Gap analysis related to GNSS-based positioning in ITS standards and regulations

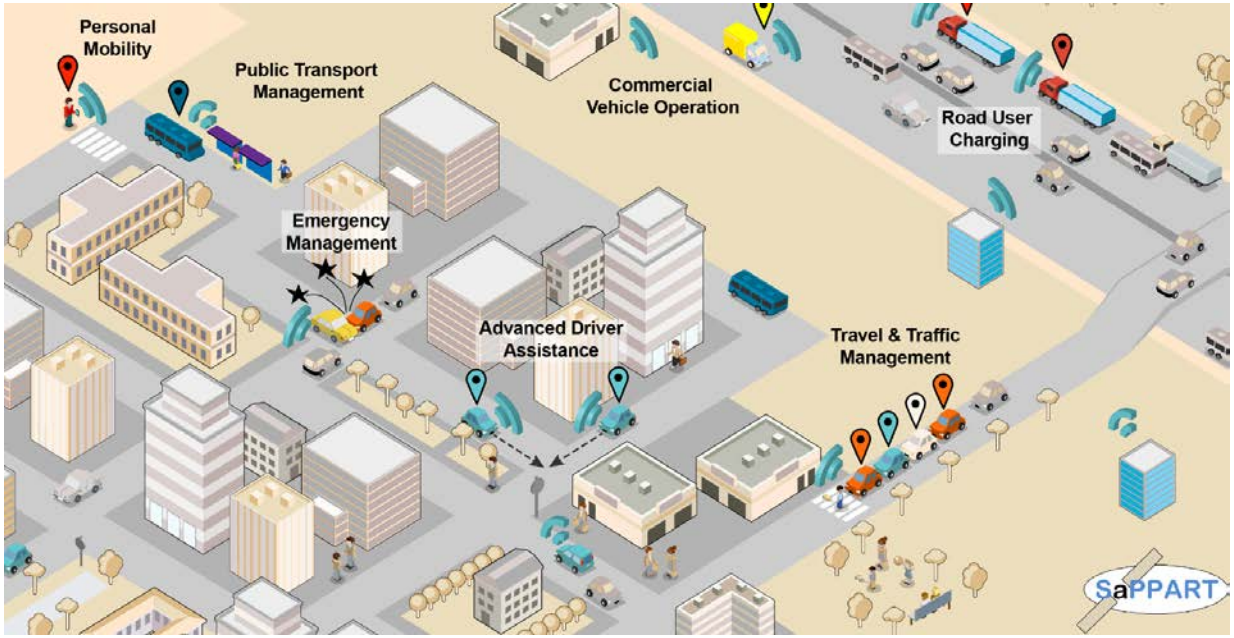
May 2016

Outline

- Context
- SaPPART's role
- Gap analysis
  - Approach and current focus
  - Provisional findings
- Summary

Context

GNSS have a bright future in ITS



- increasing capacity, improving safety, reducing congestion and emissions
- forecast to represent more than 50% of the GNSS market, estimated 236 b€/y by 2025 (GSA market survey, 2010)

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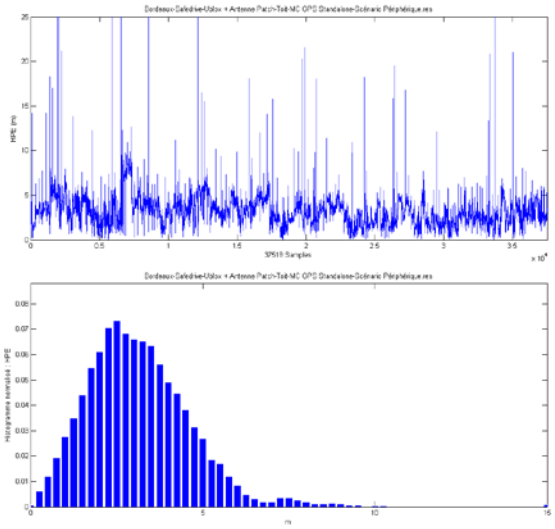
Context

