

## Development and evolution of positioning techniques



INTERVIEW  
**Vincent Rooke**  
Director SouthPAN Section  
Geoscience Australia



## **Small Satellite & Services International Forum (SSSIF 2023)**

Malaga (Spain), February 21 - 23

GMV is to feature in the 4<sup>th</sup> Small Satellite & Services International Forum (SSSIF 2023), to be held in Malaga from 21 to 23 February.

GMV, besides supporting the forum as a platinum sponsor, will be presiding the panel given over to the Spanish Space Agency, presenting several papers and running a stand (A08) to showcase its space products and services.

**Drop in and see us!**

To find out more:  
<https://sssif.com>



## Letter from the president

The SouthPAN contract is the biggest ever non-EU contract won by any Spanish space firm. GMV will be providing its inhouse satellite-navigation services and solutions to develop key subsystems of the new SBAS for Australia and New Zealand. The SouthPAN SBAS will be monitoring the satellites of various GNSS constellations as well as atmospheric conditions in order to provide real-time corrections, making sure positioning data errors keep within highly reduced error margins and, even more importantly, known at each moment.

Lockdown constraints disappeared for much of the world during 2022. Sadly, the same year marked the start of Russia's invasion of Ukraine, with knock-on economic problems for everyone. Even so, GMV has been able to win several hugely relevant new contracts this year. BMW group continues to rely on GMV for the

next upgrade of the precise positioning system for its autonomous cars, after the first version of this system has already entered production. GMV will also develop the computer for Eurodrone's ground command and control system. At the same time, GMV will lead part of the new technology developments for Europe's future fighter aircraft, FCAS, under yet another big contract signed recently. GMV's development in recent years has been particularly eye-catching in the space sector; witness the SouthPAN contract itself. In the last 5 years GMV has more than doubled its space turnover, while strongly upping its responsibility level in large-scale projects. In 2022 we carried out a thorough reorganization of our space division, promoting many of our professionals who have amply proven their worth, in order to ensure a top-notch performance of these projects we find so challenging and rewarding.

*Mónica Martínez*



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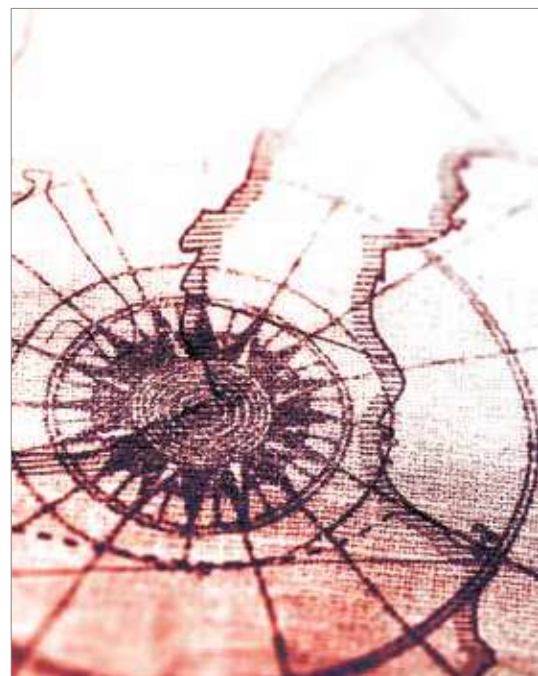
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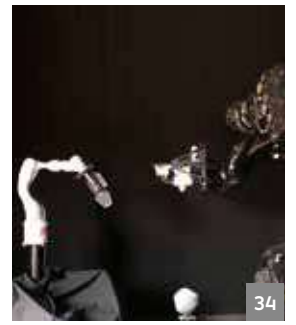
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# Development and evolution of positioning techniques

## THE HISTORY OF VESSEL POSITIONING SYSTEMS

In olden times vessels rarely ventured onto the open sea; up until the eighteenth century positioning systems gave only the vaguest idea of a ship's real location. Bucking this trend, however, ancient civilizations like the Polynesians or Vikings still managed to pull off some astonishing feats of long-distance seamanship.



