European
Global Navigation
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Agency

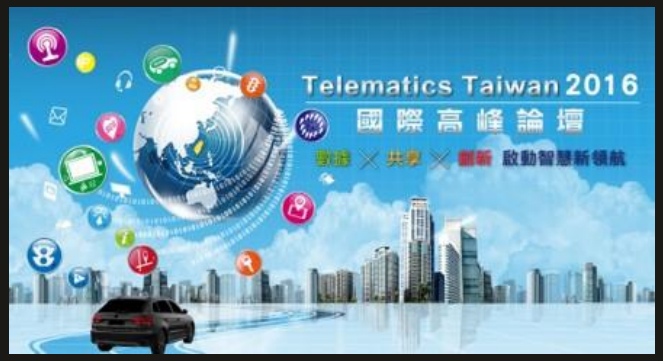
GNSS.asia

# EUROPEAN GNSS AND NEW TRENDS IN NAVIGATION (SMART MOBILITY)

Pascal Viaud

GNSS.asia Programme Expert

5 October 2016




HORIZON 2020

EUROPEAN CHAMBER OF COMMERCE TAIWAN

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# KOUROU - MAY 24TH, 2016

Galileo.mp4

Credit: ESA/CNES/ARIANESPACE

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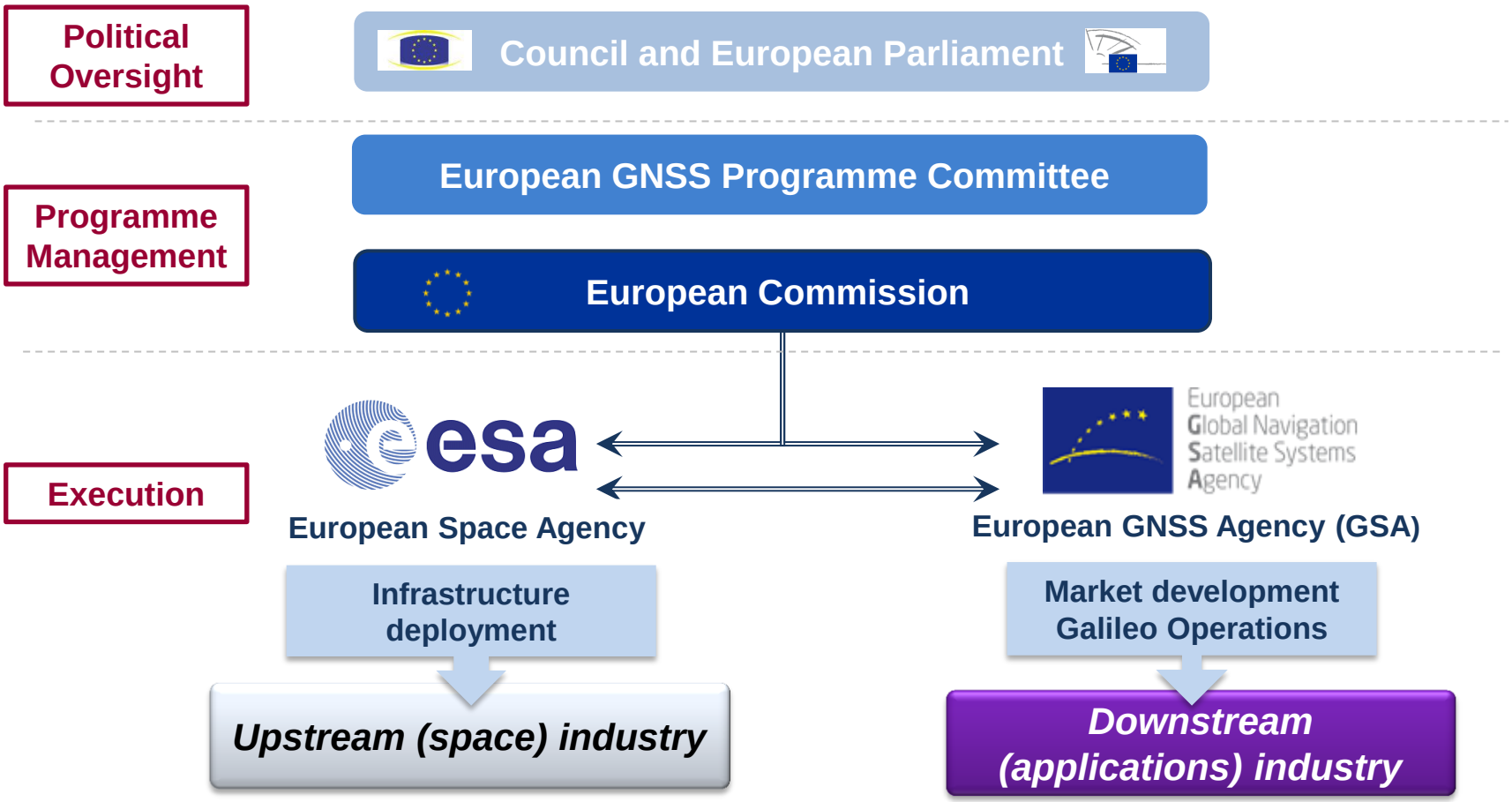
# GSA AND STATUS OF GALILEO / EGNOS

