

navisp

Industry Days 2022

Session 2: Element 1

"Enabling PNT Innovations Along the Value Chain"

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NAVISP Industry Days 2022



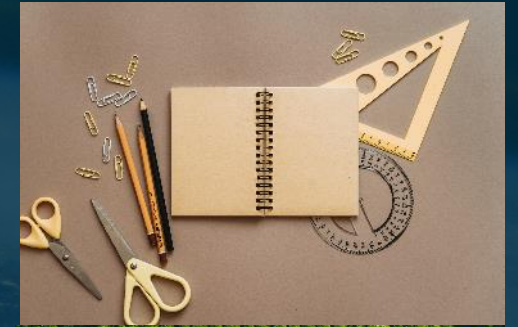
Session 2: NAVISP Element 1 - "Enabling PNT Innovations Along the Value Chain"			
	Topic	Speaker	Organization
13:15	Introduction	S.Binda	NAVISP Element 1 Manager, ESA
13:30	Robust GNSS+, PNT Innovation for Autonomous Vehicles	H.Kuusniemi	Dir&Prof. Wasa University, R&D Prof. Finnish Research Institute
14:00	013 bis-Quantum Based Sensing for PNT	B. Battelier	iXblue/Laboratoire Photonique Numerique Nanosciences (FR)
14:20	020-Artificial Intelligence/Machine Learning Sensor Fusion for Autonomous Vessel Navigation	T. Malkamäki	National Land Survey of Finland (FI)
14:40	026-Enabling Ultra-High Accuracy Positioning in Challenging Environments	P. Henkel	ANavS (DE)
15:00	Q&A		
15:15	Tea Break		

nauisp Element 1 Objectives

Perform feasibility studies and viability analysis for the emergence of new concepts in the PNT world (both upstream and downstream)

Contribute to the formulation and implementation of PNT technology strategies and roadmaps

Proof of concept of promising PNT-based services



navisp Element 1 strenghts

70

Funds engagement % (45M€ subscribed)

60

Element 1 contracts awarded

50

Funds % allocated to PNT technology Innovation objective

15

ESA's overhead % on Participating States' contribution



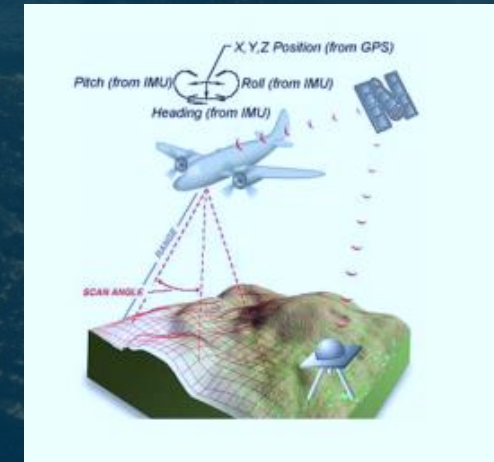
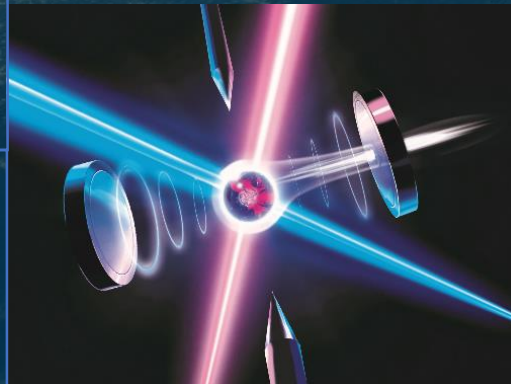
Technologies linked to PNT – on display