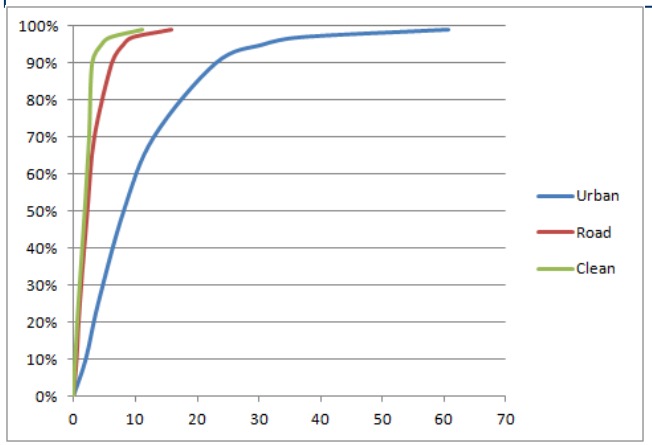
Positioning errors depend a lot on the environment

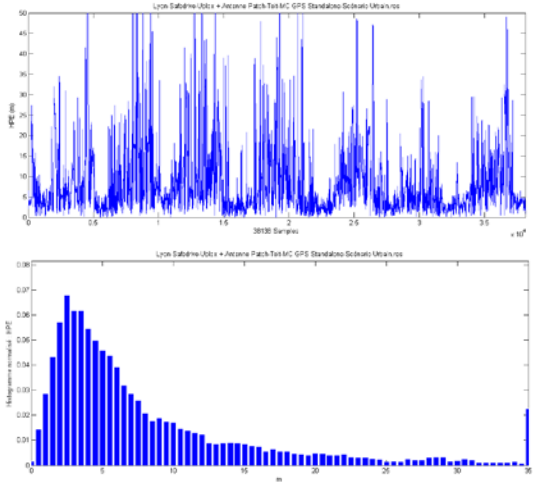


Clear environment
(Bordeaux ring-road)

uBlox receiver + patch antenna

HPE (m)		
moy	50%	95%
3.15	2.98	**5.65**





Constrained environment
(Lyon downtown)

uBlox receiver + patch antenna

HPE (m)		
moy	50%	95%
8.51	5.40	**27.23**

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Context

GNSS users and integrators face 2 major challenges:

- estimate the expected performance of the service
- lack of common framework for defining and assessing GNSS-positioning performances

