

# LISBOA 2010 16th World Meeting

MAY 25/28



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# GINA Project

GNSS for INnovative road Applications  
EGNOS/Galileo for Road User Charging and  
Value Added Services

25-28/05/2010

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# INTRODUCTION

- Big challenges in the road sector: safety / infrastructure financing / congestion & pollution
- Still obstacles for large scale take off of GNSS-based services
  - technical and economical feasibility
  - GPS performances

**Electronic Fee Collection systems** (urban and highways): a reality. GNSS presents advantages wrt DSRC for wide networks

GINA will address the adoption of EGNOS/GALILEO in the road sector considering the technical feasibility of the concept on a large scale, its economic viability and positive impacts on congestion and pollution

# THE GINA PROJECT

- **CONTEXT**: Challenges in road sector. GINA proposes a step beyond in the adoption of EGNOS/GALILEO for RUC&VAS
- GINA: project co-funded by GSA/EC, FP7 GALILEO Call 1, coordinated by GMV. Topic GALILEO-2007-1.1-01 Innovative GNSS-based Road Applications
- Not another proof of concept: large scale demonstrator of a GNSS-based RUC & VAS scheme using the Dutch ABvM system and requirements defined by real end users as a reference
- GINA main **OBJECTIVES**:
  - ✓ Analysis of context of a nation-wide GNSS-based RUC (and VAS) with especial emphasis on market and business potential
  - ✓ Trials: Dutch ABvM as a reference
  - ✓ A solid dissemination strategy



# THE USE OF GNSS FOR ROAD USER CHARGING

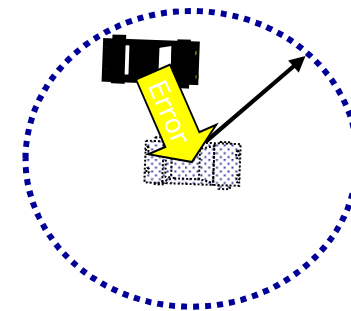
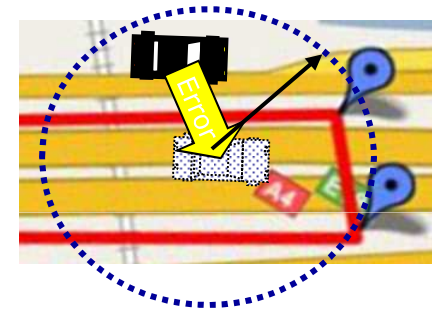
–GINA capitalizes on the use of **POSITION INTEGRITY** as a mechanism to compensate for large position errors and reduce incidence of overcharging

–Basic **use of GNSS** to **identify** whether (and when) the **vehicle is within the geo-object**. Potential use to measure travelled distance

✓Distance measurement error < threshold

✓False identification of geo-objects

–Vehicle is charged only when inside the geo-object: 1 or more PLs totally inside the geo-object=> **geo-fencing based on PLs** (not on calculated position)



