

Navigation Innovation and Support Programme, PNT Use cases in Mobility

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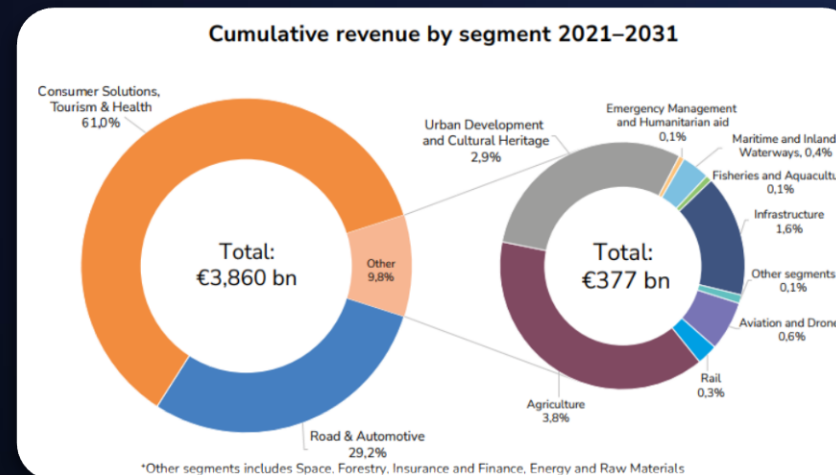
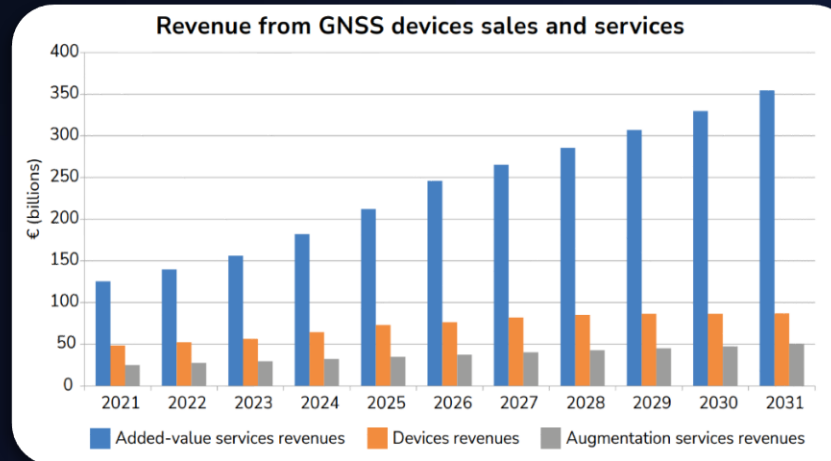


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→ THE EUROPEAN SPACE AGENCY

GNSS Market Perspective

- From 6.5 billion receiver units as an installed base (2021) to 10.6 billion (2031)
- Global annual market revenues in 2031: 87 B€(devices) and 405 B€ (services and augmentations)
- CAGR of 9.2% between 2021 and 2031
- Consumer and transport solutions dominate all other market segments in terms of cumulative revenue



EUSPA, 2022

To leverage upcoming opportunities, European PNT industry will need to:

- Develop cutting-edge technologies & effective products & services
- Maintain & increase competitiveness of the manufacturing sector
- Support PNT national programmes and relevant institutional activities following ad hoc participant MS's request

Key trends global PNT systems



GNSS Evolutions

(E.g. Galileo, EGNOS) Multi-Constellation, Multi-Frequency GNSS. Moreover, there is a need for augmentation (SBAS), especially in countries without GNSS coverage.



Terrestrial Systems

The integration of for example 5G/6G networks is expected to further enhance the performance and capabilities of PNT systems.



Lunar Systems

The future lunar economy is creating emerging commercial opportunities, lunar positioning and navigation is one of them.



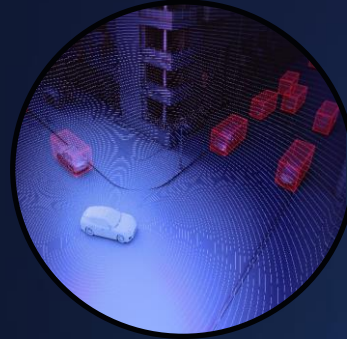
LEO-PNT Systems

LEO-constellations and commercial navigation and alternative to existing systems could be the game changer to complement GNSS.



Resilience

The growing threat of GNSS jamming and interference is driving the development of new techniques and technologies



Autonomous Systems

The growing use of autonomous systems is driving the development of new PNT technologies and creating emerging commercial opportunities.