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Current state of knowledge

R&D projects

RCI
GSC
EOTR
GIROADS
GINA
SIGNATURE
TACOT
GNSSmeter
European GNSS Agency

Fragmented knowledge and partial results

Standardization groups

ETSI 2013 Celebrating 25 years
TC SES/SCN
TC5/WG1
CEN CENELEC

First propositions but missing scientific support

Support limited in terms of time and resources

SEVENTH FRAMEWORK PROGRAMME
SUGAST
SAGITER
QualiSaR
European GNSS Agency

Standardization support projects

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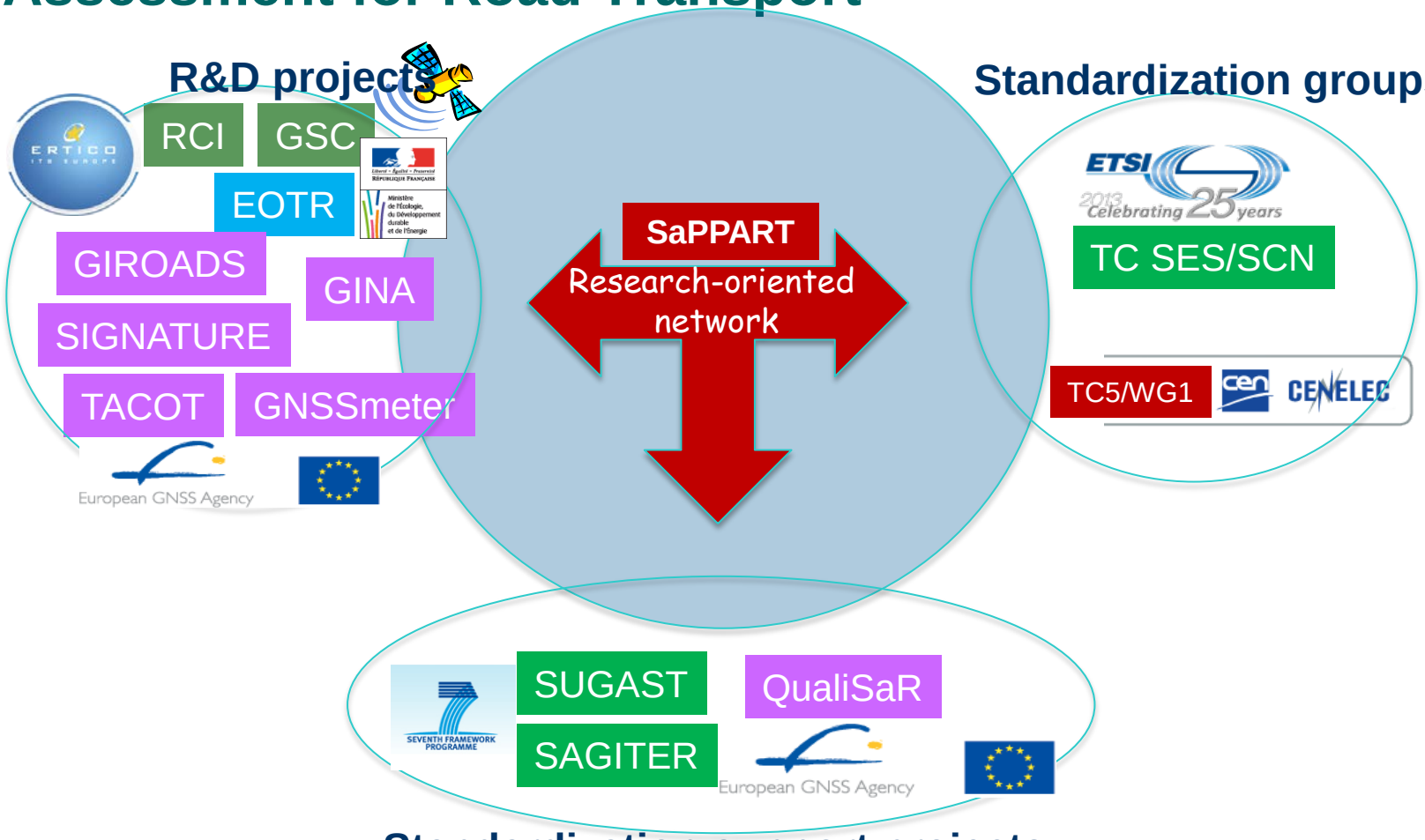
Reason for Satellite Positioning Performance Assessment for Road Transport



SaPPART's objectives

- Common framework for definition and examination of GNSS-positioning performances in ITS
- Highlight and address open issues and weaknesses of GNSS solutions envisaged in different ITS applications
- Promote high-level educational and training programs
- Share knowledge and best practice related to GNSS-based positioning in ITS standards and regulations

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ITS standards and regulations – gap analysis

Approach

- Inventory of relevant documents
- Gap analysis of the positioning aspects
- Synthesis and actions

Status

- Inventory of relevant standards (eCall, ADAS, C-ITS, EFC, DGT, taximeters; 50+) and regulations (20+)
- Initial analysis and provisional findings
- Target: finalize the analysis by 2016-06

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Provisional findings related to eCall

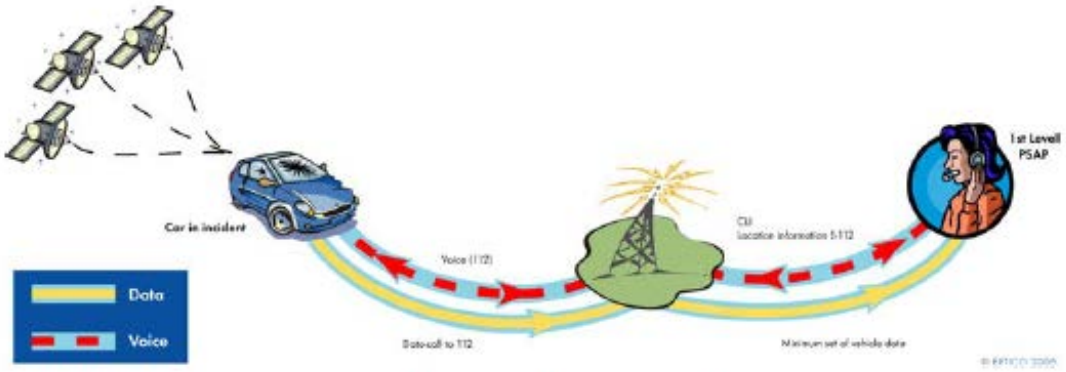


Figure 1: eCall System Overview

Positioning aspects in the eCall legislation

- The eCall system shall allowing the “PSAP operator to identify the **position and heading of the vehicle to a minimum degree of accuracy as defined in EN 15722 for the Minimum Set of Data (MSD) coordinates**”
- “the receivers shall be **compatible with the positioning services** provided by satellite navigation systems including the **Galileo** and the **EGNOS** systems”

