

GNSS Applications and Services Views from the European GNSS Downstream Industry

Workshop on Brazil-EC cooperation on satellite
navigation

Galileo Services

Aureline Borel – aureline.borel@galileo-services.org

12 July 2018, São José dos Campos – Brazil

Galileo Services – About us!

What is Galileo Services?

The leading organisation representing the European GNSS downstream industry

- Non-profit organisation founded in 2002
- Designed to be a major partner for the Galileo downstream technology and business development
- Members are companies providing services or supplying equipment in the field of satellite navigation
- Members are the major GNSS downstream industry players in Europe
 - ✓ Active across the whole GNSS value chain
 - ✓ Experienced in all sectors of applications



Road

e.g. Connected vehicles and autonomous / automatic driving vehicles



Agriculture

e.g. autonomous vehicles



Maritime

e.g. autonomous vessels / Intelligent ships / sensor fusion



Civil Remotely Piloted Aircraft Systems (RPAS)



M2M & Internet of Things

e.g. smart grids / energy management / smart cities



Indoor navigation



Big data

e.g. data position and time stamping



Rail

e.g. GNSS into ERTMS-ETCS railways train control system



Timing & Synchronization for Critical Infrastructure



Protection and efficiency of critical transport network infrastructure



Multimodal logistics
e.g. fleet and asset management



Offshore infrastructure, Defence and many other GNSS applications and services markets...

Join our forces!



Galileo Services & OREGIN together represent a community of more than

150 organisations

ranging from SMEs to large companies and academia

Galileo Services growing community

GALILEO
SERVICES



Ansaldo STS

CGI



HERTZ
SYSTEMS

Honeywell



ineco

JAVAD



KONGSBERG



QINETIQ

CATAPULT
Satellite Applications



THALES



Galileo Services – An active and living network

- Regular meetings of GS members
 - ✓ Networking opportunities
 - ✓ Information sharing
 - ✓ Privileged access to EU decision-makers
- Intelligence about GNSS programmes, GNSS-related policy and opportunities for GNSS R&D
- Coordination of working groups on key subjects
 - ✓ Standardisation, international cooperation, IPRs
- Promotion of the interest of the European Union, users and the European GNSS downstream industry
- Collaboration with national and European decision makers to foster the development of the European GNSS downstream industry

The European GNSS downstream industry

European companies account for 25% of the global GNSS market

- Ranges all domains
 - ✓ Chipset design and manufacturing
 - ✓ Integration and certification of major systems
 - ✓ Provision of innovative services
- Leading position in GNSS **security** and **resilience** domains
- Leader in systems integration in **surveying & agriculture**
- Strong position in system integration in **rail & road**
- Strong performance in **road, surveying & maritime**

Products compatible with Galileo in all domains of applications

List on <https://www.usegalileo.eu/EN/>



Some R&D projects



Building EGNSS capacity On EU & Neighbouring multimodal Domains



MAGES



ENSPACE



What YOU need...
What WE can do...

Big spectrum of services & applications



Agriculture



Surveying / Geodesy



Maritime



Road



Aviation

Companies profile

- Agriculture system integrators
 - ✓ Farm management systems
 - ✓ Device vendors
- Receivers for field measurements in agriculture
- Receivers for augmentation services
- Augmentation service providers
- Receivers for agriculture machines
- GNSS testing



Companies profile

- Augmentation service providers
- Receivers for augmentation services
- Surveying systems integrators
- Receivers by surveying applications:
 - ✓ Land surveying
 - ✓ Machine control
 - ✓ Mapping & GIS
 - ✓ Marine surveying
- GNSS testing



Companies profile

- Navigation and maneuvering
- Offshore oil and gas
- Marine seismic
- Hydrography
- Surveying
- Maritime transport
- Autonomous ships
- Communications and positioning infrastructure
- Search and Rescue
- GNSS testing



Companies profile

- Navigation and maneuvering
- Offshore
- Marine s
- Hydrography
- S
- M
- A
- C
- S
- G



**World leader in development
of autonomous vessels**

structure



Companies profile

- Fleet monitoring systems
- Road infrastructure
- Vehicle security
- Road User Charges (RUC)
- Pay as you drive
- Intelligent car sharing
- Advanced Driver Assistance (ADAS)
- Digital tachograph
- Dangerous goods transport
- GNSS testing



Companies profile

- GNSS receivers certified for civil and military aviation
- GBAS systems
- Air traffic control
- GNSS Performance monitoring and audit
- GNSS interference and jammer detection
- Ionospheric threat model assessment
- UAS receivers and full navigation & flight control solutions
- LPV approach procedures validation tools
- ARINC 653 RTOS and tools
- GNSS receiver testing



Conclusions

European GNSS downstream industry ready to work with Latin America

- GNSS applications and services part of the solutions to current global challenges: economic, environmental, social or strategic
- European industry has the expertise in all domains of applications
- Galileo Services can help you navigate this rich industrial landscape
- No actor alone has all the ingredients: research communities, large companies, SMEs, government

Together we can do so much more...

