



EUROPEAN
NAVIGATION
CONFERENCE 2024

ESA ESTEC, Noordwijk
THE NETHERLANDS

PROGRAM

22-24 MAY 2024

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PROGRAM

22 - 24 MAY 2024

WELCOME

On behalf of EUGIN, RIN and NIN: a very warm welcome to ENC 2024!
 We hope you can gain knowledge and insights, and grow your connections, all while having an enjoyable experience at ENC 2024 this week.

Best wishes,

Terry Moore, Chair, European Group of Institutes of Navigation
John Pottle & Clare Stead, Royal Institute of Navigation, Co-lead Institute ENC 2024
Bart Banning, Netherlands Institute of Navigation, Co-lead Institute ENC 2024



WEDNESDAY 22 MAY, 2024

08.30	Welcome Coffee	TENNIS HALL EXHIBITION (08.30 - 19.30)
10.00	PLENARY - WELCOME AND OPENING	HIGH BAY
<i>Chair: John Pottle, RIN</i>		
10.00 - Welcome from ENC 2024 Programme Chairs		
<i>Prof. Terry Moore, Chair European Group of Institutes of Navigation, Co-Chair ENC 2024 Technical Programme Committee</i>		
<i>Dr. Ramsey Faragher, Chair, RIN Technical Committee, Co-Chair ENC 2024 Technical Programme Committee</i>		
10.10 - ESA Shaping the Future of Navigation - <i>Marco Falcone, Head of Future Navigation, ESA</i>		
10.30 - Moving from Positioning to Resilient Navigation - <i>Gerhard Berz, Head of Navigation and Spectrum, Eurocontrol</i>		
10.40 - US GPS Briefing - <i>Col Stephen A. Hobbs, Vice Commander - PNT Delta (Provisional)</i>		
11.00	Coffee Break (TENNIS HALL)	

TRACKS:

- Algorithms and Methods
- Multi-Sensor and Autonomous Navigation
- Safety Critical Navigation
- Future Trends in Navigation
- Navigation for the Mass Market

WEDNESDAY 22 MAY, 2024 - CONTINUED

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2	EINSTEIN
Session	Interference, Jamming & Spoofing - 1 -	Multi-Sensor Systems for UAVs	High Accuracy Algorithms & Technique	Space, Lunar & Extra-Terrestrial Navigation - 1 -	PNT in Urban & Indoor Environments - 1 -
Chairs	Washington Ochieng & Mireille Elhaj	Cynthia Robinson & Ivan Petrunin	Oliver Montenbruck & Mohammad Zahidul Bhuiyan	Dimitrios Psychas & Tíre Macleod-Nolan	Vaclav Navratil & Alain Geiger
11.45	GNSS Jamming observed on Sounding Rocket Flights from Northern Scandinavia Dr. Benjamin Braun Scientist DLR, Germany	Reinforcement Learning for UAV Path Planning Under Complicated Constraints with GNSS Quality Awareness Dr. Zhengjia Xu Research Fellow in Position, Navigation and Timing Cranfield University, United Kingdom	Galileo HAS Accuracy and Convergence Performance Results Pedro Pintor GNSS Engineer Spaceopal, Spain	Positioning of a Lunar Lander using a Lunar Communication and Navigation System assuming realistic ODS Mr. Yoann Audet Navigation Engineer ESA, The Netherlands	Analysis of GNSS Signal Correlation in Terrestrial Vehicles Dr. David Gómez-Casco Radio Navigation Engineer ESA, The Netherlands
12.05	Low Cost SDR for GNSS Interference Mitigation Using Spatial Diversity Techniques Ms. Lucía Pallarés-Rodríguez Master's Student Universitat Autònoma de Barcelona, Spain	DEGREE (DronEborne Galileo Receiver) Flight Testing of a GNSS Receiver for Specific Category UASs Operations Dr. Fabio Bernardi Radio Navigation Engineer Qascom Srl, Italy	Combining Free-of-charge High Accuracy Services: Potential and Outlook Mr. Jorge Rocamora GNSS Engineer GMV, Spain	A Novel Navigation Message for Future LCNS Mr. Richard Swinden Navigation System Engineer ESA, The Netherlands	Two Stages Beamforming Technique for GNSS Applications Dr. Noori Bni Lam Research Fellow Noori BniLam, The Netherlands
12.25	Improving Structural Power Content Analysis robustness for Satellite Navigation Applications MSc Jelle Rijnsdorp Team Lead PNT S&JT, The Netherlands	Integrity Aspects of using Factor Graphs for Cooperative Swarm Navigation of UAVs in Challenging Environments Prof. Dr. Ir. Maarten Uijt de Haag Professor Tu Berlin, Germany	Establishing a Large-Scale Network PPP-RTK through Decentralized Architecture with a Common Pivot Station Mr. Cheolmin Lee Researcher Maritime PNT Research Office, South Korea	An assessment of Relative Positioning Capabilities on the Lunar Surface Dr. Dimitrios Psychas Radio Navigation Engineer ESA, The Netherlands	Resilient Time Dissemination Fusion Framework for UAVs for Smart Cities Mr. Sorin Andrei Negru Researcher Cranfield University, United Kingdom
12.45	Jammertest 2023 Event Report Test Campaign and Timing Support Infrastructure Dr. Aiden Morrison Senior Researcher Sintef As, Norway	UAV Positioning System Utilizing Radionavigation Signals: Hardware Design and Initial Evaluation Mr. Mudassir Raza Research Fellow in PNT Applications Cranfield University, United Kingdom	A Dual-Frequency Assisted Single-Frequency Carrier Phase Outlier Estimation Method Integrating Quasi-Accurate Detection and Data Snooping Guoliang Liu Nanjing Southeast University, China	An alternative PNT Solution for Future Lunar Navigation: the NAVCOM Experiment Matilde Boschiero Mission/operations System Engineer Qascom Srl, Italy	Investigation of Static and Kinematic Surveying Performance of Handheld GNSS Receiver Prof. Reha Metin Alkan Professor Dr. Istanbul Technical University, Turkey

13.05

Lunch Sponsored by UrsaNav
(TENNIS HALL)



14.40	ESTEC Navigation Lab Tour 1 at 14.40 - 15.10	MEETING POINT: Newton Foyer (pre-registration required)
15.20	ESTEC Navigation Lab Tour 2 at 15.20 - 15.50	MEETING POINT: Newton Foyer (pre-registration required)