Way back in 3000 BCE, indeed, the ancient Polynesians were already plying the Pacific Ocean on voyages of thousands of miles, working with secret navigating techniques that were passed down by word of mouth after several years' closed-shop apprenticeship in navigating guilds. To find the right heading, the navigator worked from the known setting- and rising-position of over 200 stars, guiding themselves too by the size, speed and direction of the swell. Each region also used its own idiosyncratic techniques to establish its rough position, such as meteorology, the color of the sky or sea or the local fauna.

From the 8th to 11th centuries, the Vikings, for their part, dominated the North Atlantic, reaching such areas as Iceland, Greenland and Great Britain. They are thought to have navigated by

reading the stars, the wind, the swell, using a few rudimentary instruments too. These may well have included the solar compass, which, duly calibrated for a given latitude and time of year, would then read the position from the shadow cast at different times of day by a needle on a floating circle of wood. They are also known to have carried birds on board, checking the direction they took once released to ascertain their heading.

First discovered in China, the magnetic compass came into use in the 12th century and soon became the dead-reckoning instrument par excellence: working from a known position, readings were taken of the ship's speed and heading in order to estimate a new position. The heading was read off from the compass and the speed was recorded by a device known as the chip log. This was a line knotted at regular intervals and weighted at the end with a block of wood, so it dragged in the water. To measure the speed of their ship, sailors dropped the line over the stern and counted the number of knots that went overboard during a certain period of time, as marked by an hourglass. Dead reckoning, however,

accumulated a heavy error due to such factors as drift, currents and wind.

The use of latitude and longitude for referring to geographical points dates back at least to the second century CE: by then the astronomer Claudius Ptolemy of Alexandria had published his *Geographia* in which he quoted the geographic coordinates of 8,000 localities. As was usual until the advent of advanced celestial navigation techniques, the latitude was a much more accurate reading than the longitude. To find out the latitude of any location it sufficed to measure the height of the Pole star in terms of the angle it struck with the horizon. With due corrections, the height of other stars could also be used as reference, such as the sun.

Calculation of the longitude, on the other hand depended on prior knowledge of local time in respect to a reference meridian: a one hour lag might imply a westwards longitude slew of 15 degrees. Longitude readings call for precision clocks or simultaneous observation of synchronized events, such as lunar eclipses.



Latitude readings improved over time with the successive invention of various navigation instruments: the astrolabe in the 12<sup>th</sup> century; the Davis quadrant in the 16<sup>th</sup> century, and the octant and sextant in the 18<sup>th</sup> century, bringing latitude readings within the accuracy of a single nautical mile. Longitude, however, remained a matter of dead reckoning since no clock could retain sufficient accuracy throughout the average time of a typical voyage. The first marine chronometers fit for navigation were developed in the second half of the 18<sup>th</sup> century, and were then being fitted on ships by the 19<sup>th</sup> century. Before beginning the voyage, the clocks were synchronized with the local time of the reference astronomical observatory, which published the necessary celestial almanacs for navigation purposes, such as Greenwich in England or San Fernando in Cadiz; at a given time these reference observatories would raise and lower a great time-ball up and down a mast so that navigators could note down the skew of their own clocks.

Navigation techniques were further tweaked and refined at the end of the 19<sup>th</sup> century; vessels read off their position from the height of various stars and the time of measurement in the reference observatory's timescale. The time of measurement could then be used to ascertain the position of the stars in the celestial vault; the

