



High integrity **E**GNSS **L**ayer for **M**ultimodal
Eco-friendly **T**ransportation

HELMET Project

Radiolabs



sogei



ITC

roboauto

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Space 4 Critical Infrastructure
Putting the EC proposal into action

24 May 2022

- GNSS for ITS applications
- HELMET overview
- The HELMET consortium
- Project goals, motivation and ambition
- Project Workflow
- HELMET Architecture Design
- Proof of Concept activities
- Conclusions

GNSS: a critical infrastructure for ERTMS & Connected cars



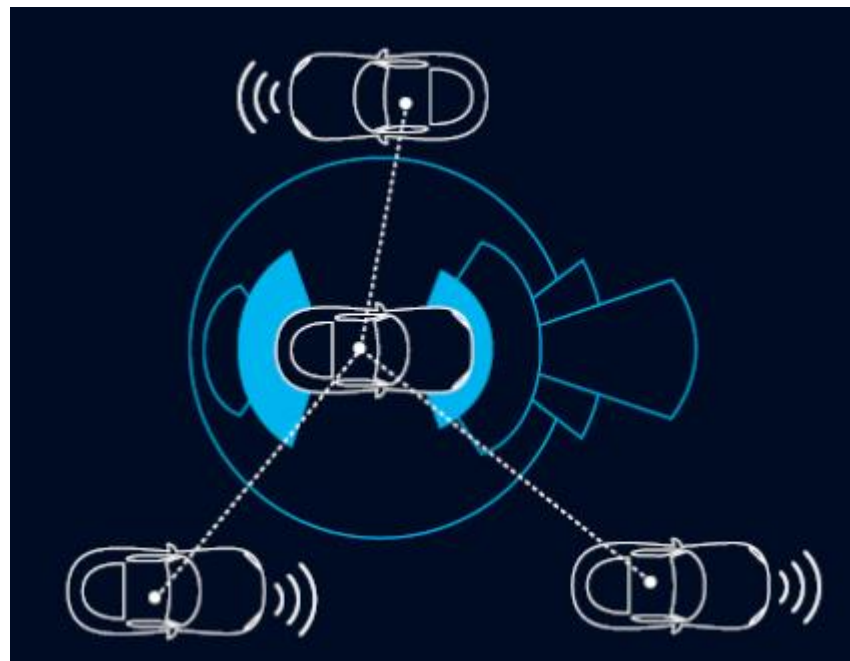
Expected ETCS status by 2040 according to the national plans



Some 57,000 km of lines and 15,000 vehicles will be equipped with ERTMS by 2030 (Matthias Ruete EC)

European Green Deal, reduce emissions by at least 55% by 2030, as compared to 1990 levels.

Connected Cars



Up to 15% of all new vehicles sold in 2030 could be fully autonomous, subject to progress on the technical, infrastructure and regulatory challenges (Mc Kinsey)

New Challenges: resiliency, autonomy, sustainability

Priorities to manage a resilient GNSS infrastructure for land transport:

- **GALILEO** in addition to GPS (ensure European autonomy)
- **Multi-sensor** technologies for vehicle's positioning (resilience)
- Multi-modal **augmentation networks** (cost efficiency)

Develop Satellite Navigation technologies for an *eco-friendly, smart and innovative* transport sector that makes the most of digitalisation and automation

Target applications

- Connected & driverless **Cars**
- **Train** management & automation
- **Drones** for surveillance roads and railways



