ESA & Automotive

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ESA Transportation Day, 27 November 2023

Why space is important to automotive

IRIS²

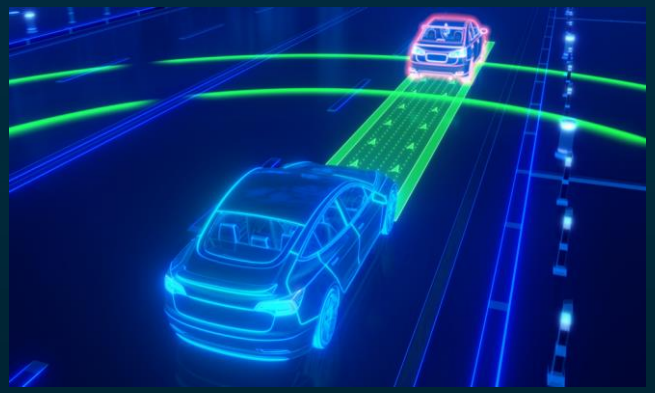
Connected cars

Decarbonization

Positioning

Green Logistics

Autonomous cars



ESA is supporting numerous initiatives to develop technology, products and services

Cooperation with “non-space” businesses to…

Stadt Essen

Aachen district

Citta’ L’Aquila

BASS for automotive - Activities

TRENDS

Rise of MaaS

Integration of various forms of transport services into a single mobility service

Connectivity & Automation

Increased automation of vehicles. V2V and V2X development for improved safety, efficiency and driver experience

Decarbonisation

Electrifying commercial and passenger vehicles. Uptake of alternative fuels such as hydrogen.

Micromobility

Many kinds of human-powered transportation like walking, biking, and scootering

Last-mile delivery

Solutions to transport an item to its recipient in the quickest way possible.

ENABLERS

BASS ACTIVITIES

- Parking Assistance
- Car Rental Finding
- Transport Management System
- Shared/On Demand Mobility
- Autonomous Vehicles
- Electric Vehicles
- Accessible Transport

ESA BASS TASK FORCES

Over the past year, ESA BASS has set up and launched a number of Task Forces, which bring together major stakeholders in a market to identify priority areas, increase the impact of space-based services in the sector, and generate positive green and economic results.

ENERGY TASK FORCE

Members

CITIES TASK FORCE

Launched on 26th September with the following members:
Cities signed: Amsterdam, Bologna, Bari, Essen, Naples, Paris, Taranto, Torino, Venice
City Networks: ICLEI

BASS for automotive – Projects examples

Human Switch

- Human Switch consists of two core applications to help drivers switch to electric based on driver's characteristics and provide live asset management for energy market applications V2G.
- Developed by UK consortium led by ATKearney, now commercialised by the joint venture EV8 set up by some members of the consortium.

5000+
User Downloads

2.7m
Miles logged

£1.60
Customer Acquisition Cost

Darwin

- The Darwin Autonomous Shuttle is a self-driving shuttle bus at Harwell Campus. An autonomous software allows vehicle to 'learn' the route and constantly improve its 'driving'.
- Darwin technology switches seamlessly between terrestrial and satellite networks for a ubiquitous connectivity, showing the ability to remotely control CAVs in urban and rural areas.

BASS for automotive – Projects examples

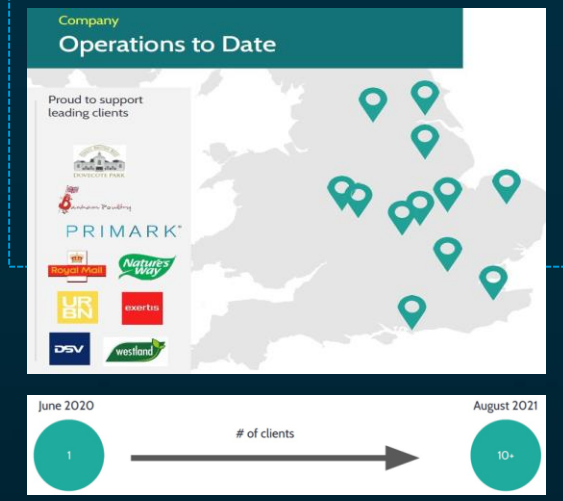
UTRAQ

- *Urban Traffic Management and Air Quality* brings Air Quality and Weather Monitoring Systems, Modelling and Traffic Forecasting tools and Adaptive Traffic Management Systems into one integrated solution

Implemented in Leicester, pilots in London and Dubai

Tandem

- Tandem is a shared mobility solution for those living in areas with limited transport options, thus supporting Sustainable Development Goals. It uses GNSS for route-matching, picking up riders, and driver navigation, etc.
- It leverages a unique business model using partnerships with local taxi/coach companies, employment agencies, local authorities, etc.