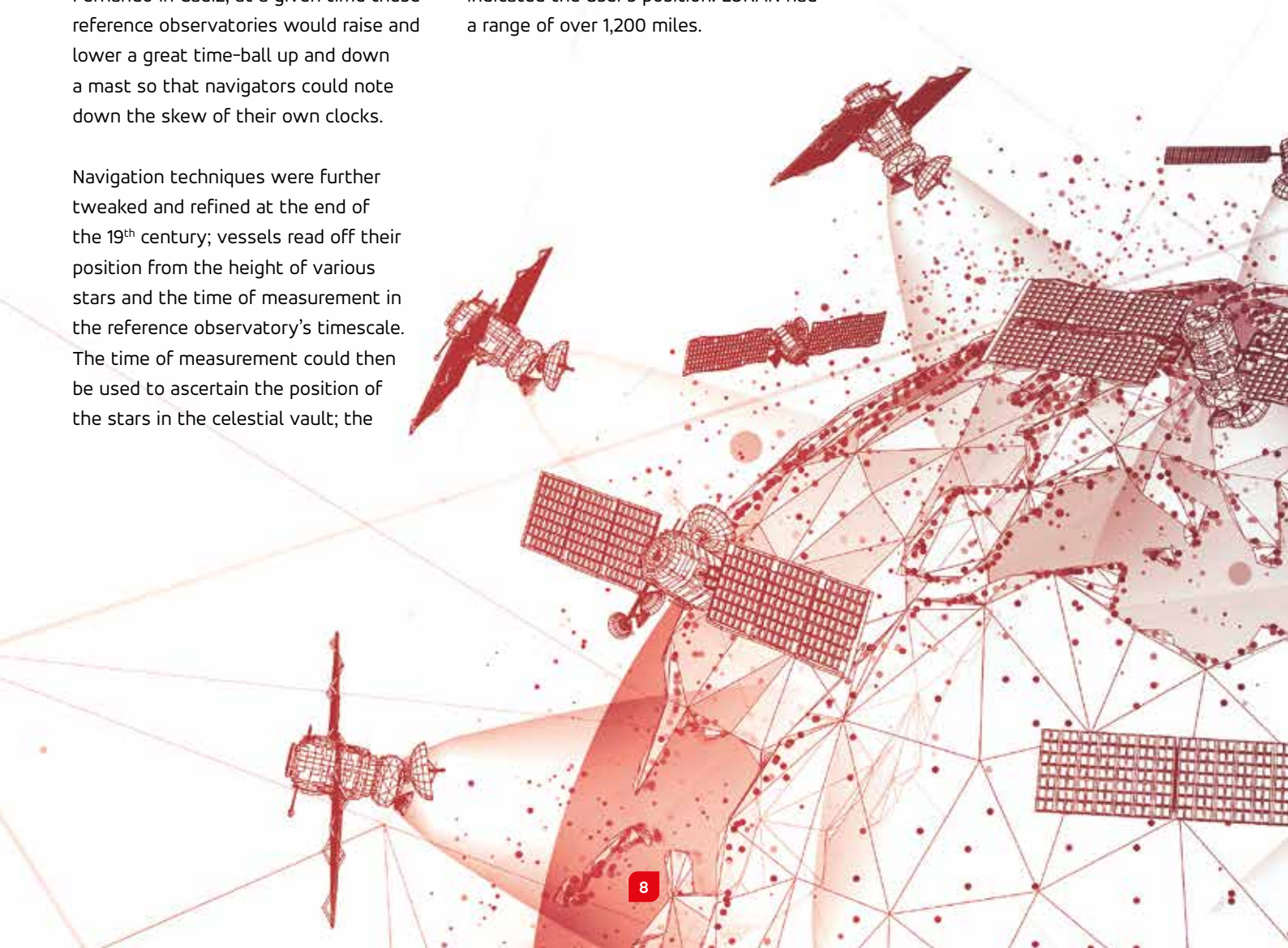
circumference could then be drawn on the surface of the earth from where the star was observed with the measured height; the vessel would then fall within this curve. This technique threw up as many circumferences as observed stars; the point where they all crossed marked the vessel's position.

At the start of the 20<sup>th</sup> century came other key navigation inventions, such as radio time signals, the gyrocompass and radio beacons. Later still, during World War II, the LORAN (Long Range Navigation) system was developed: two synchronized antennae emitted a signal and the user measured their mutual delay. The antennae positions were known, so this delay corresponded to a possible position of the receiver on a hyperbolic curve. Other antennae-pair signals generated further curves, and the point where these curves crossed indicated the user's position. LORAN had a range of over 1,200 miles.

