

Assessment of the Navigation Innovation and Support Programme (NAVISP)

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- The Navigation Innovation and Support Programme Advisory Committee (NAVAC) was formed in 2018 to provide external advice to the ESA Director of Navigation on NAVISP:
 - objectives,
 - strategy and,
 - technological priorities
- NAVAC issued in June 2019 a report on the effectiveness of NAVISP Phase 1 and recommendations for Phase 2, <https://navisp.esa.int/news/article/NAVACreport>
- This presentation recalls the findings of the report and adds a specific analysis on the relevance of the NAVISP R&D innovation
- NAVAC recommendations will be covered in a separate presentation by NAVAC chairman (NID Session 5).

- Currently 5 members. Wide experience at institutional, industry and academic level.

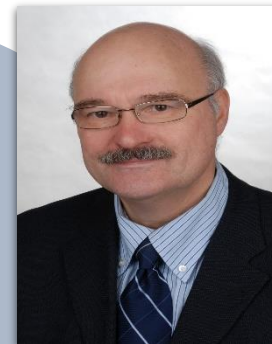
Luis Mayo, Member



Roger Mckinlay, Chair



Bernd Eissfeller, Member



Peter Grogard, Member



Stefano Debei, Member



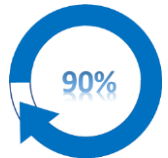
NAVISP assessment key findings (1/5)



... of Element 1 activities are geared towards technology innovation. The rest goes to analyzing the feasibility of emerging PNT concepts or to proof of concepts with a higher TRL.



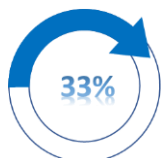
... of Element 1 resources are devoted to develop new technologies to address the needs of existing or new markets.



... of Element 2 activities aim, similarly, to develop new technologies for existing or new markets.



... of Element 2 deal with market or regulatory risks. Most of the activities aim at reducing technical risks.



... of Element 2 funding goes into exploring new markets, and only a 5% fraction of that is based on existing technology.



KF1

The non-GNSS centric approach is one of its strongest assets and is leading the way to innovation.

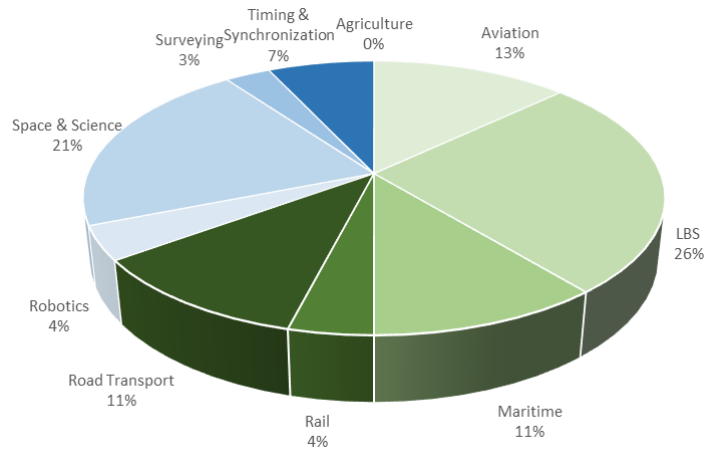
KF3

The programme has succeeded in putting together a broad portfolio of innovative activities with strong focus on technology push and less than desirable focus on market pull.








KF5

Exploration of new markets in Element 2 can be further enhanced.

NAVISP assessment key findings (2/5)



Element 2 budget allocation by application sector (source: ESA)

	Component manufacturers (Europe: 20%)			System integrators (Europe: 27%)		
	Europe*	North America	Asia+Russia	Europe*	North America	Asia+Russia
	6%	61%	33%	4%	36%	60%
	51%	23%	27%	30%	21%	48%
	25%	65%	10%	23%	76%	1%
	31%	46%	23%	33%	14%	53%
	43%	9%	47%	37%	37%	26%
	6%	63%	31%	42%	39%	19%
	36%	40%	24%	37%	34%	29%

European industry market share in the GNSS market by application sector (source: GNSS Market Report. Issue 5, 2017)

KF4

Phase 1 of the programme has succeeded in addressing a broad variety of PNT sectors, but effort is not yet fully coherent with the European industry market positions.