# THE TRIALS (I)

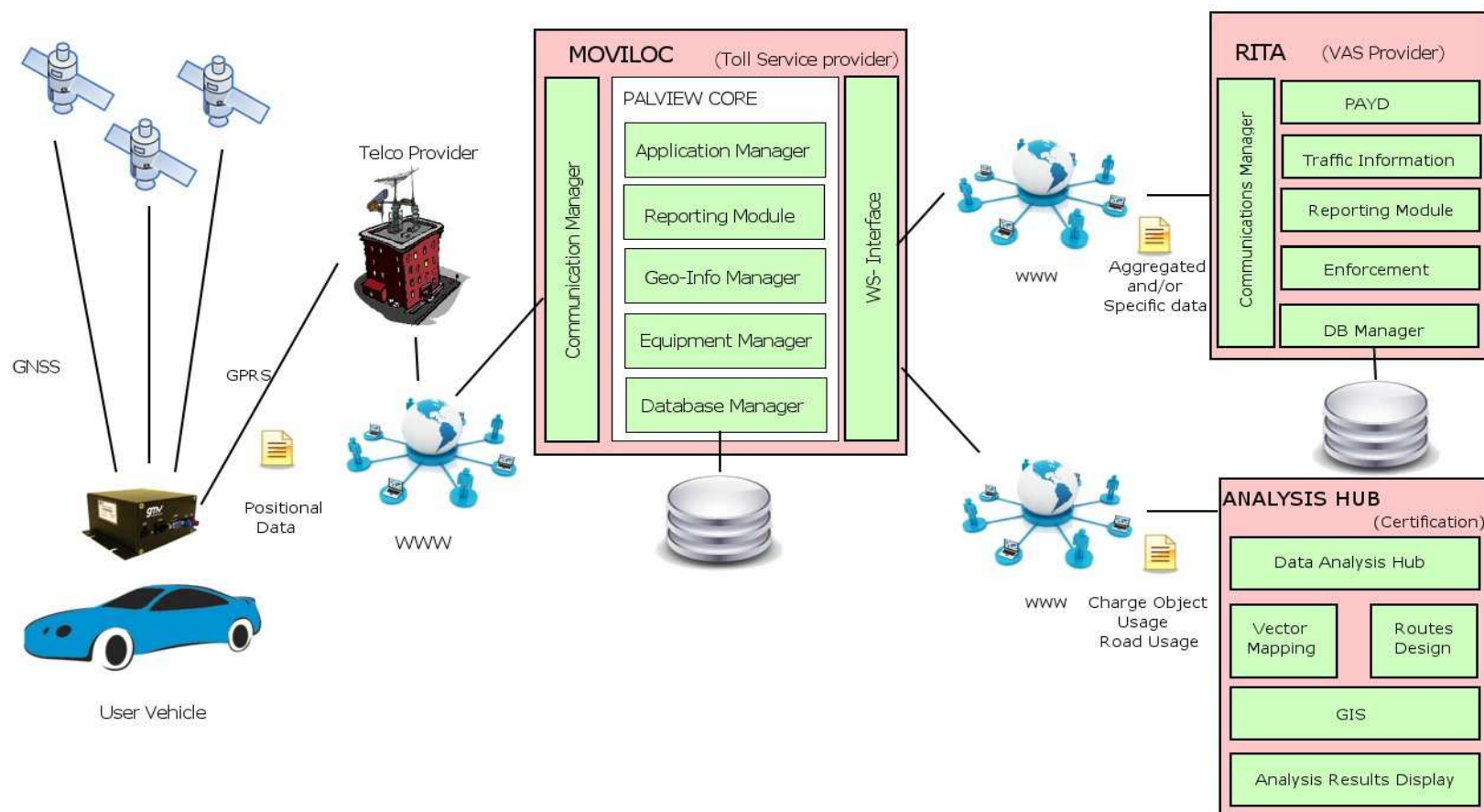
- Large scale demonstrator at national scale (in Netherlands) for RUC and VAS.
- **OBJECTIVE**: Demonstrate how and with what performance GNSS technology based on European GNSS infrastructure can support the implementation of a RUC scheme and justify its added value as compared with GPS-only (performance and cost improvement)
- 2 trials levels:

Type of trials	Number of vehicles	Duration	Vehicle & Drivers	VAS	Reference System needed	CAN BUS connection	Evaluation	Scenarios
End to end	100	6 months	Volunteers (ARVAL customers)	Yes	No	No	Application level	Uncontrolled, not fixed
Exhaustive performance	2-3	4 weeks	Controlled by project	No	Yes	Yes	GNSS performance	Defined by the project



# THE TRIALS (II)

## Demonstrator architecture





# THE EXHAUSTIVE TRIALS (I)

No. Vehicles	Period	Vehicles& drivers	VAS	Reference Systems	CANBUS	Evaluation	Scenarios
2	4 weeks	Controlled by project	NO	YES	YES	GNSS performance	Routes defined by project

## Objectives:

1. **GNSS performance** evaluation: GNSS accuracy performance, GNSS integrity performance in terms of integrity risk, GNSS integrity performance in terms of size and availability of PLs
2. **Distance measurement performance:** accuracy of distance measurements
3. **Geo-objects identification performance:** distance measurement once geo-object identified, wrong identification / misidentification of geo-objects
4. **Charging performance:** overall distance measurement accuracy, overall charging measurement accuracy, overcharging performance

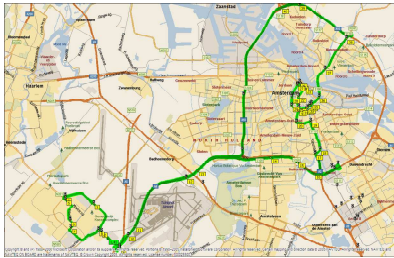
4 configurations GPS/ EGNOS, CANBUS (yes / no)