WEDNESDAY 22 MAY, 2024 - CONTINUED

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2	EINSTEIN
Session	Advanced GNSS Techniques - 1 -	Multi-Sensor & Augmented PNT	Interference, Jamming & Spoofing - 2 -	Space, Lunar & Extra-Terrestrial Navigation - 2 -	PNT in Urban & Indoor Environments - 2 -
Chairs	Mohammad Zahidul Bhuiyan & Frank Zimmermann	Ivan Petrunin & Baochen Zhang	Ali Broumandan & Barend Lubbers	Richard Peckham & Tom Willems	Alain Geiger & Terry Moore
14.30	Galileo Time System Monitoring as Key Element to boost Timing Applications - early G2STB Capabilities Mr. Jorge Rocamora GNSS Engineer GMV, Spain	DIVERGENCE - Diversity Architecture for Robust GNSS/INS Navigation in Launcher Applications Mr. Fabio Scibona Qascom Srl, Italy	On the edge Model-aided Machine Learning GNSS Interference Classification with low-cost COTS Hardware Mr. Simon Kocher Research Associate Fraunhofer Institute For Integrated Circuits IIS, Germany	Study of Proposed Signal-in-space Monitoring Strategies for a Lunar Navigation System Mr. Daniele Musacchio Navigation Performance Engineer Thales Alenia Space Italia, Italy	Software-Defined VTL GNSS Receiver with AI-enhanced Resilience in High Dynamics and Stringent Conditions Dr. Zhengjia Xu Research Fellow in Position, Navigation and Timing Cranfield University, United Kingdom
14.50	Constraining Receiver Clock Parameter in GNSS Solutions - Impact on Positions and Clocks MSc Marcin Mikoś PhD Student Wroclaw University of Environmental and Life Sciences, Poland	Radar Altimeter Inertial Vertical Loop - Multisensor Estimation of Vertical Parameters for Autonomous Vertical Landing Dr. Tomas Vaispacher Sr. R&D Scientist Honeywell International, Czech Republic	Impact on COTS Receivers from Live GNSS Interference Dr. Oscar Isoz Researcher RISE, Sweden	Space Qualified VPU Benchmarking of Crater Matching ODTS solutions based on Convolutional Neural Networks Mr. Cristian Iacurto System Engineer Thales Alenia Space Italia, Italy	Terrain Based Parameter Optimization for Zero-Velocity Update Inertial Based Navigation Solutions Mr. Taylor Knuth PhD Candidate University College London, United Kingdom
15.10	Optimised Signal Selection Algorithm for Acquisition and Re-acquisition in Multi-Constellation, Multi-Frequency GNSS receivers Dr. Rajesh Tiwari Senior Scientist QinetiQ, United Kingdom	Evaluation and Simulation of UWB Transceiver Timebases Mr. Vaclav Navratil Assistant Professor Czech Technical University In Prague, Faculty of Electrical Engineering, Czech Republic	Jamming and Spoofing Detection and Classification Performance under Hostile GNSS Environments Dr. Ali Broumandan Resilient GNSS Lead NovAtel, Canada	Taking PNT to the Moon: Ensuring Lunar PNT Mission Success through Simulation Mr. Ricardo Verdeguer Moreno Product Manager Defence and Space Spirent, Spain	On Integrity Monitoring for GNSS velocity Mr. Dennis Kulemann PhD Student Leibniz University Hannover, Institute For Geodesy, Germany
15.30	Adaptive Divided Difference Filter on Manifolds for INS-GNSS Integration Dr. Mehran Khaghani Principal Research Engineer U-blox, Switzerland	Improving Navigation Resilience by using B-splines in the Sensor Fusion of Multiple Inertial Measurement Units Mr. Marcel Maier PhD Researcher Institute of Navigation, University of Stuttgart, Germany	Early Detection of Coherent GNSS Spoofing Attacks with Cluster Analysis at Receiver Acquisition Stage Dr. Jan Michael Becker Research associate Federal Agency for Cartography and Geodesy, Germany	Architectures for the precise Timing and Synchronisation of Future Geosynchronous Coherent Systems Mr. Max Rigby Systems Engineer Satellite Applications Catapult, United Kingdom	Securing GNSS Signals: a Software Solution for Galileo Signal Authentication Mr. Adrian Chamorro Moreno GNSS Engineer GMV, Spain

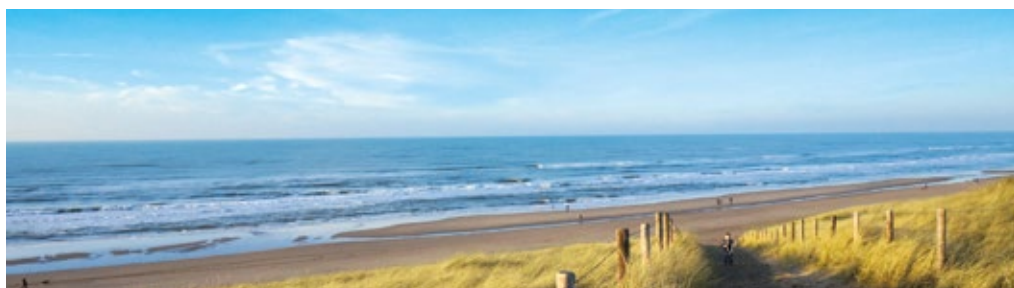
15.50

Coffee Break (TENNIS HALL)

16.45

ESTEC Test Centre Tour 1 at 16.45 - 17.15

MEETING POINT: Newton Foyer (pre-registration required)