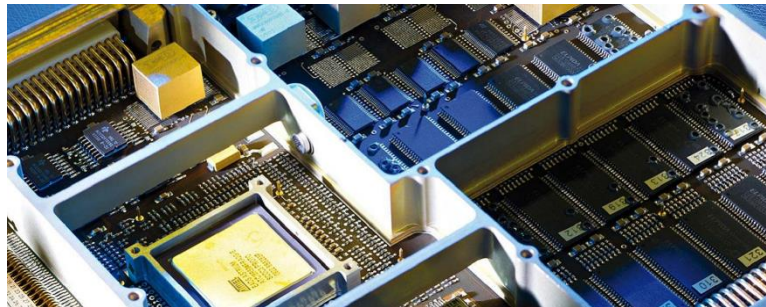


GALILEO
SERVICES

Global space industry leader in all sectors of the space business

Galileo System, Space and Ground infrastructure

- ✓ Provides system engineering expertise for the Galileo program and for the system's evolution to the next generation
- ✓ Offers capabilities in advanced spacecraft and reliable ground control for the Galileo constellation
- ✓ Ariane Group offers Ariane 5 able to launch 4 Galileo satellites simultaneously, but also the Soyuz from Kourou (2 launches). Ariane 6.2 in development will launch future Galileo satellites

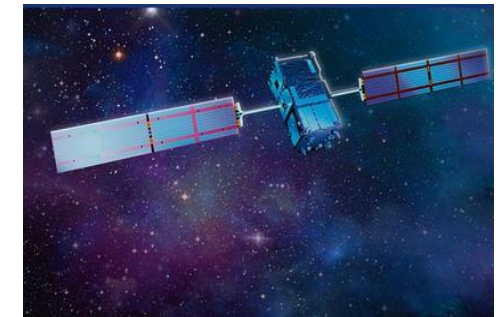


Navigation Applications

Provides GNSS application and service developers with engineering solutions and concepts for applications requiring robust, trusted and/or accurate positioning and timing

EGNOS

- ✓ Selected by ESA for developing and deploying the new EGNOS V3 that will include Double Frequencies – Multi Constellation (DFMC)
- ✓ Provides Hosted Navigation payloads for the EGNOS in Europe, and for the American WAAS



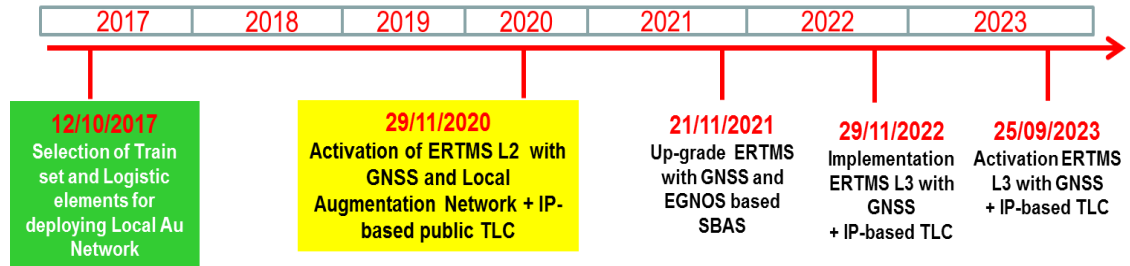
Ansaldo STS Railway & Mass Transit, Freight Solutions

Designs, manufactures and implements signaling systems for the management and control of freight and passenger traffic on mainline railways as well as metros.

Delivered first world's system, based on satellite technology and is working to deploy a certifiable solution based on ERTMS for Regional and Local lines

GNSS for Virtual balise

Multi-bearer public telecom



Catapult helps organisations make use of, and benefit from, satellite technologies, and bring together multi-disciplinary teams to generate ideas and solutions in an open innovative environment



Location-Based Services

- ✓ Exploitation of new GNSS services, such as Galileo PRS
- ✓ Creation of highly resilient position, navigation and timing systems (PNT) for national infrastructure and business-critical satellite applications



Applications and Solutions

- ✓ Provision of platforms and expertise that helps organisations to exploit satellite services and data
- ✓ Helps software developers to integrate satellite and non-satellite derived data with their applications
- ✓ Designs platforms and standards to make this integration easier



Knowledge exchange

- ✓ Supports the exchange of knowledge between businesses and universities by enabling collaboration in many different ways

R&D

- ✓ Takes part in commercially-focused R&D projects, working with or on behalf of industry to deliver satellite-based products or services that are near to market

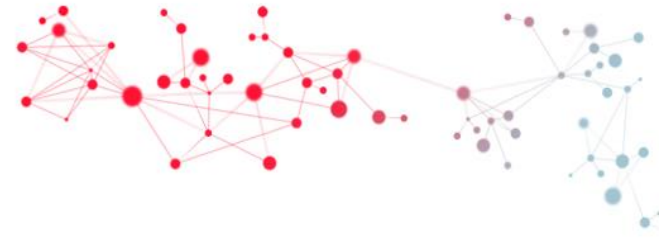


Business support

- ✓ Supports businesses of all sizes and maturity by providing a range of enabling services

Market reports

- ✓ Publishes market research reports, technology analysis, white papers to share knowledge and expertise in specific markets



CGI's satellite navigation work involves:

Ensuring that the systems are secure, reliable and fit for purpose.

- Validation and verification of the information being broadcast, for example on EGNOS
- Development of ground infrastructures and control systems. On Galileo, CGI is providing the security and key management facilities to the Ground Control and Ground Mission segments

Delivery of operational systems that incorporate satellite navigation elements to clients in many sectors:

- Road management and intelligent transport systems
- Fleet management
- Advanced driver assistance
- Rail and road infrastructure
- UK air traffic control
- Location-based services
- Machine-to-machine (M2M)
- Emergency applications





Company specialized in the operation and provision of safety-critical satellite-based navigation services

ESSP combines the best of Space and Aviation for a specific set of users and applications
ESSP is the EGNOS Service Provider (*European Satellite Based Augmentation System*)
ESSP shareholders are 7 key European Air Navigation Service Providers, of which the Spanish ENAIRE
ANSP Certified by EASA (*European Aviation Safety Agency*) for provision of satellite navigation services to aviation users



Products & Services



Delivery of the EGNOS Signal-In-Space, enabling safer and more accurate user positioning than GPS-only signals.

