GEARS project goals, achievements, future and lessons learnt

Webinar: Fundamental Elements Call 2022

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GEARS

GalilEo Authenticated Robust timing System

Participants

FDC	GNSS receiver
NLR	IDM and Smart Antenna
NLS/FGI	T-RAIM and tropo/iono model
NavCert	Testing and Standardisation
Orolia	Coordinator, integrated T&S server access to market

FDC in a nutshell

Bringing Security and Resilience to critical applications

Services

- Business Consulting & Management
- Technology Consulting
- Research, Development & Innovation

Fields of Expertise

- Space Programms and Applications
- Security

Technologies

- IP development
- GNSS attacks simulation
- GNSS Performance simulation
- Secure GNSS Rx module design and development (SW & HW)

Key facts & figures

Founded in 1989
HQ in Vincennes, France

Financially & legally independent

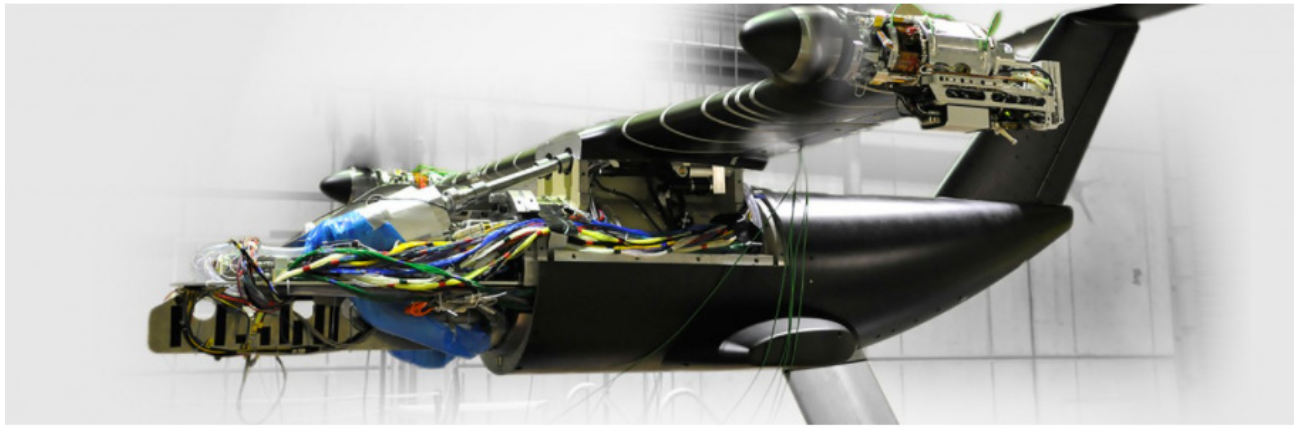
Turnover ~ 3 M€

R&D intensity ~ 20%

20 employees

Netherlands Aerospace Centre (NLR)

Dedicated to innovation in aerospace



Industry

Civil Aviation

Space

Defence

+ Since 1919

+ 700+ specialists

+ Large range of disciplines

- Aerodynamics
- Materials and structures
- Safety
- Satellite navigation
- Thermal management
- …

+ Facilities

- Windtunnels
- Environmental test facilities
- Air-traffic control simulator
- Structural test facilities
- …

Finnish Geospatial research Institute (FGI)

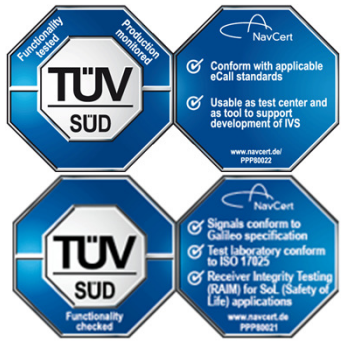
part of National Land Survey of Finland

- **FGI's current core competencies**
- Spatial Data Solutions Supporting Digitalisation
- Dynamic Earth
- Smart Environments and Interaction
- Robotics and Intelligent Transportation Systems

- **Our research impacts society widely**
- We create opportunities for innovations in smart traffic, autonomous driving, surveying, Position Navigation Timing, and terrestrial mapping systems, etc.
- Spatial Data Solutions Supporting Digitalisation
- Dynamic Earth
- Smart Environments and Interaction
- Robotics and Intelligent Transportation Systems

NavCert profile

- Provides independent **testing**, **validation** and **certification** of **GNSS** components, products, solutions and services.
- The **NavCert** GmbH was founded as a Joint Venture between **TÜV Süd** and **OECON** in 2006, since 2012 100% subsidiary of the **OECON** Holding GmbH.
- Based in Braunschweig & Munich.
- The **only laboratory** in **Europe** accredited by a national accreditation Authority in the domain of **GNSS**.
- Notified Body (NB 2603) for European Electronic Tolling Service and Chair of expert groups EETS.
- Provides certification:
  - eCall - first eCall type approval in Europe
  - GNSS solutions, GNSS testbed systems (e.g., GATE), Digital Maps
  - UAS, ….
- Member of DIN and ETSI standardization organisations and delegated expert at DIN, CEN/CENELEC and ISO



OROLIA

#1 for Space Atomic Clocks

#2 for Timing and Synchronization

#2 for PNT Test & Simulation

#2 for Emergency Location Beacons

- A Reference GNSS Critical Applications Specialist With Worldwide Leadership Positions

European Private Company Founded in 2006, with a Strong US Footprint

Develops, Manufactures and Sells Electronic Equipment and Software to Assure Precise and Reliable Positioning, Navigation and Timing (PNT) Data for Critical Operations

