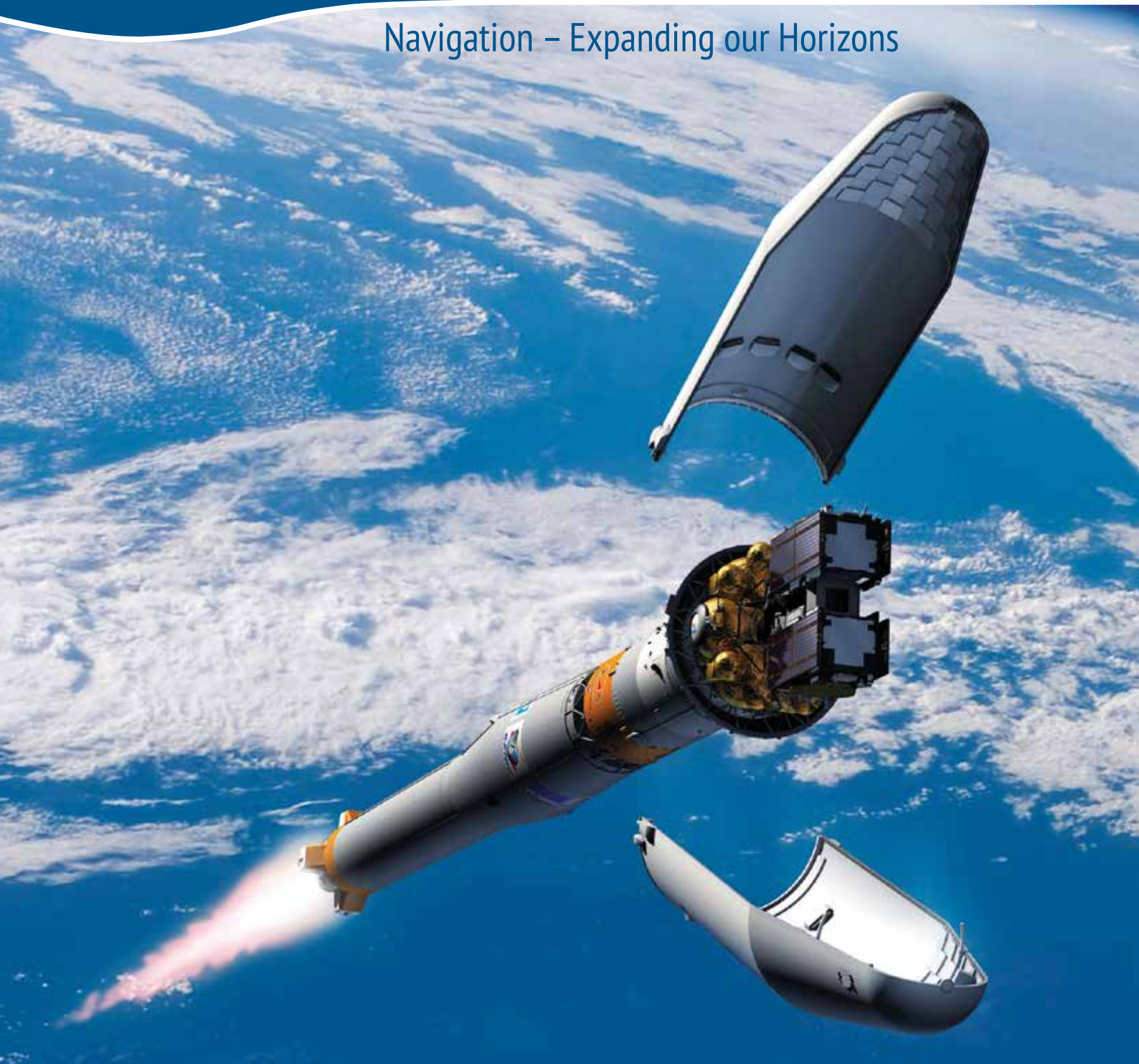# The European Navigation Conference

**ENC 2013**

Navigation – Expanding our Horizons

# 23–25 April, 2013 Austria Center Vienna

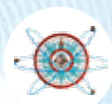www.enc2013.org

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# Welcome to the
## European Navigation Conference 2013

Space technology is of strategic importance for highly developed nations and plays a crucial role in today's infrastructures as well as in those of the future. Austria engages in space-related activities both in the context of ESA as well as the European Union. The Austrian Space Applications Programme (ASAP) supports national companies and research organisations in developing innovative space technologies – as well as in the field of navigation. It is therefore a great pleasure for me to patronise the "European Navigation Conference on Global Navigation Satellite Systems 2013" here in Vienna.

Global Navigation Satellite Systems are essential space-based technologies and play an increasingly relevant role in a number of diverse fields such as logistics, road transport, maritime transport, aviation and other location-based services. The recent progress of the European programmes Galileo and EGNOS highlight the advancements made in this field as well as the wide recognition of this technology. With EGNOS in operation and Galileo rapidly approaching its initial operations, events such as the ENC 2013 are pivotal as European focal points in the field of navigation.

I am pleased to see participants from the worlds of industry and science from around the world coming together to attend the conference this year. I would like to thank the Austrian Institute of Navigation, member of the European Group of Institutes of Navigation (EUGIN) for organising this event. I wish the conference a lot of success and hope that participants will enjoy interesting discussions, be provided with valuable networking opportunities and thus foster technological advancements in the spirit of the conference's slogan "Expanding our Horizons".

**Doris Bures**
Federal Minister
Austrian Federal Ministry for Transport, Innovation and Technology



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**Doris Bures**
Federal Minister
Austrian Federal Ministry for Transport, Innovation and Technology



AUSTRIAN TECHNOLOGY IN SPACE

More than one hundred Austrian companies and research institutes are working in the international space sector.

In order to support Austrian industry and research, the Austrian Federal Ministry for Transport, Innovation and Technology has made these organisations' profiles and technological competences publicly accessible for the first time.

WWW.SPACETECHNOLOGY.AT

An Overview of Austrian Space Industry and Research

bmvit

**On** behalf of the European Group of Institutes of Navigation (EUGIN) I would like to warmly welcome all participants of the European Navigation Conference ENC 2013 in Vienna. We are meeting at a very special place – a city, important in history of Europe. Vienna, as a capital of Austrian Empire was for many years a centre of political life for the Central and Eastern Europe. History of this city joins many contemporary European capitals, and this is one of many proofs for the European community integrity. Vienna today is not only a collection of splendid monuments but also a very important industrial centre. Vienna is also one of the most significant, major port on the Danube River; inland, land and air navigation became the most essential elements, optimising functioning of transport.

This conference has been organised by the Austrian Institute of Navigation on behalf of the European Group of Institutes of Navigation. We are meeting for the 21st time to exchange our experience and to present the achievements within the field of navigation – at sea, in air, inland and on land navigation. This platform for exchanging experience is also a meaning place for determination of navigation development trends and the supporting systems. I am convinced that this Conference will show us directions of development of satellite systems, which accompany our everyday life.

One of the fundamental tasks of EUGIN, realised by the European Navigation Conferences is supporting national research centre and indicating directions of development of the systems which are to aid navigation in this scope, especially regarding such satellite systems as GNSS, GPS, GALILEO, GLONASS, COMPASS and other regional systems. Nowadays, at the time of the world financial crisis, people are facing new challenges in economy and optimisation of using the transport measures. At this point, the obvious in navigation assignment, consisting in optimisation of time and costs of vehicles travels from point A to point B becomes expedient. Hopefully our conference will reveal new potentialities not only in maintenance of traveling objects top level safety, but also in their traffic optimisation.

I am very grateful to the Austrian Institute of Navigation, the President, Dr. Stephan Mayer and the whole organising committee for preparing the 21st European Navigation Conference concerning "Navigation – Expanding our Horizons". For me this conference is very important as I can take the floor for the first time as a Chairman of the EUGIN Council.

I would like to wish all participants great impressions in studying navigation and replacing experiences.

**Krzysztof Czaplewski**
EUGIN President



Krzysztof Czaplewski
EUGIN President

**On** behalf of the Austrian Institute of Navigation (OVN), it is a great pleasure for me to welcome each of you to the European Navigation Conference 2013 from the 23rd to the 25th of April in Vienna. The European Navigation Conference (ENC) 2013 is the twenty-first conference in the GNSS series, which have been organised annually by the European Group of Institutes of Navigation. This conference is focusing on the present status and the future developments in navigation systems with special emphasis on the European satellite navigation system Galileo. Therefore, ENC 2013 will be a showcase for the state of the art and, more importantly, for the innovations in the field of terrestrial and satellite navigation and its applications. Furthermore, the implementation of new technologies in navigation will be illustrated throughout the industry exhibition, which is running in parallel to the conference.

During the next days, you will learn more about the wide field of navigation, along the lines of our conference slogan "Expanding our Horizons". I hope you will take advantage of a programme that covers many topics ranging from the latest scientific achievements to new and innovative applications. The ENC is known for its high standard of papers and posters, as well as its technical and scientific character. The ENC is a unique networking event for all participants, where you can consider and discuss ideas and innovations that will drive the technological developments of the future.

We are very proud that this conference is being held here in the City of Vienna. Vienna is located in the very heart of Europe and is truly diverse. World-wide, this city is known for its long history of art, culture, science and education – attracting millions of visitors every year. It is also a very green city, covered with acres of forests, grassland, parks and gardens. I am confident that this environment forms an ideal forum for ENC 2013 and will make the social programme of the conference unforgettable for all of you.

I would like to express my thanks to all who have helped in realising this event here in Vienna. I would like to thank all the sponsors and of course all members of the local organising committee. Without your great efforts and dedication it would not have been possible to make this event happen.

It is my sincere hope that you will not only have an interesting and rewarding time here in Vienna, but also that your professional careers will profit from your participation in the ENC 2013. Last but not least, please take many pleasant and memorable impressions from your stay in Vienna back home and come again!