# European GNSS Agency (GSA) is responsible for Galileo market adoption and operations

*The GSA's mission is to support European Union objectives and achieve the highest return on European GNSS investment, in terms of benefits to users and economic growth and competitiveness*

- Staff: c.a. **135**
- Nationalities: **21**
- Headquarters: **Prague**
- Other Locations:
  - St Germain en Laye
  - Swanwick
  - Torrejon

# How GSA fits in the EU structure




**GSA is responsible for Galileo market adoption and operations**

# Galileo is the European GNSS…

- Worldwide navigation system **"made in EU"**
- Fully interoperable with GPS
- Open service **free of charge**, delivering dual frequencies
- Signal authentication


## Galileo is implemented in a step-wise approach

**2016** **Initial Operational Capability**
Galileo services available to users with limited coverage

- Users benefit from **Galileo in combination with other GNSS**
- **14** satellites already launched
- **4** satellites to **be launched in 2016**

**2020** **Full Operational Capability**
Full services, 30 satellites
An independent civilian infrastructure

- Galileo **fully operational**
- **12** further satellites **to be launched in 2017-2020**

# Galileo is the European GNSS…

- New modified Ariane 5 launcher ready for Galileo (4x Satellites)
- August 2016: Ariane 5 arrived in Kourou
- September 2016: 4 Gallileo (15, 16, 17, 18) arrived in Kourou
- November 2016: Launch from Kourou Spaceport

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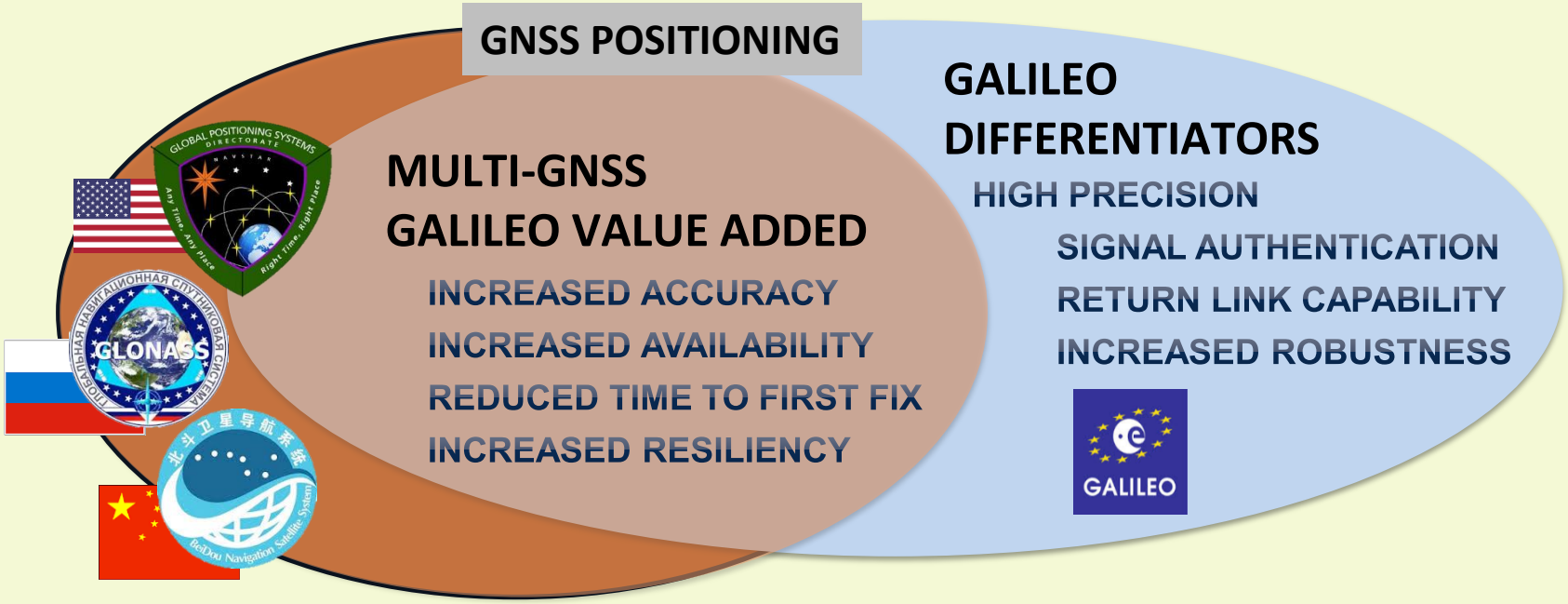
Credit: ESA