NAVISP assessment key findings (3/5)



... activities incubated within Element 2. Fast pace of budget allocation in Element 1.



... of the companies participating to Element 2 are SME.



... of the Element 2 projects are led by new entrants to ESA.



... of the projects are executed by consortia involving a mix of large companies, SME, academia and research organizations.



... however, there remains the issue of how to motivate non-space primes (i.e. market owner) to participate to the programme.



The scope of the programme is appealing and aligned with industry interests.

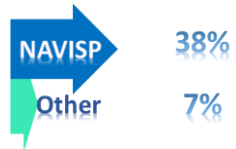


The programme has fostered the participation of new SME entrants, and business networks, however engaging large non-space primes is still a challenge.

NAVISP assessment key findings (4/5)



... participants consider that the amount of work required to obtain the funding is high, but lower than for other European programmes.



... however, they consider that the level of funding is too low to achieve their objectives.



... ESA has managed to speed up the procurement process, but the time required to prepare the full proposal and to obtain the required letter of support from national delegations is a source of frustration.



... of participants value especially ESA's technical expertise and its flexibility to share the project risks.



... ESA has met the target of maintaining the management overhead under 15%.

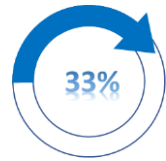


KF7

The management objectives of the programme have been broadly met contributing to a positive reception by industry and a further appetite for simplification of administrative procedures.



... of the Element 3 activities address the topic of PNT resilience.



... the rest is devoted to the development and establishment of PNT test beds.



... the activities proposed by the participating states address broader PNT issues than the needs and realities of those countries, which opens room for across borders cooperation.



Element 3 has been a suitable mechanism to accommodate activities of national interest in a wider multi-national programme. This opens opportunities for cross-fertilization between activities.