The first navigation satellite system was TRANSIT, also known as NAVSAT (Navy Navigation Satellite System), using Doppler readings to determine the user's position; TRANSIT was declared operational in 1964. Despite its usefulness, TRANSIT did suffer from some constraints, such as the time taken to fix any position; it was therefore dropped in 1996 in favor of the Global Positioning System (GPS). Coming on stream in 1995, GPS was the first modern global navigation satellite system (GNSS), a family that now includes GLONASS, Galileo and BeiDou.

## THE BASICS OF GLOBAL NAVIGATION SATELLITE SYSTEMS

All GNSSs share the same characteristics with small variations. A GNSS comprises





a constellation of between 20 and 30 intermediate-orbit satellites fitted with atomic clocks and signal generators. The signals are emitted in at least two frequency bands; their special modulation tells us the time they were emitted from the satellites plus satellite orbit information and the synchronization error of the onboard clocks with regard to the system timescale.

To determine their position, terminal users receive signals from four or more satellites, noting the instant of reception in their local clock. The reception-transmission timing difference is multiplied by the vacuum speed of light to build up the pseudoranges between satellites and users. These pseudoranges are corrected by eliminating the cumulative delay during the atmospheric transit. A technique called trilateration is then used to seek the user-terminal position and

the synchronization error that best fits in with the pseudorange readings. The fact that three space coordinates need to be obtained (latitude, longitude and height above sea level) plus a user terminal clock synchronization error value, explains why at least four position-fixing satellites are needed.

The atmospheric signal delays are built up mainly in the ionosphere and troposphere. The ionosphere contains free electrons that interact with the electromagnetic waves, generating delays that depend on the frequency of these waves, while the tropospheric delay is frequency-independent. The tropospheric delay has a highly local component and depends on the weather conditions of the time, whereas the ionospheric delay stems from interaction of the solar flux with the earth's magnetic field; this makes it much more difficult to predict with any accuracy. This ionospheric delay can be corrected either

by means of a model transmitted from the navigation satellites themselves or by users if pseudoranges obtained from signals of two or more frequencies are being used, but this calls for much more complicated equipment in the users' handheld. For the troposphere an estimate based on simplified models is used.

To achieve the best performance possible, due consideration has to be given to a whole host of details using advanced techniques from many different disciplines. These include the relativist effects suffered by orbiting satellites or the earth deformation effects due to the position of the moon. Despite this, the position obtained by the user terminal has an error that depends on many different factors such as constellation geometry, the precision of the satellite information (predicted orbits, clock synchronization error and ionospheric delay estimate), the tropospheric model applied by the user and the other local effects suffered by the signals, such as diffraction or rebound, interference or thermal noise.





## GNSS FOR AVIATION: SBAS

Although GNSSs are ideal for most users they do not cater for the needs of civil aviation. One of the fundamental parameters handled in this user community is safety, understood as the probability that a GNSS failure can generate an accident. Although the probability of failure is small, the civil aviation authorities do not consider it acceptable, given that the objective is to be below one failure every 10 million (10<sup>-7</sup>) flight hours or landing maneuvers. These failures may stem from a satellite equipment problem, control center processing or anomalous ionospheric behavior that cannot be corrected by the satellite-transmitted model. Although GNSS system control





centers are fitted with mechanisms to detect and remediate these problems, their response time for correcting them or closing down the faulty satellite adds up to minutes or even hours.

The most complete and flexible solution for using GNSS in civil aviation in any given region is to roll out a Satellite Based Augmentation System (SBAS) that monitors and corrects the GNSS satellites and ionosphere in real time. To do so, about thirty GNSS reference stations are set up in and around the service zone, compiling information that is then sent on to a processing center. This center detects the faulty satellites, recalculates the satellite orbit and synchronization error, models the ionospheric delay and assigns intervals of confidence at the calculated magnitudes. The information thus generated is transmitted to users from two or more geostationary satellites. This information allows

aircraft to shun the faulty satellites and use better corrections to calculate positions. Even more importantly they construct a cylinder around the estimated position, containing the real position with a possibility acceptable to the civil aviation authorities.