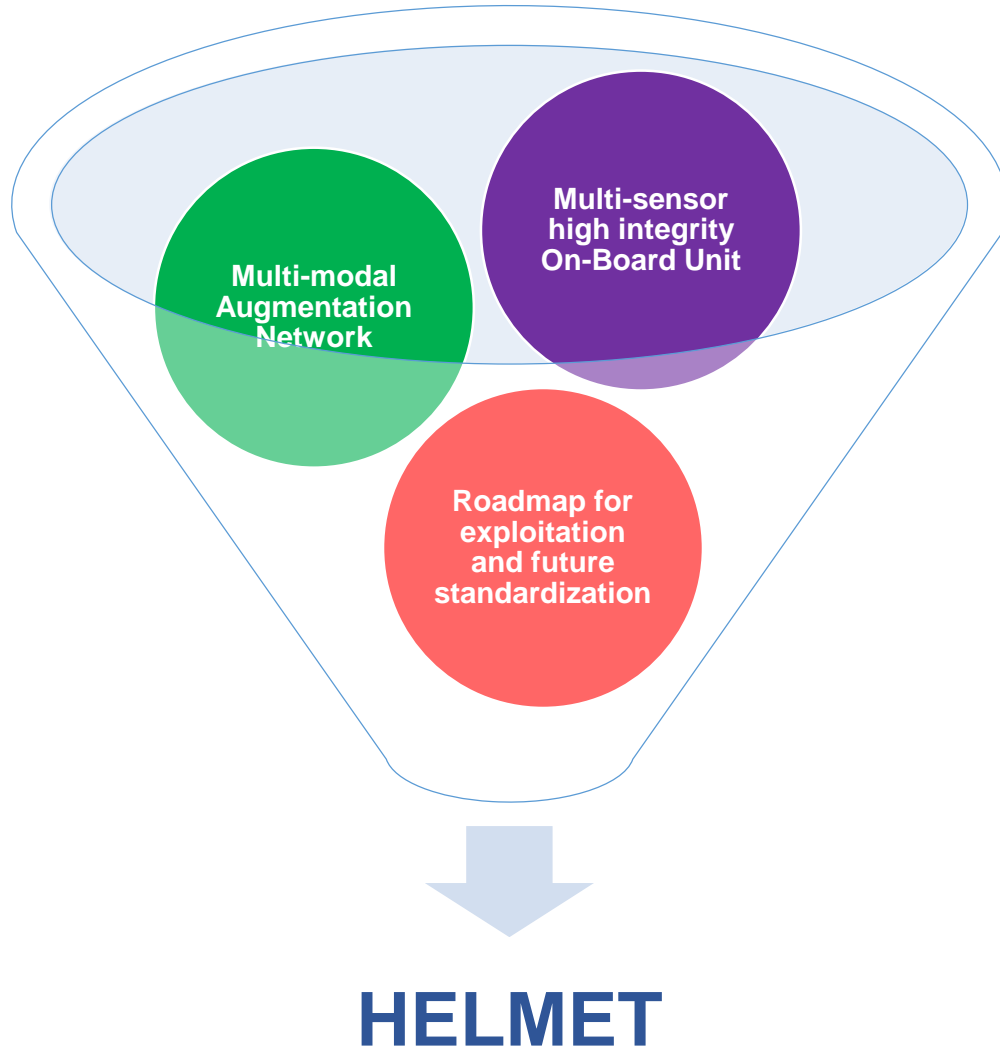
Make Transport safer, more sustainable, accessible and reliable by optimising new technological infrastructures

HELMET main goals



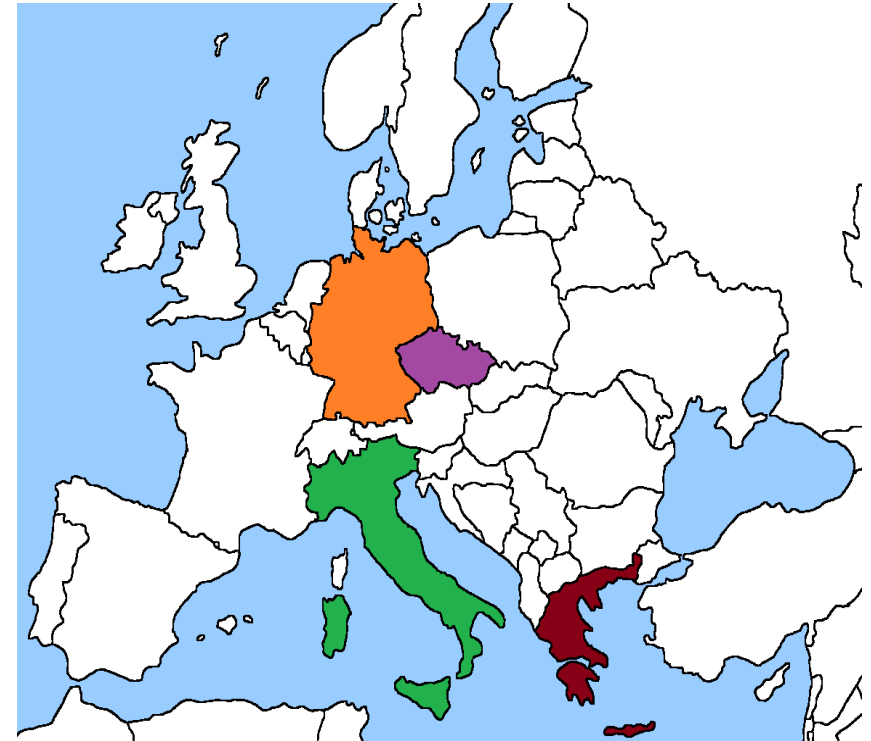
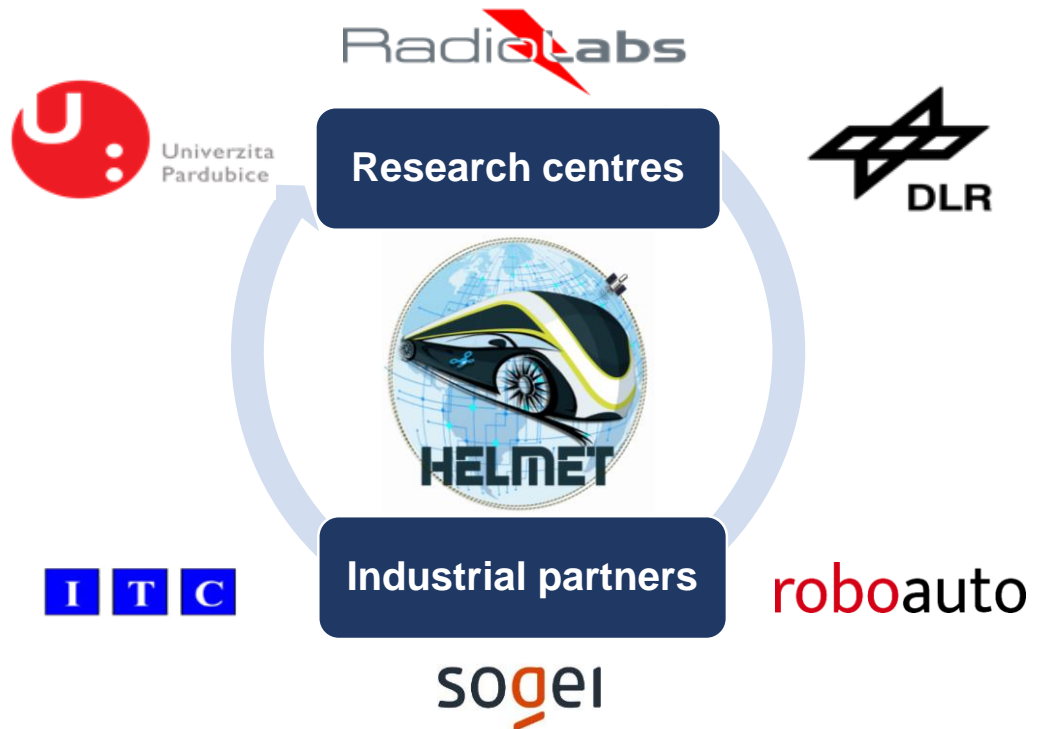
- To develop a **cyber-secured multimodal, multi-sensor integrity monitoring architecture** based on EGNSS to introduce High Integrity Location Determination System (LDS) for cars and trains automation aggregating the demand of monitoring rail and road assets with UAV
- To assess the system performance by a **Proof-of-Concept (PoC)** in real mobility environment
- To draw a **roadmap for exploitation and future standardization and certification of HELMET** results in terms of
 - the designed multi-modal AIMN architecture
 - high integrity and accuracy OBU algorithms fully customized for land transportation (rail and road)