# …that will deliver services in a competitive technological scenario

**OTHER POSITIONING TECHNOLOGIES:**

- WI-FI
- Inertial sensors
- Mobile network positioning

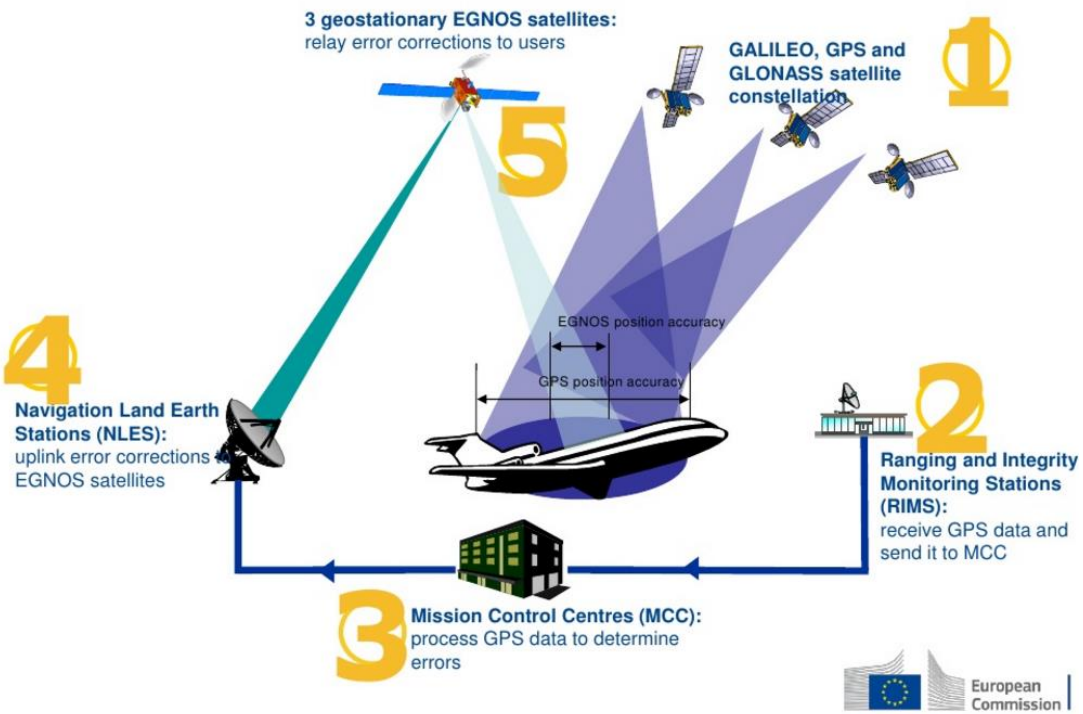



= OTHER GNSS = GALILEO

# …while EGNOS already provides value to European citizens

EGNOS
'It's there, use it'

- Satellite Based Augmentation System (SBAS)
- Measures and improved GPS performance
- Sends corrections to users via satellite or terrestrial links (EDAS)
- European coverage (but under extension in other regions, e.g. North Africa)

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APV: Approach with Vertical Guidance

RIMS: Ranging and Integrity Monitoring Station

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# SMART MOBILITY

# GNSS is an enabler of several applications in Smart Mobility

## Market driven applications

*Introduced by market players due to the added value they provide to clients and end users:*

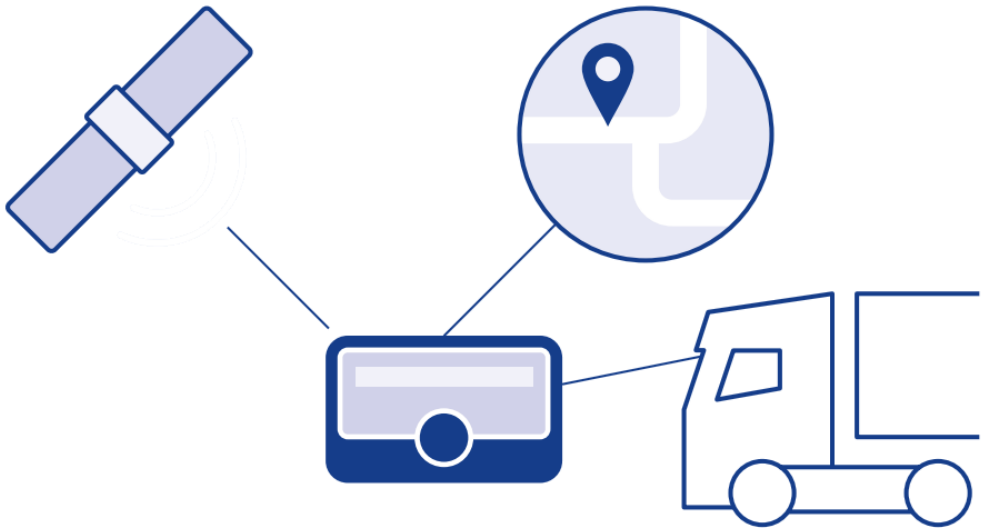
- **Navigation,** the most widespread application of Satellite Navigation
- **Satellite road traffic monitoring,** to collect floating car location data from vehicles and process traffic information
- **Insurance telematics services,** relying on GNSS to increase the transparency for insurers and subscribers
- **Fleet management solutions,** to enable transport operators to monitor the logistics activities' performance
- **Connected, Automated, Autonomous Driving,** integrating GNSS, other sensors and communications systems to enhance road safety and comfort for the driver, by enabling V2V communication