With my best personal wishes,

**Stephan Mayer**
President of the Austrian Institute of Navigation – OVN



Stephan Mayer
President of the Austrian Institute
of Navigation – OVN

# Table of Contents
## ENC 2013

## Österreichischer Verein für Navigation
## Austrian Institute of Navigation

The Austrian Institute of Navigation (OVN) is a non-profit organisation of public interest with no political concern and backgrounds. The main objective of the institute is to support science and research as well as engineering and application in the context of navigation.

Experts and interested parties of public authorities, universities, scientific and research organisations, industry, users, politics, and the private sector collaborate with the OVN to fulfil this objective.

Benefits to the members
- Overview of actual topics in the field of navigation from both a technical and political point of view
- The publications „The Navigation Flashlight" and „The European Journal of Navigation" for free
- Discount tickets for selected national and international navigation events
- Opportunity to play an active role within the OVN

www.ovn.at

# Programme at a Glance
## 22 April 2013 – 25 April 2013

| | Monday, April 22 | Tuesday, April 23 | Wednesday, April 24 | Thursday, April 25 |
|---|---|---|---|---|
| 08:30–10:00 | | Registration / Opening, Welcome Talks | A3 B3 C3 D3 | A7 B7 C7 |
| 10:00–10:30 | | Keynotes & Panel | Coffee/Tea Break | Coffee/Tea Break |
| 10:30–12:00 | | | A4 B4 C4 D4 | A8 B8 C8 |
| 12:00–13:30 | | Galileo First Fix / Lunch | Lunch | Lunch |
| 13:30–15:00 | Pre-Meetings EUGIN, IAIN, EJN | A1 B1 C1 D1 | A5 B5 C5 D5 | A9 B9 C9 |
| 15:00–15:30 | | Coffee/Tea Break | Coffee/Tea Break | Coffee/Tea Break |
| 15:30–17:00 | | A2 B2 C2 D2 | A6 B6 C6 | Closing Session |
| 17:15–18:30 | | Poster Session | Poster Session | |
| 18:30–20:30 | Ice Breaker Party | Social Event: Gala Dinner Town Hall | Exhibitor Party | |

Exhibition is shown along Tuesday, Wednesday, and Thursday columns. Registration appears in the Monday column.

**Registration**
Monday **16:00–19:00** and Tuesday, Wednesday, Thursday **8:30–18:00**

**Testbed Telematics Austria (TTA)** demonstrates the navigation options in urban cooperative systems on 23 and 24 April 2013 between 12.00 and 14.00 at the European Navigation Conference. Please visit the Testbed Telematics booth in the exhibition area for more details.

# Map of the Conference Venue –
# Austria Center Vienna



Room E2
Room E1
Room F2
Room OEE558
Lunch
Poster Area
Coffee/Tea Exhibition
Registration
Entrance
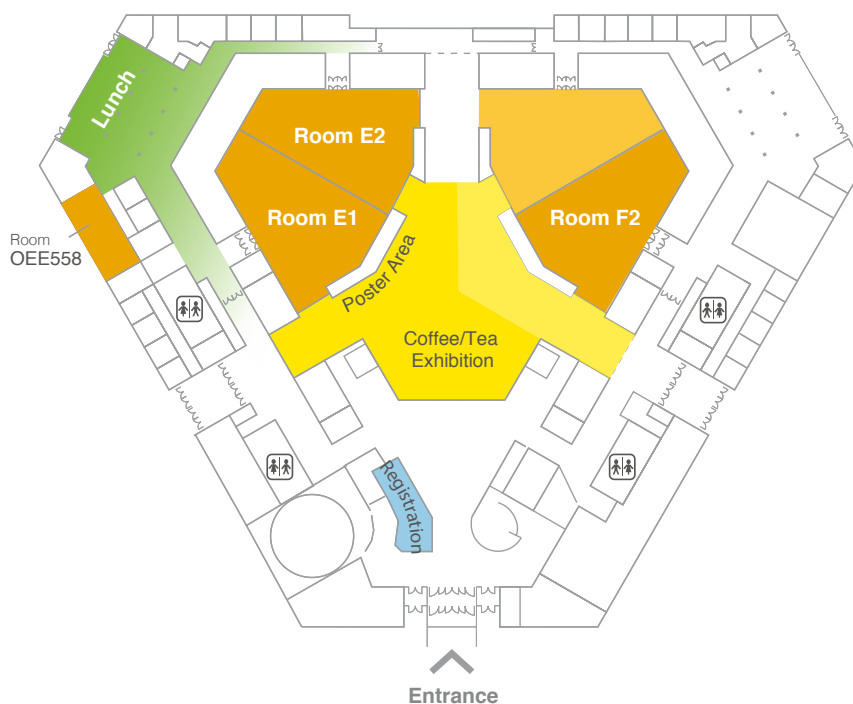
**You are kindly invited to the**

› Ice Breaker Party in the evening of Monday 22 at **18:30** at the Austria Center Vienna

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## TUESDAY AT A GLANCE

| | ROOM E1 | ROOM E2 | ROOM F2 | ROOM OEE 558 |
|---|---|---|---|---|
| | **Opening, Welcome Talks in Room E1** | | | |
| 09:30–10:00 | Stephan Mayer [President of the Austrian Institute of Navigation]<br>Ingolf Schädler [Deputy Director General of Innovation, Austrian Federal Ministry for Transport, Innovation and Technology]<br>Klaus Pseiner [Managing Director of the Austrian Research Promotion Agency, FFG]<br>Krzysztof Czaplewski [Chairman, EUGIN Council] | | | |
| | **Keynotes & Panel in Room E1** | | | |
| 10:00–12:00 | Didier Faivre [Director of Galileo Programme & Navigation Related Activities, ESA]<br>Paul Flament [Head of the EU Satellite Navigation Programme Unit, EC]<br>Carlo des Dorides [Executive Director, GSA]<br><br>Panel Discussion: "European Space Infrastructures for Services and Applications"<br><br>Harald Posch [Head of Aeronautics and Space Agency, FFG], Moderator<br>Mazlan Othman [Director, UN Office for Outer Space Affairs]<br>Bernhard Hofmann-Wellenhof [Vice Rector for Academic Affairs, Graz University of Technology]<br>Frank Salzgeber [Head of Technology Transfer Programme Office, ESA]<br>Gard Ueland [Chairman, Galileo Services] | | | |
| | **Special Presentation in Room E1** | | | |
| 12:00–12:30 | Galileo IOV Status and First Results by D. Blonski, J. Hahn [ESA] | | | |
| 12:30–13:30 | Lunch | | | |
| | **Session A1** | **Session B1** | **Session C1** | **Session D1** |
| 13:30–15:00 | Space-based Augmentation Systems (1) | GNSS Receiver Technology – Software, Algorithms (1) | Specific Navigation (1) | Waterway Navigation |
| 15:00–15:30 | Coffee/Tea Break | | | |
| | **Session A2** | **Session B2** | **Session C2** | **Session D2** |
| 15:30–17:00 | Space-based Augmentation Systems (2) | GNSS Receiver Technology – Software, Algorithms (2) | Specific Navigation (2) | Side Event<br>ARIADNA Workshop<br>Public Workshop |
| | **Poster Session in Poster Area** | | | |
| 17:15–18:30 | List of Posters (page 10) | | | |

**After the sessions you are kindly invited to the**

› Gala Dinner in Town Hall – Reception **19:00**
**Town Hall – Wiener Rathaus**: Lichtenfelsgasse 2, 1010 Vienna

| Room<br>E1 | **Session A1, Space-based Augmentation Systems (1)**<br>*Chairs: Marc Jeannot [ESA], Satoshi Kogure [JAXA]* |  |
|---|---|---|
| P1 | The European Space Agency free SBAS software tools: Learning, practising and accessing the EGNOS performances in real-time | F. Toran, A. R. Mathur, C. A. Pandele, K. Urbanska |
| P2 | Enhanced EGNOS data access service | P. Azcárraga, J. Vaquez, M. A. Sánchez, F. J. de Blas |
| P3 | Characterization and modeling of the ionosphere for EGNOS development and qualification | S. Schlüter, R. Prieto-Cerdeira, R. Orus-Perez, J. Pedro-Lam, M. Juan, J. Sanz, M. Hernández-Pajares |
| P4 | Do more GPS satellites lead to a better integrity performance? A demonstration for SBAS. | M. Mink, J. Daubrawa |
| P5 | Robust EGNOS GEO ranging with electric propulsion satellite | H. Secretan, F. Mercier, D. Pascal |

| Room<br>E2 | **Session B1, GNSS Receiver Technology – Software, Algorithms (1)**<br>*Chair: Thomas Pany [Ifen Gmbh]* |  |
|---|---|---|
| P1 | Phase locked loop with multifrequency phase unwrapping structure | S. Roche, S. Bidon, L. Ries, M. Monnerat, P. Thevenon, J. Giraud |
| P2 | Accurate Doppler-shift estimation for increased sensitivity of computationally efficient GNSS acquisition | P. Esteves, M. Sahmoudi, L. Ries, M. L. Boucheret |
| P3 | An efficient strategy for the acquisition of weak galileo E1 OS signals | M. Foucras, O. Julien, C. Macabiau, B. Ekambi |
| P4 | Enhanced RAIM based on weighted and subset schemes for multi-constellation receiver | H. Wu, L. Yang, Y. Sun, Y. Zheng, Y. Zhang |
| P5 | Transform domain interference suppression based on FrFT with adaptive threshold | H. Wu, L. Yang, Y. Sun, Y. Zheng, Y. Zhang |

| Room<br>F2 | **Session C1, Specific Navigation (1)**<br>*Chairs: Michael Kieslinger [Fluidtime Data Services GmbH], Gard Ueland [Galileo Services]* |  |
|---|---|---|
| P1 | Safe navigation for autonomous robot systems – SiNafaR | O. Kurz, D. Aschenbrenner, M. Stahl, M. Fritscher, R. Hess, K. Schilling |
| P2 | Mobility and security service for rescue organisations using vehicle and pedestrian navigation | C. Aichhorn, C. Fösleitner, C. Sommer |
| P3 | CrashPos – A navigation application for a novel ADAS test system | R. Lesjak, T. Moder, V. P. Makkapati, M. Wieser, H. Steffan |
| P4 | ARGUS: Assisting personal guidance system for people with visual impairment | C. Fösleitner, M. Troger, O. Otaegui, J. Spiller, D. Patti, R. Olmedo, M. Dubielzig |

| Room<br>OEE<br>558 | **Session D1, Waterway Navigation**<br>*Chairs: Dick Smith [Royal Institute of Navigation], Jac Spaans [Netherlands Institute of Navigation]* |  |
|---|---|---|
| P1 | Precision navigation system based on GNSS for inland waterway navigation | D. Kuci, M. Troger, K. Aichhorn, J. Nemeth |
| P2 | Maritime volumetric navigation system (ARIADNA) | M. Troger, K. Aichhorn, C. d. l. C. de Bedoya, P. Berglez, M. L. Cabeceira, J. Nemeth |
| P3 | Impact analysis of radio frequency interference on maritime DGNSS | K. Seo, S. Park, Y. Kim |
| P4 | Design and performance evaluation of real time maritime traffic safety system | S. Song, D. J. Cho, S. G. Park, C. Hong, S. H. Suh |
| P5 | Assessment of the compatibility of a ship simulation model with its real counterpart | K. Czaplewski, P. Zwolan |
| A1 | Common maritime data structure for e-navigation | N. Ward |
| A2 | The application of methods of robust M-estimation in establishing ship position in marine traffic surveillance systems based on radar observations | K. Czaplewski, S. Swierczynski |