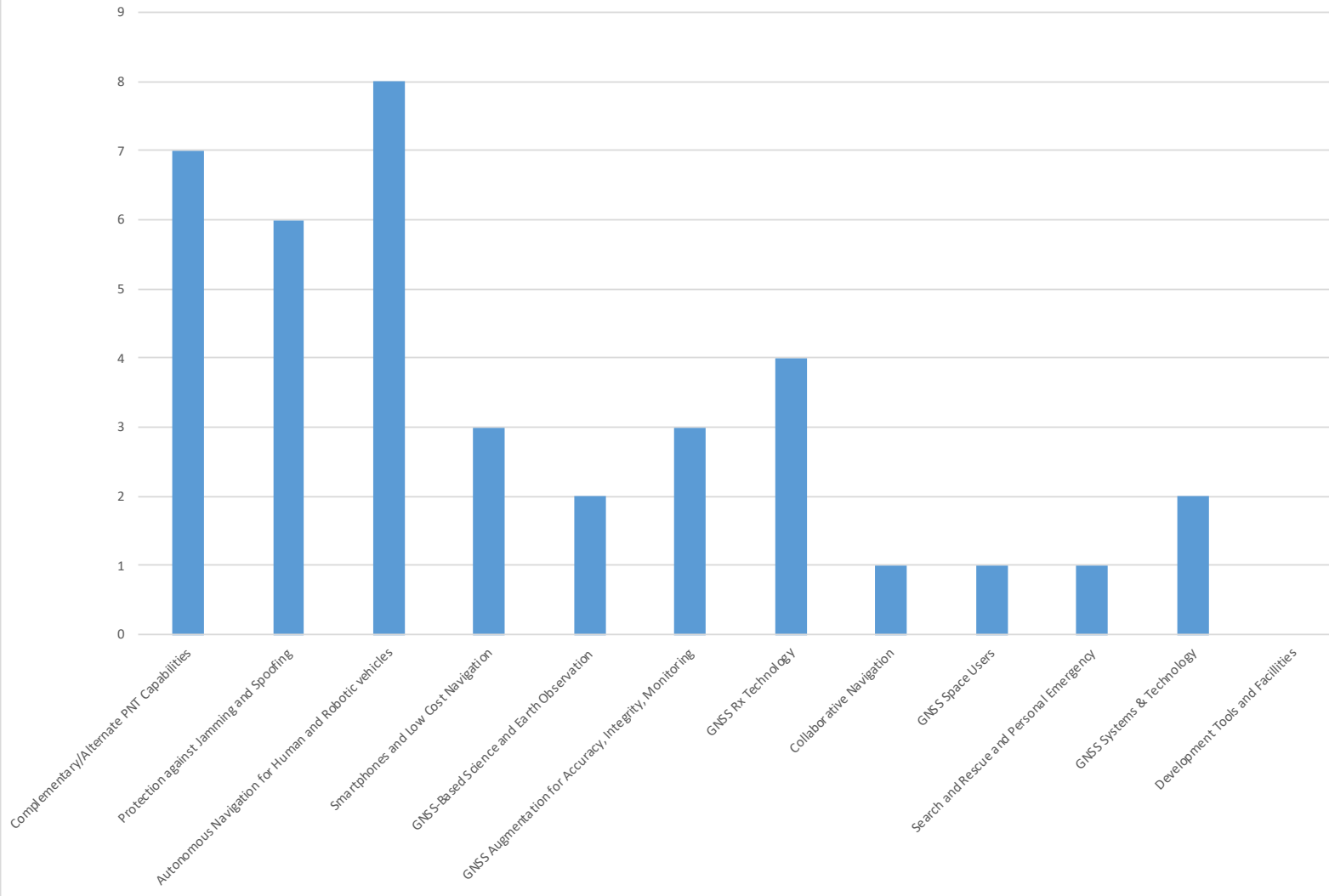
- In broad terms, NAVAC has found that NAVISP is doing well and on the way to achieve the programme objectives.
- NAVAC found that NAVISP approach to support PNT innovation is right, it addresses a high level of innovation.
- To advance on the understanding on the relevance of the NAVISP PNT innovation, a comparison with the topics addressed at the last ION GNSS+ conference is made.



- GNSS Systems and Technology
- GNSS Receiver Technology
- GNSS Augmentations for Integrity, Accuracy and Monitoring
- Complementary to GNSS/Alternative PNT Capabilities
- Protection Against Jamming and Spoofing of GNSS Signals
- Autonomous Navigation for Human and Robotic Vehicles
- Use of Smartphones and Low Cost Navigation
- GNSS-Based Science and Earth Observation
- Collaborative Navigation
- GNSS Space Users
- Search and Rescue and Personal Emergency
- Development Tools and Facilities