BASS for automotive - Activities

Green Energy Task Force
Smart and Green Cities Task Force

Automated Road Transport
Mar 2017

Space and 5G Convergence: Transport & Logistics
Jul 2020

Satellite Connectivity for Autonomous Land Vehicles Safety
Nov 2022

Last-mile delivery
Feb 2024

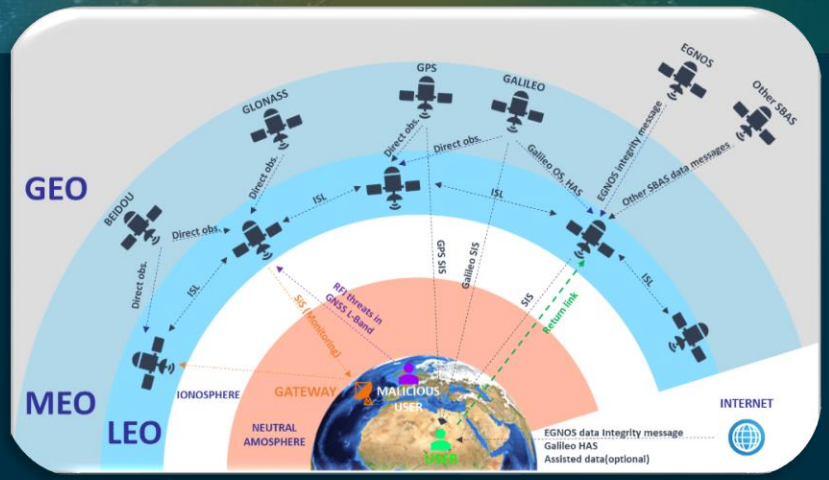
Sept 2017
People Mobility

Apr 2021
Intelligent Transport

Apr 2023
Sustainable Micro-

Q2 2024
Electromobility

NAVISP for automotive - Context in a PNT system of systems



NAVISP

- Builds upon the developments of Galileo & EGNOS, focusing on **technology development** and **competitiveness for industry**
- **Strong engagement with stakeholders** to understand the needs of industry for PNT ecosystem development
- Generates **significant return on investment** for participants
- **End-to-end programme**: provides support from R&D device development to National testbeds
- Works closely with industry to create **PNT Champions in Europe**

GALILEO

- Most accurate satnav system worldwide
- 3.5 billion users
- 2nd Gen on the way

EGNOS

- Ensuring safety-of-life for aviation maritime, rail and road
- Regional coverage over EU, worldwide compatibility

LEO-PNT

- PNT from LEO to complement existing GNSS systems
- Frequency diversity
- In orbit Demonstration

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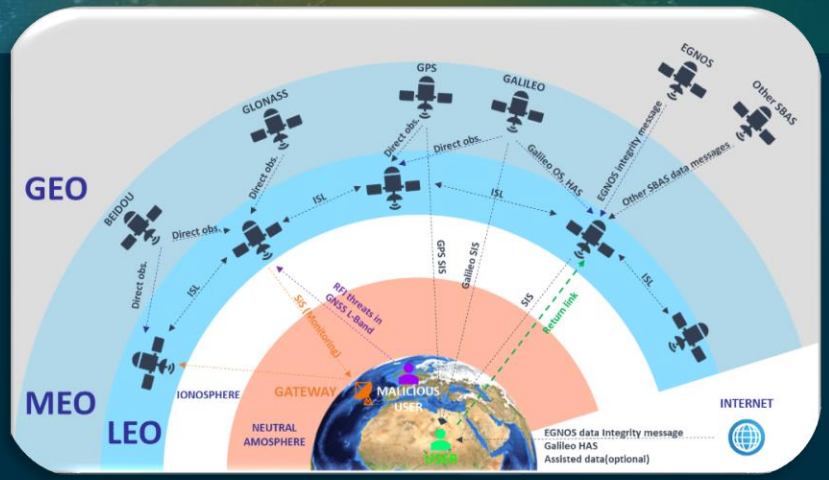

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NAVISP for automotive – PNT

NAVISP Industry Days identified key PNT concepts for automotive

Safety and **PNT resilience** are critical for autonomous vehicles

- Operational infrastructures in ground, space and inside the vehicles rely on PNT technologies
- Protection against interference and spoofing of signals

Ubiquitous PNT is still a challenge

- Urban environments require 10cm absolute positioning for autonomous vehicles
- The convergence of many technologies is required to build a sustainable PNT ecosystem

Standards and regulations

- These are influenced by PNT capabilities
- Can be a driver to open up new market opportunities.