**2 vehicles** (Navteq, GMV) equipped with I-20 OBUs + high performance reference equipment

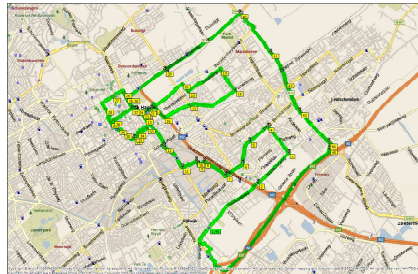


# THE EXHAUSTIVE TRIALS (II)

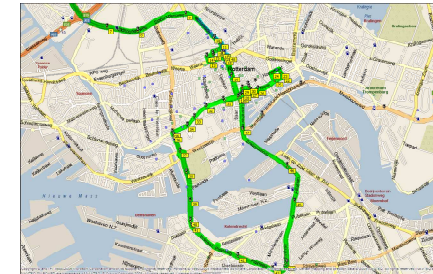
- **3 test routes** defined to challenge GNSS accuracy and/or availability and representative of conditions likely to be faced by drivers in NL



Route 1 – Motorway, urban  
Amsterdam



Route 2 – Urban  
The Hague



Route 3 – Urban, motorway  
Rotterdam

- Each route repeated >20 times => gathering sufficient data for statistically significant results
- **Geo-objects** defined for each route with challenging environments for GNSS
- **Post-processing** of data => increased flexibility in the analysis
- Vehicles I and II already equipped and performing calibration pre-trials in Netherlands. **Exhaustive trials campaign (March 2010)**. Currently, analysis of data.

# THE END2END TRIALS (I)

No. Vehicles	Period	Vehicles& drivers	VAS	Reference Systems	CANBUS	Evaluation	Scenarios
100	6 months	Volunteers (ARVAL customers)	YES	NO	NO	Application level	Uncontrolled, not fixed

## •Objectives

1. **"Soft" analysis:** Overall assessment of capabilities of the system from different perspectives (including capability to generate invoices, evaluation of drivers reaction and feedback, provisioning of added-value services, effects of interferences in system performance etc.)
2. **Data analysis:** exhaustive performance analysis for those variables with no need of a reference system (including estimation of overcharging performance, capability of getting repeatable results for same conditions etc.)

## •100 vehicles fitted with I-20 OBUs

- **Drivers:** ARVAL's customers: volunteers driving as usual.
- Periodic **feedback** by means of anonymous questionnaires => soft & data analysis + relevant inputs for business and exploitation plan

kenteken	merk en type	zipcode home	zipcode client	annual kilometers
Confidential	Volkswagen Polo 1.2 51kW Comfortline 5drs	Confidential	>	28 971
	BMW 318i Business Line		>	25 581
	Citroen C5 1.6HDiF Ligne Business		>	49 213
	Toyota Prius 1.5 Hybrid Synergy Comf.		>	33 466
	Volvo V50 1.6D Base		>	22 073
	Toyota Prius 1.5 Hybrid Synergy Tech		>	35 929
	Renault Laguna Est.2.0 T Dynamique Aut		>	35 565
	BMW 318i touring High Execut.Aut.6		>	33 205
	Ford Mondeo Wagon TDCi 105 Tit. Aut		>	32 613
	Volkswagen Golf 1.4 TSI 90 Comfortline 5d		>	35 296
	Nissan Qashqai 1.6 Tekna 2WD		>	22 031
	Volkswagen Golf 2.0SDI Optive 3 5drs		>	31 572
	Toyota Avensis 2.0 Executive Bus.4drs		>	40 404
	Ford Focus 1.6 16V Futura 5drs		>	18 262
	Volkswagen Golf Var.TSI 90 Comfortline		>	43 253

# THE END2END TRIALS (II)

- Automatic downloading of data recorded to Palview GMV's platform, making data available for analysis
- No post-processing: **geo-objects** defined considering driving habits of drivers and **programmed into OBUs**
- Running **until September 2010**