P=presentation, A=alternate presentation

### After Sessions (A1, B1, C1, D1)

› Coffee/Tea Break **15:00–15:30**

› Demonstration drives are offered today between **12:00** and **14:00**.
  Visit the Testbed Telematics booth in the exhibition area for more details.

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2013

# Tuesday, 23 April 2013
## 15:30–17:00

| Room E1 | **Session A2, Space-based Augmentation Systems (2)**<br>*Chairs: Robert Weber [Vienna University of Technology], Krzystof Czaplewski [Polish Navigation Forum]* | |
|---|---|---|
| P1 | Advanced RAIM integrity concept and integrity support message architecture design | I. Martini, M. Rippl, M. Meurer |
| P2 | New trends in the prototyping of the SBAS navigation message algorithms | A. Madrazo-Fernandez, V. M. Esteban, M. A. Odriozola, V. Izquierdo, F. J. Simón, J. Ostolaza, J. Caro |
| P3 | Distribution of GNSS augmentation service at high latitudes using the Iridium Communications System | O. Ørpen, E. Vigen |
| P4 | Potential use of GBAS techniques to improve SBAS signal quality monitoring | M. Schenk, K. Narayana, H. Su |
| P5 | Solar cycle 24 activities: First impacts on SBAS | N. Suard, F. Carvalho, E. Rifa, P. Yaya, E. Robert, M. Mabilleau |
| A1 | Current status of QZSS and its technical demonstration results | S. Kogure |
| A2 | Initial assessment of the BeiDou Interface Control Document (ICD) released December 2012 | E. Anyaegbu, B. Townsend, Rui |

| Room E2 | **Session B2, GNSS Receiver Technology – Software, Algorithms (2)**<br>*Chair: Bernhard Richter [Leica Geosystems]* | |
|---|---|---|
| P1 | Stress testing of the GNSS tracking loop for land vehicle navigation | M. Gaeb, A. Wehr |
| P2 | GNSS spoofing mitigation in multipath environments using space-time processing | S. Daneshmand, A. J. Jahromi, A. Broumandan, G. Lachapelle |
| P3 | Comparison of two approaches of GNSS positioning in NLOS environments using a 3D model for reliable navigation | K. A. Bin Ahmad, M. Sahmoudi, A. Bourdeau, C. Macabiau |
| P4 | Benefits of synthetic aperture GNSS signal processing under canopy and indoors | T. Pany, N. Falk, B. Riedl, J. Winkel, F.-J. Schimpl |
| P5 | Adaptive GNSS signal tracking techniques in the context of a deeply integrated GNSS/INS navigation system designed for tackling multipath in urban environment | S. F. Syed Dardin, V. Calmettes, B. Priot, J. Y. Tourneret |
| A1 | Design of TDOA based method for localization of PPD jammer | H. W. Kang, D. W. Lim, M. B. Heo |

| Room F2 | **Session C2, Specific Navigation (2)**<br>*Chairs: Marco Boero [Softeco Sismart SrL], Bertrand Merminod [ION-CH]* | |
|---|---|---|
| P1 | Robust navigation in complex environments | M. Mujahed, D. Fischer, B. Mertsching |
| P2 | A novel GPS measurement prediction algorithm for fail-safe navigation | S. G. Park, D. J. Cho |
| P3 | A novel system for cooperative and non cooperative UAV sense-and-avoid | L. Rodriguez, R. Sabatini, A. Gardi |
| P4 | Cooperative mission planning for search and rescue applications for micro aerial vehicles based on artificial potential fields | J. Seibold, P. Crocoll, G. F. Trommer |
| P5 | Somewhere out there – Spaceborne GNSS-receiving systems for LEO and beyond | M. Sust, F. Zangerl |

| Room OEE 558 | **Session D2, Side Event (ARIADNA Workshop)** | |
|---|---|---|
| | Public Workshop **15:30–18:30** | |

P=presentation, A=alternate presentation

### After Sessions (A2, B2, C2)

› Poster Session **17:15–18:30**

› Exhibition parallel to sessions (page 22–25)

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## Poster Session in Poster Area: Navigation Technologies and Methods

| | |
|---|---|
| A novel method of accurate positioning for SINS during GPS outages | J. Xiao, X. Meng, C. Hill |
| A preliminary study of multi-GNSS data combination | D. Pradipta, R. Weber, A. Wieser, D. Wijaya |
| Adaptive MUKF based INS/GPS integrated navigation system for low-cost land vehicle applications | S. Y. Cho, K.-H. Kim |
| Advanced power control scheme for second generation beacon | J. Kim, J.-H. Lee, S. Lee, W. Ahn, M.-J. Yu |
| Analysis of architecture and characteristics of compass location based service network | F. Zhao, L. Cheng, Z. Jun, L. Tiejun |
| Anomaly detection of IGS predicted orbits for improvement of near-real-time positioning accuracy using GPS | J. Ha |
| Attitude determination using low-cost single-frequency GPS receivers and inertial sensors | S.-G. Lin, H.-J. Jhuang |
| Comparison of accuracy of two types of DR/GNSS systems | P. Kaniewski |
| GNSS network RTK | E. Samarah |
| Modeling of failure of GPS satellite for realization of anomalous signals on real-time | J. Y. Ko, Y. Han, M. Y. Shin, D. J. Cho |
| Motion compensation system for UAV-based miniature SAR radar | P. Kaniewski, S. Konatowski |
| Optimizing RTK cluster technique using GNSS signal | M. A. Zayan, O. Emam |
| Performance analysis of CORS systems: A case study in ÇORUM | R. M. Alkan, V. IlÇi, F. E. Tombus, I. M. Ozulu, M. Sahin |
| Real-Time GPS satellite clock correction estimation at the Technical University Vienna | F. Hinterberger, R. Weber |
| Resilient PNT for e-navigation | D. Last, P. Williams, M. Bransby, N. Ward |
| Software for improving EGNOS service in local conditions | A. Felski |
| The high-resolution ionosphere grid based service for Korean SBAS | J. Joo, J. Cho, M. Heo |
| Using IGS products for near real-time comparison of UTC(k)'s | P. Defraigne |
| Weak GNSS signal acquisition using prolate spheroid wave function | T. Halder, A. Bhattacharya |

**After the session you are kindly invited to the**

› Gala Dinner in Town Hall – Reception **19:00**

**Town Hall – Wiener Rathaus**
Lichtenfelsgasse 2
1010 Vienna

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## WEDNESDAY AT A GLANCE

| | ROOM E1 | ROOM E2 | ROOM F2 | ROOM OEE 558 |
|---|---|---|---|---|
| | **Session A3** | **Session B3** | **Session C3** | **Session D3** |
| 08:30–10:00 | Space-based Augmentation Systems – Applications | GNSS Receiver Technology – Hardware, Antennas | ITS – Land and Sea | Time and Frequency Transfer |
| 10:00–10:30 | Coffee/Tea Break | | | |
| | **Session A4** | **Session B4** | **Session C4** | **Session D4** |
| 10:30–12:00 | GNSS – Certification, Standardisation, Simulation | Integrated Navigation | Land Vehicle Navigation | Scientific GNSS (1) |
| 12:00–13:30 | Lunch | | | |
| | **Session A5** | **Session B5** | **Session C5** | **Session D5** |
| 13:30–15:00 | GNSS – Security and Vulnerability | Non-GNSS Navigation Sensors and Infrastructure (1) | Railway Navigation | Scientific GNSS (2) |
| 15:00–15:30 | Coffee/Tea Break | | | |
| | **Session A6** | **Session B6** | **Session C6** | |
| 15:30–17:00 | Location-based Services | Non-GNSS Navigation Sensors and Infrastructure (2) | Aeronautic Navigation | |
| | **Poster Session in Poster Area** | | | |
| 17:15–18:30 | List of Posters (page 16) | | | |

**After the sessions you are kindly invited to the**

› Exhibitor Party **18:30–20:30**

› Exhibition parallel to sessions (page 22–25)

› Demonstration drives are offered today between **12:00** and **14:00**.
  Visit the Testbed Telematics booth in the exhibition area for more details.