Equipment

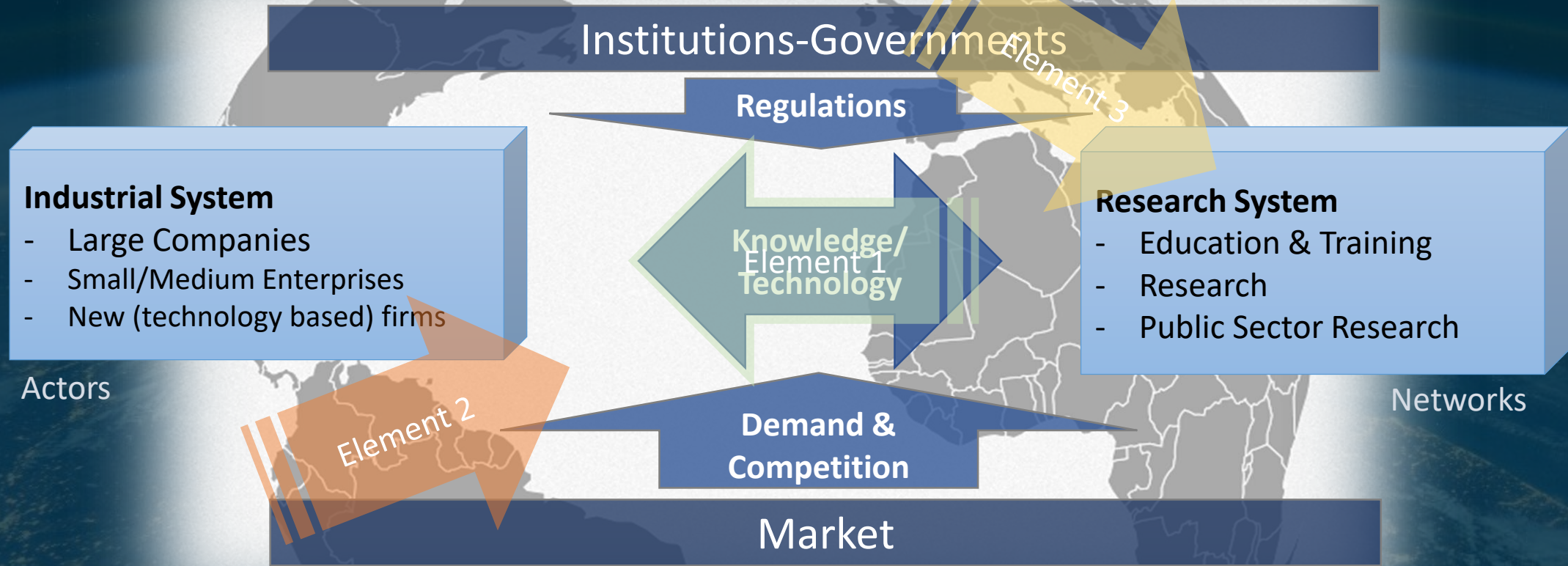
- Innovative Clocks
- Communications (5G, LEO, Laser)
- WiFi (Round Trip Time) / RFID / UWB
- Pseudolites, Locationalites, Reflective Intelligent Surfaces
- Low Frequency (eLoran,...)
- Celestial (Pulsar, Sun, Moon, Stars,...)
- Smaller, cheaper, more accurate inertial sensors
- Magnetic, barometer, sonar
- IR, Lidar and Visual Cameras
- Quantum / Photonics
- Cryptography
- Biosensors
- Multipath, interference, impairments detection and mitigation

Processing/System

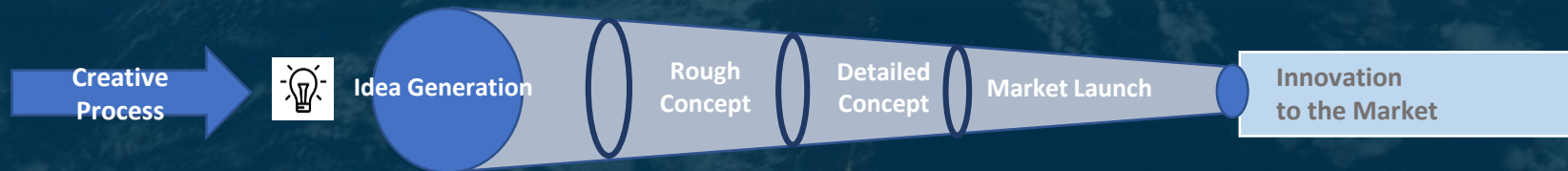
- High processing power
- Robustness, Resilience
- Sensor fusion
- Cooperative processing (platooning, formation flying...)
- Autonomy
- Integrity
- Digital mapping (outdoor/indoor)
- 3D Mapping aiding (Simultaneous Localization And Mapping)
- Artificial Intelligence/Machine Learning



Element 1 component of navisp Innovation Process



Courtesy S.Bandau



- Addressing innovative PNT concepts, techniques and technologies
- From NAVISP Advisory Committee:
 - Autonomous Transport and Green Mobility
 - Seamless PNT applications for Industry 4.0, e.g. for indoor infrastructure logistics
 - Alternate PNT timing, alternative or complementary to GNSS
 - PNT Robustness and resilience

Element 1 Workplan 2022

ID: Title	Status	Budget (k€)
NAVISP-EL1-063 RIS-aided wireless localization and mapping	Seamless PNT applications	
NAVISP-EL1-064 Block-box for an optimised GNSS spectrum monitoring network using AI	PNT Robustness and resilience	
NAVISP-EL1-065 eLoran antenna for handheld devices	Alternate PNT	
NAVISP-EL1-066 Deeply Coupled GNSS Vector tracking loop robust solution for autonomous vehicle	Autonomy	
NAVISP-EL1-067 Precision Agriculture - High precision coordinate and alignments transfer	Autonomy	
NAVISP-EL1-068 Biosensor and PNT Integration	Innovative PNT	
NAVISP-EL1-069 Enabling high performance PNT in lunar environment	linked to Moonlight	
NAVISP-EL1-070 Advanced MEOSAR Test Beacon Setup	linked to Demonstration Centres	

Find “Tender Actions” (ITTs) and submit bids



- navisp.esa.int general info
- <https://esastar-publication-ext.sso.esa.int/> official

The screenshot shows the search results page for 'EL1' on the ESA Star Publication website. The page displays four tender actions, each with a status label, title, description, and key dates.