Although SBAS have been custom designed to meet civil-aviation needs, they have also come in very handy for other precision-demanding domains, such as precision farming.

The first SBAS to come on stream was the US's WAAS in 2003, followed by Japan's MSAS in 2007, Europe's EGNOS in 2011 and India's GAGAN in 2013. When today's SBAS were set up, consideration was given only to the US GNSS, GPS, and the only GNSS frequency band reserved for civil aviation was L1. Users, therefore, did not have the option of using other frequencies to calculate the ionospheric delay.

First-generation SBAS therefore had to monitor the ionosphere; this meant setting up a dense network of reference stations, taking up a large chunk of user-communication bandwidth for ionospheric information and balking the setting up of SBAS in regions where the ionosphere is very active and difficult to predict, such as the tropical and polar zones.

Allocation of the L5 band for civil navigation and its first transmissions back in 2009 ushered in the possibility of developing the SBAS protocol, so that users could estimate the ionospheric delay themselves using the L1 and L5 frequencies. Work is now nearing completion on the definition of a new dual-frequency SBAS protocol that takes in existing GNSS constellations too. This new standard, called "Dual-Frequency Multi-Constellation SBAS" (DFMC SBAS), will enable SBAS to be provided for any region with a lower density of reference stations.

## GMV'S SBAS EXPERIENCE

GMV has been working on SBAS (Satellite Based Augmentation System) for over 25 years now. The company currently holds responsibility for designing, developing and maintaining the Central Processing Facility Processing Set (CPFPS) of Europe's current SBAS, EGNOS V2. GMV has also carried out various SBAS technology promotion projects in various parts of the world, such as the Caribbean and South America (2010), South Africa (2016) or Australia and New Zealand (2017-2020), in the latter case combined with a Precise Point Positioning (PPP).

GMV offers PPPs for many applications and market domains: ***magicGNSS*** (<http://magicgnss.gmv.com/>). It is also one of the organizations that have been collaborating since 2007 in the International GNSS Service (IGS) in real time.

In September 2022 GMV closed a crucial agreement with Lockheed Martin for the development of the control and processing centers of the Southern Positioning Augmentation Network (SouthPAN). SouthPAN is a joint initiative of the governments of Australia and New Zealand for providing both countries with a combined SBAS and PPP. GMV will also be responsible for monitoring both services in the region and ensuring they meet the required performance standards.



Australian Government  
Geoscience Australia



# Vincent Rooke

Director SouthPAN Section of Geoscience Australia

**You've had a robust career at Geoscience Australia, where you held various posts until your 2022 appointment as Director of SouthPAN. What is your remit in this post?**

I returned into the role as Director of the SouthPAN section at Geoscience Australia in August last year, my remit is to work with my colleague in Toitū Te Whenua Land Information New Zealand (LINZ), Dr. Matt Amos as SouthPAN

Technical Directors to deliver and operate SouthPAN across Australia and New Zealand. In my role as Technical Director, I am responsible for SouthPAN's early Open Services and the delivery of enhanced SouthPAN services over the coming years. The enhanced services and delivery timeframes are outlined in the SouthPAN Service Definition available on Geoscience Australia's website ([www.ga.gov.au](http://www.ga.gov.au)).

Prior to this role, I was the Director of Geoscience Australia's GNSS Analysis section which is the business area delivering the Ginan project. I have worked at Geoscience Australia for over 17 years across earth observation, geospatial and now PNT (position, navigation and timing) business areas. In my time at Geoscience Australia I have held the responsibility of 8 years managing the Geoscience Australia





satellite ground station based in Alice Springs with a focus on earth observation satellites in low earth orbit. I managed this mission critical ground station through transitioning the infrastructure from an aging capability to now being one of three Landsat stations in the global Landsat Ground Network building and sustaining close working relationships with United States Geological Survey (USGS) and NASA. This satellite ground station now does tracking, telemetry and commanding (TT&C) capabilities of civilian low earth orbit satellites.