Provisional findings related to eCall

- 5 main eCall standards
- Only EN 15722 on eCall minimum set of data deals with positioning performance: **a flag in the MSD should be set to 'no confidence' when "there is less than 95% confidence that exact position is within a radius of ± 150 m of reported position**"

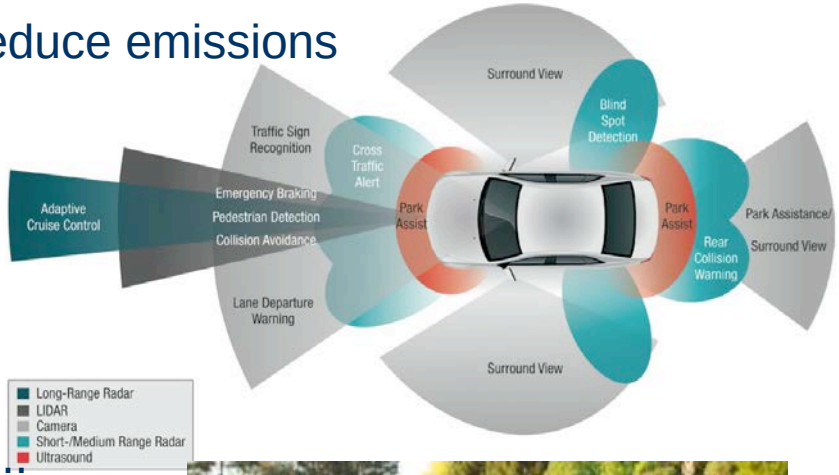
Gaps

- EN 15722:
  - The meaning is not clear: the 95th percentile of the error distribution < 150 m?
  - No conformity assessment test case
- Regulation only refers to EN 15722

Provisional findings related to ADAS

Advanced Driver Assistance Systems (ADAS)

- Increase safety and driving comfort, reduce emissions
- New services
  - Adaptive cruise control
  - Curve speeds assistance
  - Lane change assistance
  - Vision enhancements
  - Intersection collision avoidance ….
- New technologies – competing concepts
- Legislation and liability difficult issues



Provisional findings related to ADAS

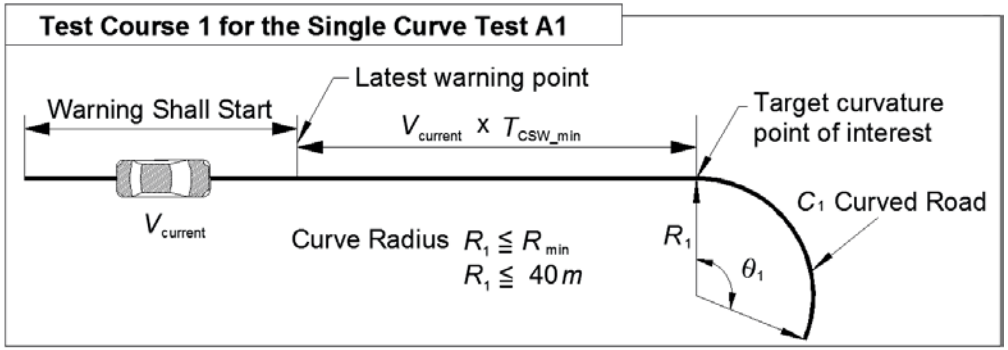
What about vehicle positioning?

- **vehicle positioning is not necessary for every service**
  - ABS, automatic lighting, rear view assistance…
  - depends on the vehicle design (e.g. collision avoidance based on radar measuring the distance between the vehicles)

- **but is part of the vehicle's system**
- navigation based only on relative information is not sufficient to cover all the cases
- **necessity to have an absolute position**
  - calibration of sensors: odometer, accelerometer, gyros
  - map matching or image correlation (optical, lidar)

Provisional findings related to ADAS

- **Example: Curve speed warning systems**
- Performance requirements and test procedures (ISO 11067)
- Test system installation and configuration: **The test course shall be located in an open place so that the GNSS receiver of CSWS functions properly**



Gaps

- Positioning performance indicators are generally neglected or not verifiable
- Test procedures do not reflect the real operational environment

Provisional findings related to Autonomous Driving

- From level 0 (no automation) to level 4 (fully autonomous)
- Levels 0, 1, and 2 corresponds to ADAS
- Levels 3 and 4 are what most people recognize as autonomous driving

- NHTSA does currently not recommend to establish safety standards for self-driving vehicle technologies.

