NAVISP

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NAVISP Programme Manager

NAVISP INDUSTRY DAYS
ESTEC The Netherlands
17 January 2019
Cumulative Revenue 2015-2015 by market segment

- LBS: 43.4%
- Road: 50.0%
- Other: 6.6%
- Agriculture: 1.3%
- Surveying: 2.6%
- Aviation: 0.7%
- Maritime: 0.7%
- Timing & Sync.: 0.7%
- Rail: 0.1%
- Drones: 0.5%
Example of professional applications.

- Basic dGPS: 0.8 - 3m
- RTK: 1 - 2 cm
- High Quality dGPS: 20 - 80 cm
- Standalone GPS: 5 - 10 m
PNT unbalance...

$100,000,000,000$ invested + $6,000,000,000$ per year to run + 200,000 people in industry

1 Van Driver + 1 All GNSS & Map Spoofing equipment ($225)

PNT Out of Balance
Typical GNSS Vulnerabilities

- **Spoofing**
  - Covert
  - Deception

- **Multipath**

- **Interference**
  - Intentional
  - Unintentional

- **Cyber Attacks**
  - Non-RF

- **GNSS Segment Errors**
  - Erroneous upload data
  - SV Faults (e.g., SVN49)

- **Atmosphere**
  - Scintillation
  - Solar Activity
Jamming examples

Newark Intl EWR

Boston

Seconds, Minutes

Weeks +
**New technology**

- More GNSS satellites
- More GNSS signals
- Communications
  - WiFi / RFID
  - UWB, Sparse Band
  - Digital broadcasting
- Pseudolites, Locatalites
- Smaller, cheaper inertial sensors
- Digital mapping (outdoor & indoor)
- More processing power

**Drives new applications**

**New applications**

- Seamless indoor-outdoor personal navigation
- Intelligent Transport Systems
- Rail signalling & control
- Precision aircraft landing
- Ships in harbours
- Location-dependent billing
- Virtual security fences
- Tracking people/animals/assets
- Social inclusion

**Creates new challenges**

*Courtesy of Dr Paul Groves, UCL*
Why PNT? Ubiquitous Positioning

What is Ubiquitous Positioning?

- **Multi-sensor, low-cost and robust positioning**
  - Based on single or multiple users
  - Different types of platforms and sensors
  - Autonomous or cooperative navigation
- **Seamless transition when transitioning between different environments**
  - Different sensors
  - Different platforms
  - Different algorithms
- **Continuous positioning across all environments**
  - Open areas
  - Partially obstructed
  - Indoor
Adaptable PNT sensors and systems

**Global Navigation Satellite System**
- Present: GPS, GLONASS, WAAS, EGNOS
- Future: Galileo, BDS, QZSS, IRNSS

**Other Sensors**
- Present: Camera, Pilot, RADAR, magnetometer, etc.

**Signals of Opportunity**
- Future: Cell towers, SATCOM, Radio, TV, Lightning, etc.

**Inertial Sensors**
- Present: IFOG, RLG, MEMS
- Future: PINS-HIDRA, TIMU, C-SCAN, MRIG, PASCAL

**Clocks**
- Present: Cesium beam, Rubidium quartz oscillators, CSAC
- Future: QuASAR, IMPACT, MEMs

Adaptable PNT systems
Optimal solution algorithms;
Plug-and-play architectures

Source: DARPA Micro-Technology Office
**NAVISP**, the ESA programme designed to foster innovation & competitiveness of the European PNT sector

To leverage these upcoming opportunities, the European PNT sector will need to:

- Develop cutting-edge technologies & effective products & solutions
- Maintain & increase competitiveness of the research and industrial sectors to keep them at par with existing and emerging solutions worldwide

**Objectives of NAVISP**

- **Improve industrial innovation** and competitiveness at all industrial levels and all industrial sizes, and driving growth and jobs
- **Flexibility for MS** to target investments to support national objectives, under MS control
- Enables ESA MS to invest in developing industrial capacity, e.g. qualify **new entrants for the market**
- 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
- Designed to **avoid any duplication** with work funded by the EU under H2020 or Fundamental Elements
**NAVI$P The Programme Structure**