## ADDITIONAL TRIAL IN PORTUGAL

**ASCENDI** (Portuguese highway operator). Summer 2010

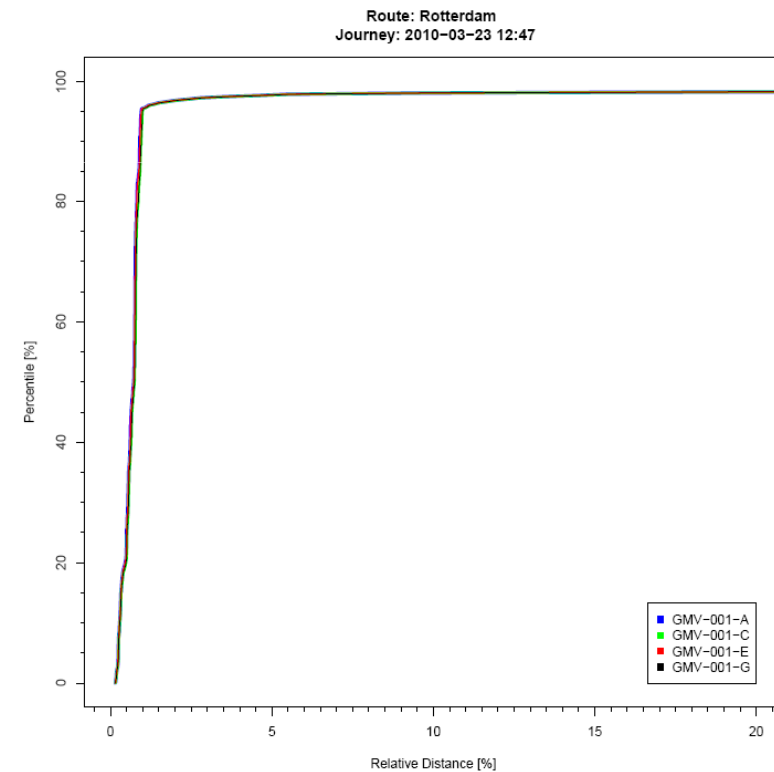
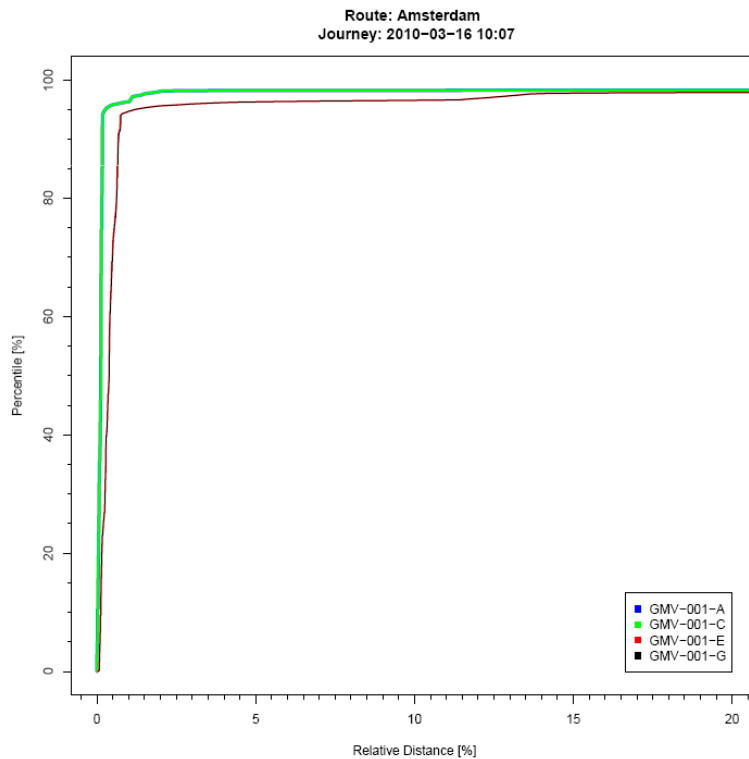
**Objective:** to demonstrate how GINA and GNSS-based Road Pricing systems could be used for event based charging, such as motorway toll roads.