WEDNESDAY 22 MAY, 2024 - CONTINUED

Room	HIGHBAY	AUDITORIUM	NEWTON 1	NEWTON 2	EINSTEIN
Session	Urban & Indoor Environments	Advanced GNSS Techniques - 2 -	Space, Lunar & Extra-Terrestrial Navigation - 3 -	Interference, Jamming & Spoofing - 3 -	New Technologies, Opportunities & Challenges
Chairs	Mireille Elhaji & Cynthia Robinson	Charles Schue & Vaclav Navratil	Richard Peckham & Richard Swinden	Ali Broumandan & Barend Lubbers	Terry Moore & Hans Visser
16.30	Integrating Multi-Sensor Augmented PNT for Enhancing Outdoor Human Motion Capture Using Low-Cost GNSS Receiver Mr. Andrea Maffia PhD Student Unige, Italy	Deriving a Dilution of Precision Indicator for GNSS Factor Graph Optimization Solutions Dr. Paul Thevenon Assistant Professor Enac, France	Lunar PNT Beacon and Reference Station Concept Study Dr. Stefano Bonafini R&D Engineer Qascom Srl, Italy	Jamming and Spoofing Campaign in Norway: Receiver Performance Analysis Mr. Wim De Wilde Oem Platform Team Lead Septentrio NV, Belgium	Cosmic Ray Muons for Positioning and Navigation in GPS/GNSS Denied Locations Prof. Lee Thompson Technical Director Geoptec, United Kingdom
16.50	WiFi-RTT SLAM: Pedestrian Navigation in Unmapped Environments using WiFi-RTT and Smartphone Inertial Sensors Mr. Khalil Raja PhD Researcher University College London, United Kingdom	On Maximum Tolerable Multipath for Successful Meta-signal Subcarrier Ambiguity Fixing Mr. Mohamed Bochkati Senior Research Associate University of the Bundeswehr Munich, Germany	Improvement of PNT Performances using DLCNS in the Lunar Navigation System Dr. Marco Fortunato Thales, Italy	UWB-based Positioning is not invulnerable from Spoofing Attacks: A case study of Crazyswarm Mr. Mahyar Shariat TU Wien, Austria	Long-Term Analysis of Sentinel-6A Orbit Determination: Insights from Three Years of Flight Data Mr. Daniel Calliess Student TU Delft, The Netherlands
17.10	Tightly coupled Low-cost GNSS-RTK/INS/Odometer Integration via Factor-Graph-Optimization Aided by GNSS Outlier Mitigation in Urban Canyons Mr. Baoshan Song PhD Student The Hong Kong Polytechnic University, Hong Kong	An end to end Solution Towards Navigation Message Authentication utilizing Open Source FGI-GSRx and FGI-OSNMA Prof. Mohammad Zahidul Bhuiyan Professor Finnish Geospatial Research Institute, Finland	Resilient Cis-lunar Navigation through a Novel Approach using Satellite-to-satellite Tracking Links and X-ray Pulsar Observations Dr. Zhengan Zhu Senior Engineer DFH Satellite Co., Ltd., China	Field Test Results of QZSS SAS (Signal Authentication Services) for QZSS, GPS and Galileo Signals Dr. Dinesh Manandhar Associate Professor The University of Tokyo, Japan	Environment Characterization Using GNSS Data: a Preliminary Analysis Mr. Giovanni Cappello PhD Student University of Naples "Parthenope", Italy
17.30	Enhancing GNSS Robustness in Automotive Applications with Supercorrelation: Experimental Results in Urban and Under-foliage Scenarios Mr. Javier Gonzalo Garcia Perez Principal GNSS Engineer Focal Point Positioning, United Kingdom			Sensitivity Analysis of Galileo OSNMA Cross-Authentication Sequences Mr. Aleix Galan PhD Student KU Leuven, Belgium	GENESIS: an ESA Mission for the benefit of Navigation and Science Dr. Pierre Waller Engineer ESA/ESTEC, The Netherlands

18.00 - 19.30

Ice Breaker Drinks Reception (TENNIS HALL)



THURSDAY 23 MAY, 2024

08.30 Welcome Coffee **TENNIS HALL**
EXHIBITION (08.30 - 18.00)

09.00 PLENARY - LEADERSHIP IN PNT **HIGH BAY**

Chair: Washington Ochieng, Head of Civil and Environmental Engineering, Imperial College London, Vice President RIN
09.00 - Electronic Warfare and its Civil Spillover Effects - *Prof. Todd Humphreys, Professor of Aerospace Engineering, The University of Texas at Austin*
09.15 - UK Space Agency Briefing - *Harshbir Sangha, Missions and Capabilities Director, UK Space Agency*
09.30 - EGNOS present and future - *Hélène Gauthier, Exploitations, services and evolution of European GNSS, EC*

10.10 ESTEC Navigation Lab Tour 3 at 10.10 - 10.40 **MEETING POINT: Newton Foyer (pre-registration required)**

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Advanced Methods for Aviation Application	Artificial Intelligence & Machine Learning	Interference, Jamming & Spoofing - 4 -	Space, Lunar & Extra-Terrestrial Navigation - 4 -
Chairs	<i>Bart Banning & Nadezda Sokolova</i>	<i>Geraint Ffoulkes-Jones & John Pottle</i>	<i>Todd Humphreys & Mike Turner</i>	<i>Allison Kealy & Giorgio Taylor</i>
10.00	Flight-test Results of Separation Assurance Methods for joint Manned, Unmanned Aircraft Operations using GNSS-Measurement-based ADS-L <i>Mr. Benjamin Lochow</i> <i>Technische Universität Berlin, Germany</i>	Multiple Gyroscopes Calibration: A Deep Learning Approach <i>Mr. Yair Stolero</i> <i>MSc Student</i> <i>University of Haifa, Israel</i>	Validation and Analysis of Distributed GNSS Spoofing Threat <i>Mr. Minghan Zhong</i> <i>PhD Candidate</i> <i>Tsinghua University, China</i>	Improving Precise Orbit Determination of Swarm Satellites by Fusing Precise Baseline Information <i>Ms. Paula Peitschat</i> <i>PhD candidate</i> <i>Institute of Navigation, University of Stuttgart, Germany</i>
10.20	Flight Test Performance Assessment of a Machine-Learning Software-Enhanced Inertial Navigation System <i>Mr. Matthew Starkey</i> <i>Robotics Development Lead</i> <i>Flare Bright Ltd, United Kingdom</i>	Enhancing GNSS PPP Algorithms with AI: Mitigating Multipath Effects <i>Mr. Adrian Chamorro Moreno</i> <i>GNSS Engineer</i> <i>GMV, Spain</i>	Efficient Detection of Galileo ACAS Sequences using E6-B Aiding <i>Mr. Rafael Terris-Gallego</i> <i>Researcher</i> <i>Universitat Autònoma Barcelona (UAB), Spain</i>	AI for LEO PNT - A Review <i>Dr. Jaz Hill-Valler</i> <i>Systems Engineer</i> <i>Satellite Applications Catapult, United Kingdom</i>
10.40	Resilient ADS-B based Airspace Surveillance by means of TDOA <i>Mr. Clemens Sonnleitner</i> <i>Research Associate</i> <i>University of Stuttgart - Institute of Navigation, Germany</i>	NLOS Signal Detection From Early Late Prompt Correlators using Convolutional LSTM Network <i>Dr. Zhengjia Xu</i> <i>Research Fellow in Position, Navigation and Timing</i> <i>Cranfield University, United Kingdom</i>	Mitigating GPS Spoofing Threats With Honeywell GPS Aided Inertial Systems <i>Mr. Matej Kucera</i> <i>Sr. Engineer/Scientist R&D</i> <i>Honeywell International, Czech Republic</i>	