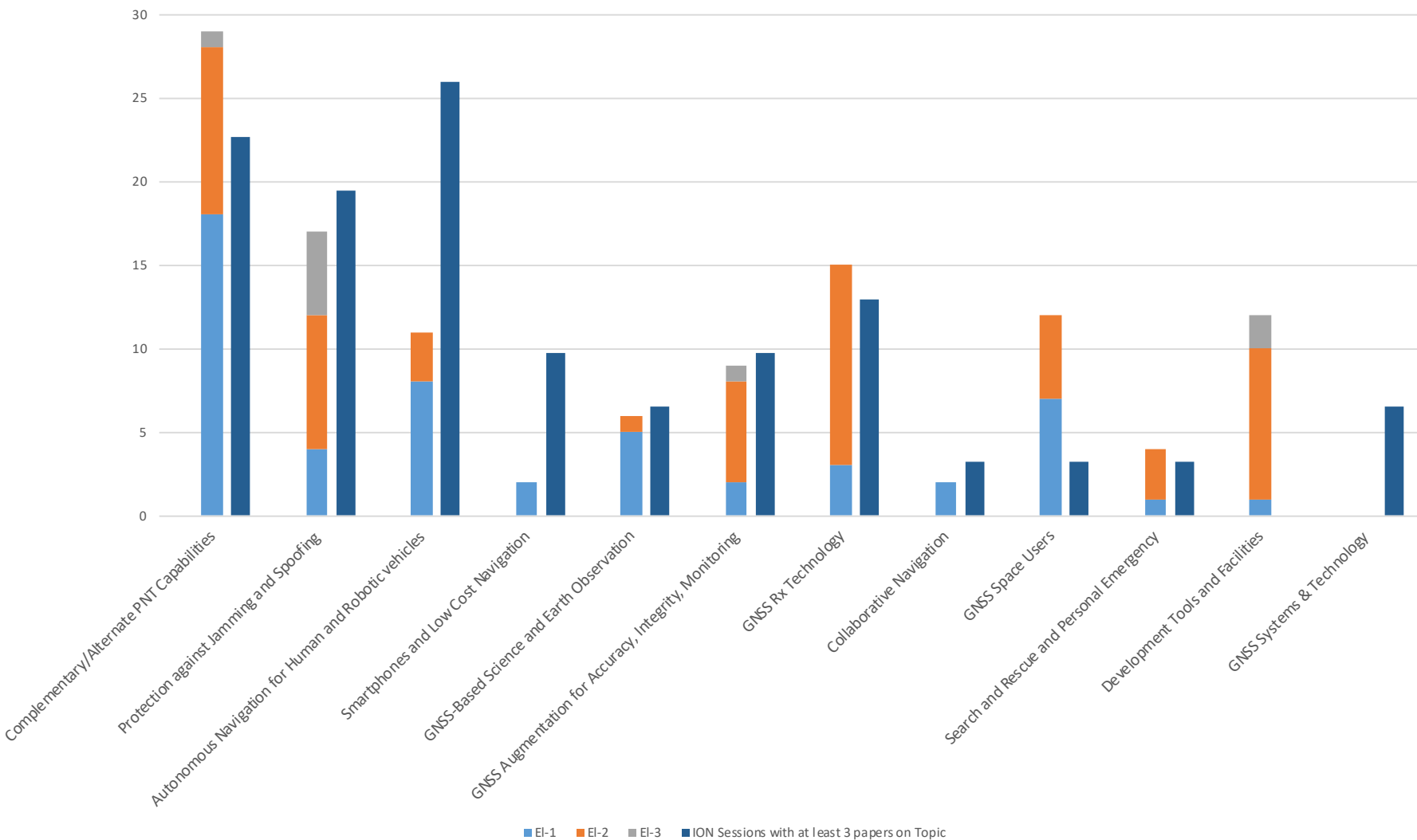
Number of ION19 Sessions/Panels with at Least 3 Papers on Topic



- 33 sessions and 5 panels
- Papers where GNSS is the only topic are a minority
- Complementary/alternate PNT capabilities, protection to jamming and spoofing and autonomous navigation techniques are the largest topics
- GNSS augmentations still raises a lot of attention despite the increase in performance of GNSS systems