ENC 2013

| Room E1 | **Session A3, Space-based Augmentation Systems – Applications** Chairs: Rein van Gooswilligen [Netherlands Institute of Navigation], Antonella Di Fazio [Telespazio S.p.A.] | |
|---|---|---|
| P1 | Europe's progress towards a full scale EGNOS LPV implementation. Current status (first implementations), lessons learned and challenges for the future | P. Azcárraga, F. J. de Blas, J. Vaquez |
| P2 | GNSS performance based navigation procedure validation | F. Jiménez, P. Pintor, A. Gavín, A. García |
| P3 | EGNOS LPV approaches all around Europe: A reality | A. Fransoy, L. Chocano, J. Murcia, E. J. González, C. Aguilera |
| P4 | Future evolution of LPV in support of advanced PBN concepts – FilGAPP Project | J. Murcia, L. Chocano, E. González, A. Fransoy, C. Aguilera |
| P5 | PANDAS (Positioning And Navigation Data Assistance Service) for location based services | S. Obergröbner, A. Kemetinger |
| A1 | SBAS training and capacity building activities in South Africa | A. Madrazo, E. Avenant, N. Costa, E. Spaltro, J. Redelkiewicz |

| Room E2 | **Session B3, GNSS Receiver Technology – Hardware, Antennas** Chairs: Michael Meurer [DLR], Alexander Rügamer [Fraunhofer IIS] | |
|---|---|---|
| P1 | Performance evaluation of different high-rate GPS receivers under various dynamic stress scenarios | C. Bischof, S. Schön |
| P2 | Detection and suppression of PPD-jammers and spoofers with a GNSS multi-antenna receiver: Experimental analysis | A. Hornbostel, M. Cuntz, A. Konovaltsev, G. Kappen, C. Hättich, C. A. Mendes da Costa, M. Meurer |
| P3 | Using software-based GNSS simulator for testing data processing software and receiver PVT modules | O. Leontyeva, M. Lytvyn, P. Berglez |
| P4 | Development of a reconfigurable positioning platform for demanding machine control applications | Q. Shi, X. Meng, Y. Zhu, A. Dodson, K. Soar |
| P5 | The impact of interference caused by GPS repeaters on GNSS receivers and services | E. Steindl, W. Dunkel, A. Hornbostel, C. Hättich, P. Remi |
| A1 | GNSS receiver hardening against interference | G. Shaw, C. J. Hill, C. Dixon, M. Andreotti, N. Ward |

| Room F2 | **Session C3, ITS – Land and Sea** Chairs: Christoph Amlacher [Kapsch], David Broughton [IAIN] | |
|---|---|---|
| P1 | User acceptance assessment in the Austrian large scale FOT Testbed Telematics – methodology and first results | D. Bankosegger, J. Liebermann |
| P2 | Urban congestion pricing systems based on global navigation satellite systems (GNSS) | M. Klumpp, T. Marner |
| P3 | IMPAKT – GPS assessment for cooperative services (car2x-communcation) | S. Krampe, J. Pfister, G. Pucher |
| P4 | E-Navigation and the ACCSEAS project | N. Ward, A. Williams, W. Cook, T. Porathe, T. Christensen, S. Procee, G. Shaw, P. Williams, A. Grant |
| P5 | Distributed maritime observation systems for navigation safety | V. V. Popovich, C. Claramunt |

| Room OEE 558 | **Session D3, Time and Frequency Transfer** Chairs: Christoph Günther [DLR], Andreas Bauch [PTB] | |
|---|---|---|
| P1 | Time transfer with different navigation systems | P. Defraigne |
| P2 | Time scales comparisons using new systems and new signals | P. Pánek, A. Kuna |
| P3 | Absolute calibration of dual frequency timing receivers for Galileo | B. P. B. Elwischger, M. Suess, S. Thoelert, J. Furthner |
| P4 | Quasi-optimal atomic clock ensemble frequency combining algorithm | S. Yu. Medvedev, K. G. Mishagin, S. D. Podogova, B. A. Sakharov, I. N. Tchernyshev |

P=presentation, A=alternate presentation

**After Sessions (A3, B3, C3, D3)**

› Coffee/Tea Break **10:00–10:30**

› Demonstration drives are offered today between **12:00** and **14:00**.
  Visit the Testbed Telematics booth in the exhibition area for more details.

| Room E1 | Session A4, GNSS – Certification, Standardisation, Simulation<br>*Chairs: Martin Grzebellus [NavCert], Hermann Rohling [DGON]* |  |
|---|---|---|
| P1 | Certification of traffic information system | M. Hentschinski |
| P2 | Prediction of NLOS GNSS signals with a 3D model of the user urban environment | A. Bourdeau, M. Sahmoudi, J.-Y. Tourneret |
| P3 | Alberding GNSS monitoring solutions | T. Horváth |
| P4 | Multi-frequency, multi-constellation IF software simulator including Galileo PRS-like signals | S. Hinteregger, O. Leontyeva, P. Berglez |
| P5 | Simulating GNSS position accuracy using raytracing and non-line of sight reflected signals | J. Jakobsen, A. B. O. Jensen, A. Bærentsen, J. Marais |

| Room E2 | Session B4, Integrated Navigation<br>*Chairs: Xiaolin Meng [University of Nottingham], Ismael Colomina [Institut de Geomatica]* |  |
|---|---|---|
| P1 | Outdoor foot mounted inertial navigation – A particle filter approach | J. Pinchin, P. Bartie, W. Mackaness |
| P2 | GNSS/INS integration using a tightly coupled approach for navigation of people with visual impairments | M. Troger, C. Fösleitner, J. Seybold |
| P3 | Retrospective gap filling – The Easy-OBU way | F. Kressler, J. Pfister, H. Stratil, R. Srp, S. Belinova |
| P4 | Autarkic and inertial sensor based low-cost reconstruction of motorcycle forward speed | Y. Stebler, R. Filliger, N. Munzinger, R. Lot, J. Skaloud, K. Hug |

| Room F2 | Session C4, Land Vehicle Navigation<br>*Chairs: Alexander Frötscher [AustriaTech], Börje Forssell [Nordic Institute of Navigation]* |  |
|---|---|---|
| P1 | ITS Vienna region and the intermodal realtime traffic information service AnachB.at | H. Fiby |
| P2 | Determination of driving lanes through low cost GPS receivers | J. Liebermann, F. Kressler, G. Navratil |
| P3 | Personalization of travel times for personal navigation systems | A. Landau, J. F. Ehmke, D. C. Mattfeld |
| P4 | Improved navigation in challenging areas by robust, high-precision positioning (NAV-CAR project) | E. Schoitsch, E. Althammer, R. Kloibhofer, R. Spielhofer, M. Reinthaler, P. Nitsche, S. Jung, S. Fuchs, H. Stratil |
| P5 | Reconstruction and analysis of jackknifing & rollover using an articulated vehicle's HILS based on GPS/INS simulator | B. S. Lee, M.-B. Heo, J. H. Lee |

| Room OEE 558 | Session D4, Scientific GNSS (1)<br>*Chairs: Robert Weber [Vienna University of Technology], Manuel Hernandez-Pajares [Universitat Politecnica de Catalunya]* |  |
|---|---|---|
| P1 | GPT2: An improved blind model for tropospheric slant delays in GNSS analysis | J. Böhm, K. Lagler, M. Schindelegger, R. Weber, G. Möller |
| P2 | GNSS-Reflectometry from ground-based, airborne and satellite platforms: Observations and simulation studies | J. Beckheinrich, G. Beyerle, R. Stosius, S. Schoen, H. Apel, M. Semmling, J. Wickert |
| P3 | Multi-frequency dynamic GNSS altimetry | J. Dampf, T. Pany, N. Falk, B. Riedl, J. Winkel |
| P4 | Analysis of IfE-Robot based group delay variations for the positioning and navigation of mobile platforms | T. Kersten, S. Schön |
| P5 | Small movements detection: Challenges for GNSS-geomonitoring | A. Geiger, A. Villiger, P. Limpach, Z. Su, J. Beutel |

P=presentation, A=alternate presentation

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### After Sessions (A4, B4, C4, D4)

› Lunch **12:00–13:30**

› Demonstration drives are offered today between **12:00** and **14:00**.
  Visit the Testbed Telematics booth in the exhibition area for more details.

# Wednesday, 24 April 2013
## 13:30–15:00

| Room E1 | **Session A5, GNSS – Security and Vulnerability** <br> *Chairs: Friedrich Teichmann [bmvit, Austria], Michael Luczensky [bmvit, Austria]* |
|---|---|
| P1 | Signal quality indicators and reliability testing for spoof-resistant GNSS receivers | H. Kuusniemi, M. Z. H. Bhuiyan, T. Kröger |
| P2 | PVT solution authentication based on monitoring the clock state for a moving GNSS receiver | A. Jafarnia Jahromi, S. Daneshmand, A. Broumandan, J. Nielsen, G. Lachapelle |
| P3 | Interference analysis tool | A. Kemetinger, S. Hinteregger, P. Berglez |
| P4 | Specification and testing of GNSS vulnerabilities | S. Smith, C. Dixon, C. Hill, G. Shaw |
| P5 | The improvement of a DOA estimation method using a phase-shift measurement in dynamic jammer environments | J. H. Lee, H. H. Choi, M. H. Jin, C. Park, S. J. Lee |

| Room E2 | **Session B5, Non-GNSS Navigation Sensors and Infrastructure (1)** <br> *Chairs: Paul Meissner [Graz University of Technology], Edgar v. Hinüber [IMAR]* |
|---|---|
| P1 | Context dependent heading fixing approaches in IMU-based pedestrian navigation | M. Krammer, T. Bernoulli, S. Muhic, M. Schneeberger, U. Walder |
| P2 | New approaches for locating railways using accelerometers, vibration sensors and micro-phones | I. Partzsch, S. Klipphahn, G. Dürrschmidt, O. Michler |
| P3 | A new method to improve the accuracy and reliability of the algorithms of strapdown inertial navigation systems | S. Yakushin |
| P4 | Elevation variation for local user terminals in communication with LEO search and rescue satellites | S. Cakaj |
| P5 | DOP relationship between TDOA and TOA with no clock bias receiver | H. H. Choi, M. H. Jin, C. Park, S. J. Lee |