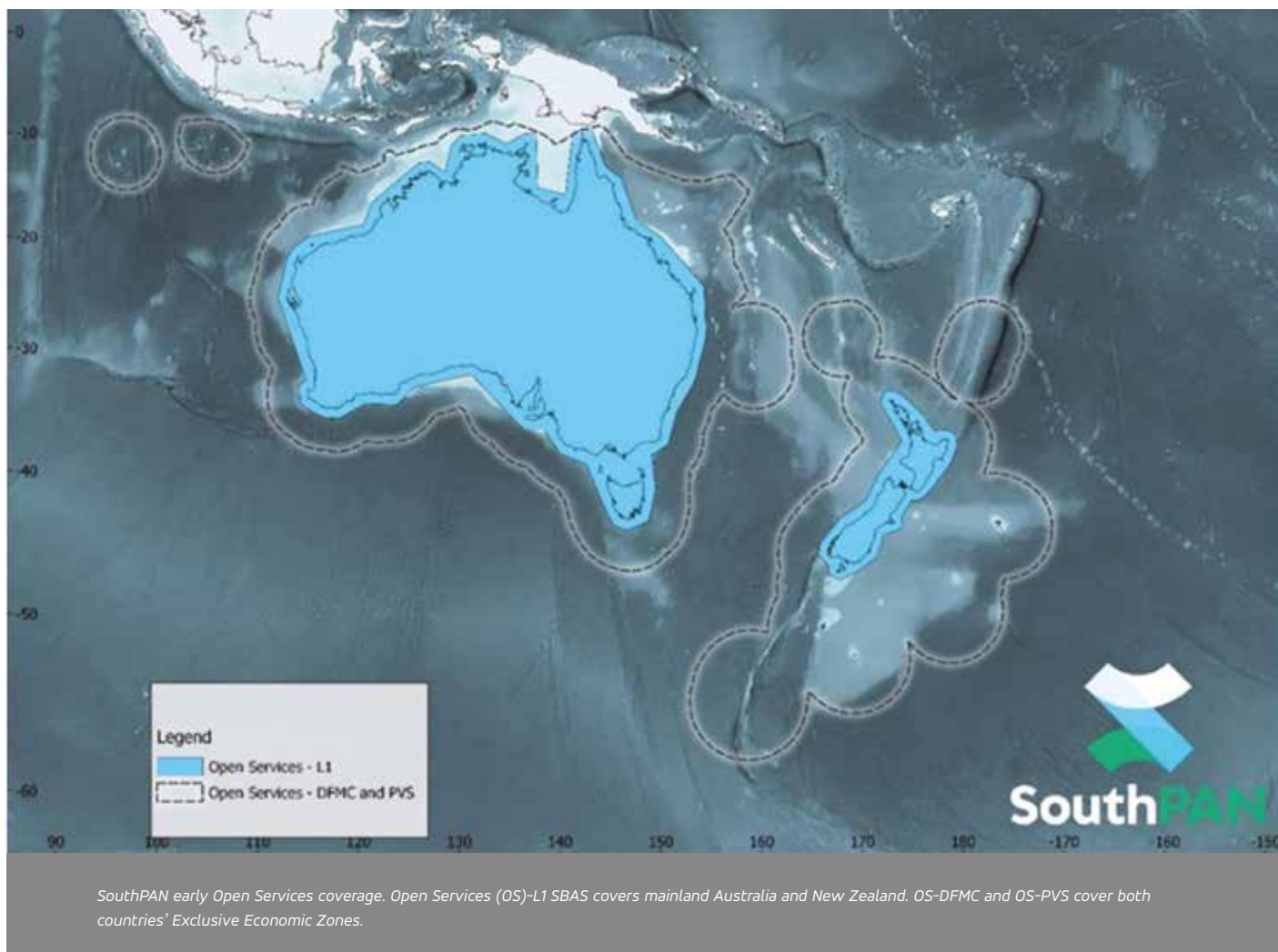
I have a background in engineering focusing on computer, satcoms and systems engineering, together with an extensive knowledge and experience leading complex software and infrastructure projects across Geoscience

Australia, collaborating with national and international stakeholders, as well as focusing on whole-of-Government collaborations.