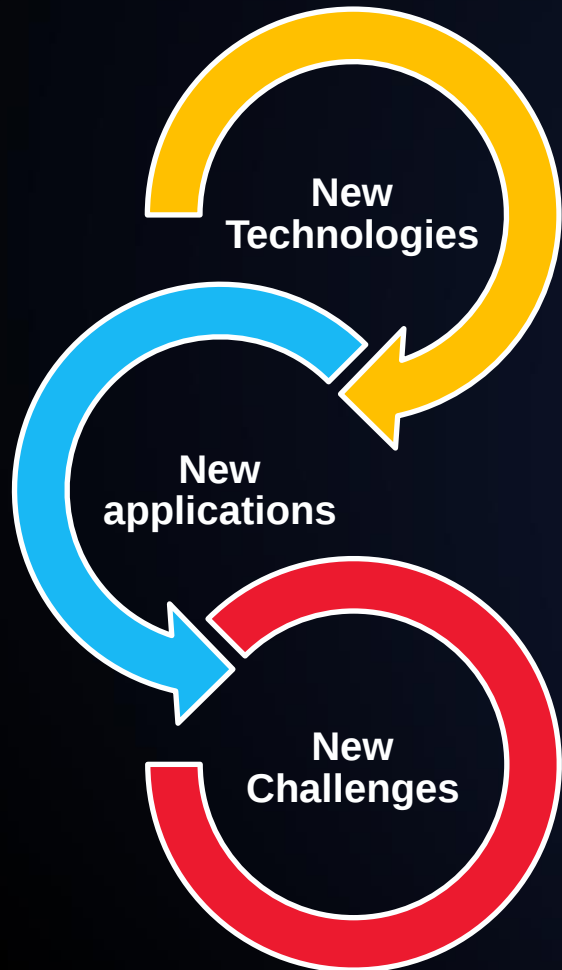


Service Innovations

Key Tech advancements (e.g. cloud computing, ML, AI) enable new possibilities e.g. for correction and positioning services

PNT Challenges and Vision

PNT-Vision 2030: Ubiquitous, reliable (integrity), resilient, dm-level accuracy



- More GNSS satellites
- More GNSS signals
- Pseudolites, Locatalites
- Smaller, cheaper inertial sensors

- Digital mapping (outdoor & indoor)
- More processing power
- Communications
 - WiFi / RFID
 - UWB, Sparse Band
 - Digital broadcasting

- Intelligent Transport Systems
- Rail signalling & control
- Precision aircraft landing
- Ships in harbours

- Location-dependent billing
- Virtual security fences
- Tracking people/animals/assets
- Social inclusion

- Multi-sensor, low-cost and robust positioning
 - Based on single or multiple users
 - Different types, platforms, sensors
 - Autonomous or cooperative navigation

- Seamless Transition between sensors, platforms, algorithms
- Seamless transition between and continuous positioning across different environments

navisp – The Programme

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- ❑ Develop cutting-edge technologies & effective products & services
- ❑ Maintain & increase competitiveness of the manufacturing sector
- ❑ Support PNT national programmes and relevant institutional activities following ad hoc participant MS's request



- Improve industrial innovation + competitiveness at all industrial levels, and drive growth and jobs
- Support SMEs to break their way into (new) markets
- Flexibility for MS to target investments to support national objectives
- Uses best practice in terms of responsiveness and fast contracting procedures
- Open for non-space industry to capture the full spectrum of PNT innovation and commercialisation
- Programme fully coordinated with EU/EUSPA

Three programmatic phases, partially overlapping:

- ❑ Phase 1 from 2017 until 2021 (5y)
- ❑ Phase 2 from 2020 until 2022 (3y)
- ❑ Phase 3 from 2022 until 2025 (3y)

NAVISP is attracting new actors while enlarging the (PNT) footprint in Europe



- 56% of the companies belong to other economic sectors
- 40% have never worked with ESA before
- 48% of Funding is allocated to SME's (as Prime)