| Room F2 | **Session C5, Railway Navigation** <br> *Chairs: Michaela Haberler-Weber [ÖBB], Florian Schramm [Berner&Mattner]* |
|---|---|
| P1 | The milestone based SiPoS-Rail concept for a safe autonomous localization of trains – An experimental proof of concept | M. Breuer, R. Rütters, D. Abel |
| P2 | Estimation of the train travelled distance, velocity and acceleration by using GPS signals | G. Zhu, L. Fillatre, I. Nikiforov |
| P3 | Detecting track events with a laser scanner for using within a modified multi-Hypothesis based map-matching algorithm for train positioning | C. Rahmig, L. Johannes, K. Lüddecke |
| P4 | Curvature change detection for trains using GNSS coasted with 3DoF IMU | B. Belabbas, A. Grosch, O. Heirich, A. Lehner, T. Strang |
| P5 | An example of railway application using EGNOS | E. González, C. Prados, V. Antón, A. Galimberti, C. Morel, J.-C. Pérez |
| A1 | Assessment of augmentation network solution for the evolution of the ERTMS-ETCS train control system | V. Palma, F. Toni, A. M. Vegni, A. Neri, F. Rispoli, A. Filip |

| Room OEE 558 | **Session D5, Scientific GNSS (2)** <br> *Chairs: Manuel Hernandez-Pajares [Universitat Politecnica de Catalunya], Robert Weber [Vienna University of Technology]* |
|---|---|
| P1 | Impact of single and dual-frequency carrier smoothing techniques on range error for medium to severe temporal ionosphere decorrelation and multipath: Validation & simulation results | G. Lalgudi Gopalakrishnan, J. Feltens |
| P2 | Positioning accuracy within a single-frequency GNSS network using a new ionospheric model | N. Magnet, R. Weber |
| P3 | Assimilation of GNSS data into the ionospheric model, using the ensemble Kalman filter | D. V. Solomentsev, B. V. Khattatov, A. A. Titov, V. U. Khattatov, R. V. Mazakirov |
| P4 | The IGS Multi-GNSS Experiment (MGEX) | R. Weber, O. Montenbruck, P. Steigenberger, U. Hugentobler, R. Khachikyan |
| P5 | Assessment of ionosphere gradient overbounding due to spatial decorrelation in GBAS | G. Lalgudi Gopalakrishnan, J. Feltens, F. Schmidt Bruecken |
| A1 | Analysis of DGPS performance based on the multi-reference station | K.-T. Kim, K.-D. Park, E.-S. Lee, M.-B. Heo, G.-H. Kim |

P=presentation, A=alternate presentation

### After Sessions (A5, B5, C5, D5)

› Coffee/Tea Break **15:00–15:30**

› Demonstration drives are offered today between **12:00** and **14:00**.
  Visit the Testbed Telematics booth in the exhibition area for more details.

| Room E1 | Session A6, Location-based Services<br>*Chairs: Haosheng Huang [Vienna University of Technology], Jukka Krisp [University of Technology Munich]* | |
|---|---|---|
| P1 | ASSISTANT – Aiding SuStainable Independent Senior TrAvellers to Navigate in Towns | K. Kalian, W. Kainz |
| P2 | A smartphone application for an innovative user supporting location based shopping experience | M. Krammer, T. Bernoulli, U. Walder |
| P3 | FLIXDATE – Floating ski data by GNSS | C. Sommer, G. Abwerzger, J. Vallant, P. Berglez |
| P4 | Exploiting EGNOS in leisure activities: The WalkEGNOS Project | M. Pini, A. Defina, O. Boyer, D. Meinhard, E. Spaltro |
| Room E2 | Session B6, Non-GNSS Navigation Sensors and Infrastructure (2)<br>*Chairs: Edgar v. Hinüber [IMAR], Paul Meissner [Graz University of Technology]* | |
| P1 | Sovereign PNT solutions using eLoran | G. Offermans, C. Schue |
| P2 | The deployment of eLoran in the UK | P. Williams, D. Last, N. Ward |
| P3 | A practical approach to acoustic transponder localization methods available for the offshore construction support surveys | A. Tomczak |
| P4 | Navigation performance using the aeronautical communication system LDACS1 by flight trials | N. Schneckenburger, B. Elwischger, D. Shutin, M. Suess, M. Schnell, J. Furthner, B. Belabbas, M. Meurer, U. Fiebig |
| P5 | Plausibility analysis of navigation related AIS parameter based on time series | F. Heymann, T. Noack, P. Bany's |
| Room F2 | Session C6, Aeronautic Navigation<br>*Chair: Holger Flühr [FH Joanneum]* | |
| P1 | A novel flight management system for SESAR intent based operations | S. Ramasamy, R. Sabatini, A. Gardi, Y. Liu |
| P2 | The role of RFID in a low-cost localization system for provision of a complete operational picture on regional airports | S. Niedermayr, G. Retscher, A. Wieser |
| P3 | Evaluation of a commercial low-cost GPS/INS platform in an aeronautical environment | M. Gruber, H. Flühr |
| P4 | GNSS in real time: Demonstration experiment at Berlin Airport International | J. Wickert, G. Dick, M. Ge, S. Heise, X. Li, M. Shengguan, T. Nischan, M. Ramatschi, H. Schuh, J. Alberding, U. Weigmann |

P=presentation, A=alternate presentation

**After Sessions (A6, B6, C6)**

› Poster Session **17:15–18:30**

› Exhibition parallel to sessions (page 22–25)

## Poster Session in Poster Area: Business Aspects, Applications, Science

| | |
|---|---|
| Evaluation of auditory icons in ship bridge alarm management system | S. Oh, J. H. Jang, H. Kim |
| Augmented GPS tracking for sport applications | G. Moeller, R. Weber, J. Krocza, C. Klug, G. Thaler |
| Comparison of different ionospheric correction methods for single-frequency positioning | D. Minkwitz, T. Gerzen, V. Wilken, N. Jakowski |
| Exploiting V2X to improve GNSS vehicle tracking performance | S. Stephenson, X. Meng, Y. Gao |
| Future enhancements for the internet of things based on GNSS services and time-triggered ethernet | C. Fidi, M. Jakovljevic |
| GNSS accurate positioning including satellite visibility check in a multiple hypotheses 3D mapping framework | D. Bétaille, M. Ortiz, F. Peyret |
| Grid-based transformation of absolute railway track coordinates to the national coordinate system | M. Haberler-Weber, A. Eder, R. Weber, F. Hinterberger, Herbert Döller |
| LOBSTER – Filter approaches for indoor positioning tailored to emergency situations | P. Hafner, T. Moder, M. Wieser |
| Measurement of simulator sickness by scene movement using COP in ship handling simulator using SSQ and COP | J. H. Jang, S. Oh, H. Kim, T. H. Fang |
| Performance of low-cost HS-GPS under forest canopy | S. Heuboeck, G. Retscher |
| RAIM performances for GNSS with self-contained aiding | S. Gaglione, M. Vultaggio |
| Show me the way in a way that I can remember – Focusing on semantic aspects of route descriptions | J. Neuschmid, W. Wasserburger |
| Temporal analysis of the troposphere delay using GNSS data | D. Pradipta, K. Wedyanto, K. Prijatna, R. Weber, A. Wieser |
| The comparison of algorithms of the atomic clocks frequency calibration using GNSS signal receiver | K. G. Mishagin, S. D. Podogova |
| Underground position application by internet of things in coal mine area | G. Chen, X. Meng, Y. Wang |
| WiFi indoor positioning integrated with low cost IMU | M. Kalarus, A. Foks-Ryznar |

**After the session you are kindly invited to the**

› Exhibitor Party **18:30–20:30**

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| THURSDAY AT A GLANCE | | |
| --- | --- | --- |
| **ROOM E1** | **ROOM E2** | **ROOM F2** |
| **Session A7** | **Session B7** | **Session C7** |
| 08:30–10:00 Business and Economic Aspects of GNSS | GNSS Network-RTK (1) | Integrated Applications |
| 10:00–10:30 Coffee/Tea Break | | |
| **Session A8** | **Session B8** | **Session C8** |
| 10:30–12:00 Quick and Slow, Dynamic Content: The future of Location-based Services | GNSS Network-RTK (2) | Modern Applications and Future Developments |
| 12:00–13:30 Lunch | | |
| **Session A9** | **Session B9** | **Session C9** |
| 13:30–15:00 European Satellite Navigation Competition 2013 – International Kick-off Meeting | Precise Point Positioning (PPP) | Indoor Positioning |
| 15:00–15:30 Coffee/Tea Break | | |
| **Closing Session in Room E1** | | |
| 15:30–16:00 Moderated by Gérard Lachapelle [University of Calgary] | | |

**Parallel to Sessions**

› Exhibition (page 22–25)

ENC 2013

| Room E1 | **Session A7, Business and Economic Aspects of GNSS** *Chair: Dieter Meinhard [Brimatech Services]* | |
|---|---|---|
| P1 | Commercialising GNSS OBUs to public transport: Finding the first enabling business modell | W. Aigner, P. Kolbert, J. Pfister, W. Schildorfer |
| P2 | User requirements for GNSS services derived from business process modeling | F. Teichmann |
| P3 | Cooperative ITS services roll-out approach – Targeting specific user groups first instead of marketing the majority | W. Schildorfer, W. Aigner, D. Bankosegger, M. Jandrisits |
| P4 | Mobicap – An ecosystem for access to finance in GNSS applications | R. Horn, T. Tanghe |
| P5 | Austrian technology in space | A. Kleinsasser, J. Egger-Berndorfer |

| Room E2 | **Session B7, GNSS Network-RTK (1)** *Chairs: Hans-Jürgen Euler [Inposition], Matthias Becker [University of Technology Darmstadt]* | |
|---|---|---|
| P1 | Adaptive filter design of the float solution in the presence of multipath | S. L. Cho, Y. S. Choi, S.-R. Yeo, M. B. Heo, C. Park, S. J. Lee |
| P2 | How to distinguish the clock errors and the orbit errors from the satellite anomaly | Y. Han, J. Ko, M. Y. Shin, D. Cho |
| P3 | Issues of different estimation models of epoch-by-epoch double-difference GPS observation equations: A comparative study | H. F. Suhandri, E. Realini |
| P4 | New algorithms to mitigate false-lock impact over an orbit determination and time synchronization process | X. Serena, C. Catalán, B. Martin |
| A1 | Generation of ionosphere and troposphere grid model in Korea Peninsula | S. Eun-Seong, J. Won, K.-D. Park, E. Lee, M.-B. Heo, K. Choi |
| A2 | The high-precision area augmentation technique and system for the combined processing of COMPASS, GPS and GLONASS measurements | D. Wang, S. Pan, C. Gao, X. Meng |

| Room F2 | **Session C7, Integrated Applications** *Chair: Erich Klock [ESPI]* | |
|---|---|---|
| P1 | Dynamic last-mile-routing as business-value-application for Galileo | G. Sandhaus, M. Klumpp |
| P2 | "LOPT-GNSS" – Hose line optimization with GNSS | F. Schöggl, J. Vallant |
| P3 | GSP – Technical feasibility and achieve results | J. Pfister, B. Horváth, T. Kulpa, T. Tvrzs |
| P4 | A new fast acquisition technique for spaceborne receiver | A. de Latour, J. Dantepal, D. Laurichesse |
| A1 | The integration of GPS precise point positioning and inertial navigation in the aerial remote sensing applications | H. Sun, J. Fu, Q. Chen |
| A2 | Application of navigation systems in the derivation of location information for geographic profiling in Nairobi, Kenya | L. Mburu |