Supplier of Large System Integrators, Governments and Blue-Chip Companies

2nd Largest High-Precision Timing Specialist
N°2 World Leader for GPS/GNSS* Signal Simulation

Only Independent Provider of Resilient PNT Solutions

4 Main Hubs; Industrial Presence in 4 Countries (FR, ES, CH, US)

Project objectives

- OBJ# 1 Improving performances and resilience of Galileo and GNSS Timing receiver
- OBJ# 2 Develop and demonstrate the effectiveness of unique Galileo services to operators within 2 Y
- OBJ# 3 Strengthen market adoption through Standardisation activities

Market driven approach

- End User and Critical infrastructures operators survey
  - Focus on Telecom, Energy, Finance
- Requests:
  - Compatibility with existing per domain standards
  - Network element with IP infrastructure enhancement connectivity
  - Resilience to threat: maintain service in predictable way, detect failure, recover from compromised status
- Evaluation of market value and market share target

Technical development definiton

FOCUS ON DIFFERENTIATING RESILIENCE CAPABILITIES

IDM filter — Clean residual jammer in frequency vs time: Digital **filtering in frequency domain**

Iono-tropo corrections — Improve single frequency iono-correction: **NeQuick correction** scheme

T-RAIM — Detect integrity issues: **Timing Receiver Autonomous Integrity Monitoring**

OS-NMA — Authenticate Galileo data: **Galileo OS-NMA** authenticated data

NEW GNSS CLOCK

CRPA 4 elements — Prevent jammer entering signal processing: **Spatial filtering of RFI** in up to 3 directions

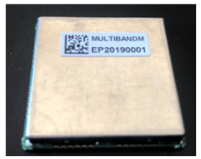
NEW GNSS ANTENNA

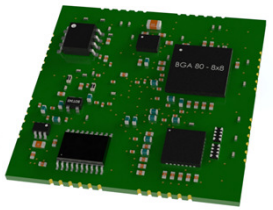
GNSS Clock prototype

A FULLY CAPABLE GNSS CLOCK IN A COMPACT FORM FACTOR

- All time transfer standards implemented as inputs and outputs
- Three high speed Ethernet ports to support NTP, PTP and network management on different media: copper or fibre
- New Orolia mRO-50 integrated as high stability frequency reference
- Dual frequency, multi-GNSS, Galileo OSNMA processing receiver
- All new functions IDM filter, Corrections, T-RAIM, integrated

MCM receiver

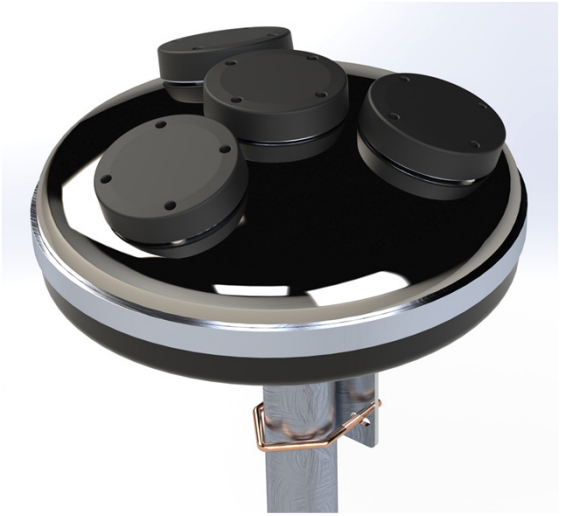




GNSS smart antenna

Resilience - Radio Frequency Interference (RFI) can seriously degrade time availability from GNSS constellations:

- 4-element Controlled Reception Pattern Antenna (CRPA) with null forming for spatial filtering of RFI.
- Protects Galileo and other constellations.
- Specially designed for use with the new GNSS Clock.
- Receiver agnostic processing, will also work with other timing receivers.



Standardisation activity

- The definition and establishment of a **Galileo-Based GNSS timing receiver** standard will provide a context on which a certification process can take place.
- Possible ESO's were to develop a **Galileo-Based GNSS timing receiver** standard are:

- The certification of a product is a powerful tool to support the market development, to establish a consensus among stakeholders, such as manufactures, providers, users, and regulators.
- A certification is, therefore, a quality stamp which assures the user that the product fulfils, at least, the minimum requirements of a standard for timing accuracy and stability.
- This is important because it will ensure users, using the product, that the product comply with the most advanced techniques, providing trust on the product. By consequence, it will also define a state-of-art product.

After grant and future

- NLR is following engineering work on automatic processing of jamming with **smart antenna**
- FDC and OROLIA are using GNSS receiver and clock unit to test **live sky open test Galileo OSNMA signals** and validate long periodes of operation
- OROLIA is **industrialising the clock unit** to release a comprehensive product to the market in phase with declaration of full operation for OSNMA service
- NAVCERT and OROLIA are supporting EC initiative to develop **standardisation for timing GNSS device** dedicated to supply critical services. Activity submitted to **CEN**

Lessons learnt: Submission

- Initial core team was active about 1 year before the call for proposal to define main goals for participants
- Demonstrate business model fit to goals of the grant and market requests
- Engage in funding completion of the industrialisation and productisation tasks
- Balance technical and application skills within the consortium

Lessons learnt: Execution

- Create a balanced **consortium agreement** and management scheme
- Work in **pro-active mode** with weekly coordination meeting inside the consortium
- Need to extend 6 months to recover from pandemic slow-down and extend to live OSNMA signals tests – **Grant amendment**
- Dedicate careful attention to **IP share** and sign pre-industrialisation agreements to enable productisation
- **EUSPA is adapting** to project definition evolutions to enable effective market fit.

Linking space to user needs

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