**Comparison** of performance of GINA with existing **DSRC**-based Road tolling solutions. Use of GNSS for **other VAS** of interest for a highway



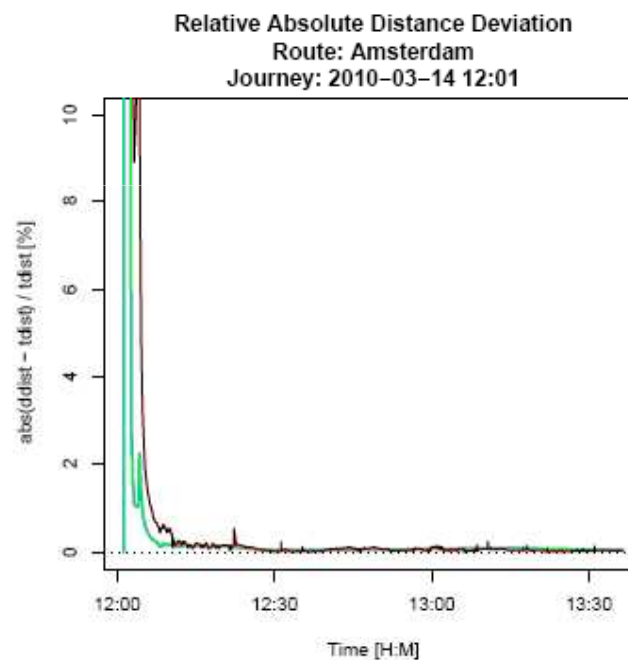
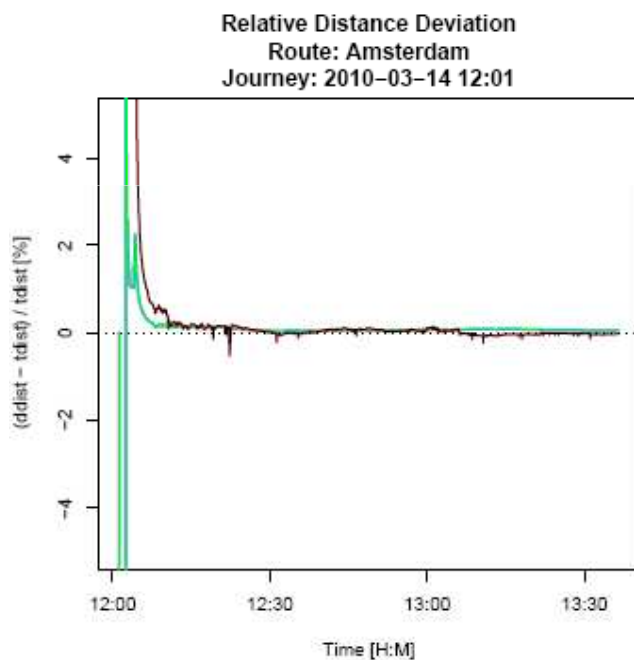
# SOME PRELIMINARY RESULTS (I)