P=presentation, A=alternate presentation

**After Sessions (A7, B7, C7)**

› Coffee/Tea Break 10:00–10:30

| Room E1 | Session A8, Quick and Slow, Dynamic Content: The future of Location-based Services<br>*Chair: Frank Salzgeber [ESA]* | |
|---|---|---|
| P1 | Smart cities – How maps and big data will enrich people´s life | M. Halbherr |
| P2 | How technology can be used as a multi channel business model | F. Gschwandtner |
| P3 | Maps 2.0 – The cooperative way to keep maps up to date | O. Kühn |

| Room E2 | Session B8, GNSS Network-RTK (2)<br>*Chairs: Matthias Becker [University of Technology Darmstadt], Hans-Jürgen Euler [Inposition]* | |
|---|---|---|
| P1 | A method of verification for measurements propagation delay for GNSS in land transportation environment | G. Kim, E. Lee, B. Park, M. Heo |
| P2 | Network RTK GNSS quality assessment | X. Meng, Y. Quan, L. Yang |
| P3 | Trimble CenterPoint RTX – A first study on supporting Galileo | F. Zhang, M. Brandl, X. Chen, R. Drescher, M. Glocker, H. Landau, R. Leandro, M. Nitschke |
| P4 | The Fehmarnbelt positioning system for a mega construction site | A. Jensen, J. Rüffer |
| P5 | RTK-WLAN based monitoring system for landslides detection | D. Koch, K. Landfahrer, N. Kühtreiber |

| Room F2 | Session C8, Modern Applications and Future Developments<br>*Chair: Gerhard Reitmayr [Graz University of Technology]* | |
|---|---|---|
| P1 | 3D virtual urban planning based on PTAMM | C. Luo, J. Zidbeck |
| P2 | Evaluation of location accuracy of track application in mobile devices | P. Sádovská |
| P3 | Automated intent negotiation and validation system for 4-dimensional trajectory based operations | A. Gardi, R. Sabatini, S. Ramasamy |
| P4 | Conformance tests for eCall | M. Grzebellus |
| A1 | Challenges and issues in developing pedestrian/wheelchair navigation services on smartphones | H. Karimi, M. Ren, P. Kasemsuppakorn |
| A2 | Spacecraft control using Adaptive Neural-Network Predictive Controllers (ANNPC) and GNSS signals | M. A. Zayan, O. Emam |

P=presentation, A=alternate presentation

**19**

**After Sessions (A8, B8, C8)**

› Lunch **12:00–13:30**

ENC 2013

| Room E1 | Session A9, European Satellite Navigation Competition 2013 – International Kick-off Meeting |
|---------|-----------------------------------------------------------------------------------------------|
|         | Detailed programme for international kick-off meeting see page 21 |

### Room E2 — Session B9, Precise Point Positioning
**Chairs: Maoreng Ge [GFZ Potsdam], Alain Geiger [ETH Zurich]**

| | | |
|----|----|----|
| P1 | Real time PPP with Galileo | E. Vigen, T. Melgård, O. Ørpen, R. Strandli, D. Lapucha, J. Tegedor |
| P2 | PPPserve – Network based GNSS phase biases to enhance PPP applications | K. Huber, F. Hinterberger, R. Lesjak, R. Weber, C. Klug, G. Thaler |
| P3 | Suitability of single-frequency PPP for the detection of slow mass movements | C. Pöllabauer, M. Lytvyn |
| P4 | GNSS data pre-processing strategy for near real-rime single-frequency PPP | M. Lytvyn |

### Room F2 — Session C9, Indoor Positioning
**Chairs: Günther Retscher [Vienna University of Technology], Heidi Kuusniemi [Nordic Institute of Navigation]**

| | | |
|----|----|----|
| P1 | Exploring human factors in indoor navigation | M. Brown, J. Pinchin |
| P2 | Indoor navigation for a micro aerial vehicle aided by laser range finder measurements | P. Crocoll, J. Seibold, M. Popp, G. F. Trommer |
| P3 | IFEN's integrated (GNSS, foot-mounted IMU and QR codes) navigation device applied for supporting fire fighters | J. Gruber, W. Bär, E. Göhler, I. Krol, T. Pany, J. Winkel |
| P4 | Accurate and robust indoor localization systems using ultra-wideband signals | P. Meissner, E. Leitinger, M. Froehle, K. Witrisal |
| P5 | Analysis of bayesian filters for position estimation in ultra-wideband localization systems | D. Kakkar, T. Nowak, P. Karbownik, N. Franke, R. Galas |

P=presentation, A=alternate presentation

### Room E1 — Closing Session
**Moderated by Gérard Lachapelle [University of Calgary]**

15:30–16:00

**Parallel to Sessions**

› Exhibition (page 22–25)

EUROPEAN
SATELLITE NAVIGATION
**COMPETITION 2013**

in cooperation with

**EUROPEAN SATELLITE NAVIGATION COMPETITION 2013**
**INTERNATIONAL KICK-OFF MEETING**
IN LINE WITH THE EUROPEAN NAVIGATION CONFERENCE 2013

**25 APRIL 2013, 13:30 – 15:00**
AUSTRIA CENTER VIENNA (PLENARY SESSION)

PROGRAMME

| Time | Item | Speaker |
|------|------|---------|
| 13:00 | Registration | FFG |
| 13:30 | Welcome by bmvit & FFG | Andrea Kleinsasser, bmvit & Harald Posch, FFG |
| 13:40 | ESNC 2013 – International Kick-Off | Thorsten Rudolph, AZO |
| 13:55 | ESNC 2013 – Austria Challenge | Elisabeth Fischer, FFG |
| 14:05 | Winner Austria Challenge '12, BikeCityGuide | Daniel Kofler, BikeCityGuide |
| 14:20 | GSA Special Prize | Mr Gian Gherardo Calini, GSA |
| 14:30 | ESA Special Prize | Frank Salzgeber, ESA |
| 14:40 | DLR Special Prize | Robert Klarner, DLR |
| 14:50 | EPO Special Prize | Oswald Schröder, EPO |
| 15:00 | University Challenge | Paul Bhatia, GRACE |

AS OF 25 MARCH 2013

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EUROPEAN
SATELLITE NAVIGATION
**COMPETITION 2013**

in cooperation with

JOIN THE ESNC INTERNATIONAL
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25 APRIL 2013, 13:30 - 15:00
AUSTRIA CENTER VIENNA
(PLENARY SESSION)

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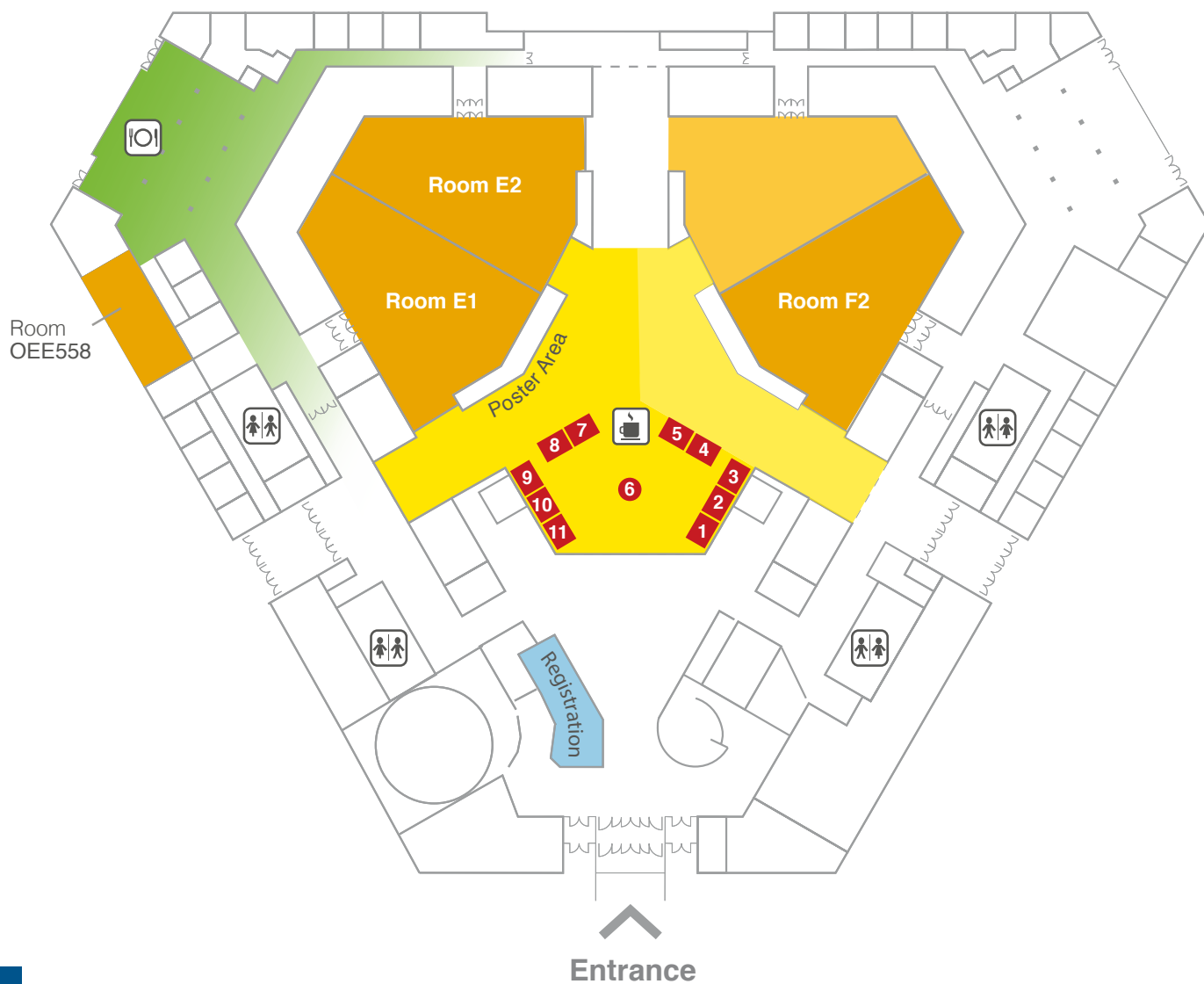
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|---|---|---|---|
| **1** | Spirent Communications | **7** | IFEN GmbH |
| **2** | Artech House | **8** | DLR |
| **3** | Austrospace | **9** | Berner & Mattner |
| **4** | EPOSA | **10** | Alberding GmbH |
| **5** | RUAG Space | **11** | Fraunhofer IIS / TeleOrbit GmbH |
| **6** | Testbed Telematics | | |