Comparison with NAVISP

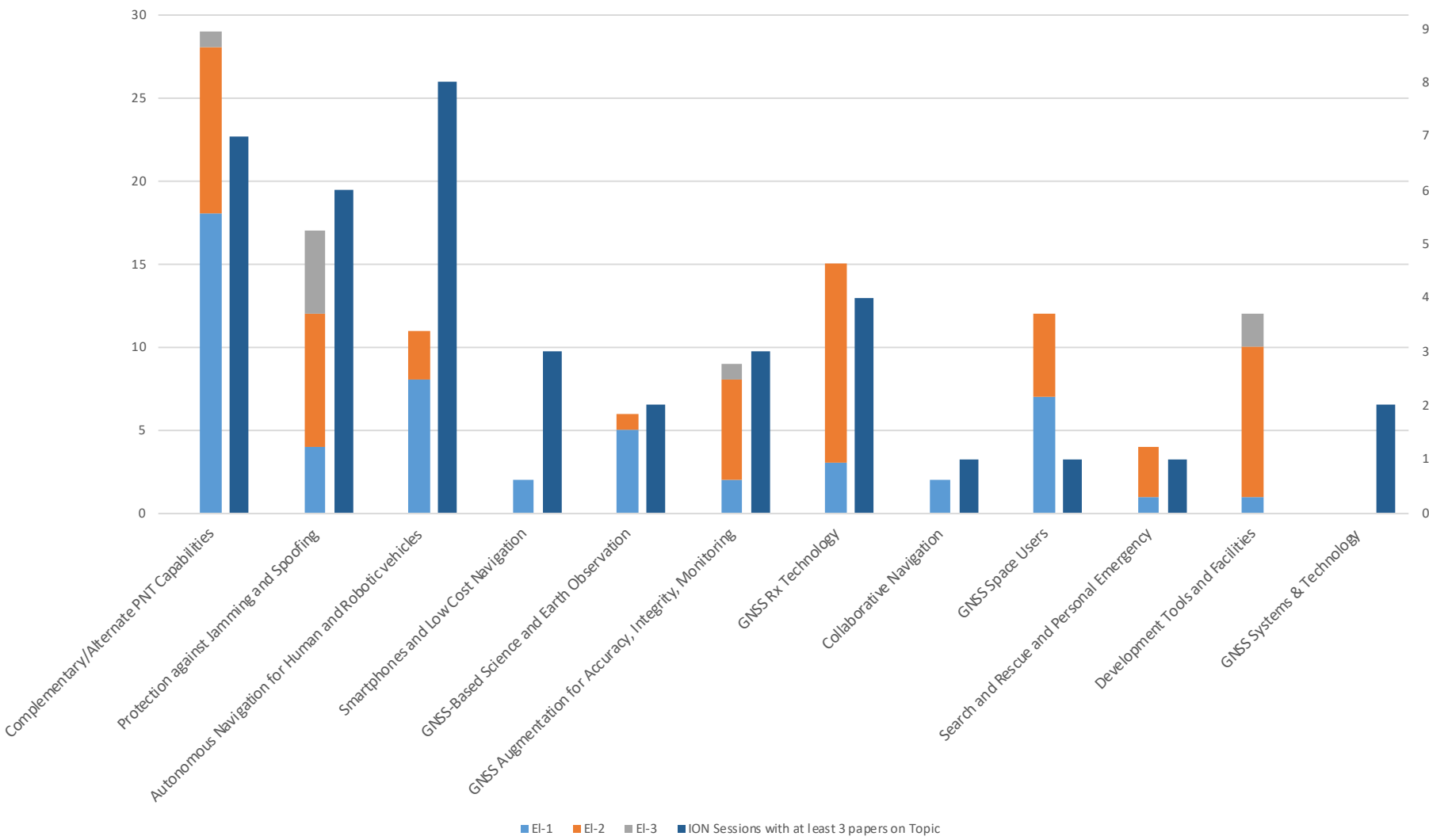
Number of NAVISP Activities Compared with GNSS+2019 Sessions on Same Topic



- 120 NAVISP activities
- In general, NAVISP follow the same trend as GNSS+19
- GNSS-only activities are a minority
- Complementary/Alternative PNT and protection to jamming and spoofing are a majority
- NAVISP Element 1 effort on Alternative PNT is visible
- Protection to jamming and spoofing is an area of interest at commercial (Element 2) and national level (Element 3)

Comparison with NAVISP

Number of NAVISP Activities Compared with GNSS+2019 Sessions on Same Topic



- The areas of Smartphones, Low cost Navigation, GNSS-based Science and Collaborative Navigation are mostly driven by Element 1 (not enough commercial attention yet)
- There is significant commercial interest in GNSS Augmentations, GNSS Rx Technology and Development Tools
- GNSS Systems and Technology not addressed in NAVISP, as per objectives.