## Relative absolute distance deviation



# SOME PRELIMINARY RESULTS (II)

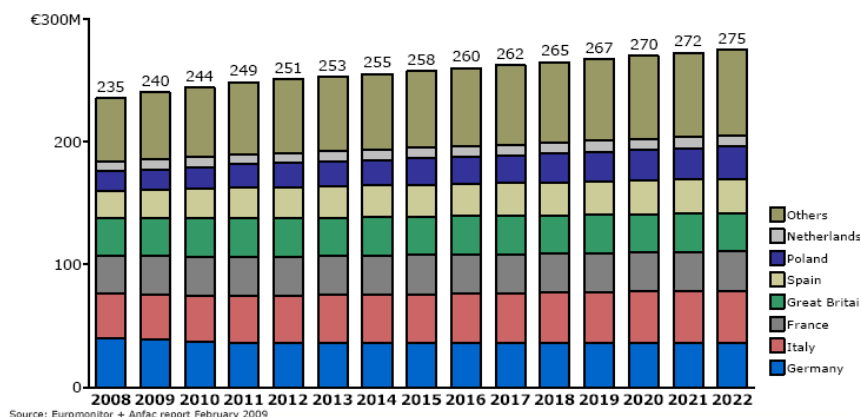
## Journey distance deviation



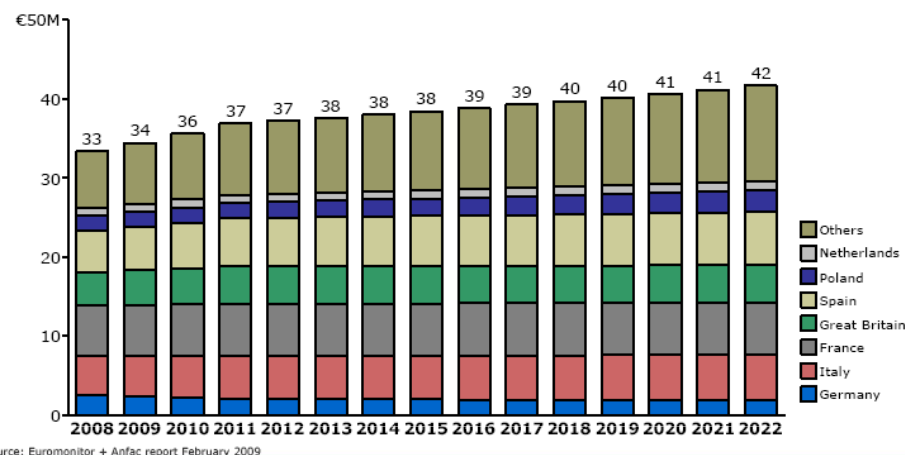
And others (analysis on-going)



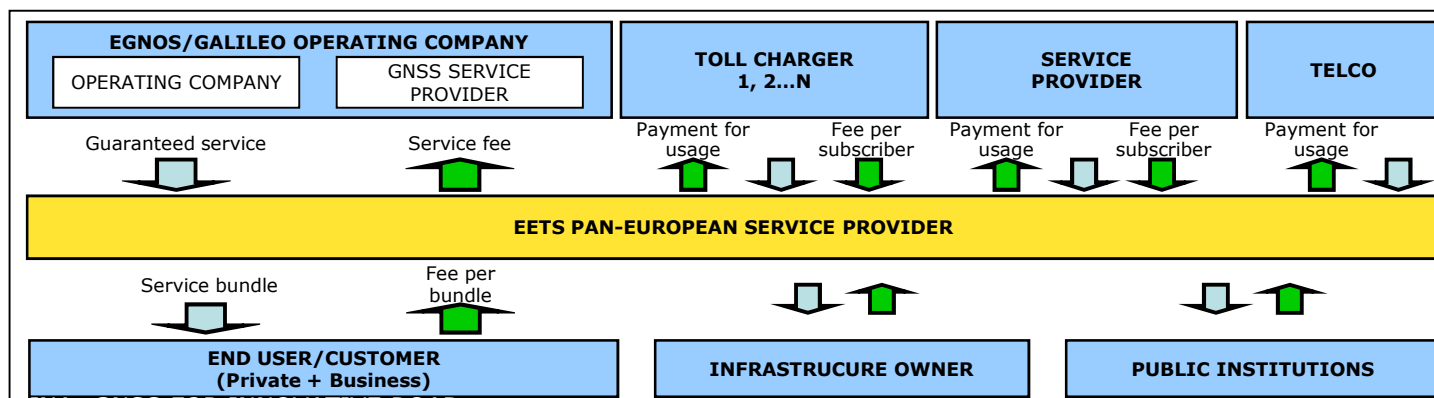
# THE GINA BUSINESS APPROACH



Cars market (EU27)



Commercial Vehicles market (EU27)



RUC + VAS:

- ✓Emergency Call
- ✓PAYD services
- ✓Fleet Management
- ✓ Freight/Transport Management
- ✓Recovery after theft
- ✓Traffic information

# CONCLUSIONS

- GINA: a **step beyond in introduction of EGNOS / GALILEO** in RUC and VAS
- Not another proof-of-concept: **Large scale demonstrator**
- **Trials:**
  - Exhaustive trials: GNSS performance analysis
  - End2End trials: overall assessment from service perspective
- Great amount of data. Realistic scenario, realistic conditions and valuable feedback from drivers experimenting system in operational conditions
- Next step: definition of a **solid business and exploitation plan** based on preliminary model already proposed + interesting results of the large scale trial
- GINA will offer clear conclusions with respect to the added value of position integrity (EGNOS / GALILEO) for GNSS-based Road User Charging. Turning point towards adoption of GNSS in road.

# Thank you!



**Rui Carlos Alves GMV - [rui.calves@gmv.com](mailto:rui.calves@gmv.com)**