11.00 Coffee Break (TENNIS HALL)

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Advanced Processing Techniques	Alternative & Complementary PNT - 1 -	Performance Prediction, Monitoring & Assessment - 1 -	LEO Systems & PNT - 1 -
Chairs	<i>Maarten Uijt de Haag & Mohammad Zahidul Bhuiyan</i>	<i>Ramsey Faragher & Janusz Uriasz</i>	<i>William Roberts & Tom Willems</i>	<i>Andy Proctor & Octavian Thor Pleter</i>
11.45	Concept of a Multi-Receiver-Vector Tracking Algorithm within a GNSS Network <i>Dipl. Ing. Stefan Laller</i> <i>University Assistant</i> <i>Graz University of Technology, Austria</i>	Improving Magnetic Flux Density Fingerprint Map Matching by Mitigating Alternating Current Induced Variability <i>Mr. Peter John Thompson</i> <i>PhD Student</i> <i>UCL, United Kingdom</i>	Assessment of Situational Awareness in relation to Advanced Navigation Systems using Ship Handling Simulators <i>Mr. Hari Sundar Mahadevan</i> <i>Research Associate</i> <i>Fraunhofer Center for Maritime Logistics and Services, Germany</i>	Integrity Monitoring of GNSS Constellations with only LEO-PNT Satellites <i>Mr. Luis García Iglesias</i> <i>GNSS Engineer</i> <i>GMV, Spain</i>

THURSDAY 23 MAY, 2024

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
12.05	<p>Putting the Synthetic GNSS Meta-signal Paradigm into Practice: Application to Automotive Market Devices</p> <p>Mr. Domenico Di Grazia GNSS System Architecture and Sw R&D Principal Engineer STMicroelectronics Srl, Italy</p>	<p>Initial Experimentation of a Real-Time 5G mmWave Downlink Positioning Testbed</p> <p>Dr. José A. Del Peral-Rosado Senior R&D Navigation Engineer Airbus Defence and Space, Germany</p>	<p>Monitoring and Data Distribution of the Galileo HAS System and User Performance</p> <p>Dr. Paolo Zoccarato Science for Policy Researcher Joint Research Center of the European Commission, Italy</p>	<p>A Digital Twin Architecture for Operating a LEO-PNT Constellation</p> <p>Dr. Spencer Ziegler Head of Department DLR Galileo Competence Center, Germany</p>
12.25	<p>Next Generation Network Assisted PNT Assurance</p> <p>Mr. Martin Bransby Head of Navigation Telespazio UK, United Kingdom</p>	<p>Drone-based TERPROM using a low-cost Automotive-class FMCW Radar to enable GNSS-denied Navigation</p> <p>Mr. John Markow VP of Innovation Plextek Services Ltd, United Kingdom</p>	<p>Performance Monitoring for Galileo High Accuracy Service and Reliable Galileo Space Operations</p> <p>Dr. Ing. Ganesh Lalgudi Gopalakrishnan KPI and GNSS Tools Engineer Spaceopal GmbH, Germany</p>	<p>Numerical Assessment of LEO-PNT Performance: a Comparison between Ambiguity-float and Ambiguity-fixed Precise Point Positioning solutions</p> <p>Mr. Lotfi Massarweh GNSS Researcher Delft University of Technology, The Netherlands</p>
12.45	<p>Starlink Receiver Prototyping for Opportunistic Positioning</p> <p>Mr. Alessio Curzio GNSS Receiver and Test Engineer Qascom, Italy</p>	<p>Exploitation of 5G, LTE, and AIS Signals for Falback Unmanned Aerial Vehicle Navigation</p> <p>Mr. Adrian Winter PhD Student Department of Engineering Cybernetics, Norwegian University of Science and Technology (NTNU), Norway</p>	<p>Permanent Train-side GNSS Multipath Characterization Considering Time-Correlation for Safe Railway Localization</p> <p>Ms. Ana Kliman Researcher German Aerospace Center (DLR), Germany</p>	<p>Geometric Analysis of LEO-based Monitoring of GNSS Constellations</p> <p>Mr. Can Özmaden Research Associate RWTH Aachen University, Germany</p>

13.05 Lunch & Poster Session Go to page 11 to view the full list of posters. (TENNIS HALL)

14.40	ESTEC Navigation Lab Tour 4 at 14.40 - 15.10	MEETING POINT: Newton Foyer (pre-registration required)
15.20	ESTEC Navigation Lab Tour 5 at 15.20 - 15.50	MEETING POINT: Newton Foyer (pre-registration required)