Support to downstream GNSS users: performance monitoring, user support, earl-time GNSS data dissemination via the internet



Definition and maintenance of operational concepts commensurate with the requirements of safety-critical systems

Expertise provided by the ESSP: initial definition of optimized operational concepts, turn-key solutions for deployed systems and H24 operations of safety-critical services. Operations and services supported by field-proven safety and security management systems.



Through the EGNOS service, equipment and application developers from all sectors can benefit form a standard and free-of-charge expertise on GNSS downstream applications in all sectors



Consultancy Services in Aviation for supporting implementation of Performance Based Navigation (PBN) process

Capitalizing on the experience and reputation gained in Navigation services, ESSP is now turning towards delivering other satellite-based ATM/CNS services as DataLink Services & ADS-B

A world leader in satellite broadcasting



Applications & Services

Professional data networks

- Private networks for interconnecting LAN/WAN and extending voice networks
- Data broadcasting services
- Corporate television and videoconferencing

Internet services

- Internet backbone connectivity
- Broadband access for Consumers, enterprises, government agencies
- Satellite-based Virtual Private Networks
- Maritime and in-flight broadband

Video applications

- Direct broadcasting of TV channels and radio stations
- Channel distribution to terrestrial networks (cable, DTT, IP...)
- Contribution links
- Professional video networks for programme exchanges

<http://www.eutelsat.com/en/home.html>

Key figures

40: Capacity commercialised on 40 satellites

150: Reaching up to 150 countries in Europe, Africa, Asia and the Americas

6,000: Broadcasting 6,000 channels

Contacts:

Mr Ignacio Gonzalez Nunez – igonzaleznunez@eutelsat.com

Mr Hector Fenech – hfenech@eutelsat.com

We do GNSS since 1989, E-GNSS since the early 90s...



Fields of Expertise



Space
Programmes and
Applications



Security



First Secured, Trusted and Resilient GNSS Receiver for ITS applications

Two-in-One device:
GNSS & Secure MCU



- GNSS replay, spoofing & meaconing attack mitigation
- GNSS interferences & jamming detection
- Attack identification
- Galileo OS authentication capability
- Ciphred or/and signed data delivery
- Additional IT security services
- Tamper resistant
- Automotive grade

<https://www.youtube.com/watch?v=mt2loLOzhxc>

Services

Business
Consulting
& Management

Technology
Consulting

Research,
Development
& Innovation



Bringing Security and Resilience to critical applications



IP development



GNSS attacks
simulation



GNSS Performance
simulation



Secure GNSS Rx module
design and development (SW
& HW)



Tools & Technos

- Hardware design & development
- FW/SW design & development
- Embedded system
- ARM/Intel
- Secure MCU / Smart Card
- EDA

Contact: Mr Pascal Campagne - CEO – pascal.campagne@fdc.fr



World's leading, independent provider of geo-intelligence and asset integrity solutions for large constructions, infrastructure and natural resources
Provides the technical data and information required to design, construct and maintain your structures and infrastructure in a safe, reliable and efficient manner

Global reach

Fugro works around the globe, predominantly in energy and infrastructure markets, employing approximately 11,000 employees in around 60 countries.

Services

Marine site characterisation
Marine asset integrity
Land site characterisation
Land asset integrity
Consulting

Fugro supports your offshore and maritime work with a global network of reference stations, monitoring signals from GNSS (GPS, GLONASS, Beidou and Galileo) satellites and generating corrections to significantly improve the accuracy of unaugmented GNSS signals. Correction messages are transmitted to vessels via a robust, fault-tolerant broadcast infrastructure, providing precise, reliable, real-time satellite positioning that is accurate worldwide, to just a few centimetres.

Fugro Satellite Positioning Markets

Our innovative positioning infrastructure and expert staff have ensured a quality-controlled and cost-effective positioning service to the offshore industry for over 30 years. Based on our proprietary infrastructure, hardware and software, we provide a wide range of GNSS based positioning and correction services:

Starfix – Positioning services for Oil & Gas Construction support and Survey operations

Seastar – Positioning reference services for Offshore DP vessels or rigs

Marinestar - High accuracy positioning services for maritime operations in coastal waters

Oceanstar – GNSS based Onboard decision support system for merchant vessels

Development of mobile applications on smartphones to provide an operational response to the digital transformation of the public policies of cities

Applications include geolocation, electronic payment, data storage, calls, chat and consultation by a local authority of its citizens

Glorytech's digital technologies meet a growing range of needs :

- ✓ Information distribution and sharing tools optimising exchanges (Cloud, Big Data, Social networks)
- ✓ Smartphone applications to make life easier for users thanks to geolocation
- ✓ Tools for regulations, management and forecasting adapted to the needs of the territories
- ✓ In accordance with the EU General Data Protection Regulation





GMV's portfolio of activities in the satellite navigation area provides solutions to our customers in the following areas:

- ✓ Satellite navigation systems engineering
- ✓ Satellite navigation algorithms
- ✓ Precise positioning and augmentation solutions (<https://magicgnss.gmv.com/>)
- ✓ Operational GNSS data processing facilities
- ✓ GNSS tools development, including simulators, data processing and performance analysis tools
- ✓ GNSS receiver development
- ✓ GNSS-based applications development for different markets. e.g. air transportation, ground transportation, maritime navigation, agriculture, defense, security, civil engineering and more