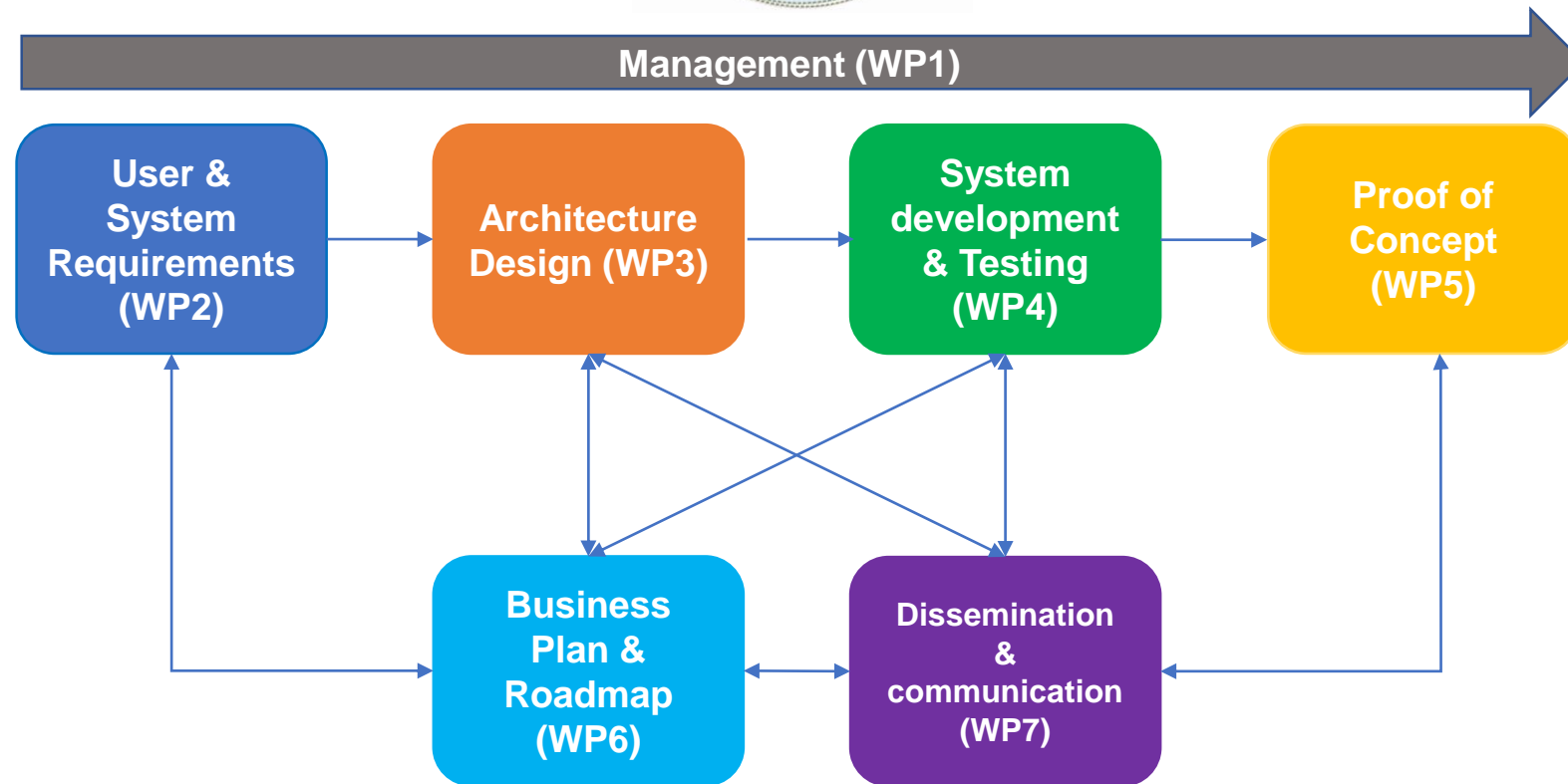




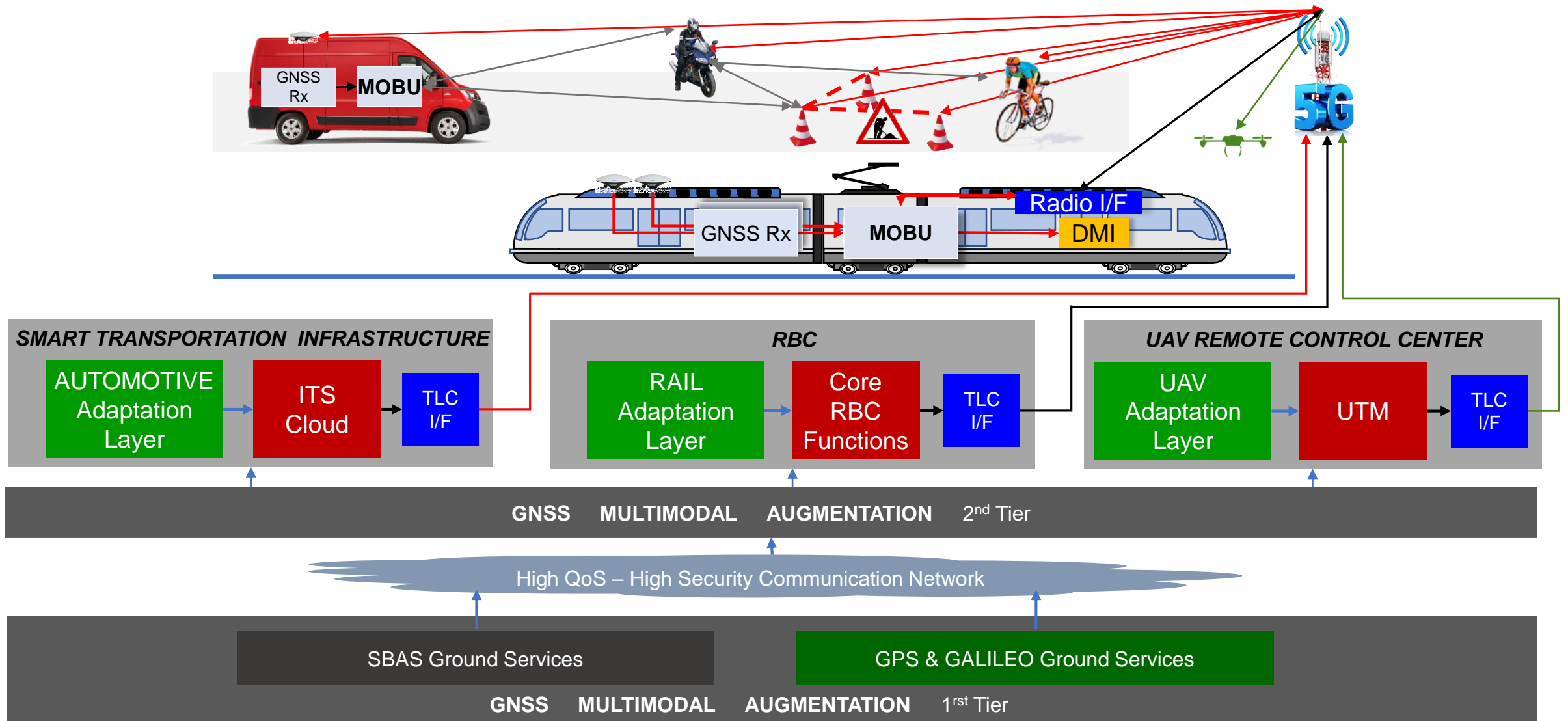
- Leverage of expertise, experience and cutting-edge technologies available in state-of-the art for designing high integrity and **high accuracy multimodal AIMN** for land transportation and UAV
- Design of high integrity and high accuracy **multi-sensor** algorithms based on **COTS** devices
- Contribution to draw an advanced **roadmap** for exploitation and future commercialisation of EGNSS solutions for land transportations
- Contribution to the GNSS **certification** and authorization process into the ETCS/ERTMS and connected and semi-autonomous sectors
- Working collaboration methodology **Industry 4.0**