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Simulation & Testing	Alternative & Complementary PNT - 2 -	Performance Prediction, Monitoring & Assessment - 2 -	LEO Systems & PNT - 2 -
Chairs	Stuart Smith & John Pottle	Noori Bni Lam & Peter Thompson	Rajesh Tiwari & Jacobus Hogervorst	Washington Ochieng & Heiko Engwerra
14.30	<p>Considerations for Testing Resilient PNT beyond GNSS: LEO and Other Sensors</p> <p>Mr. Stuart Smith Senior Manager Products & Solutions Spirent Communications PLC, United Kingdom</p>	<p>ESA NAVISP Element 3 UK Time Distribution (UTC). Progress and Performance to Date</p> <p>Mr. Tony Flavin Manager of Strategic Research Chronos Technology, United Kingdom</p>	<p>Mathematical Modeling of the Effect of Single Source of Interference on an Airborne GNSS Receiver</p> <p>Dr. Ahmad Esmaeilkhah Postdoctoral Researcher École De Technologie Supérieure (ets), Lassena Laboratory, Canada</p>	<p>Definition of Optimal Ephemeris Parameters for LEO-PNT</p> <p>Mr. Carlos Gómez Navajas GNSS Engineer GMV, Spain</p>
14.50	<p>A Model for Data-Pilot Biases in Presence of Satellite and Receiver Imperfections</p> <p>Dr. Christoph Enneking Research Associate German Aerospace Center (DLR), Germany</p>	<p>LDACS PNT Architecture Integrating Asymmetric Two-way Timing Filters for Enhanced and Reliable Positioning</p> <p>Mr. Gianluca Zampieri Researcher German Aerospace Center (DLR), Italy</p>	<p>A Multipath Characterization of GNSS Ground Stations using RINEX Observations and Machine Learning</p> <p>Dr. Gerardo Allende Alba Research Associate DLR - German Aerospace Center, Germany</p>	<p>Combined Navigation and Tracking with Applications to Low Earth Orbit Satellites</p> <p>Mr. Domenico Di Grazia GNSS System Architecture and Sw R&D Principal Engineer STMicroelectronics Srl, Italy</p>
15.10	<p>Evaluation Service for Real-time Orbit and Clock Satellite Corrections</p> <p>Dr. Kamil Kazmierski Assistant Professor Wrocław University of Environmental and Life Sciences, Poland</p>	<p>ADVENT: Development of Advanced VDES-R User Technologies for Alternative PNT (NAVISP-EL1-057)</p> <p>Mr. Michael Turner PNT System Technical Authority GMV, United Kingdom</p>	<p>Enhancing GNSS Situational Awareness by Monitoring the New Galileo Services</p> <p>Prof. Mohammad Zahidul Bhuiyan Professor Finnish Geospatial Research Institute, Finland</p>	<p>GNSS Interference Monitoring from Space: the OPS-SAT Experiment</p> <p>PhD Francesco Menzione Scientific Officer European Commission Joint Research Centre, Italy</p>

THURSDAY 23 MAY, 2024 CONTINUED

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
15.30		GNSS Constellations Monitoring using a Phased Array Antenna system GNSS Constellations Monitoring using a Multibeam Luneburg Lens Antenna system Mr. Lionel Tombakdjian PhD Candidate UniCA / CNRS, France	Analysis of the PNT Performances of freely available GNSS Signals and Services over the UK Mr. William Roberts Division Head Positioning Navigation and Timing in UK GMV, United Kingdom	Spatial Sensitivity of Navigation using Signal-of-Opportunity (SoOP) from Starlink, Iridium-Next, GlobalStar, OneWeb and Orbcmm Constellations Dr. Ahmad Esmaeilkhah Postdoctoral Researcher École De Technologie Supérieure (ets), Lassena Laboratory, Canada

15.50 Coffee Break (TENNIS HALL)

16.30	ESTEC Test Centre Tour 2 at 16.30 - 17.00		MEETING POINT: Newton Foyer (pre-registration required)	
17.15	ESTEC Test Centre Tour 3 at 17.15 - 17.45		MEETING POINT: Newton Foyer (pre-registration required)	

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Standards & Testbeds	Applications of GNSS from Smartphones	Integrity & Interference - 1 -	LEO Systems & PNT - 3 -
Chairs	Stuart Smith & Noori Bni Lam	Geraint Ffoulkes-Jones & Heiko Engwerda	Annetarie Van Zwol & Jacobus Hogervorst	Frank Zimmermann & William Roberts
16.30	Galileo Timing Receiver Standard Mr. Héctor Llorca Llorca GNSS Engineer GMV, Spain	Hybrid Cycle Slip Detection Method for Smartphone GNSS Mr. Naman Agarwal PhD Student University of Calgary, Canada	Determination of PSD Over-bounding for High-integrity Inertial Navigation using Interval Analysis Mr. Jingyao Su PhD Student Leibniz University Hannover, Institut für Ermessung (IfE), Germany	LEO-PNT Signals in L, S and C-band: Comparative Tracking Results from a Hardware Receiver Prototype Dr. Ir. Sibren De Bast R&D Engineer Man & Brouw, Belgium
16.50	UKSBAS Testbed Performance Assessment of Two Years of Services Mr. Javier González Merino GNSS Engineer GMV, United Kingdom	Real Time Kinematic Positioning using Multi-frequency Smartphone Measurements Dr. Melania Susi Senior Researcher Topcon Positioning System, Italy	Towards Integrity Monitoring for GNSS-based Time Synchronization in Technical Applications MSc Qianwen Lin PhD Student Institut für Erdmessung, Leibniz Universität Hannover, Germany	Indoor Signal Strength Evaluation of the Orbcmm Low Earth Orbit Satellite Constellation Mr. Wout Van Uyttsel PhD Researcher University of Antwerp - IDLab- imec, Belgium
17.10	Experimental Setup for Performance assessment of Multi-antenna Beamforming Techniques in GNSS Handheld devices Mr. Pedro Boto GNSS Engineer GMV, Portugal	Galileo HAS Enabled Smartphone GNSS Positioning Dr. Sunil Bisnath Professor York University, Canada	Advanced RAIM and Local Effects Models for Rail, Maritime and UAVs Systems Mr. Javier De Toro De Murga GNSS Engineer GMV, Spain	Signal Design and Compatibility assessment for LEO Navigation Augmentation System Mr. Tao Yan Engineer China Academy of Space Technology (Xi'an), China
17.30	Evaluation of H-ARAIM Reference Algorithm Performance using Flight Data Mr. Natali Caccioppoli GNSS Operational Validation Expert EUROCONTROL Innovation Hub, France	Performance Assessment of Smartphones' PVT Solution in GNSS-Harsh Environments Using Single-Differences Between-Satellites and SSR Corrections Mr. Amarildo Haxhi PhD Student National and Technical University of Athens, Greece	Characteristics of Experimental VDE-SAT Ranging Signals and System Performance Analysis for Critical Navigation Mr. Øyvind Bryhn Pettersen Engineer Space Norway, Norway	

18.30 - 23.30
NETWORKING DINNER
 Strandpaviljoen De Zeemeeuw, Noordwijk

FRIDAY 24 MAY, 2024

08.30 Welcome Coffee

**TENNIS HALL
EXHIBITION (08.30 - 15.00)**

09.00 PLENARY - NEW FRONTIERS

HIGH BAY

Chair: Clare Stead, RIN

09.00 - Spaceopal: Innovation and Opportunity in GNSS - *Sebastian Fedeli, Procurement & Sales Director, spaceopal GmbH*