## Regulated applications

*Introduced by the EU due to the benefits on safety and transport network operations:*

- **eCall** system will send an emergency call to 112 in case of accident, including precise location, accelerating assistance to drivers
- **Digital tachographs** will facilitate registration of starting-ending time of the journey
- **Dangerous goods tracking:** robust positioning requirements uptake in EU Member States
- **Road User Charging GNSS,** supporting toll operators in charging levies in compliance with the EETS Directive

# Why GNSS for Road User Charging?



## FLEXIBILITY

Rapid changes can be implemented

## EXTENSIBILITY

Example of a network extension in 3 months

## REVENUE POTENTIAL

SP can include several VAS to their offer

## ENVIRONMENT (AND COST)

Around 80% less roadside infrastructure

## TRAFFIC MANAGEMENT

Dynamically influence traffic behavior

## LOW TRANSACTION COSTS

Data traffic costs already @ approx. 2€/month

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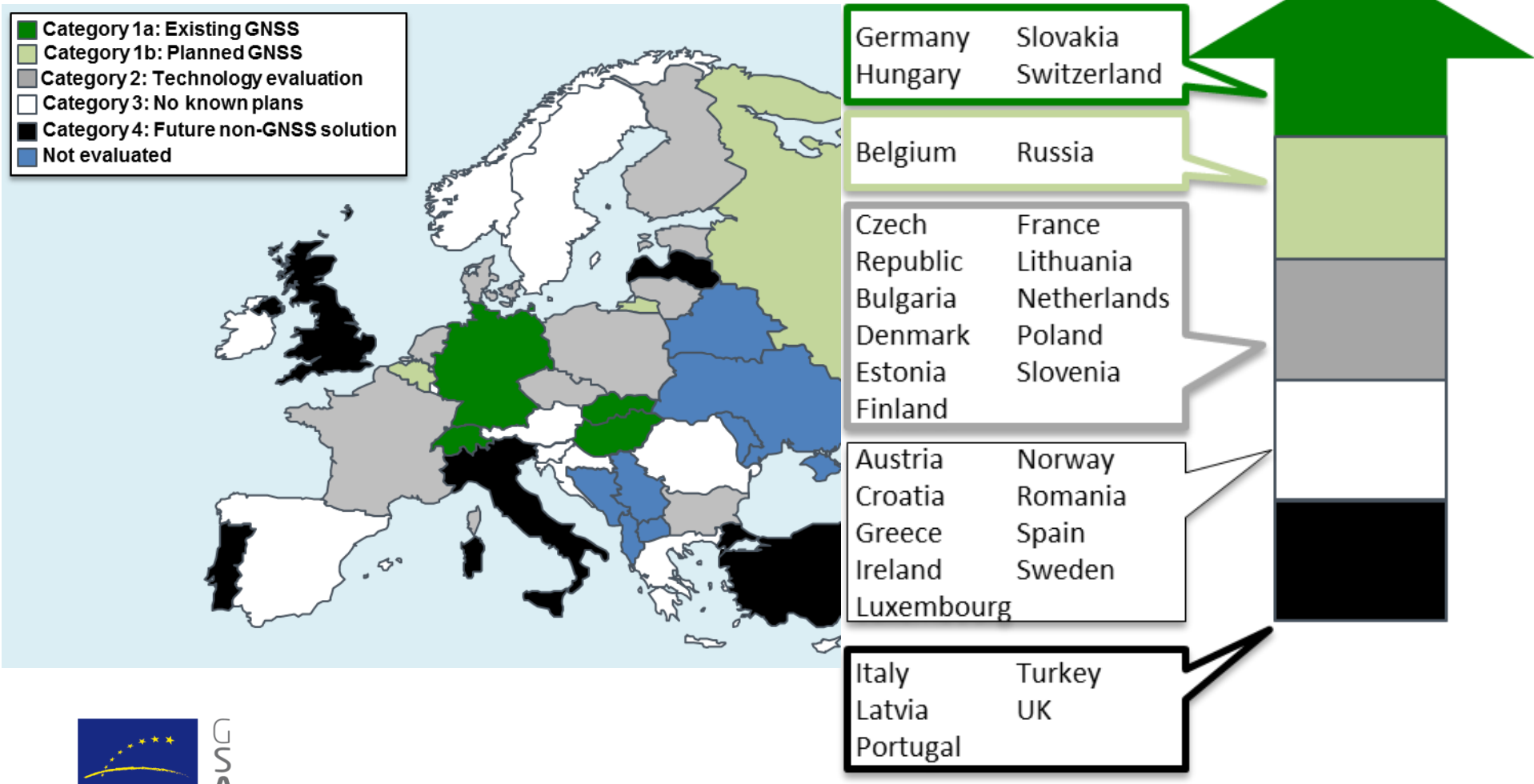
# Europe understands the benefits of GNSS for tolling