A portfolio of GMV GNSS products is available at:
<http://www.gmv.com/en/Products/GNSS/>

http://www.gmv.com/en/Sectors/space/Satellite_navigation_systems/

Contact: Juan R. Martín - GNSS Business Development Manager - jrmartin@gmv.com

***Manufacturer of GPS receivers for both civilian and military markets
Specialised in navigation, technologies & applications requiring accuracy,
availability and integrity***

The company for 29 years has been creating and developing latest technology in the sectors of:

- ▲ **Military GPS receivers with SAASM**
- ▲ **GNSS systems for commercial markets**
- ▲ **Space systems**
- ▲ **Security and critical infrastructure systems**

ARMY

Manufacturer of military GPS receivers integrated with SAASM (Selective Availability Anti-Spoofing Module) and integrator of data exchange systems for military and governmental units



GPS TRACKERS FOR CIVILIAN MARKET

Provider of GNSS-based Location Sensitive Systems: fleet monitoring, emergency dispatch, garbage collection & monitoring

Developer of GNSS/Telematic/RTLS-based systems: "Artificial Sky" RTLS / GNSS dual positioning, Eco/SaveDriving Intelligent Cost Optimization, GNSS Personal Locators



SPACE

- ▲ Navigation
- ▲ Time & Frequency Synchronization for satellites and ground applications
- ▲ Communication systems
- ▲ Ground segment applications based on GNSS
- ▲ Design of receivers and systems featuring increased resistance to interference, requiring very high accuracy and reliability of data





Provider of GNSS-based avionics, space guidance and navigation devices, critical infrastructure solutions

Expertise in all aspects of GNSS technology including GPS receivers, differential GPS, GPS/INS integration, etc.

Some GNSS-based products:

EGI: *Embedded GPS/INS navigation system*

- ✓ Meets the most challenging military requirements, along with civil interoperability capabilities
- ✓ Self-contained, all-attitude, tightly-coupled navigation systems
- ✓ Provides outputs of linear and angular acceleration, linear and angular velocity, position, attitude (roll, pitch), platform azimuth, magnetic and true heading, altitude, body angular rates, time tags and coordinated universal time (UTC) synchronized time



SIGI: *Space Integrated GPS/INS*

- ✓ Offers triple simultaneous navigation solutions of pure Inertial, GPS-only, and blended GPS/INS as well as angular rate output for autopilot input
- ✓ Measure of vehicle body attitude changes and changes in vehicle body velocities
- ✓ Can be used for Range Tracking, Target Vehicles, Reusable Launch, Reentry, On-Orbit, Rendezvous and Docking, Expendables Launch, and other Space Applications



EGPWS: *Enhanced Ground Proximity Warning System*

Reduces the risk of controlled flight into terrain by providing flight crews with timely, accurate information about terrain and obstacles in the area



GNSS market segments

| | |
|---|---|
| Aeronautical market GNSS monitoring and interference Air navigation and PBN (Performance Based Navigation) GBAS feasibility studies GBAS based CAT II-III landing, Advanced Receiver Autonomous Integrity Monitoring (ARAIM) systems and technology | Rail market Traffic management On board equipment technology and communication systems |
| Maritime market Traffic management | Security / Defence & PRS |
| | IT market IoT Smart Cities |

GNSS Services & Products

- ✓ **GNSS related applications:**
 - Aeronautical applications
 - Maritime applications
 - Rail applications
 - PRS applications
- ✓ **EGNOS and Galileo infrastructure:**
 - Galileo Sensor Station (GSS)
 - EGNOS Ranging and Integrity Monitoring Station (RIMS)
 - GNSS Service Centre (GSC)
 - EGNOS v3 Navigation Land Earth Station (NLES)
 - Galileo Time and Geodetic Processing Facility (TGVP) Core infrastructure
 - Galileo Time Service Provider (TSP)
 - Galileo Mission Key Management Facility (MKMF)
- ✓ **Consultancy on GNSS markets:**
 - Technology consultancy
 - Market consultancy
 - Standardization
 - Cost Benefit Analysis
- ✓ **GBAS infrastructure :**
 - Design and Development of GBAS Test Beds & Mock-ups
 - Prototyping and field test of GBAS CAT II/III (GAST-D)
 - Research and development of future GBAS multiconstellation & Multifrequency
 - Design and Development of GBAS Monitoring Stations

Fields of Expertise

- ✓ GNSS navigation and augmentation systems (SBAS & GBAS)
- ✓ GNSS Multiconstellation / Multifrequency monitoring systems
- ✓ Transport applications and systems based on GNSS:
 - Aeronautical
 - Maritime
 - Rail
- ✓ Galileo PRS technology
- ✓ GNSS consultancy
- ✓ GNSS signal conditioning and processing
- ✓ Digital Beamforming Antenna array technology
- ✓ Real time System hardware and software developments
- ✓ Testing and validation activities on critical Systems
- ✓ Model based software development methodologies
- ✓ Critical (DAL) software development
- ✓ ECSS and DO-178/278 standards
- ✓ ICAO regulations and rules

Contacts: Mr Lluís Pina - Director, Satellite Navigation - lpina@indra.es
Mr Emilio Viedma - Business Development, Space Solutions - ejviedma@indra.es

Engineering and consultancy firm attached to the Spanish Ministry of Transport INECO provides mobility and safe & sustainable transport innovative solutions

Leads a large number of GNSS international projects which main goal is to promote the adoption and implementation of GNSS-based applications in the various transport modes

Collaborates with the European and Spanish institutions in the set-up, provision and development of GNSS services to citizens

Provides engineering and consultancy for the introduction of satellite-based air navigation solutions

Operates the European GNSS Service Centre (GSC) as part of the “Galileo Service Operator” contract for the next 10 years



