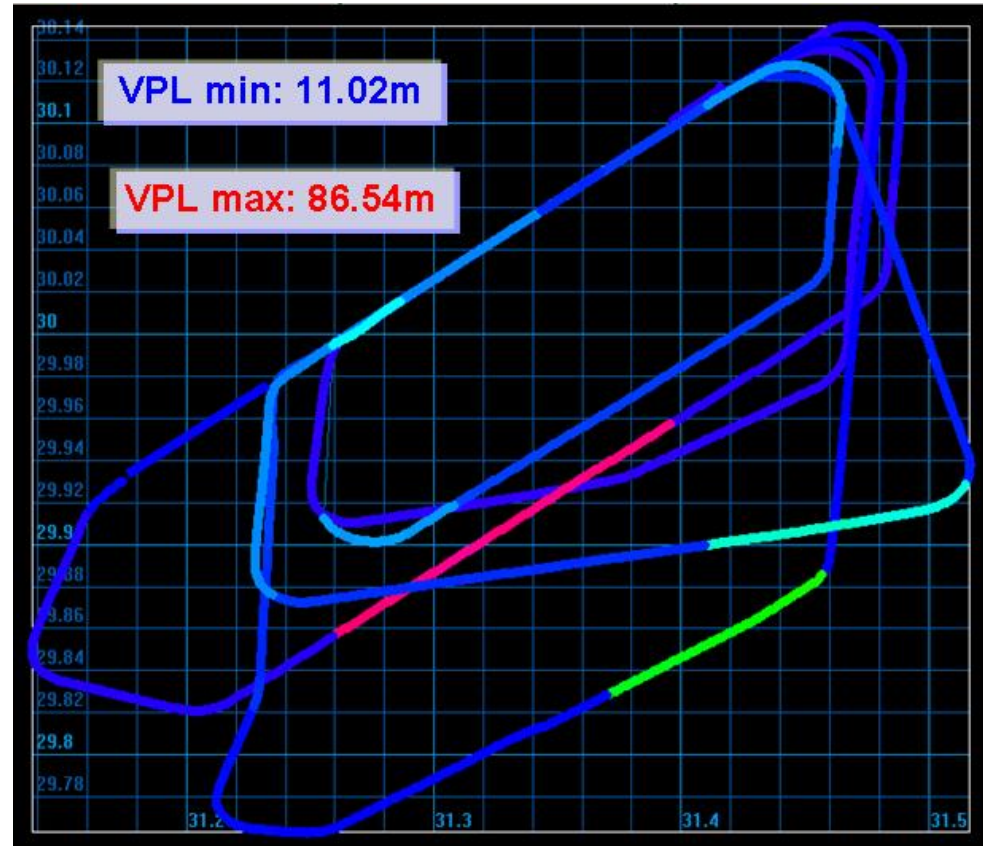
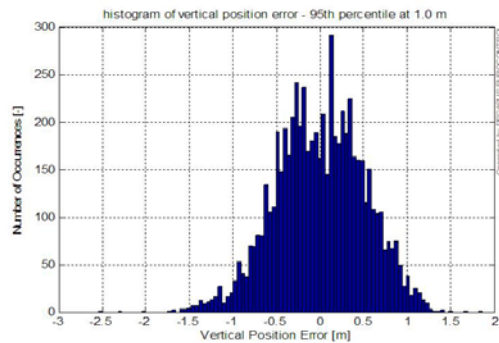
SISNeT Application

- Blind pedestrian navigation demonstration done in Spain
- EGNOS confirmed to significantly improve service wrt GPS-based existing application



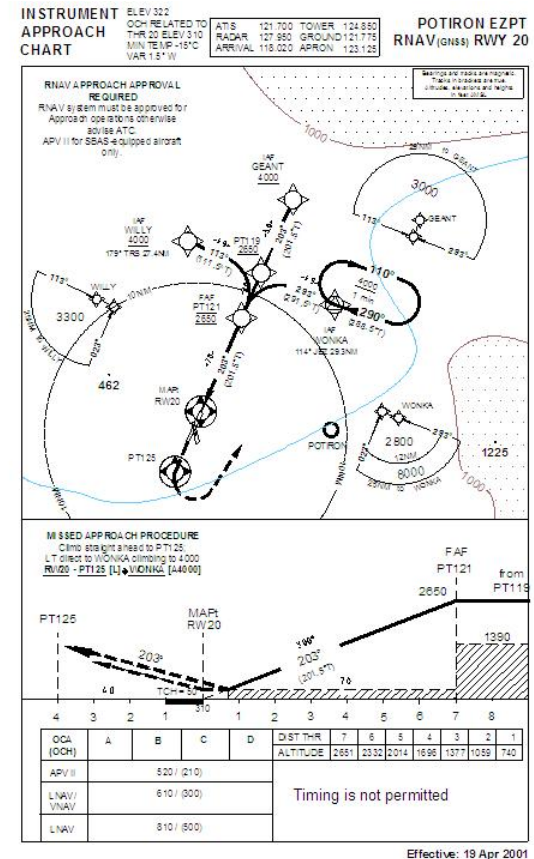
Flight Demonstrations MIDAN

- Flight Trials Performed in 2002 in Egypt
- Sequence of ILS approaches performed
- Proved APV-1 level service performance provided by EGNOS



Flight Demonstration Nice Airport

- Flight trials performed in 2002 in Nice (French Riviera)
- Proved EGNOS capability to support curved instrument guided approaches to airports



EUROCOPTER Flight Trials

- High EUROCONTROL interest in the frame of their “All-Weather Helicopter Research”
- Guidance candidates are:
 - Stand-alone GPS
 - EGNOS / SBAS
 - D-GPS / GBAS
- Flight Trials made for Medical Helicopters
 - Almost all Medical Helicopters operations are today still performed in day / night VFR,
 - even in adverse weather conditions
- EGNOS proven valid candidate for guided approaches
 - No ground installation required
 - Sufficient accuracy for most IFR helicopter operations
- Important market expected for Other critical helicopter applications (North sea Platforms, ..)



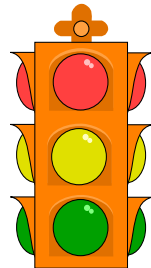
EGNOS-VDL-4 Trials

- Trials carried out at Kiruna airport in March 2003
- Dissemination of EGNOS data via standard ground-air and ground-ground VHF link (VDL-4).
- Low cost alternative to deployment of local differential stations.
- Aircraft navigation.
- Surveillance of vehicles at the airports.



GPS/EGNOS & Galileo

Enabling GNSS sole mean for Critical Applications



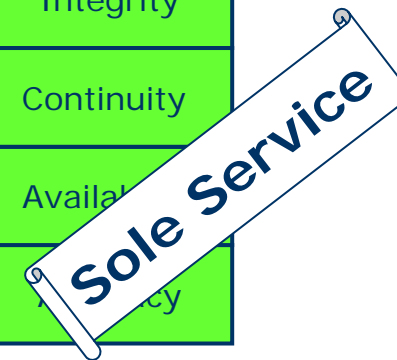
GPS



GPS+ EGNOS



GPS/EGNOS + Galileo



Conclusive remarks

- GNSS applications are:
 - An asset which may change the life of every one
 - A possibility to change working conditions in a vast range of applications
 - Galileo improved accuracy and service guarantee will expand the use of Satellite Navigation Systems beyond the current set of applications
- EU and ESA are promoting to dedicated projects the increase of awareness on the strategic importance of Navigation Satellite System Applications