WRITTEN IN THE STARS

JAN ACKERMANN OF SPIRENT SURVEYS THE GNSS LANDSCAPE - WITH A FOCUS ON GALILEO - FROM AN INSIDER'S VIEWPOINT, AND HIGHLIGHTS THE NEED FOR ENGINEERING EXCELLENCE TO ULTIMATELY DRIVE GLOBAL BENEFIT

The global nature of GNSS means that access to precise Positioning, Navigation & Timing (PNT) data has become a fundamental expectation and mainstay of the modern world. Access to highly accurate PNT data opens enormous potential for economic growth, reduced inequality and co-operation within the framework of international politics. For public companies such as Spirent, the goal is to work across boundaries to continue delivering the best products and services to its customers across Europe and the world.

Galileo's orbit

Spirent is a global provider of test and assurance solutions for networks, cybersecurity and positioning. At its heart, the business is largely a collection of engineers, researchers and scientists – and many of its partners are similar in their composition. This is particularly evident within its work across the aerospace sector where, for nearly 40 years, Spirent's PNT division has worked closely with space agencies, defence organisations and prime contractors to develop and test Global Navigation Satellite Systems (GNSS) and the equipment that depends on them.

With a focus on Galileo, the Global Navigation Satellite System (GNSS) created by the European Union through the European Space Agency (ESA), Spirent has been a contributor since the early days of the constellation. Most notably, it was contracted by ESA via Thales Alenia Space (TAS) to provide the reference test equipment to enable certification of the Galileo Ground Receiver Chain (GRC) as well as Test User Receiver (TUR) elements.

The set of Spirent simulators supplied under this contract during the early days of Galileo in the 2000s, were able to support all Galileo frequencies and services, including

Spirent GNSS signal simulation systems, most recently its GSS9000 Series products (pictured here with companion SimGEN software for scenario definition and simulation control) are used extensively as reference test equipment for the EU's Galileo satellite system. Images: ESA / Spirent

the Open Service, Commercial Service, Safety-of-Life and the Public Regulated Service (PRS). These simulator platforms were then able to support ESA as the Galileo constellation evolved from the In-orbit-Validation (IOV) phase through to the Full-Operational-Capability (FOC) phase, where TAS was ESA's chosen provider of Systems Support – and these simulators continue to be in operation today.

Testing and integrating the various elements of GNSS means simulating a broad variety of highly realistic scenarios, with full control of all relevant parameters—from navigation data and signal power levels to environmental interference.

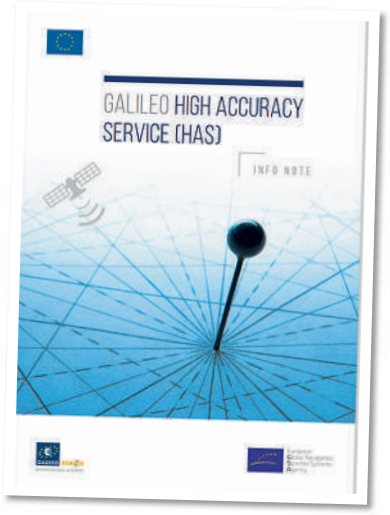
Over the history of Galileo's planning, testing, launching and operational phases, Spirent has supported and enabled major Galileo contributors and users including TAS, the EU Commission's Joint Research Centre, the German aerospace agency Deutsche Zentrum für Luft- und Raumfahrt (DLR), Fraunhofer IIS and many others to test in highly realistic simulation environments. As a consequence of that, there is a large fleet of simulators in use to support Galileo related development, testing and evolution at key sites across Europe and globally.

Preparing for change

The practical change for Spirent following the departure of the UK from the EU was the ability to continue to directly interact with the Galileo PRS program. Whilst this required a repositioning for this element, it has not impacted our close relationship with the key partners that rely on us to provide advanced test and measurement systems.

That repositioning was supported in 2018 through Spirent signing a partnership agreement with Fraunhofer IIS and LZE GmbH enabling the continuity of the Galileo PRS capability on the Spirent Radio Frequency Constellation Simulator (RFCS) platforms.

The arrangement is made technically possible through Spirent's RFCS system architecture providing a clearly defined interface, with strict need-to-know separation between the core RFCS and PRS hardware and software components. This well-defined delineation, built on



The Galileo High Accuracy Service is expected to be fully operational in 2024. Image: European GNSS Agency

our proven and ongoing concern for interoperability, ensures that both the RFCS and PRS simulation tools can be developed independently, driving technical excellence and ensuring access to the most advanced test and measurement technologies.

Our partners, many of whom have also been involved in the project for nearly two decades, recognise the critical importance of Galileo for the Europe and the global community. They also recognise that only a combination of the best minds and technologies working together can deliver on its true potential.

Looking forward

The ultimate outcome of Spirent's innovation focus is enabling the next generation of PNT technologies – whether in space, defence, or in the consumer technologies that we will start to see more and more of.

To support applications with a critical dependency on positioning and navigation integrity and precision, Galileo programs have been and are being undertaken to deliver a stronger technological base. In an effort to provide the high level of precision needed for autonomous systems, for instance, the Galileo High Accuracy Service (HAS) is being developed.

HAS will offer real-time improved user positioning performances with accuracy less than two decimetres (in nominal conditions) – making it the most precise publicly accessible GNSS anywhere in the world. As throughout the last two decades – and longer, with systems such as GPS – Spirent is currently actively working to deliver this new signal type in its simulation platforms via an early beta release.

Another critical issue facing the next-gen PNT applications is the threat of spoofing. Previously only a concern for nation-state actors and defence activities, spoofing takes on a new threat level when UAS, mining, transportation, surveying, building, services and other applications that cannot rely on encrypted signals become more dependent on reliable position. Reported incidents in the Black Sea and in ports in China are testament to this threat.

In order to address this, the Open Service Navigation Message Authentication (OSNMA) service is being developed. OSNMA will add a layer of security to enabled receivers. Spirent's ongoing relationship with Qascom – lead contractor in the GSA funded OSNMA PATROL project and contributor to the definition of the OSNMA signal – enables us to offer our customers the earliest chance to incorporate this potential game changer into their testing and development regimes.

Global perspective

Projects such as OSNMA highlight the need for subject matter experts, engineers and technology providers to collaborate seamlessly. Galileo is designed to be interoperable with other GNSS such as the US GPS System, Russia's GLONASS and China's BeiDou. Reflecting the international cooperation of expertise that underpins each of these systems, this interoperability delivers tangible benefits to us all as users.

Looking to the future there is potential for other sovereign nations creating their own GNSS or regional augmentation systems. The decision for any new entrants would need to weigh up factors including cost, sovereignty, security and the potential for driving economic growth that this would bring. If and when these new entrants emerge, Spirent will be ready to support the test and measurement needs enabled through our highly flexible, proven architecture and technology.

As we head into an era of AI powered autonomy – much of it predicated on the accuracy and integrity of how we measure the world – progress must be based on merit. The next generation of GNSS will change our society and the future will be written in the stars.

Galileo started testing Open Service Navigation Message Authentication (OSNMA) in its signal-in-space earlier this year, allowing the first-ever OSNMA-protected position fix to be successfully computed. Image: GSA

Jan Ackermann is Director of Product Line Management for Spirent Communications plc, headquartered in Crawley, West Sussex (https://www.spirent.com/)