09.15 - Developments and Emerging Trends in Spaceborne GNSS - *Prof. Oliver Montenbruck, Head of GNSS Technology and Navigation, DLR/GSOC*

09.30 - Navigating New Frontiers: Lunar and Beyond - *Javier Ventura-Traveset and Floor Melman, European Space Agency*

10.10 ESTEC Navigation Lab Tour 6 at 10.10 - 10.40

MEETING POINT: Newton Foyer (pre-registration required)

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Aviation Applications	Atmospheric Modelling & Sensing - 1 -	Integrity & Interference - 2 -	Quantum Technology and PNT
Chairs	<i>Martin Bransby & Octavian Thor Pleter</i>	<i>Paul Thevenon & Mike Turner</i>	<i>Nadezda Sokolova & Aiden Morrison</i>	<i>Andy Proctor & Ramsey Faragher</i>
10.00	Disruptive Opportunities, Threats and Mitigations for Efficient Timing and Navigation in Worldwide Civil Air Transport <i>Mr. Bart Banning</i> <i>ATM Architect</i> <i>LVNL, The Netherlands</i>	Impact of Solar Cycle 25 on GNSS Measurements: Analysis of Ionosphere Scintillation and Positioning Challenges <i>Dr. Ali Broumandan</i> <i>Resilient GNSS Lead</i> <i>NovAtel, Canada</i>	Quantification of Multi GNSS Protection Layers for Integrity Monitoring Design in Challenging Environments <i>Ms. Anja Grosch</i> <i>Senior Researcher</i> <i>DLR - German Aerospace Center, Germany</i>	Aspects of an Integrated Quantum Inertial Navigation System <i>Mr. Benjamin Tennstedt</i> <i>Scientific Staff</i> <i>Leibniz University Hannover, Germany</i>
10.20	Jamming of a Parked Passenger Jet: Sensitivity of the Aircraft to Jamming with Varying Power <i>Dr. Susanne Schweitzer</i> <i>Scientist</i> <i>Joanneum Research, Austria</i>	Approaching Solar Maximum - NeQuick G model Performance over Europe <i>Ms. Natalia Hanna</i> <i>PhD Student / Project Assistant</i> <i>TU Wien, Austria</i>	GNSS Accuracy Under Jamming <i>Mr. Barend Lubbers</i> <i>Assistant Professor</i> <i>Netherlands Defence Academy, The Netherlands</i>	Quantum Time Transfer for an Accurate and Resilient PNT Architecture <i>Mr. David Mitlyng</i> <i>Ceo</i> <i>Xairos, USA</i>
10.40	Civil Air Navigation Resilience in a GNSS Contested Environment <i>Prof. Octavian Thor Pleter</i> <i>Associate Professor</i> <i>University Politehnica of Bucharest, Romania</i>	Machine Learning Framework to Produce High-resolution Tropospheric Delay fields for Corrections of Navigation Satellites' Measurements <i>Mr. Alain Geiger</i> <i>Prof. Em.</i> <i>ETH, Switzerland</i>	Investigation of User Level Integrity Algorithms in the Maritime Domain <i>Dr. Terri Richardson</i> <i>Navigation Engineer</i> <i>GMV, United Kingdom</i>	

11.00

Coffee Break (TENNIS HALL)

12.00 ESTEC Navigation Lab Tour 7 at 12.00 - 12.30

MEETING POINT: Newton Foyer (pre-registration required)



FRIDAY 24 MAY, 2024 CONTINUED

Room	HIGH BAY	AUDITORIUM	NEWTON 1	NEWTON 2
Session	Atmospheric Modelling & Sensing - 2 -	Rail & Maritime Applications	Integrity & Interference - 3 -	Future Trends in Navigation Technology
Chairs	Dorota Grejner-Brzezinska & Dimitrios Psychas	Martin Bransby & Allison Kealy	Aiden Morrison & Rajesh Tiwari	Todd Humphreys & Tíre Macleod-Nolan
11.30	Auroral Zone Disturbance Impacts - Time- and Distance-dependent Degradations of Network RTK Performance Dr. Knut Stanley Jacobsen Researcher Norwegian Mapping Authority, Norway	Robust Railway Ground Truth Estimation based on RTK/INS Forward-Backward Smoothing Ms. Anja Grosch Senior Researcher DLR - German Aerospace Center, Germany	Towards a Trustworthy Position Solution; Evaluating OSNMA and Protection Levels Mr. Heiko Engwerda Navigation Engineer Royal Netherlands Aerospace Centre, The Netherlands	Satellite Laser Ranging to GNSS Constellations: Galileo and BeiDou-3 - Results and Recommendations Prof. Krzysztof Sośnica Professor Wrocław University of Environmental and Life Sciences, Poland
11.50	BiScEF - A New Format for Archiving and Sharing Scintillation Data Dr. Knut Stanley Jacobsen Researcher Norwegian Mapping Authority, Norway	In-band MF R-Mode Signal Quality Estimation Mr. Filippo Giacomo Rizzi R&D Engineer DLR, Germany	Performance Analysis of Spoofing and Interference Detection Techniques for SBAS GNSS Reference Receivers Mr. Xavier Alvarez-Molina Research Support Technician Universitat Autònoma de Barcelona, Spain	GNSS Global PPP System Technology: Bottleneck and Development Direction Prof. Yansong Meng Team leader China Academy of Space Technology (Xi'an), China
12.10	Global Ionospheric Corrections: Enhancing High-Accuracy Positioning Mr. Adrian Chamorro Moreno GNSS Engineer GMV, Spain	Detection of Multi-Container Loss for Safety of Navigation: The ContAD Approach Mr. Moritz Oberjatzas Research Fellow Jade University of Applied Sciences, Germany	Integrity Performance of a GPB Filter Dr. Carl Milner Associate Professor Enac, France	Cloud-native Architectures and Operational Systems: the G2STB Case Mr. Jorge Rocamora GNSS Engineer GMV, Spain
12.30	GNSS Variometric Approach for Real Time Slant Tropospheric Delay Analysis: a Preliminary Investigation Eng. Rachele Fratini PhD Candidate in Earth Observation Geodesy Sapienza University of Rome, Italy	IEC-61108-7 SBAS Standard for Ship-Borne Receivers: Preliminary Testing Validation Activities Dr. Ciro Gioia Consultant At The Joint Research Centre External Consultant for the JRC, Italy		Performance Analysis for the Galileo HAS and Related Work in the DLR Galileo Competence Center Dr. Marios Smyrniotis Research Associate DLR - German Aerospace Center, Germany
13.00	PLENARY - CLOSING			HIGH BAY
	Chair: Prof. Terry Moore, EUGIN			
	13.00 - Conference Review - Dr. Ramsey Faragher , Chair, RIN Technical Committee, Co-Chair ENC 2024 Technical Programme Committee			
	13.10 - ESA Navigation Vision & Perspectives - Javier Benedicto , Director of Navigation, ESA			
	13.25 - ENC 2024 Awards - Prof. Terry Moore , EUGIN Chair			
	13.30 - Future Navigation Conferences			
	- ENC 2025, Poland - Prof. Janusz Uriasz , President, Polish Navigation Forum			
	- IAIN World Congress, Beijing - Ying Liu , Deputy Secretary General, China Institute of Navigation			
	13.40 - Conference Close - Prof. Terry Moore , EUGIN Chair			