## 1    Spirent Communications

With nearly 30 years of experience in developing, manufacturing and supporting GNSS test equipment, Spirent is recognised as the world leader in its domain. Spirent GNSS test equipment is widely chosen by major manufacturers, integrators, test facilities and Space Agencies. This track record displays a firm commitment by the company to maintaining its products at the leading edge of customer requirements and responding to application developments in this arena.

Spirent's strength in understanding emerging GNSS requirements is as a result of its global presence and participation in a wide range of markets which has led to the most comprehensive range of simulators available, enabling the Spirent user community to rapidly benefit on its unique focus on navigation and positioning test. In particular, developers of systems incorporating GNSS have benefited from Spirent's span of capabilities enabling consistent trajectory and environment models to be applied across a range sensor emulation technologies including inertial, WiFi and cellular radio as well as GNSS.

As a participant in the Galileo IOV Programme for the development of the RFCS (RF Constellation Simulator), Spirent has been able to use all its experience and technology in generating Multi-Constellation and Multi-Frequency systems. Current products fully address all Galileo frequencies and Services.

In 1998 Spirent produced the first GLONASS constellation simulator and in 2008 the introduction of products to support Japan's QZSS augmentation System.

Spirent has always been first to market with test systems for new and modernised GPS signals and Augmentation systems. For example, Spirent simulators have supported L2C, L5, MCode, MNoise, MSAS, WAAS, and EGNOS for more than four years.

More recently in 2012, Spirent starting shipping BeiDou-ready systems to customers, now the SIS-ICD has been released these systems are being upgraded to full BeiDou-2 capability. BeiDou has been added to all Multi-GNSS RF constellation simulators and signal generators in Spirent's range.

### PRODUCT STRENGTHS

Hardware
- High fidelity and high quality of generatedsignals
- Accuracy and stability – Direct digital synthesis
- Reliability – Modular design
- Capacity – High channel and carrier count, including multipath channels
- Adaptability – FPGA core is re-programmable
- Powerful – High speed processors and gate arrays
- Scalable – Multi-chassis support is standard
- Fully specified and verified

Software
- Comprehensive – Ground, space and user segment models
- Configurable – multiple hardware types supported
- Easy-to-use "Point-and-click" interface – built in "help"
- Industry Standard OS – Microsoft Windows®
- Fully Real-time operation – define and then click to run
- Full hardware in the loop support as standard
- Quality – Audited development environment
- Fully verified and proven – 23-year development history

## 2    Artech House

A leading technical book publisher, Artech House provides engineers with cutting-edge books and software from the world's top authorities in GNSS, antennas and propagation, microwave/RF, remote sensing and radar amongst other areas.

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## 3    Austrospace

AUSTROSPACE, the association of Austrian space industries and research institutions, is a non-profit organization focusing on:

- Comprehensive information about Austrian space activities
- Representation of common interests of Austrian suppliers and users of space technologies vis-à-vis Austrian authorities and international organizations

The members of AUSTROSPACE account for the predominant part of Austrian contributions to space programs and cover a broad spectrum of space technologies and applications in the areas of telecommunications, navigation, earth observation, meteorology, space transportation, and space science.

During the last decade, the Austrian space industry has successfully expanded the customer network from Europe to the global space market. Scientific co-operations have been established with all major space agencies worldwide.

AUSTROSPACE

## 4    EPOSA

EPOSA – Real-time Positioning Austria:
The partners Energie Burgenland AG, ÖBB Infrastruktur AG and Wien Energie Stromnetz GmbH founded EPOSA with the aim of providing infrastructure for precise real-time positioning. Due to high demands within the founding companies, an extraordinarily high standard for solving questions of positioning has been developed there. EPOSA know-how builds upon the competences of three high-tech companies. From this results a range of highly precise positioning data in real-time and post processing applications.

Data offered are:
- DGNSS correction data
- L1 / L2 – GPS / GLONASS
- RINEX data (GPS / GLONASS)
- Online transformation parameters
- User training
- EPOSA Hotline +43 1 90190 32930

Contact:
Wien Energie Stromnetz GmbH
Mariannengasse 4-6
1095, Wien, Österreich
Tel.: +43 1 90190 32900
Fax: +43 1 90190 9932900
Email: info@eposa.at
Internet: www.eposa.at

ECHTZEIT POSITIONIERUNG AUSTRIA

### Security Rules

Products strictly forbidden to enter the venue are:

- Flammable substances, gases, gas bottles and/or dangerous products, including substances, which run the risk of irradiating
- Products that expel odours and any device that generates noises or irradiates annoying lights
- Devices (generators, compressors) with internal combustion engine
- Animals also must be kept out of the stands

ENC 2013

**5** **RUAG Space GmbH**

RUAG Space GmbH in Austria belongs to the Swiss RUAG Group since September 2008. It is part of the RUAG Space Division, which employs some 1100 people in Switzerland, Sweden and Austria, thus, forming the largest independent equipment supplier in Europe.

RUAG Space GmbH (RSA), with its 175 employees the largest space company in Austria, has started its activities in the space market in 1983 and has since then been developing and manufacturing space products and related ground support equipment in the areas of electronics, mechanics and thermal hardware.

The product portfolio of RSA comprises On-board Electronics, Mechanisms and Thermal Hardware as well as Mechanical Ground Support Equipment.

In the area of On-board Electronics RUAG Space is a leading supplier of on-board Digital Signal Processing equipment, covering hardware and software solutions as well as systems engineering.

An area of particular experience in digital signal processing lies in the field of navigation signal processing. Navigation Receivers for Precise Orbit Determination of satellites are core products of RSA and are delivered to all recent ESA Earth Observation satellites as well as to NASA.

The RUAG Space dual-frequency GPS Precise Orbit Determination (POD) Receiver provides an excellent on-board real-time navigation solution of less than 2 meters. After on-ground post-processing, a position measurement accuracy of the satellite of a few centimeters can be achieved.

Another product developed by RUAG Space in the area of digital signal processing is the Navigation Signal Generation Unit (NSGU), which is the main subsystem of the Galileo navigation satellite payload. The NSGU generates the signal that enables users on ground to determine their position and to benefit from information that is distributed by those satellites.

## Together ahead. RUAG

**6** **Testbed Telematics**

Testfeld Telematics Austria Demonstration @ European Navigation Conference 2013

The European Navigation Conference 2013 takes place at the Austria Center Vienna from 23 to 25 April 2013.

Testbed Telematics Austria (TTA) demonstrates the navigation options in urban cooperative systems on 23 and 24 April 2013 at the European Navigation Conference.

The demonstration starts directly at the booth in the entrance area of the Austria Center Vienna and consists of a 25 minutes demonstration drive through urban motorways and urban roads in Vienna. After a short introduction in the concept of TTA and the different end user devices you can experience advanced cooperative systems in your drive. You will see dynamic in vehicle warnings, real time traffic signs, and urban traffic lights adapted to your journey and the current traffic conditions. During the drive you will also get an insight into next generation mobile ITS platforms like smartphones, personal navigation devices or in vehicle solutions for dynamic navigation support.

The demonstration drives are offered on 23 and 24 between 12.00 and 14.00. Please register for the demonstrations as soon as possible and contact alexander.froetscher@austriatech.at

See pictures of vehicles, in vehicle HMI's, demonstration route, and events below.



**7** **IFEN GmbH**

IFEN GmbH is a leading provider of GNSS navigation products and services, with a technology portfolio that includes GNSS RF signal generators, software receivers, test ranges, simulation and data processing tools. Their outstanding satellite navigation know-how offers customers a wide range of services, from GNSS system studies, design and development of GNSS software and hardware to

research and development of navigation and integrity algorithms up to the engineering of turnkey facilities and systems.

IFEN's product range includes:

- NavX®-NCS GNSS HF-Signal Simulator:
  A highly flexible and capable RF signal generator for GPS, Galileo, GLONASS and SBAS constellations on the market. With up to 9 L-band frequencies and 108 channels, it redefines the current state-of-the-art in RF signal simulation. To cover the different user testing needs for GNSS testing, the NavX®-NCS RF constellation simulator is available in different versions: The "NavX®-NCS Essential" is focused on research and development, system integration and production testing for GNSS "Automotive and Consumer Applications". The "NavX®-NCS Professional" is optimized for research and development of multi-frequency GNSS "Safety & Professional Applications".

- SX-NSR Software-Receiver:
  The SX-NSR is the only commercial software receiver offering advanced signal processing combined with a powerful quad-band RF-front-end. It delivers unrivalled performance in scientific applications such as signal evaluation (e.g. multipath, spoofing), interference monitoring and reflectometry. Weak signal processing (as e.g. typical for indoor-applications) is another important capability of SX-NSR. Its ability to act as a hardware-infrastructure for your own signal processing algorithms makes it a powerful tool for research and development.