ID	Title	Status	Description	Announcement Date	Open Competition	Closing Date
1-11071	NAVISP EL1-061: NAVIGATION PAYLOAD DEMONSTRATOR OF FUTURE LCNS SATELLITES	Intended	In complement to the Agency's Lunar Communications and Navigation Services (LCNS) Phase A/B1 system study, this activity will provide a detailed assessment of the critical technologies associated with the Navigation Payloads on-board the future lunar orbiting satellites, whose main function is to provide additional navigation signals from lunar orbit to future cis-lunar users (e.g. moon orbiters, moon landing/ascent and moon surface operations). The activity aims to develop an Elegant BreadBoard (EBB), including all critical functionalities of the future payload flight models. This EBB should provide a good indication/reference of the achievable performance for this payload and of the associated mass/power/thermal/size/environmental and interface requirements, as well as confirming the compliance against the LCNS system concept and system performance allocated to the navigation payload. This activity will also define the specifications for the navigation antenna.	03/11/2021	Yes	
1-11087	NAVISP-EL1-062: LUNAR SURFACE PNT BEACON DEMONSTRATOR	Intended	In complement to the Agency's Lunar Communications and Navigation Services (LCNS) Phase A/B1 system study, this activity will provide a detailed assessment of the critical technologies associated with the a PNT beacon transmitter/reference station, which may complement future LCNS satellites, providing additional ranging sources (from the Moon's surface) and supporting their accurate orbit determination as well as having the potential to provide localised relative positioning and to support selenodetic/scientific applications. This Moon PNT beacon element may as such, become an essential subsystem of the future LCNS system, providing significant benefits to future lunar PNT users (e.g. moon landing/ascent and moon surface operations). The objective of this activity is to develop an Elegant BreadBoard (EBB) of a PNT Moon surface Beacon and Reference Station demonstrator as part of the future LCNS System. An EBB in this context is a candidate model of the final LCNS lunar surface station that is in between a simple Breadboard and an Engineering Model in terms of representativeness and Technology Readiness Level (TRL).	03/11/2021	Yes	
1-11043	NAVISP-EL1-052: ROBUST NAVIGATION OF AIRBORNE AUTONOMOUS SYSTEMS WITH CARRIER PHASE OF ARNS SIGNALS	Intended	In the search for robust and resilient positioning alternatives, users have already looked at signal-of-opportunity (SOOP) techniques that make use of radiofrequency signals broadcasted for different purposes (e.g. wireless, TV, etc.). In recent studies, the feasibility of using carrier phase positioning techniques has also been demonstrated over the cellular networks and other types of SOOP. It is therefore envisaged that similar techniques could also enable high-accuracy alternative PNT solutions for UAV, if they are based on reliable and certifiable signals-of-opportunities such as the Aeronautical Radionavigation Service (ARNS) signals. In order to use ARNS signals in safety-critical UAV operations such as autonomous landing, take-off and BVLOS navigation, one would also have to be guaranteed on a certain level of trust in the PNT solution and be provided with timely alerts when the criticality threshold is exceeded. Although the consolidated knowledge on safety cases and feared events for UAV operations is not yet mature, the precise characterisation (e.g. position and clock parameters) of ARNS transmitters could facilitate the definition of integrity, integrity risks, and integrity monitoring concepts. This activity aims at developing an ...	18/10/2021	Yes	
1-10897	NAVISP-EL1-056: ADVANCED ALGORITHMS AND TECHNIQUES FOR RESILIENT TIME PROVISION - EXPRO+	Issued	This activity comprises the review, analysis, development, implementation and validation of advanced techniques and algorithms for the generation of a resilient time reference based on a multiplicity of time sources (local clocks, GNSS, NTP, PTP/WR, signals of opportunities etc.). In particular and as a minimum, algorithms based on hybrid (frequency-time) Kalman filters and including machine-learning techniques shall be considered. The software algorithms will be combined with hardware prototypes in order to validate the performance for both high-end metrological users and commercial users.	04/10/2021	Yes	27/10/2021 23/12/2021



- Objectives confirmed
- NAVAC Recommendations
 - maintain the non-GNSS-centric view with the objective to enhance the robustness of the user's PNT
 - encourage the participation of a wider number of member states due to the positive effect on competition
 - monitor the capability to generate follow-on industrial initiatives in the PNT sector
 - include more activities to reduce regulatory risk related with the introduction of existing PNT technologies in new markets (e.g. Proof-of-Concept or demonstration activities)
 - strengthen the relationship with other public bodies, industry associations or institutions to improve effectiveness
 - discuss with non-space European key players in the GNSS/PNT markets
 - support to key PNT technology developments, e.g. GNSS chips, should be strengthened
 - implement a higher research culture by stretching the scope of activities, including high risk activities
- ESA's Executive
 - Specific technologies development prospective studies
 - Element 1 Workpackage to follow up in Element 2
 - Follow up Element 2 Thematic calls (PNT in 5G/Assisted GNSS with Imaging Sensors and 3D models for Mobility Applications)

Thanks for your attention!



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For additional questions: navisp@esa.int

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