14.00 - 15.00
Lunch (TENNIS HALL)

POSTERS

Thursday 23 May, 13.05 - 14.30, Poster Session in the Tennis Hall

Each poster author will be present at this time to discuss and answer questions.

POSTER		NAME	COMPANY
P1	Improving Wayfinding in Hospitals for People with Diverse Abilities: An Approach Based on Multi-Criteria Decision-Making	Dr. Ido Norag , Senior Lecturer	Shenkar College of Engineering and Design, Israel
P2	New Design for Ranging Codes for Galileo HAS	Gangsan Kim , Graduate Student	Yonsei University, South Korea
P3	Enhanced Adaptive Genetic Algorithm for Precise Point Positioning with Integer Ambiguity Resolution	Amarildo Haxhi , PhD Student	National and Technical University of Athens, Greece
P4	RINEXAV: Open-source Software Based on Qualitative Analysis of RINEX Files for GNSS Global Network Analysis	Prof. Krzysztof Sońnica , Professor	Wroclaw University of Environmental and Life Sciences, Poland
P5	Factor Graph Optimization in GNSS Positioning: a Systematic Review	Mr. Giovanni Cappello , PhD Student	University of Naples "Parthenope", Italy
P6	Galileo HAS in Real-time Geosciences Applications	Dr. Kamil Kazmierski , Assistant Professor	Wroclaw University of Environmental and Life Sciences, Poland
P7	LDPC and Polar Codes for CNAV2 Subframes	Kim Daekyeong , Student	Yonsei University, South Korea
P8	Performance analysis of CUDA based Galileo Signal Quality Monitoring	MSc Florian Binder , Research Associate	Institute of Space Technology and Space Applications, Universität der Bundeswehr München, Germany
P9	GNSS Fault Detection and Isolation Strategy for Robust Vector Tracking	Katrin Dietmayer , Senior Engineer	Fraunhofer IIS, Germany
P10	Accuracy of GNSS Receivers in Sports Watches in terms of Positioning, Height, and Distance Measurements	M. Sc. Marcin Mikoś , PhD Student	Wroclaw University of Environmental and Life Sciences, Poland
P11	LIOP: Long-Term Tight Coupling of Lidar Inertial Odometry and Prior Information for SLAM	Prof. Jichao Jiao , Professor	Beijing University of Posts and Telecommunications, China
P12	A Technical Overview of Current "New Space" LEO-PNT Initiatives and their Application Potential	Wout Van Uytsel , PhD Researcher	University of Antwerp - IDLab- Imec, Belgium

REGISTRATION AND SPEAKER SERVICE DESK

Opening Hours Registration Desk

Wednesday, 22 May 2024	08.00 – 19.30
Thursday, 23 May 2024	08.00 – 18.00
Friday, 24 May 2024	08.00 – 15.00

Opening Hours Speaker Service Desk

Wednesday, 22 May 2024	09.00 – 16.30
Thursday, 23 May 2024	08.30 – 16.30
Friday, 24 May 2024	08.30 – 12.00

INTERNET ACCESS

Wi-Fi is available at the venue. Connect to the “esa-conference” Wi-Fi; you will be automatically taken to the browser where you can provide your login details. You will find your Wi-Fi login details at the back of your badge. The login details are valid for 3 days.

DOWNLOAD THE CONFERENCE APP

Via the ENC 2024 app you will not only be able to find information on the conference program, speakers, sponsors and exhibitors, you will also be able to connect with other participants.

The app is available on Google Play and on the App Store. You can download the app by scanning the QR-codes below. Personal login credentials have been provided to you via email.



If you do not have a QR-code reader, search for the name of the App:
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When you download the App, you will be directed to the generic EventsAir App.
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TIP: Please ensure you update your profile when you first login and select the virtual Name Badge option that displays your full name, position and company name. This way, it will be easier for your fellow ENC participants to find you and connect with you.

Please also enable App notifications to be notified when a participant reaches out to you via the App.

TRANSPORT ON CONFERENCE DAYS

A transfer service is available on conference days from the NH Leeuwenhorst Hotel and Noordwijk (pick up at Two Brothers Noordwijk Beach Hotel) to ESA ESTEC and return. Some return transfers will end at Leiden Central Station. Please see the transfer service times below. Transport is offered on a first come first served basis.