- Alternative PNT

EI1: Quantum-Based Sensing for PNT



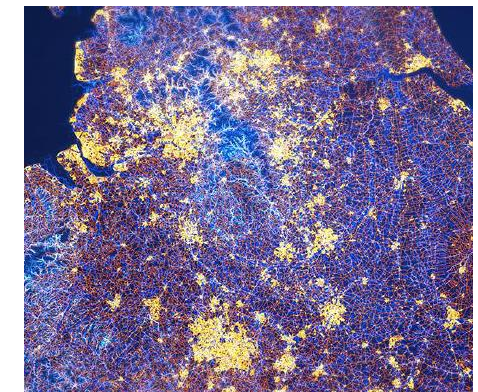
- Complementary PNT

EI2: ENERSYN
(GNSS + e-LORAN Timing Engine for
Smart Grids)



- Protection to Jamming and Spoofing

EI3: GNSS Event Service



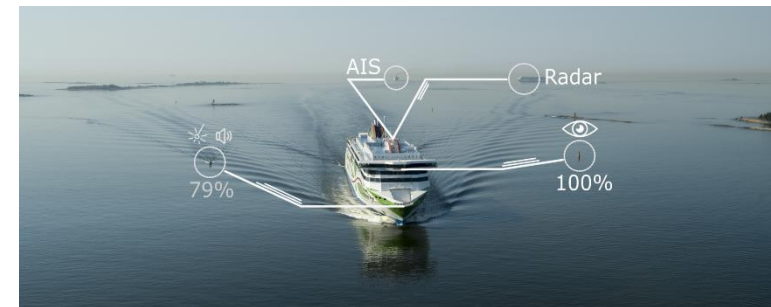
- Autonomous Navigation of Human Vehicles

EI2: Video odometry with Lidar and EGNSS for ERTMS Applications



- Autonomous Navigation of Robotic Vehicles

EI1: Artificial Intelligence / Machine Learning Sensor Fusion for Autonomous Vessel Navigation



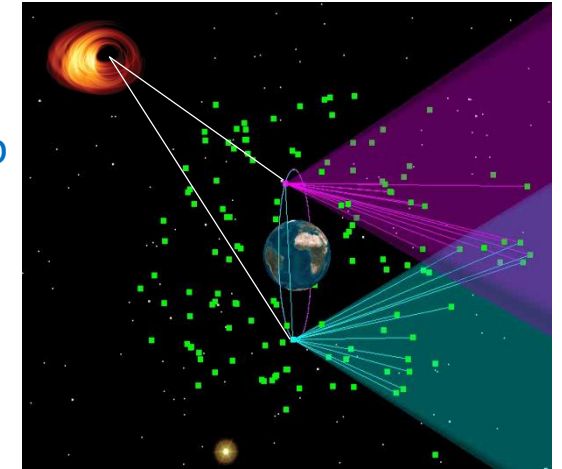
- Smartphones and Low Cost Navigation

EI1: Ultra-Low Power Device Positioning Concepts



- GNSS-Based Science

EI1: Precise Relative Positioning in MEO to support Science Missions



- GNSS Augmentations

EI2: Crowd-sourced platform for GNSS anomaly identification, isolation and attribution analysis



- GNSS Receiver Technology

EI2: MISSATO L1/L2/L5 Triband GNSS Antenna for Automotive



- Collaborative Navigation

EI1: Cooperative Positioning and Integrity
Concept in Vehicle Platooning



- Search and Rescue and Personal Emergency

EI2: SAR Second Generation Beacon



- Development Tools and Facilities

EI3: Trondheim Fjord Test Area



- NAVAC has found that NAVISP is doing well and on the way to achieve the programme objectives
- NAVAC found that NAVISP approach to support PNT innovation is right and it addresses a high level of innovation
- A comparison with the topics addressed at the last ION GNSS+ conference confirms the relevance of the NAVISP activities.
- The influence of the NAVISP Element drivers is clearly visible on each of the R&D topics. This provides useful guidance for the steering of the NAVISP portfolio of activities.