Gaps

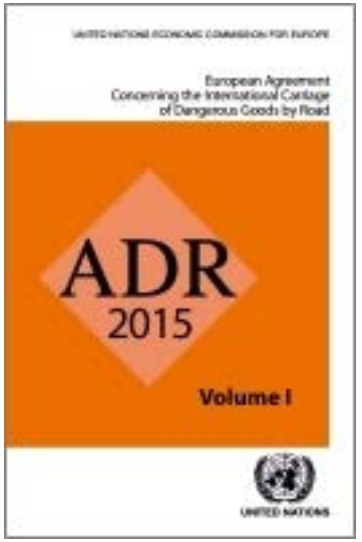
- Technological as well as human performance issues must be addressed in more depth before standardization is started.

Provisional findings related to dangerous goods transport (DGT) by roads

- EU DGT regulations barely address positioning aspects
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2015)

Devices, equipment or arrangements to prevent the theft of the vehicle carrying high consequence dangerous goods (see Table 1.10.3.1.2) or high consequence radioactive material (see 1.10.3.1.3) and its cargo shall be applied and measures taken to ensure that these are operational and effective at all times. The application of these protective measures shall not jeopardize emergency response.

NOTE: *When appropriate and already fitted, the use of transport telemetry or other tracking methods or devices should be used to monitor the movement of high consequence dangerous goods (see Table 1.10.3.1.2) or high consequence radioactive material (see 1.10.3.1.3).*



- What about positioning aspects of non-“high consequence dangerous goods”?
- Geofencing (e.g for tunnel safety or in urban areas)?

Provisional findings related to dangerous goods transport (DGT) by roads

- **Directive** 2008/68/EC on **inland transport of dangerous goods**
  - References the “provisions” in ADR concerning “tracking and tracing aspects”

Gaps

- Tracking and tracing of non-high consequence dangerous goods
- Geofencing of DGT on certain roads or areas
- Cross-border monitoring of DGT

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Summary

- GNSS-based positioning performances in ITS depend on the environment and are often overestimated
- Critical ITS applications require positioning performance indicators (accuracy, protection level and availability) and examination framework
- Positioning QoS requirements are often neglected or not verifiable in current ITS regulations and standards
- Privacy protection considerations in current European regulations limit the use and societal benefits of positioning services
- Linking of GNSS-positioning and ITS experts starts to bear fruits. Room for strengthening the exchanges with the automotive industry and ITS legislators
- Standards are under development that can be used to underpin agreements between ITS stakeholders and to support ITS legislations

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THANK YOU FOR YOUR ATTENTION !

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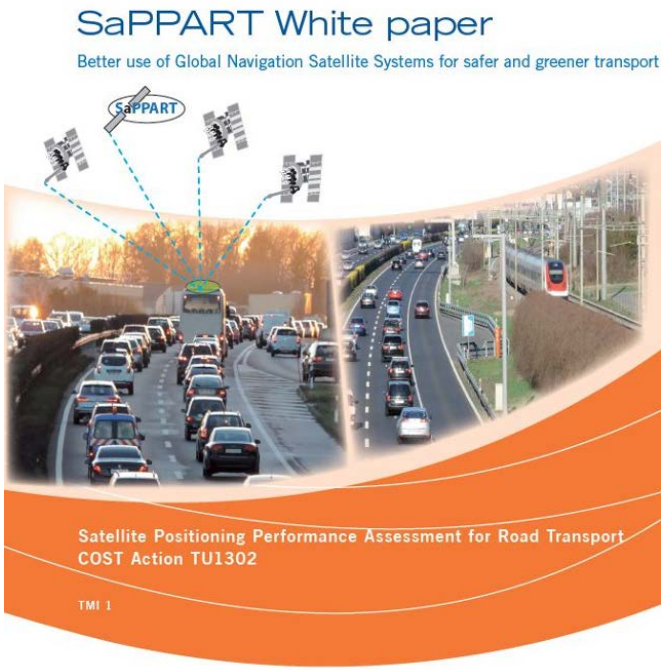

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