The GSC is conceived as the single interface of the Galileo system, apart from the SIS, with the Open & Commercial Service user communities worldwide and the Galileo system infrastructure and operator for the provision of specific added-value services beyond the Galileo Signal-In-Space (SIS)

<https://www.gsc-europa.eu/>

Electrical / Electronic manufacturing



Products & Services

- ✓ Designs and develops GNSS receivers for high precision applications
- ✓ Also offers Triumph chips, OEM boards, antenna types for surveying market
- ✓ Provide software applications for use of GNSS receivers in surveying markets

Robust GNSS defending against spoofers and jammers, providing the information about tracked, used, spoofed, jammed, replaced and faked signals

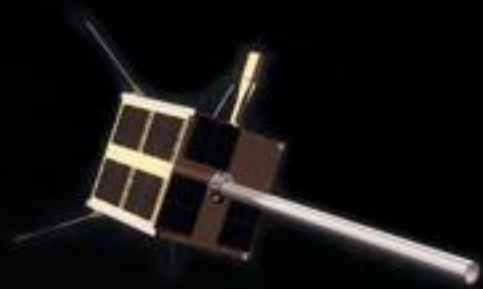
Provision of products through a Web-based ordering system and distribution channels

Moscow engineering Research & Development Center: design of GNSS receivers and full-featured office post-processing software for high-precision Geodesy and GIS applications

Kongsberg Seatex AS



KONGSBERG



Kongsberg Seatex develops and supplies products and solutions for accurate positioning, communication, motion measurement and situational awareness for applications such as navigation and manoeuvring, offshore oil and gas, marine seismic, hydrography, surveying, maritime transport, autonomous ships, as well as communications and positioning infrastructure and NewSpace satellite payloads for maritime applications.

www.km.kongsberg.com/seatex



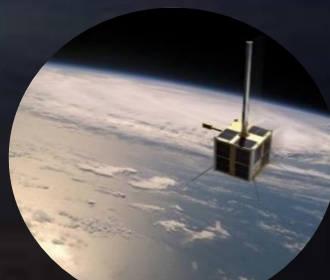
Dynamic Positioning
Reference Systems



Marine Seismic
Positioning and Control



Navigation and
Infrastructure



Global Navigation
Satellite Systems



Attitude Determination
Systems



Communication
Solutions



Sensor Solutions
Autonomous Vessels



Specialised in navigation studies and applications requiring high level of accuracy, availability and integrity

Services

Provision of engineering services in satellite radio-navigation (GNSS) and Air Traffic Management (ATM)

R&D

- ✓ Navigation solutions for critical applications (autonomous systems : automotive, drones)
- ✓ Radio Navigation signal processing (innovative algorithms) and monitoring (signal quality, interferences,...)
- ✓ Innovative Concepts to improve safety and efficiency in ATM

Products

StellaNGC® GNSS a Flexible and modular Test and measurement solution based on National Instrument S/W radio platforms (VST/Pxie, USRP):

- Multi-constellation signal Simulation (GPS, GALILEO, GLONASS, BEIDOU)
- RF signal record /playback
- Real time GNSS signal monitoring
- Data processing and receivers performance evaluation



Fields of EXPERTISE



Pan-European eCall



EETS
(European Electronic Toll Service)



GNSS



Flight control



Traffic information

SERVICES

Independent assessment in the following areas

eCall laboratory: Independent assessment of conformity of eCall solutions

- Expert for type approval according delegated regulation 2017/79
- Assess conformity and interoperability of components, systems and solutions (vehicle)
- Assess conformity and suitability for use for PSAPs
- Assess the implementation of eCall requirements in mobile networks

GNSS laboratory: Independent assessment of GNSS products and services

- Evaluation of performance and robustness for receiver
- Evaluation of eCall Type approval for GNSS

Certification

Certification in the non-regulated areas and in the following areas: eCall, GNSS, electronic trip Logs, C2X, reference services, traffic information, signal generators, testbeds, receiver

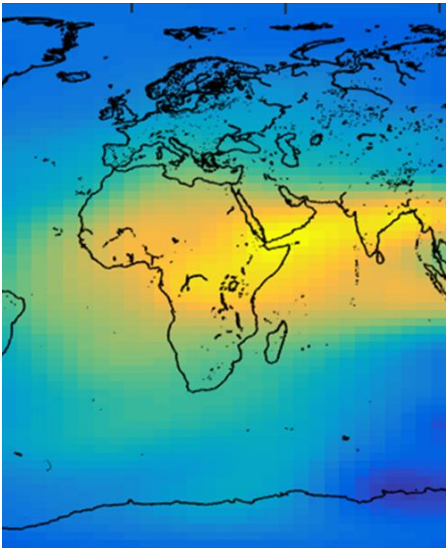
Expert opinion

Notified Body for Tolling Services based on EU-directive 2004/52/EC



Do you need:

- ✓ A robust satellite navigation solution for your critical application
- ✓ To test your GNSS application in the air (aircraft or UAV)
- ✓ To test your GNSS application under critical conditions (interference, spoofing, jamming)
- ✓ to know the performance of satellite navigation systems
- ✓ the best receiver technology for your application



What NLR has:

- ✓ Experience in design, testing and verification of satnav systems
- ✓ Experts in GNSS security and performance
- ✓ A laboratory and field test facility
- ✓ GNSS testing and simulation tools
- ✓ A research aircraft for GNSS flight trials
- ✓ UAVs of different sizes and capabilities
- ✓ High quality GNSS receivers, antennas and software defined radios
- ✓ An anechoic chamber and antenna test range
- ✓ A GNSS performance monitoring station