Efficiency and performance

- This will be enhanced by accurate PNT-enabled real-time map production linked to in-vehicle sensors.

https://navisp.esa.int/

NAVISP for automotive - Thematic Window on PNT4CCAM with ERTICO

ERTICO ITS EUROPE

Ubiquitous PNT for Connected, Cooperative and Automated Mobility for more efficient, safe, and sustainable roads and vehicles

Identified the present PNT needs/gaps for CCAM applications

NAVISP for automotive – Projects examples

Technology development for Automotive

Supercorrelator – (UK)

- Software Defined GNSS receiver for vehicles
- Capable of exploiting the angle-of-arrival of GNSS signals through software processing alone
- Provides higher levels of sensitivity, accuracy and integrity
- Unique multipath mitigation, non-line-of-sight signal rejection, anti-spoofing and spoofer localisation capabilities without requiring encryption, authentication messages or multi-element antenna arrays

Testbeds and Validation for Automotive

PNT Center for Automated Road Transport – (IT)

- Safety and Performance Evaluation for PNT in Connected Autonomous Driving
- Supports tasks related with the design and certification of the CAD solution
- Hardware-In-the-Loop testing
- Network operation with external laboratories
- Extension of the lab capabilities to support the autonomous mobility use cases of Smart Roads are planned

NAVISP for automotive – Memorandum of Intent with ERTICO-ITS Europe

- MoI between ESA - ERTICO since 2022
- Focused on the development, promotion and connection of intelligent road systems and services
- Resulted in the NAVISP Thematic Window on Cooperative, Connected and Automated Mobility (CCAM)

ESA contribution:

- NAVISP Participated in ITS congress in Lisbon 2023
- Enlarging the non-space footprint of ESA in automotive
- Bringing in new market owners
- Stakeholder engagement

ESA-5GAA partnership, a roadmap for TN-NTN connectivity

- Cooperation since 2021
- MoU in 2022
- TN-NTN group lead by BMW

ESA contribution:

- Neutral expertise (tech, standards, spectrum, regulatory)
- OEM requirements > 5G roadmap
- Leading industry developments
- Federating stakeholders
- Championing European industry and European sovereign industrial capabilities

Representatives L-R: DLR, BMW, ESA, 5GAA, OHB, EC. 7 Nov. 23

https://connectivity.esa.int/automotive
5g@esa.int

‘No connectivity is not an option’ BMW/5GAA

No ubiquity without communication satellites

ESA (co-)invests in future 5G TN-NTN connectivity

Communications and Secure Connectivity for Automotive – Related calls

Antenna related:

- HIGHLY EFFICIENT 20 W S-BAND AMPLIFIER FOR 5G-CONNECTED CARS (ARTES 4.0 SPL 5G/6G 7C.082)
- 5G AUTOMOTIVE ANTENNA PROTOTYPE AND DEMONSTRATION (ARTES 4.0 SPL 5G/6G 7C.084)
- DISTRIBUTED, SCALABLE ANTENNA ON GLASS FOR AUTOMOTIVE CONNECTIVITY TO SATELLITE (ARTES 4.0 AT 7C.081)
- PRINTED CIRCUIT BOARD TECHNOLOGY FOR AUTOMOTIVE CONFORMAL ANTENNAS (ARTES 4.0 AT 7C.083)

System related:

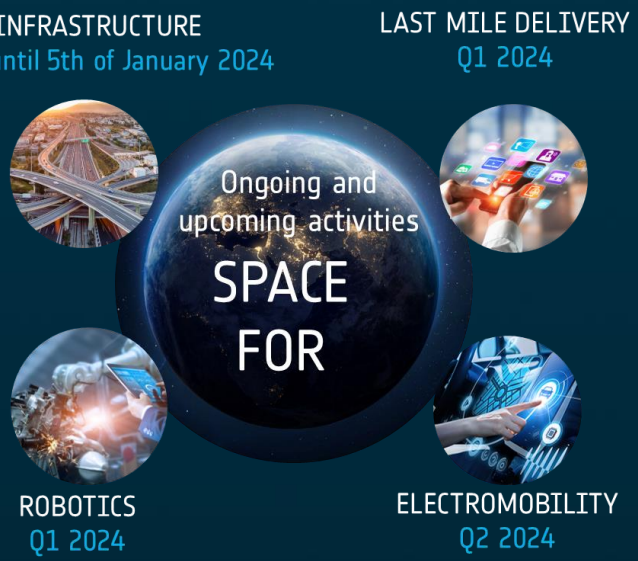
- STUDY AND DEMONSTRATOR OF HEO PAYLOAD ARCHITECTURE FOR 5G-CONNECTED MOBILE SERVICES (ARTES SPL 5G 5A.084)
- NGSO SIMULATOR FOR 5G VEHICLE-TO-EVERYTHING (V2X) (ARTES 4.0 SPL 5G/6G 3A.183)
- AD HOC VEHICLE TO VEHICLE MESH NETWORK FOR IMPROVED SATELLITE THROUGHPUT (ARTES 4.0 AT 6B.117)

Demonstration related:

- VEHICLE-TO-EVERYTHING (V2X) SERVICES DEMONSTRATION OVER SATELLITE (ARTES 4.0 SPL 5G/6G 3A.182)

ESA and automotive: What's next?

BASS



NAVISP

Upcoming ITTs:

- EL1-087 Verifiable AI/ML techniques for PNT applications
- EL1-090 Robust Navigation for Autonomous Driving with Low-Cost/SWaP Arrays of Antennas
- EL1-095 Exploitation of Geo-spatial Data for Automated Vehicles

PNT Permanent open calls:

https://navisp.esa.int/

Thank you