Multidisciplinary team including research centres and industrial partners

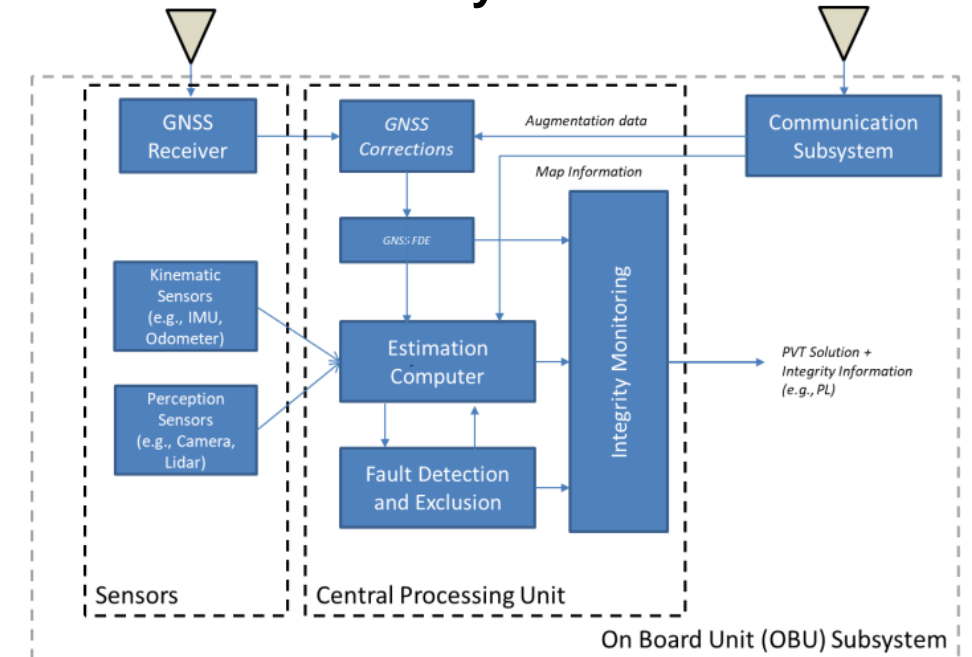
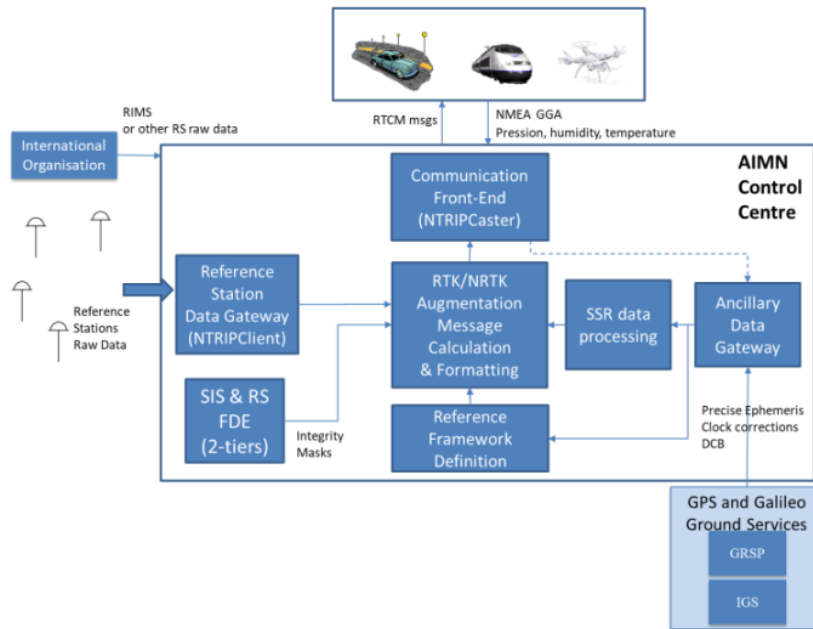
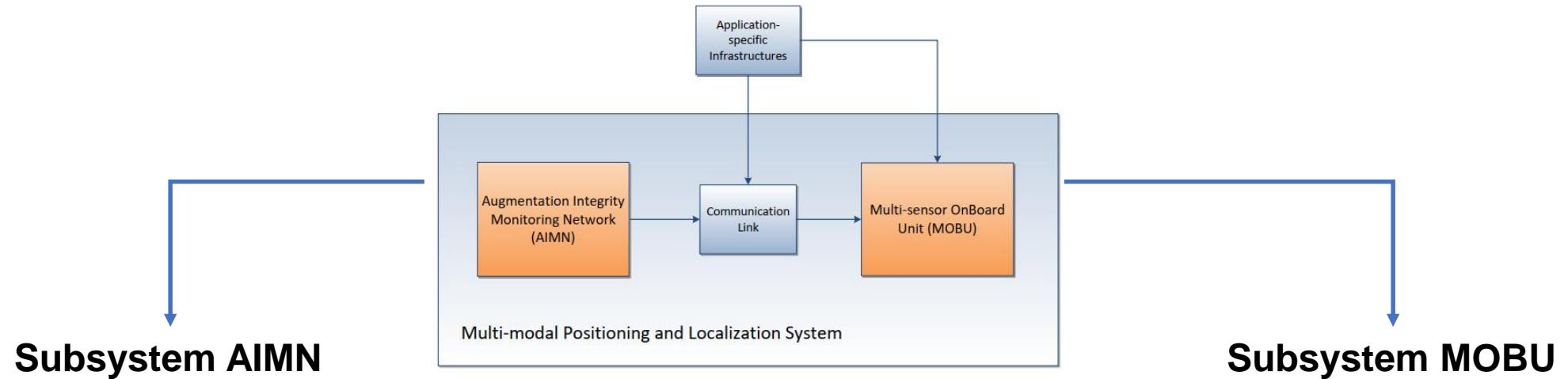