NovAtel offers the broadest range of high precision, OEM GNSS positioning products in the industry

✓ **High precision GNSS receivers**

✓ **SPAN® GNSS Inertial Navigation Systems**

Couples OEM precision GNSS receivers with robust Inertial Measurement Units (IMUs) for reliable, continuously available, position, velocity and attitude even when satellite signals are blocked or unavailable



✓ **Antennas**

✓ **Correction Services**

TERRASTAR corrections for land-based applications and OCEANIX corrections for marine applications



✓ **SMART Antennas**

High-precision products that include a board level GNSS receiver and GNSS antenna integrated into one compact enclosure



✓ **Firmware Options & PC Software**

✓ **Waypoint® Software**

Post-processing solutions for high precision applications





NSL specializes in the use of Global Navigation Satellite Systems (GNSS) within critical markets such as those that:



- directly affect the safety of citizens
- are key in terms of national security
- affect the way business is conducted

Business services

- GNSS software receiver technology
- GNSS performance monitoring systems and services
- GNSS simulation tools
- GNSS interference and jamming monitoring services
- Integrated GNSS and communications systems
- Provision of GNSS technology into EU GNSS programmes

Domains of applications

- **Civil aviation:** performance monitoring and audit
- **Maritime:** DGPS service qualification
- **Rail:** integration of GNSS within train control and signaling applications
- **Road:** road pricing
- **Security:** GNSS interference and jammer detection + low-end PRS for emergency services and critical infrastructure providers
- **Safety:** monitoring natural and built environment for detection (deformation, displacements, landslides, structural health)



The main business activities and applications

- ✓ Earth observation
- ✓ Satellite navigation
- ✓ Telecommunications
- ✓ Reconnaissance
- ✓ Science missions
- ✓ Launchers

OHB is manufacturing for the European Commission the 34 satellites of the Galileo constellation



Space Systems

- ✓ Satellites, human spaceflight, exploration and security/reconnaissance technologies.
- ✓ Develops, builds, launches and operates low-orbiting and geostationary small satellites for scientific applications, communications and terrestrial observation.

Earth observation, Satellite navigation, Scientific payloads, Testing of new technologies.

Aerospace + Industrial products

Manufacturing of products for aviation and space travel, as well as electronic data transmission.

- ✓ Equipment provider for aerospace structures for aviation and space travel. Germany's largest supplier to the Ariane 5 programme and an established manufacturer of sensitive components made of highly heat resistant nickel based alloys and titanium for aircraft engines.
- ✓ Electronic data transmission systems provide global logistics support through efficient transport management and shipment tracking.

Research and development in secured navigation
Technology advice / Consultancy in secured navigation

Products & services

- Civil, military and national security clients in secured navigation
- Development of user equipment (receivers and security modules), infrastructure, services and tools for robust PNT including security, user management and key management for PRS
- Manufacturer of a high performance, next generation GNSS receivers:
 - Will incorporate signals from the new Galileo system
 - Multi constellation and multi frequency
 - Designed to process encrypted signals from the Galileo PRS service as well as open services such as GPS
 - Unprecedented levels of availability, accuracy and assurance of positioning, navigation and timing



Septentrio

High Precision Positioning - GNSS

World Leader in Cm level Positioning
with GNSS
Integrated with IMU/INS
Robust against Interference
Resilient to Scintillation
Lowest possible power

ESA contractor for Galileo development
Partner in Cigala and Calibra

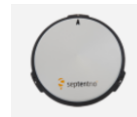
Markets

Mining- Machine Automation
- Industrie 4.0
Earthquake and Hazard Monitoring
Atmospheric Monitoring and Analysis
Aerial Mapping and UAVS



OEM Products

For integration into systems...



Contact

Septentrio
Neil Vancans
Neil.Vancans@Septentrio.com

Representatives in Brazil
C+ Tecnologia
Robert H. Bernhard
rbernhard@ctecnologia.com.br



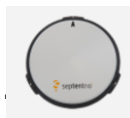
Septentrio

High Precision Positioning - GNSS

- Líder mundial em posicionamento por GNSS a nível de cm
- Integrado com IMU/INS
- Excelente imunidade à interferências
- Resiliente à cintilação
- Contratada pela ESA para desenvolvimento para o Galileo
- Parceiro nos projetos Cigala e Calibra

Soluções OEM

- Para integração em sistemas .



Mercados

- Mineração – Automação de máquinas – Indústria 4.0
- Monitoramento sísmico e de perigos
- Monitoramento e análise atmosférica
- Mapeamento aéreo e VANT