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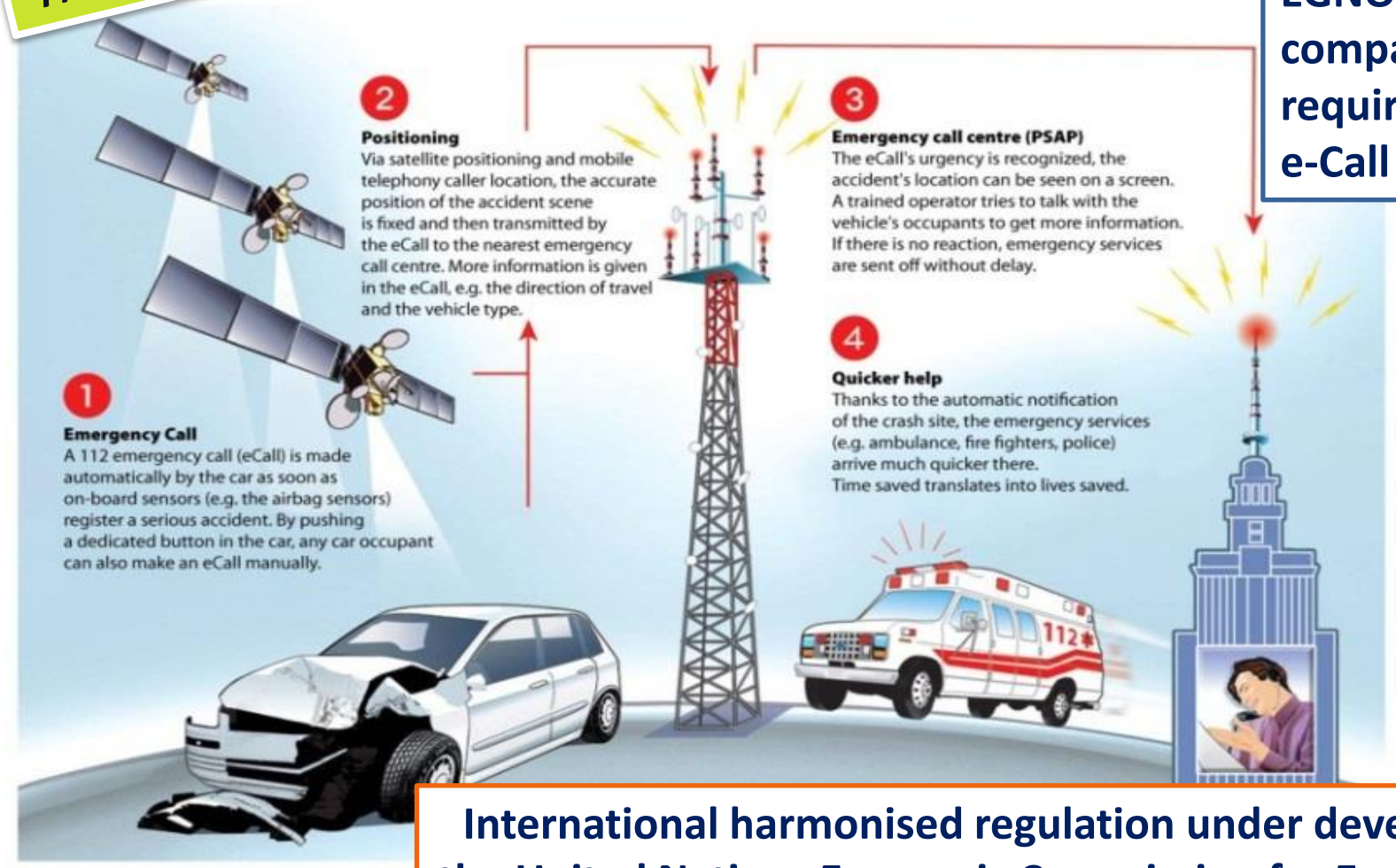
# The eCall case: Automatic Emergency Call Systems