<table>
<thead>
<tr>
<th>Content</th>
<th>General principles for implementation of the activities</th>
<th>Lead for the definition of the activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELEMENT 1 [Innovation in Satellite Navigation]</strong></td>
<td>Analyses and developments linked to new and emerging design and operational concepts, techniques and technologies related to satellite navigation systems</td>
<td>ESA</td>
</tr>
<tr>
<td><strong>ELEMENT 2 [Competitiveness]</strong></td>
<td>Ad hoc technological &amp; product developments and pre-operational activities along the whole satellite navigation value chain in support of the competitiveness of the industrial sector in the participating Member States</td>
<td>Industry</td>
</tr>
<tr>
<td><strong>ELEMENT 3 [Support to Member States]</strong></td>
<td>Support to MS national Programmes &amp; Activities in satellite navigation and along the whole value chain</td>
<td>Member States</td>
</tr>
</tbody>
</table>

- **Competitive tender, 100% ESA funding on the basis of yearly work-plan adopted by PB NAV**
- **Continuous open call, unsolicited proposals, ESA co-funding (level of support to vary according to TRL level), MS support letter**
- **On request by MS, ad-hoc mechanism to be established on a case-by-case basis that ensures ESA’s full costs are met**
NAVISP Financial Status: Contributions.

Contribution to the financial envelope covering NAVISP phase 1:

<table>
<thead>
<tr>
<th>Participating States</th>
<th>Element 1</th>
<th>Element 2</th>
<th>Element 3</th>
<th>Total</th>
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<td><strong>33.5</strong></td>
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</table>
64% of the subscribed envelope already booked at only 33% of NAVISP lifetime.
NAVISP is off to a great start

- WP’s for Element 1 2017, 2018 and Addendum are being implemented: 19 contracts already awarded for a total of 39 approved activities including WP2019

- Element 2 activities have been incubated at a very fast pace together with several Member States and key European PNT stakeholder for a total of 50 activities

- Element 3 has also been rapidly implemented since recent kick off

- 64% of the total available funds already engaged

- Several NAVISP activities very much linked to the broader PNT sector and partnerships with new non-space entrants
NAVISP motivation to participate

- The Programme is managed with 15% of overhead
- IPR remains with the Contractor
- All information is treated as commercial sensitive
- Transferable product ownership upon contract completion
- ESA partnering and facilitating the procurement and execution
NAVISP on the way....

- **Further MS’s subscriptions** to NAVISP are already materialising:
  - New Participant States, with Germany that joined in Q3 2018
  - Increase of subscribed amount, e.g. Poland

- **A High-Level NAVISP Advisory Committee (NAVAC)** has been set-up to support the programme with external expert advice
NAVAC Rationale

- NAVISP aims to foster innovation on the PNT field while supporting industry and member states interests.

- NAVISP portfolio of activities is quite heterogeneous: mix of ESA-driven, industry-driven initiatives, namely bottom-up in an attempt to capture the broad scope of NAVISP.

- Is the NAVIPS portfolio complete? Is it meeting the needs of an evolving and highly competitive PNT market?

- An advisory committee of high-profile experts has been set up to provide an external view to help ESA in answering the above questions.

  • NAVAC: NAVigation Innovation and Support Programme Advisory Committee
NAVAC Composition

• 5 members appointed in Sept 2018:

  Roger Mc Kinlay  Chair
  Stefano Debei    Member
  Peter Grognard  Member
  Bernd Eissfeller Member
  Luis Mayo       Member

• NAVAC Secretariat provided by ESA: Rafael Lucas
- Challenge Director – Quantum Tech, for UK Research and Innovation.
- Previous member of the National Quantum Technologies Programme Strategic Advisory Board and Panel member of 2016 Blackett Review on Quantum technologies.
- Occupied several technical, management and strategy positions in the oil and gas, civil aviation, defence, security, maritime and rail industries.
- Past president of the Royal Institute of Navigation.