Contato

Septentrio

Neil Vancans

Neil.Vancans@Septentrio.com

Representantes no Brasil

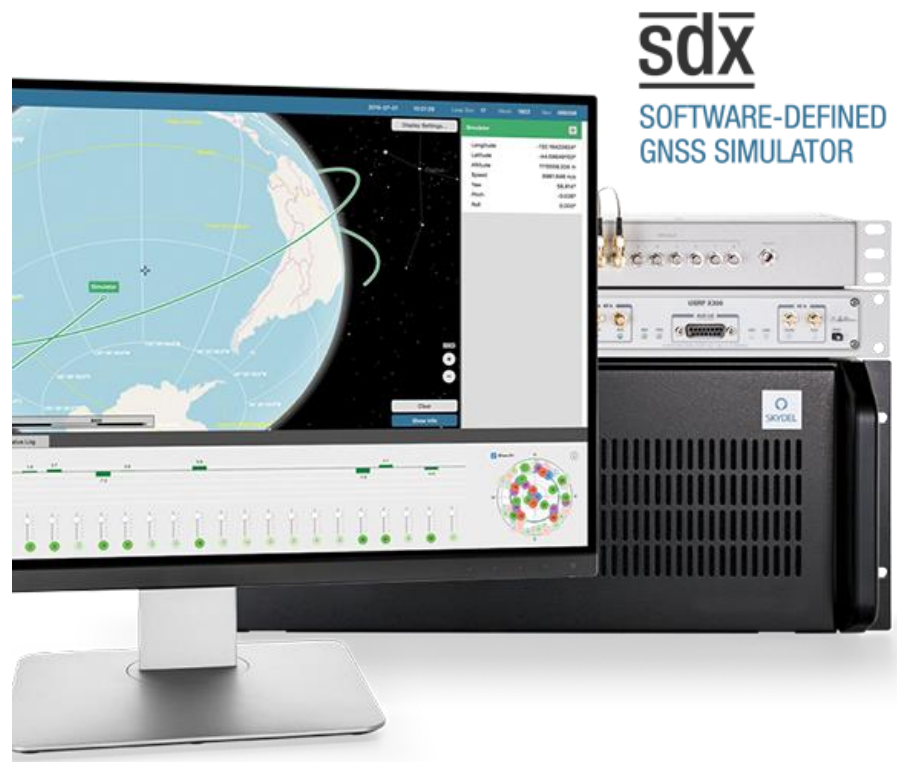
C+ Tecnologia

Robert H. Bernhard

rbernhard@ctecnologia.com.br



Skydel offers GNSS simulation solutions to scientists and engineers who develop navigation systems



Products & Services

Skydel SDX

SDX is a software-defined GNSS simulator that features real-time signal generation for multiple constellations and multiple frequencies.

SDX is all about flexibility: from building your own configuration to complete turnkey systems, SDX's benefits include hardware reuse, easy upgrades and quick integration.

SDX comes with innovative automation tools and a complete, documented API. It features an advanced interference module that is completely integrated with the simulator – including full jammer dynamics & user-defined waveforms –, enabling the setup of complex test scenarios easily.

Professional Services

Development and integration of components into your own GNSS or SDR systems

Customization of our GNSS simulator to meet your specific use cases

GNSS and RF data processing and analysis

Specification and implementation of turnkey projects



High precision surveying and mapping

Expertise

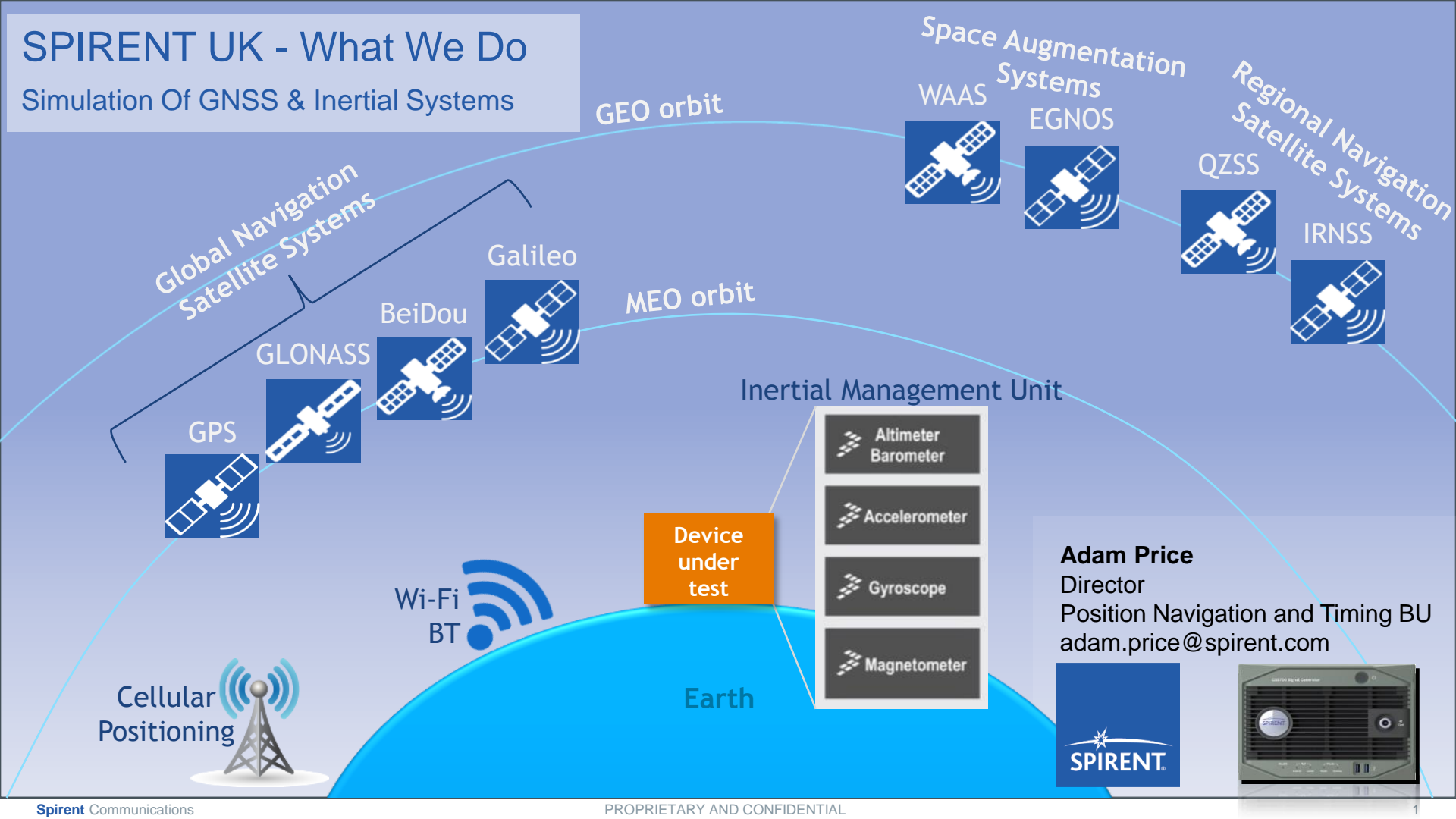
- ✓ Sogei is owned by the Ministry of Economy and Finance of Italy
- ✓ Sogei develops ICT Systems and services for the Italian Tax Administration
- ✓ International Workshop on GNSS advances (IGAW)
- ✓ R&D in the field of IoT, GIS, GNSS Software Receiver and High Precision
- ✓ Member of RTCM (SC-134 Vice-chairman)