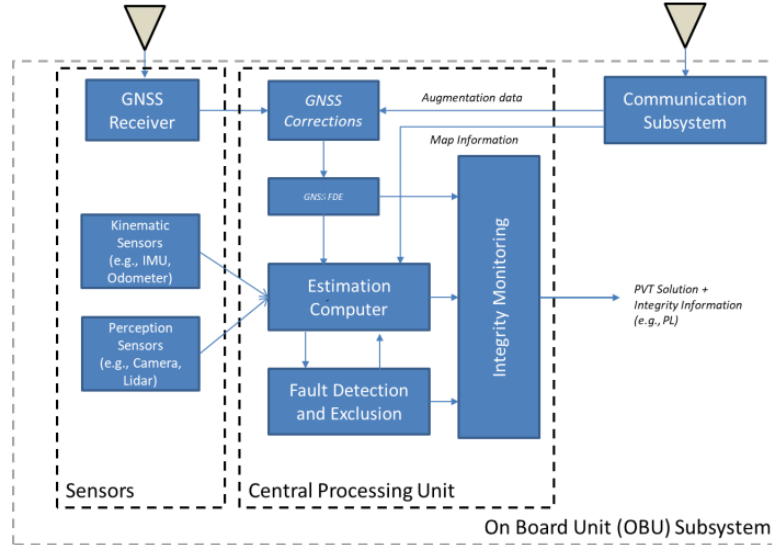
Multi-modal architecture



High-level Architecture



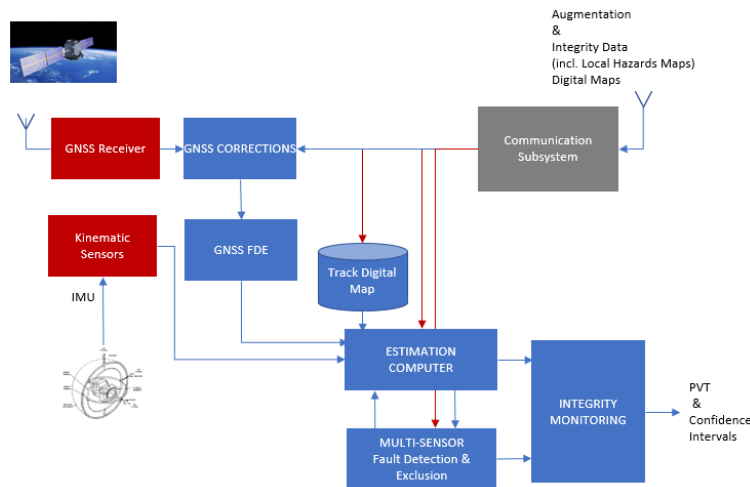
Multisensor Onboard Unit Architecture



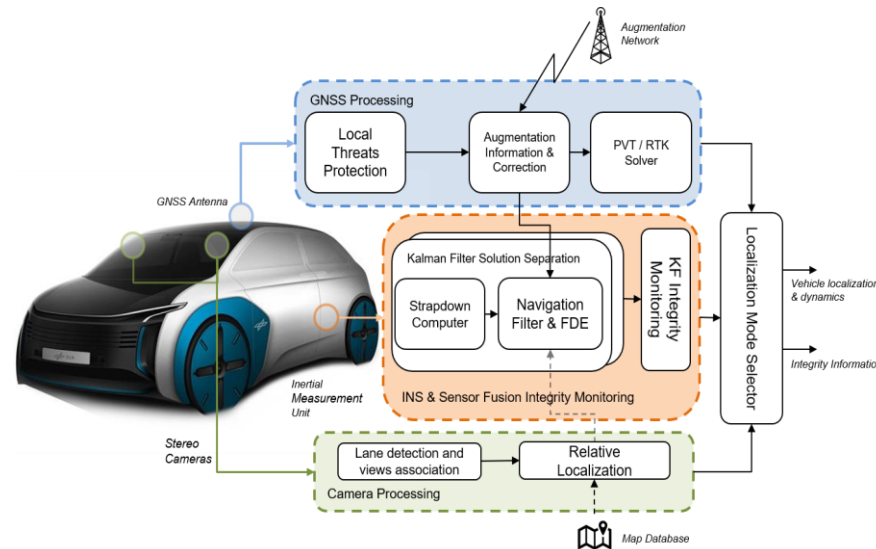
Design targets: High Accuracy, High Integrity, High Availability

Key Aspects:

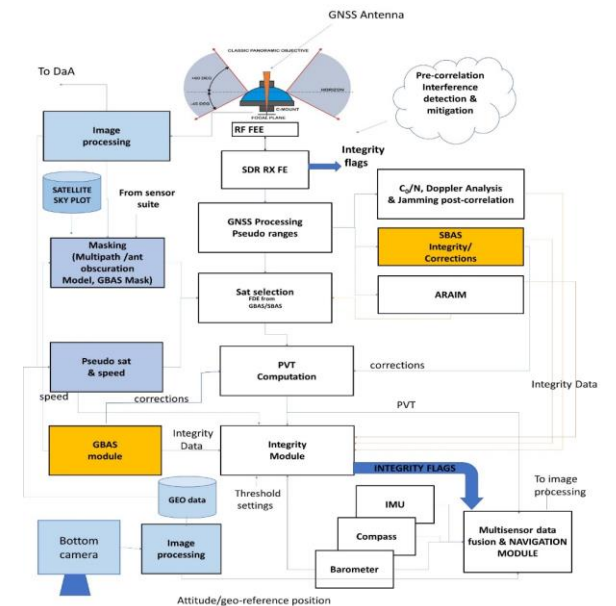
- Inclusion of GNSS Augmentation and Integrity Information
- Handling/protection of local GNSS threats
- Integration of additional sensors (IMU, Camera)
- Error and integrity risk quantification



Railway



Automotive



UAV

HELMET PoC – DEMO APRIL 2022 (Rome)



HELMET Tests successfully completed on the Rome - Fiumicino motorway from 11 to 13 April 2022.

The work team coordinated by Radiolabs with Roboauto, DLR performed the phases of field tests, data analysis and reporting on the performance of the on-board navigation platforms (MOBU) **developed for vehicles and trains and based on the integration of multi-constellation and multi-frequency GNSS receivers and on-board sensors** (eg IMU and LIDAR), **with the support of the SOGEI augmentation network.**

With the achievement of this important milestone, HELMET confirmed the expectations and effectiveness of the developed platform - **the first in Europe that allows to serve railway, cars and drones applications sharing technological infrastructure and making full use of EGNOS and Galileo.**



Start/End Race - RomaTre University Parking



A91: Rome-Fiumicino highway

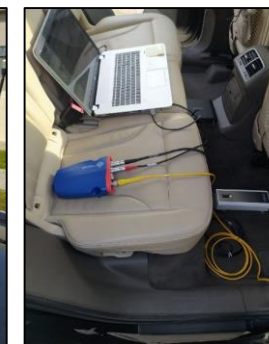
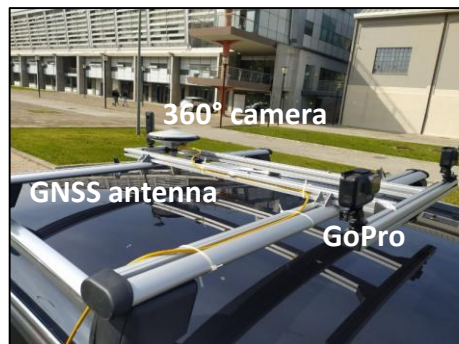
DEMO APPROACH FOR RAIL



Behavior of the train
simulated by the vehicle with
Track-constrained PVT
calculation



TrackDB based on real data (first field test campaign on Rome-Fiumicino highway) and augmentation information from commercial service (RTK).