- Professor in Mechanical Thermal Measurements Space Robotics, Universita' degli Studi di Padova, Italy.
- Director of Centre for Studies and Activities for Space “G. Colombo”.
- Technical Manager of BepiColombo’s Instrument SYMBIOS-SYS.
- Co-principal investigator of DREAMS, environmental and meteorological experiment for Exomars 2016.
- Technical responsible for the wide-angle camera in Rosetta OSIRIS telescope.
- Member of NASA’s Mars Exploration Programme Analysis Group (MEPAG).
- Author of more than 200 publications. 3751 citations.

- Managing Director of the Von Karman Institute for Fluid Dynamics.
- Till 2017, Managing Director of the new Thales Alenia Space site in Leuven developing new generation of spacecraft & launcher electronics.
- Founder and manager of Septentrio until 2014. Septentrio receivers have played a fundamental role in the Galileo programme.
- Previously, satellite navigation business development manager at the Interuniversity Microelectronics Center in Belgium
- 1994-1998 S&T attaché at the Embassy of Belgium in Washington
- 1993-1994, member of the Belgian Delegation to ESA.

- Director of Space Applications, Institute of Space Technology & Space Applications, and Professor of Navigation at Faculty of Aerospace Engineering, Universität der Bundeswehr, München(02), Germany.
- Member of several advisory groups to the EC, CSI WG, CS-WG, and WG Evolutions, Member of Program Board Communication & Navigation at DLR Organizer of the Munich Satellite Navigation Summit
- Member of the US ION, Member of German Institute of Navigation (DGON)
- Formerly, at Kayser-Threde GmbH pioneering R&D on GNSS integrity monitoring.
- More than 250 scientific and technical publications.

- Managing Partner Enfi Strategy Consulting S.L., Madrid, Spain
- Formerly, Chairman and CEO of Tecnobit, the Aerospace and Defence branch of Grupo Oesia
- Formerly, CEO of Grupo GMV. Under his leadership, GMV became the world leader among the suppliers of satellite control centers
- Member of the Board of Directors of Galileo Sistemas y Servicios S.L., Galileo Industries S.A. and ENSIS GmbH
- Contributor to the Spanish National Space plans’ definition. Member of the Advisory Committee for Space Matters of the Spanish Centre for National Defence Studies. Full member of the French Air and Space Academy.
NAVAC Work Status

• NAVISP Element 1 WP2019 comments:
  - Portfolio of activities supported

• Recommendations for future WPs:
  - Increase of activities portfolio addressing integration of space/non space sensors
  - Strengthen link between use-cases and proposed solutions
  - Acceleration of schedule in Proof-of-Concept projects
  - Cross linking of activities results

• Evaluation of achievements of NAVISP phase I by mid 2019 in support of NAVISP phase II programme proposal preparation
NAVISP Outreach

• Outreach events:
  - participation/presentation of NAVISP in many fora
  - dedicated national workshops

• Other outreach activities:
  - operational website: https://navisp.esa.int
  - flyers
  - video
The NAVISP Portal

A web portal serves as a “gateway” to the NAVISP programme.

The goals of this portal is:

- Serve as a ‘notice board’ for NAVISP calls, ITTs, news stories, events, workshops
- Repository of documentation and information / education tool for user
- Promotional tool for NAVISP activities (workplan, ongoing projects, etc.)
- Promotional tool for NAVISP actors (list of actors involved contacts, etc.)
- A central single entry point (of contact) for all NAVISP

[https://navisp.esa.int](https://navisp.esa.int)
Solicited by the increasing interest of Member States, ESA is preparing NAVISP Phase II in view of Cmin 2019 doubling the funding request from to 20 to 40 MEuro per year.
The way to CMIN 2019

- 7 Feb PB-NAV 2019: draft Programme Proposal submission

- 8 March 2019 Potential Participants meeting: fine-tuning of the Implementing Rules

- 9 May PB-NAV 2019: Programme Proposal finalisation, Implementing Rules updated and Declaration