22 May 2024

To ESTEC from:

- 08.15 NH Leeuwenhorst – 8.25 Noordwijk (Two Brothers Hotel) (50 pax)
- 08.30 NH Leeuwenhorst – 8.40 Noordwijk (Two Brothers Hotel) (50 pax)
- 08.45 NH Leeuwenhorst – 8.55 Noordwijk (Two Brothers Hotel) (50 pax)

Return from ESTEC to:

- 19.15 Noordwijk (Two Brothers Hotel) – NH Leeuwenhorst – Leiden (50 pax)
- 19.30 Noordwijk (Two Brothers Hotel) – NH Leeuwenhorst – Leiden (50 pax)
- 19.45 Noordwijk (Two Brothers Hotel) – NH Leeuwenhorst – Leiden (50 pax)

23 May 2024

To ESTEC from:

- 08.00 NH Leeuwenhorst – 8.10 Noordwijk (Two Brothers Hotel) (50 pax)
- 08.15 NH Leeuwenhorst – 8.25 Noordwijk (Two Brothers Hotel) (50 pax)

From ESTEC to Dinner Location:

- 18.15 Dinner in Noordwijk (De Zeemeeuw Strandpaviljoen) (100 pax)
- 18:30 Dinner in Noordwijk (De Zeemeeuw Strandpaviljoen) (100pax)

Return from Dinner Location to:

- 22.00 NH Leeuwenhorst – Leiden (60 pax)
- 23.00 NH Leeuwenhorst – Leiden (60 pax)
- 23.45 NH Leeuwenhorst – Leiden (60 pax)

24 May 2024

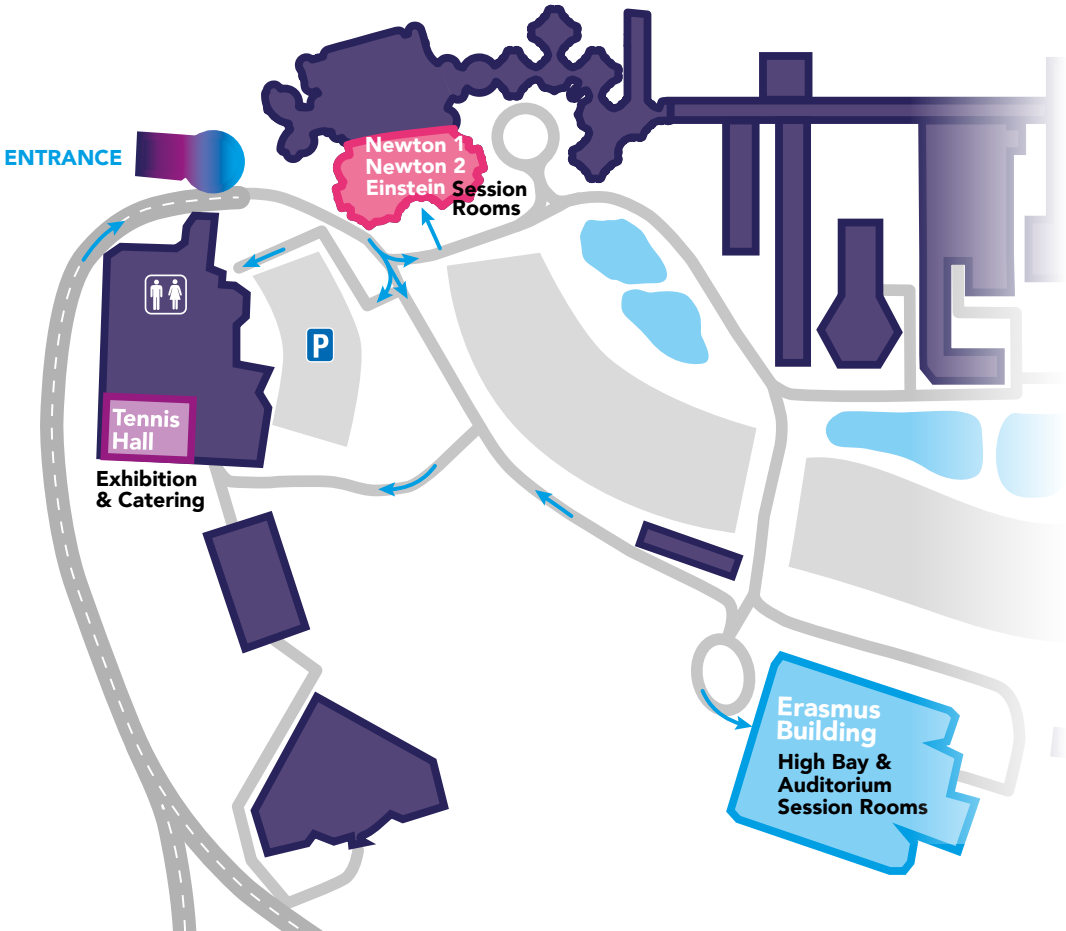
To ESTEC from:

- 08.00 NH Leeuwenhorst – 8.10 Noordwijk (Two Brothers Hotel) (50 pax)
- 08.15 NH Leeuwenhorst – 8.25 Noordwijk (Two Brothers Hotel) (50 pax)

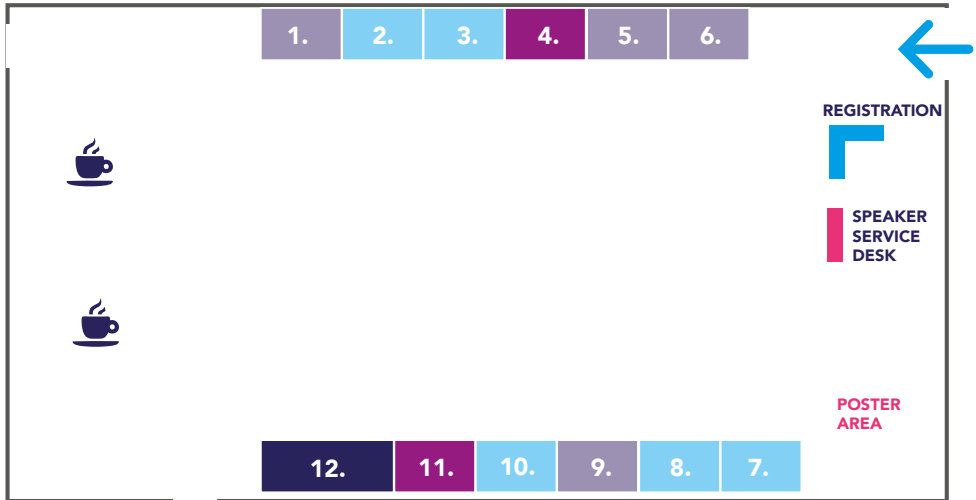
Return from ESTEC to:

- 15.15 Noordwijk (Two Brothers Hotel) – NH Leeuwenhorst (50 pax)
- 15.45 Noordwijk (Two Brothers Hotel) – NH Leeuwenhorst (50 pax)
- 15.15 Leiden (50pax)

CONFERENCE LOCATION ESTEC MAP



EXHIBITION FLOORPLAN TENNIS HALL



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10. Fraunhofer Institute for Integrated Circuits
11. Spaceopal
12. European Space Agency – Navigation Directorate



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