Products & Services

- e-Leader in GNSS High Precision topography and digitalised cartography, supported by advanced GIS technologies, developed for the Italian Revenue Agency
- PREGEO: National Land Registry Map Update Information System: Management of the Cadastral Maps Updating System, 300,000 map updates/year; fully automated; full integration of GNSS and traditional topographic measurements
- GRDNet (GNSS R&D Network): a GNSS Local Augmentation System, providing innovative RTK/NRTK services for cm level real-time positioning for the Italian Revenue Agency activities; Galileo Ready; Real-Time Integrity Monitoring system

SPIRENT UK - What We Do

Simulation Of GNSS & Inertial Systems



Adam Price

Director

Position Navigation and Timing BU

adam.price@spirent.com



THALES SIX GTS FRANCE offers interoperable and secure information and telecommunications systems for military forces, security forces and essential operators

Thales SIX GTS FRANCE activities include radiocommunications, networks, protection systems, critical information systems and cybersecurity. They respond to the needs of markets in which the use of new digital technologies such as 4G mobile communications, cryptography, cloud computing and big data are of the utmost importance.

THALES SIX GTS FRANCE is present throughout the value chain, including equipment, systems, systems of systems, as well as logistical support and related services.

Products

Services

Defense

- Radiocommunications
 - ✓ Tactical Products
 - ✓ Air & naval Products
- Systems
 - ✓ Infrastructure and Strategic Networks
 - ✓ Mobile Networks
 - ✓ Defense Protection Systems
 - ✓ Information Technologies Security
- Urban Security Systems
- Critical infrastructure protection Systems (airports, energy, sensitive sites...)
- Secured Identification Systems
- Protection Systems against Nuclear Radiological Bacteriological & Chemical attacks

Ground Transportation

- Integrated Railways Systems
- Communication & Supervision
- Integrated Systems
- Systems of computer ticketing

Operational Services
Users support
Maintenance Services



GNSS market segments

- ✓ Civil Aviation (Commercial, Regional, Business Jets, Helicopters)
- ✓ Military Navigation (Air Transport and Fighters, UAV, Missiles, Navy)
- ✓ Critical Infrastructure protection
- ✓ Navigation Solution for Rail

Fields of expertise

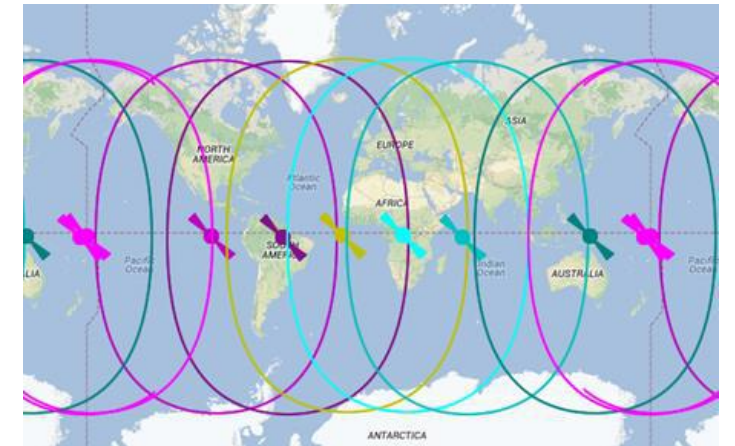
- ✓ Navigation solutions for safety-critical applications
- ✓ Design and manufacture of GNSS receivers and anti-jamming devices
 - Open Service Signals
 - Military GPS and Galileo
- ✓ Data Fusion

Services & products

- ✓ TopStar C family of GPS receivers certified for civil aviation
- ✓ TopStar M family of military GPS SAASM receivers for A/C and missiles
- ✓ TopShield GNSS Anti Jamming equipment (Air, Sea, Ground vehicles)
- ✓ TopAlert GNSS interference monitoring and location System



- **VERIPOS**: providing precise satellite positioning solutions to the offshore marine industry worldwide
- **TerraStar**: providing land-based positioning services through GNSS manufacturer partners (NovAtel, Leica, Septentrio, Topcon)
- Delivering services with positioning accuracy of 2-3cm globally
 - Global network of tracking stations: ~80 sites
 - Generating precise orbits, clocks and biases
 - Real-time corrections for GPS, GLONASS, GALILEO, BEIDOU and QZSS
 - Broadcast via 7 L-band channels on geostationary satellites
 - Infrastructure (stations & servers) fully owned by VERIPOS
- Positioning of ESA Sentinel and LEO satellites
- Applications: Offshore, Near Shore, Agriculture, Survey



Contact: Mr Pieter Toor - Services Systems Manager - pieter.toor@veripos.com