**From April 2018**




**EGNOS and Galileo compatibility required in every e-Call device**

**International harmonised regulation under development in the United Nations Economic Commission for Europe (UNECE)**

# Digital Tachograph (DT) is the early driver of the next Galileo Authentication

**From March 2019**

- **Digital Tachograph** (DT) is used to enforce the respect of drive timing, in accordance with European regulation
- The new amended **EU legislation** is proposing a new generation of DT with GNSS:
  - ✓ GNSS is proposed to register at least starting-ending time/location of the journey for enhanced regulation
  - ✓ Robustness and trustability required!

**Galileo compatibility will be recommended in the proposed Technical Annex** of the amended regulation, taking advantage of the GNSS signal authentication

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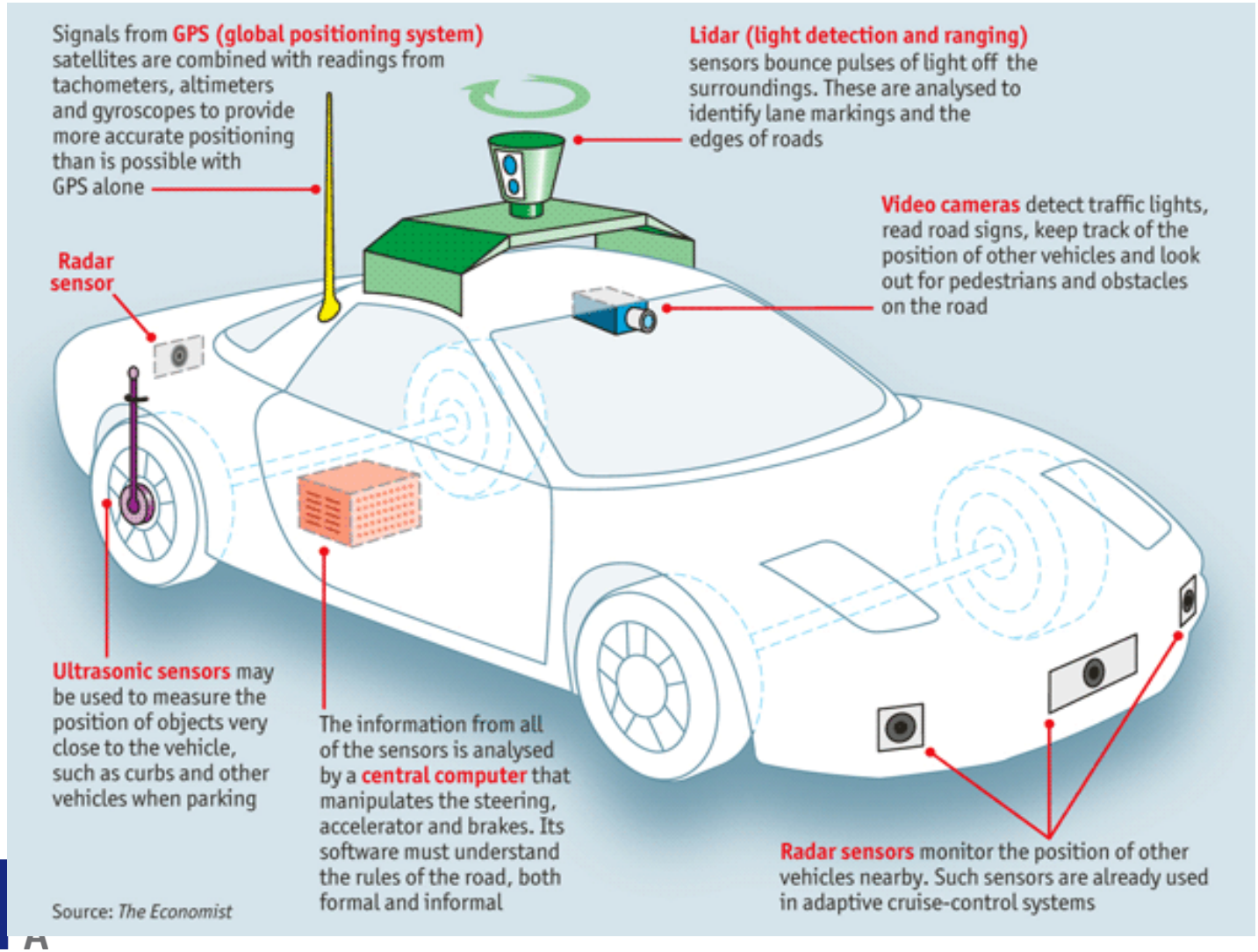
# In the automotive market, robust GNSS is a complement to Connected Cars functions…