NAVISP supports sustainable initiatives



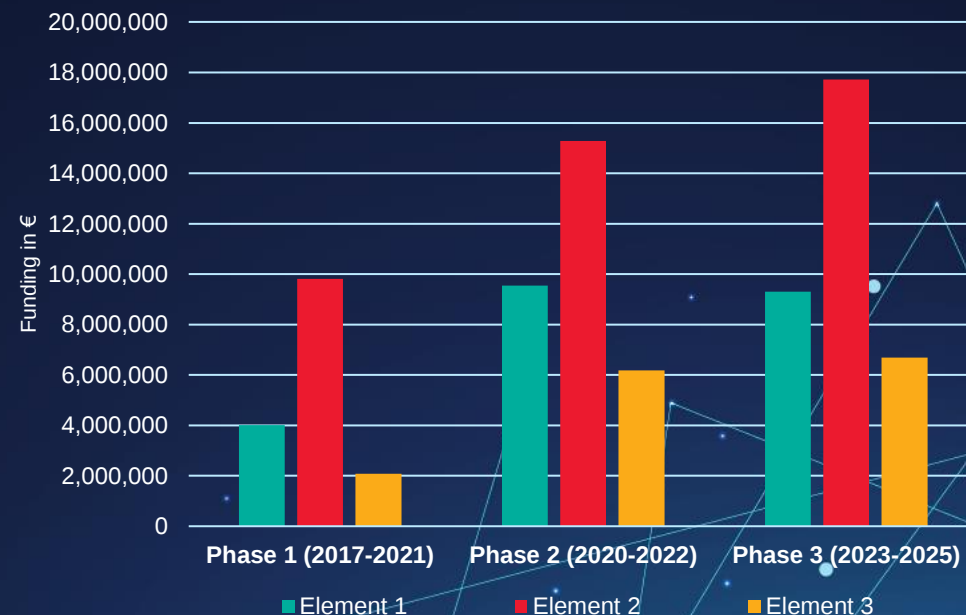
- NAVISP supports several activities aimed at reducing global CO2 emissions, improving weather monitoring, and enabling more accurate, sustainable agriculture