Get in touch with these powerful and user friendly test solutions at ENC 2013, booth 7



**8** **DLR**

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures.

The Institute of Communications and Navigation, located in Oberpfaffenhofen, develops and investigates new systems and methods for radio transmission and positioning. In satellite navigation the Institute puts emphasis on safety-critical applications, which require a reliable positioning and timing information, and on positioning in urban canyons and indoors.

**GALANT** – Multi-antenna GNSS-receivers with new beamforming and signal-processing algorithms enable a more accurate and dependable positioning in satellite navigation by suppressing interference and multipath signals. They can also estimate the

direction-of-arrival of the signals and thus identify and locate deceptive signals and repeaters (spoofers, meaconers). These incorrect data can then be excluded from the navigation solution. The outstanding performance has been tested and demonstrated in GATE in Berchtesgaden.

**LDACS-NAV / APNT** – LDACS1 is currently the most promising candidate for the new digital aeronautical communication system. Currently, DLR investigates in addition to the communication service a possible deployment of LDACS1 system for navigation service during possible GNSS outages. To this end, flight trials have been performed to validate the navigation performance of LDACS1 in realistic scenarios. Preliminary positioning results obtained using measured data show a horizontal positioning accuracy of about 10 meters.

**GBAS / ARAIM** – DLR conducted the first experimental GBAS CAT III flight trials worldwide. Together with DFS, DLR established the German ionosphere threat space used for the certification of the worldwide first operational GBAS station for CAT I in Bremen. DLR is one of the major institutions designing the Integrity Support Message (ISM) architecture to enable LPV-200 (Localizer Performance with Vertical guidance down to 200ft decision height) using Advanced Receiver Autonomous Integrity Monitoring.

**GNSS Signal Verification** – The Institute of Communications and Navigation operates in co-operation with the German Space Operation Center (GSOC) a verification facility for satellite signals. The facility allows highly precise reception and analysis of the signal of navigation systems such as Galileo, GPS, GLONASS or COMPASS. Current research is focused on the Galileo IOV signals, which are received in Weilheim, Germany, by two independent receiving chains using the 30 m dish of the DLR.

**Indoor Navigation** – DLR has developed indoor navigation technology based on Inertial Measurement Units (IMUs). The combination of inertial navigation with maps is a powerful method for accurate indoor positioning. To achieve this, novel algorithms for simultaneous localization and mapping (FootSLAM) using foot mounted IMUs have been developed. They provide position information for the user as well as a map containing walking paths inside a building. This is unique because it allows the automatic generation of maps without using any other sensor, such as cameras or laser scanners.



## 9  Berner & Mattner Systemtechnik GesmbH

Berner & Mattner specialises in the specification, development and testing of electronic systems. We provide services ranging from consultancy and conceptual design to software and system development as well as operational testing and systems integration for the automotive, aerospace, defence, transportation and industrial automation industries. As an efficient interface between science and industry, we help to realise demanding missions through high-quality ECSS conformal services. We provide reliable quality through our integrated Quality Management System according to ISO 9001 and ISO/IEC 27001:2005.

**Technologies and competences**

Berner & Mattner is a pioneer in model-based technologies and has been an important development partner to world-wide leading companies for more than 30 years. Through our consistent model-based engineering approach we can optimize efficiency and quality for our customer's software and system development.

**Products and services in space**
- Software development: SW for ground stations, onboard SW, test automation, HMI SW and frameworks
- Software/System integration & test
- Support of scientific institutes for space related activities
- Consultancy for process optimisation



## 10  Alberding GmbH

Alberding GmbH is a privately-owned German company that develops and distributes professional GNSS system solutions supporting precise positioning, GIS and navigation applications. We provide GNSS raw data management, processing, monitoring and distribution software applications for GNSS infrastructure operators and system developers.

The Alberding DataConv software supports the conversion of GNSS raw binary data into various standard formats in both real time and post processing.

Our web based monitoring and quality control solutions range from data stream availability and content analysis to service performance and deformation monitoring. The Alberding reference station coordinate monitoring solution is based on Precise Point Positioning (PPP) technology and is independent from the algorithms used by service providers for correction data generation.

Alberding GmbH actively participated in the development and standardisation of the Ntrip technology. We provide a professional web based Ntrip Caster software as well as Ntrip Server and Ntrip Client applications for various platforms.

We offer a complete solution for beacon DGNSS service operators, including real-time processing of a network of reference stations, DGNSS VRS data generation, Pre-Broadcast and Far Field Monitoring, correction data distribution and beacon transmitter control.

We also produce customisable GNSS receivers and other hardware modules for construction and mining machine control, reference station operation, system monitoring, personal navigation and mobile data communication. For more information please visit www.alberding.eu

Alberding GmbH – We improve your position.



## 11  Fraunhofer IIS

Founded in 1985, Fraunhofer Institute for Integrated Circuits IIS in Erlangen, Germany, ranks first among the Fraunhofer Institutes concerning headcount and revenues. Apart from mp3 as best known development, Fraunhofer IIS is also a recognized expert for satellite navigation, additional localization technologies and sensor fusion. Since 1996 the Institute has been developing integrated hardware components as well as complete systems and prototypes for applications in the fields of mobile end devices, driver assistance systems, machine control and precise measurement technologies.

Detailed information on research and development portfolio on
http://www.iis.fraunhofer.de/en/bf/ln/technologie/gnss.html



## 11  TeleOrbit GmbH

TeleOrbit is a marketing and sales company providing innovative satellite navigation technologies and solutions incorporating satellite navigation, satellite communication and geoinformation. We closely cooperate with our strategic partners Fraunhofer IIS, Germany and TeleConsult Austria.

We develop and operate GNSS based services and provide project and quality management consultancy support.

We ensure that innovative and enabling satellite technology will be made available to the people and the businesses – in innovative applications, products and new services.

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1220 Wien

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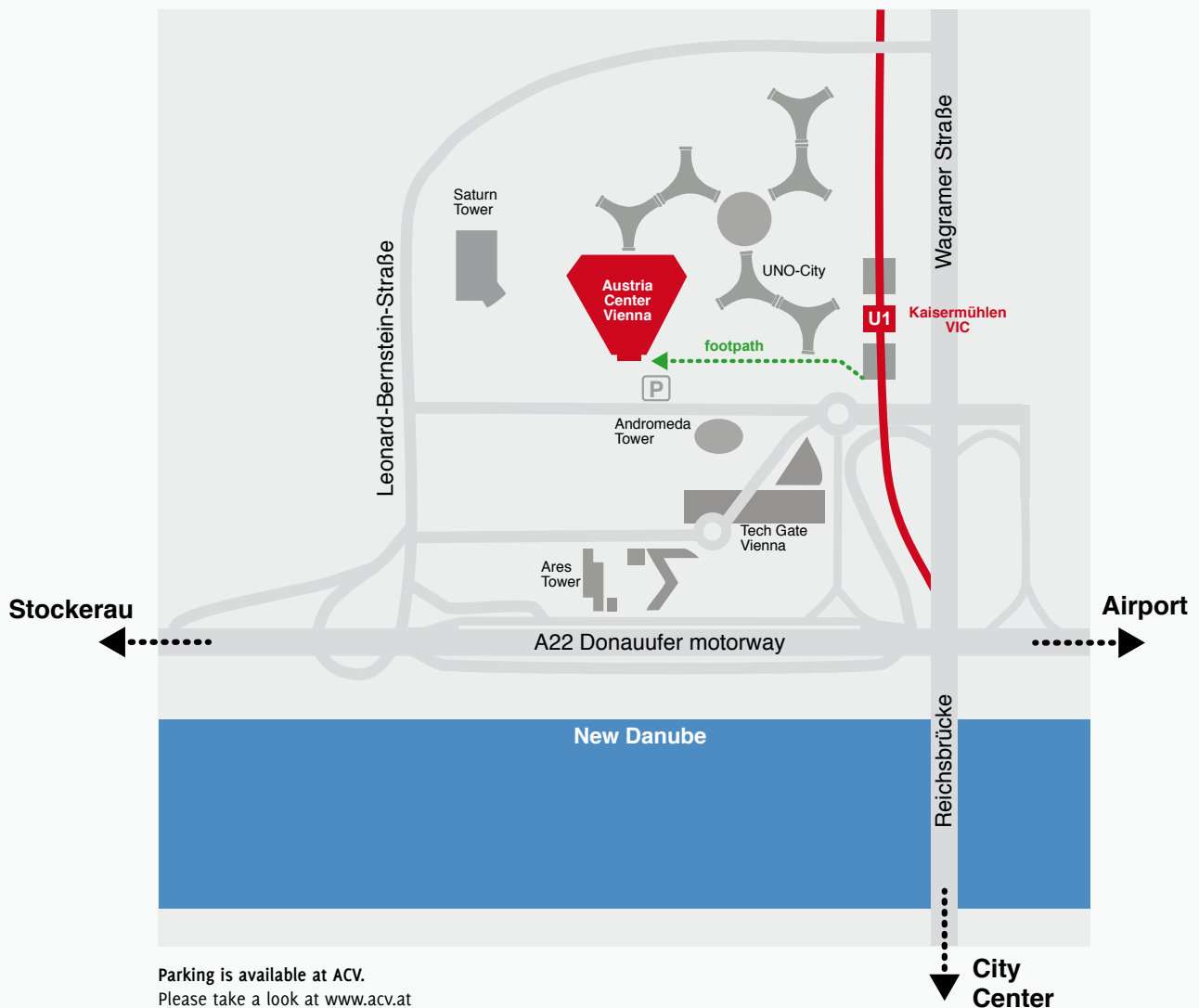
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**Public Transport:**
To reach the Austria Center Vienna from the city centre (Stephansplatz) take the U1 underground line (red).
Alight at Vienna International Centre/Kaisermühlen and take the exit marked Schüttaustraße.
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**For questions please contact the registration desk or S. Fuchs, Conference Manager: +43 664 9689421**

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