**Connected cars are likely to include the following capabilities:**

- ✓ Integration with home networks*
- ✓ Data exchange with insurers, manufacturers and third parties*
- ✓ Diagnostics and vehicle health reports
- ✓ Improved navigation and positioning*
- ✓ In-vehicle WiFi hotspot
- ✓ Payment integration*
- ✓ Streaming of music and Video on Demand
- ✓ Localised information and advertising*
- ✓ Police warnings and location*
- ✓ Car-to-car gaming
- ✓ Real time traffic and incident alerts*
- ✓ Assisted and automated driving*


** GNSS supported*

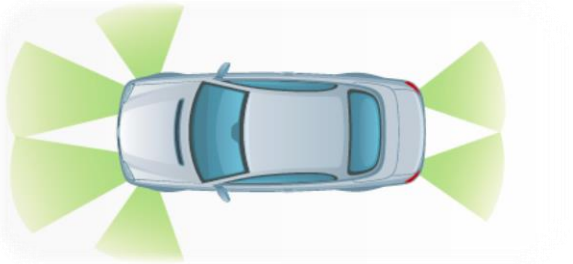
# … and it is paving the way for autonomous driving



# GNSS shares the complementarity and interoperability with automotive technologies

## SENSOR BASED VS. CONNECTION BASED VS. CONVERGED SOLUTION

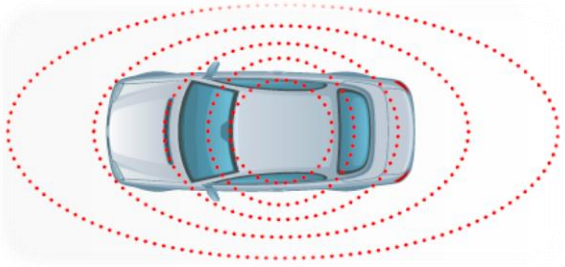
### Sensor-Based Solution Only



- **Cannot sufficiently mimic human senses**
- **Not cost-effective** for mass market adoption
- **Lack of adequate 360º mapping** of environment in urban grids

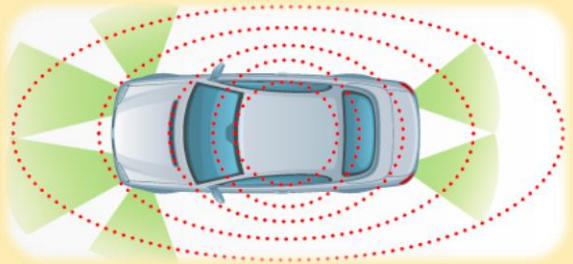
*Source: KPMG Self-driving cars: The next revolution*

### Connected Vehicle Solution Only



- **DSRC does not currently work with pedestrians, bicyclists, etc.**
- DSRC-based V2I (Vehicle-to-Infrastructure communication) might **require significant infrastructure investment**
- V2V (Vehicle-to-Vehicle communication) **requires high market penetration** to deliver value reliably

### Converged Solution



- **Facilitate adequate mimic of human senses**
- Convergence will **provide the necessary level of functional redundancy**

**Converged solution reduces need for both expensive mix of sensors and infrastructure investments. Accurate and reliable GNSS will contribute to drastically reduce the cost!**