NAVISP enables new innovative programmes

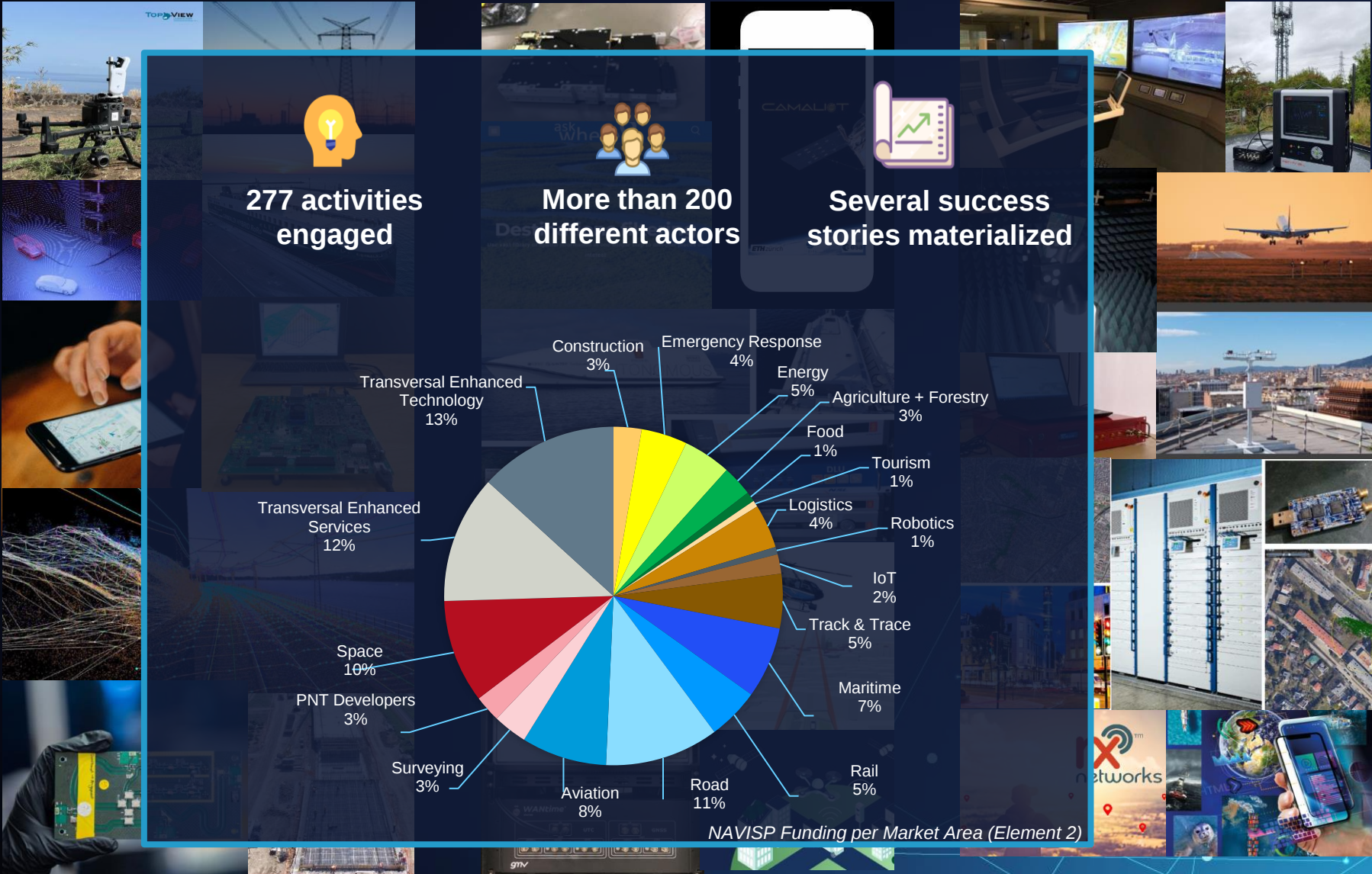


- Element 1 activities supported the Programmatic Earth-Moon Initiative, which led to the recently agreed Moonlight initiative. Moreover, NAVISP EL1 provided an important foundation for the new LEO-PNT Programmatic Initiative

NAVISP Funding available per Year



Overall Funding per Phase			
	Phase 1 (2017-2021) 5 years	Phase 2 (2020-2022) 3 years	Phase 3 (2023-2025) 3 years
Element 1	20,068,558 €	28,626,233 €	27,910,000 €
Element 2	49,050,919 €	45,856,818 €	53,170,000 €
Element 3	10,406,990 €	18,529,093 €	20,050,000 €





11% of NAVISP Funding allocated to Road

Focus on Autonomous driving solutions:

- Receiver and antenna development
- Processing algorithms, including Machine Learning/Artificial Intelligence
- Ensuring a resilient data supply (e.g. anti-spoofing/jamming technologies)
- Hybrid technical solutions such as the combination of 5G and GNSS

5% of NAVISP Funding allocated to Rail

Focus on resilient and robust Rail Sector:

- Localization & absolute position
- Train integrity monitoring and synchronization
- Integration of GNSS needed for the realization of ETCS
- Standardization & Existing regulations
- Interoperability
- Growing interest in autonomous trains

7% of NAVISP Funding allocated to Maritime

Focus on Autonomous vessels and Maritime Resilience:

- Sensors for precise absolute positioning GNSS receivers and Inertial Measurement Unit (IMU),
- Visual sensors (monocular and stereo cameras), & audio sensors (microphones)
- Sensors for remote sensing (RADAR and LiDAR).
- Additional sources of auxiliary data, such as Automatic Identification System (AIS)

Growing interest in activities related to Drones and Urban Mobility

Focus in particular on:

- Use of GNSS together with complementing terrestrial Technologies
- Relative Positioning
- Ensuring a resilient data supply (e.g. anti-spoofing/jamming technologies)
- Drone usage in emergencies and catastrophic situations

navisp Thematic Window: PNT4CCAM

- A Thematic Window dedicated to “**Ubiquitous PNT for Connected, Cooperative and Automated Mobility for more efficient, safe, and sustainable roads and vehicles**” was issued in 2022.
- The Thematic Window was addressed to:
 - Car manufacturers or suppliers
 - Infrastructure developers (e.g. Road, IT)
 - Public Authorities
 - Developers of PNT user equipment
 - Certification[Homologation] facilities[centers]
- 5 uses cases defined in cooperation with ERTICO addressing the CCAM roadmap
- 10 proposals received at different stages of implementation



PNT for CCAM Use Cases in navisp Thematic Window



Ubiquitous and High Performance PNT for CCAM



Perception 360 for CCAM



PNT Monitoring and OTA Updates for CCAM



PNT for Clean Mobility



Testing for CCAM



Social & Ecological Relevance

- Enhanced traffic flow, eco-driving, improved efficiency
- improved driver awareness, and traffic safety

- Collision Avoidance, higher traffic safety
- Increasing lifespan of vehicles

- Cost-effective, efficient user-friendly services
- Vehicular safety applications
- OTA's for EVs important to adjust performance of cars

- Enhanced traffic flow Eco-driving, improved efficiency → Low/No Emissions
- Improved flexibility for Smart Grid

- Testing of "green" applications and vehicular safety applications
- Building trust in the society
- Part of national strategy towards CCAM

- **Element 1:**

- Based on yearly Workplan
- Workplan 2023 recently published on www.navisp.esa.int
- Currently Open ITTs:
 - *NAVISP EL1-075: Bearer Independent Secure Time Transfer*
 - *NAVISP EL1-063: RIS-aided wireless localization and mapping*
- To compile the annual Element 1 Workplan for **2024**, NAVISP invites companies and academic institutions to submit innovative PNT ideas, concepts, and solutions.

- **Element 2 :**

- Permanent Open Call for Proposals AO10516 on ESA STAR

- **Element 3:**

- Permanent Open Call for Proposals AO9427 on ESA STAR



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