Rail MOB equipment

Scheduling of activities

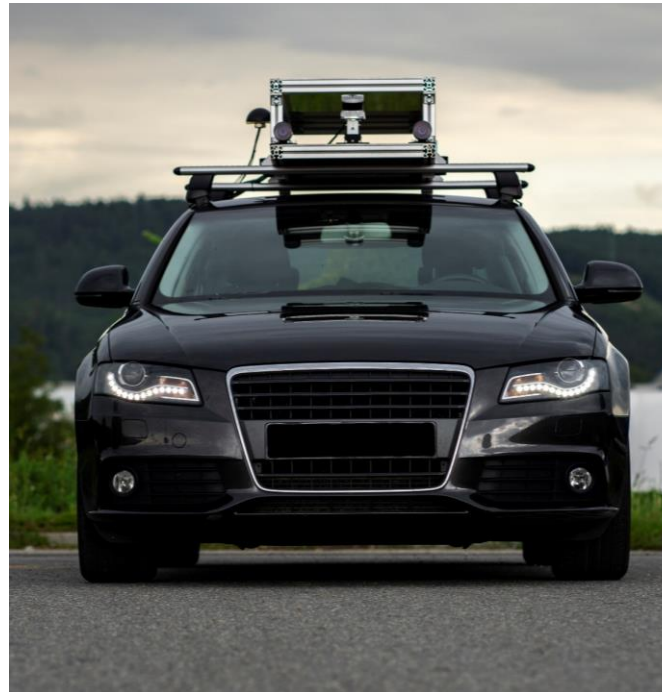
- First acquisition campaign for **trackDB creation**
- Second acquisition campaign for **post processing analysis** on the PVT calculated by the OBU
- Field test campaign for **real-time processing** of GNSS data + Sogei augmentation

Next step:
Test campaign in a real railway environment

HELMET PoC – DEMO APRIL 2022 (Rome)

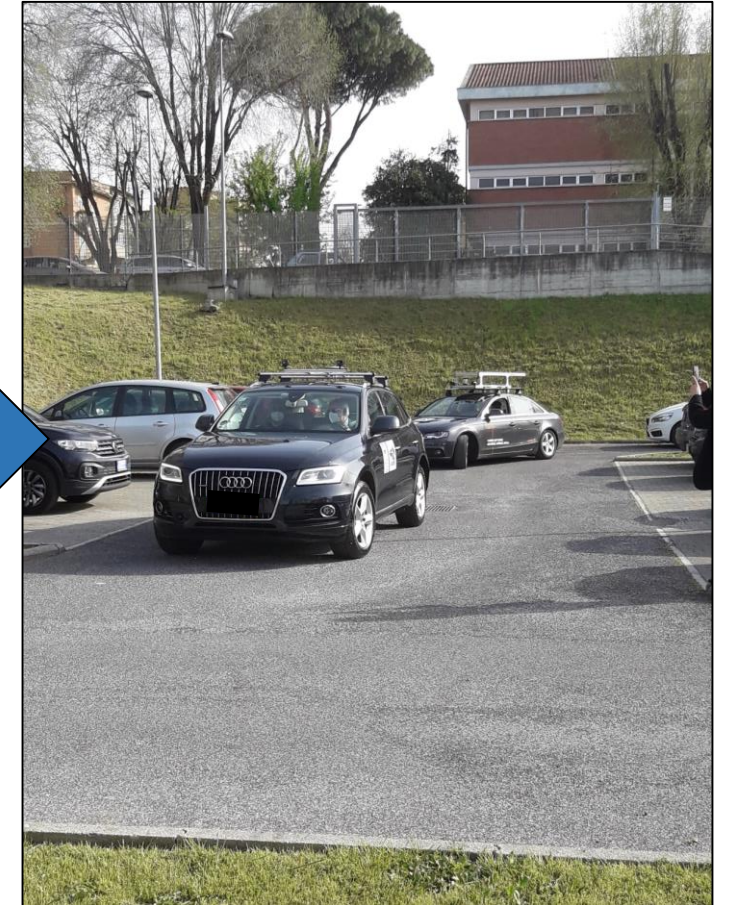


DEMO APPROACH FOR AUTOMOTIVE



Automotive MOBU equipment

JOINT DEMO (RADIOLABS – ROBOAUTO/DLR)

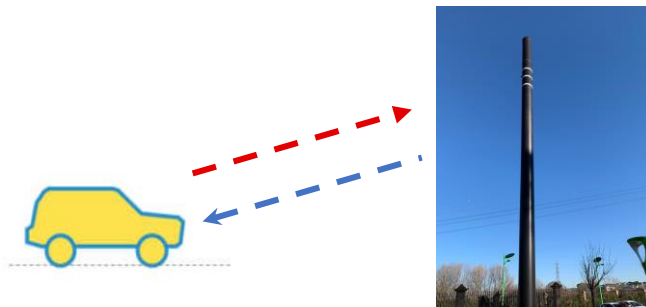


Conclusions



- **MULTI-MODAL AUGMENTATION PLATFORM** for Rail, Roads and Drones
- **SAFETY** framework for **ROAD** vehicles harmonized with avionics and rail best practices
- **MULTISENSOR On Board Unit** with advanced Integrity Monitoring Capabilities
- **TIGHTER INTEGRITY BOUNDS** incorporating (Statistical) Knowledge about **Local Hazards**
- Contribution to the standardization working-group **RTCM SC 134**
- Interested to evaluate additional collaborations

Identified *early adopters* in Italy



Smart Road - ANAS



ERSAT - RFI