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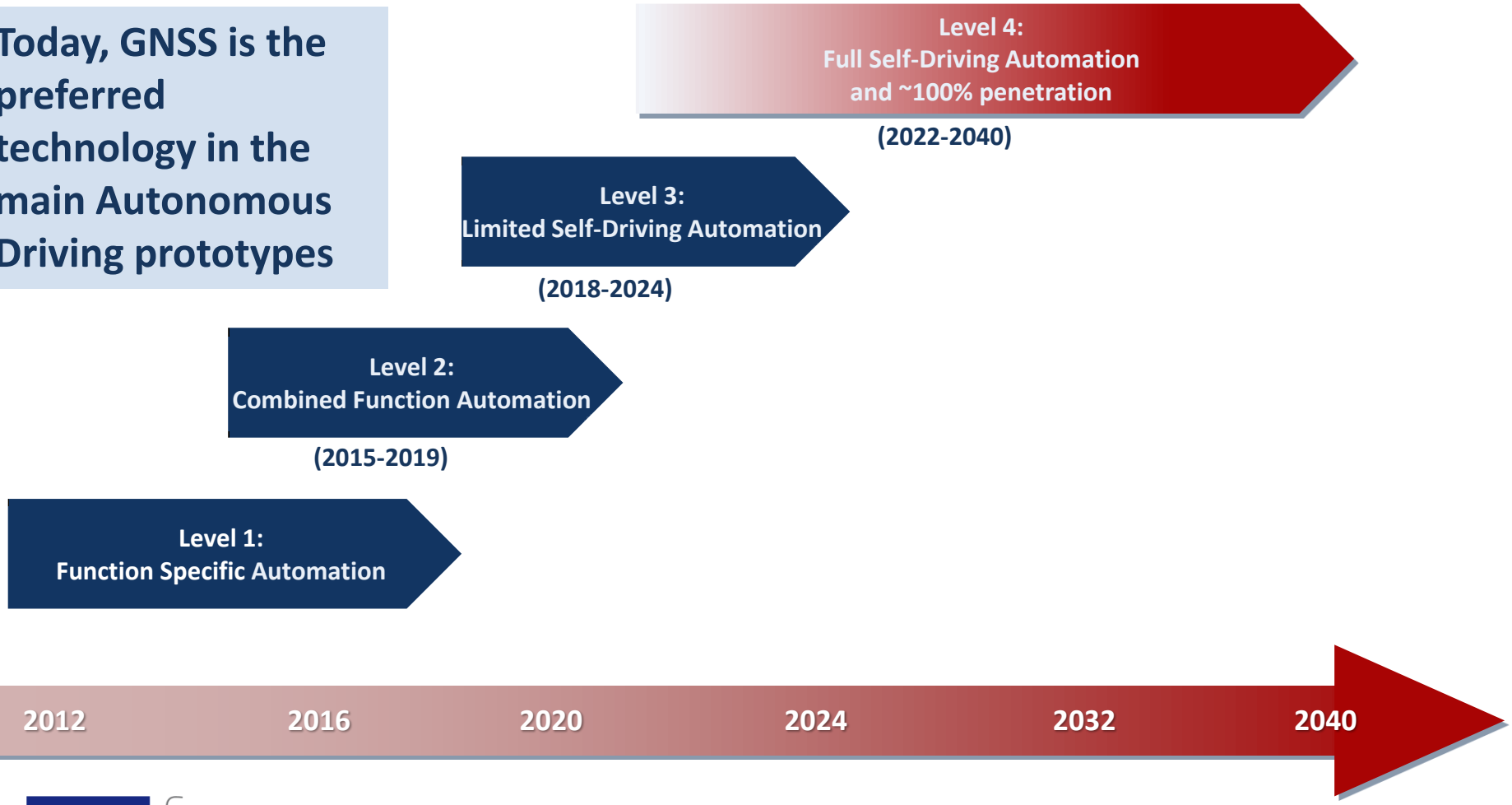
# While automation is already a reality today, full self driving automation will come after 2020

**Today, GNSS is the preferred technology in the main Autonomous Driving prototypes**




*Source: Autonomous vehicle adoption path by NHTSA; Autonomous Vehicle Implementation Predictions – Implications for Transport Planning Todd Alexander Litman © 2013-15; Self-Driving the New Industry Paradigm – Morgan Stanley*

# Personal Rapid Transit or “Podcar” was the first attempt to change mobility habits

| | |
|---|---|
| **Infrastructure** | Do not need infrastructure to operate (e.g. pavement streets in segregated areas) |
| **Circulation** | Like a bus, they follow a route, which can be dynamically modified to account for higher demand in specific spots |
| **Capacity** | Up to 15 passengers per vehicle[2] |

## European examples *(*)*

- **AKKA:** Enhanced vehicle-location capability with simultaneous localisation and mapping and robust GNSS systems
- **EASY MILE:** Hybrid sensing approach combining localisation through vision, laser and differential GNSS.



*(*) Navigation solutions developed in TAXISAT project, funded by the GSA under the FP7 programme*

# Today, GNSS is the preferred technology in the main Autonomous Driving prototypes

| Car Brand | Commercial Name |
|---|---|
| Audi | Piloted Driving |
| BMW | Active Assist |
| Chevrolet | --- |
| Chrysler (*) | (With Google) |
| Citroen and Peugeot | Highway Chauffer |
| Fiat | --- |
| Ford | --- |
| Honda | Automated Drive |
| Hyundai | --- |
| Jaguar Land Rover | --- |
| Kia | Drive Wise |
| Mercedez Benz | --- |
| Nissan | Intelligent Driving |
| Renault | Next Two |
| Tesla (**) | Autopilot |
| Toyota and Lexus | --- |
| Volkswagen | --- |
| Volvo (***) | Drive Me/Intellisafe Autopilot |

*Source: Renault´s Next Two*

(*) Recent partnership between Google and FCA (Chrysler)
(**) Commercially available: Model S latest software upgrade includes autonomous driving functions
(***) Tests with volunteer customers starting in 2017 in Sweden and UK

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# THANK YOU
# 謝謝

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