**SouthPAN is a joint initiative between the governments of Australia and New Zealand to provide both countries with SBAS. How does this**



SouthPAN team, including staff from Geoscience Australia and Toitū Te Whenua Land Information New Zealand (LINZ)



### collaboration with LINZ work?

We have a very strong partnership with our colleagues at Toitū Te Whenua Land Information New Zealand (LINZ) under the Australia New Zealand Science, Research and Innovation Cooperation Agreement (ANZSRICA). The collaboration is fundamental to delivering the first SBAS in the Southern Hemisphere. Additionally, the image above demonstrates SouthPAN's geographic coverage. The SouthPAN Open Services (OS)-L1 SBAS covers Australia and New Zealand. OS-DFMC and OS-PVS cover both countries' Exclusive Economic Zones.

**The Australian government is bankrolling the project with 1.4 billion Australian dollars over the next 20 years. What are these funds mainly to be spent on? What sort of**

### infrastructure will have to be set up in Australia?

The Australian Government's share of the SouthPAN project is \$1.4 billion over the next 20 years. The purpose of the program is to deliver national capability that accelerates the adoption and development of location-based technology and applications across Australia and New Zealand.

SouthPAN requires critical infrastructure to enable it to provide precise positioning to as little as 10 centimetres. In order to do this, SouthPAN uses a number of distributed ground stations to monitor signals broadcast by Global Navigation Satellite System (GNSS) satellites, and compares each station's known location with position data from the satellites.

The GNSS signal data and measurement information is sent to correction processing facilities. The facilities aggregate the data from all ground stations, produce error corrections and status information about the GNSS satellites, and format the data in a standardised series of messages. These messages are sent to an uplink station connected to a satellite in geostationary orbit. The data is broadcast to all precise positioning users, who combine SouthPAN's data with their own observations of GNSS satellites.

**There is no doubt that SouthPAN's boosting of positioning accuracy and trustworthiness will drive development of groundbreaking technology and speed up Australasia's growth rate. In Australia, which sectors would you**



**expect to benefit most in the short- to medium-term?**

Between 2017 and 2019 a SouthPAN SBAS test-bed project assessed the economic, social and environmental benefits of improved positioning technology through industry case study initiatives.

The SouthPAN SBAS test-bed project demonstrated the immediate impact that this significant satellite based-technology will have on every major industry in Australia, from road, rail, agriculture, utilities, construction, to the resources sector, and more.

Economic analysis estimated the benefits of SouthPAN to be more than \$7,6 billion across Australia and New Zealand over 30 years – it’s a real game changer for our economy, providing a real impact to every major industry in Australia and New Zealand.

On our roads, SouthPAN supports cooperative intelligent transport systems as well as future industries, such as autonomous vehicles.

On our seas, positioning improves safety of navigation, especially in congested waters and environmentally sensitive areas, improving safety and decreasing the risk of maritime accidents.

In our skies, from 2028, SouthPAN will be capable of safety-of-life services, particularly transforming air transport in remote and regional Australia, decreasing the likelihood of flights being cancelled or diverted due to weather conditions, and minimising efforts for multiple attempts at landing.

And on our lands, precise positioning is being used for precision spraying of crops, yield mapping, controlled traffic farming, inter-row seeding, and livestock management.

The benefits of improved positioning technology

Over 30 years



Australia's  
expected Value  
**\$6,2 billion**

New Zealand's  
Expected Value  
**\$1,4 billion**

With a combined  
total value  
**\$7,6 billion**

**SouthPAN has economic benefits across a range of sectors**  
Australia & New Zealand

**Agriculture**  
**\$2,2 billion**



**Aviation**  
**\$404 million**



**Construction**  
**\$1,2 billion**



**Consumer**  
**\$34 million**



**Maritime**  
**\$588 million**



**Resources**  
**\$1,58 billion**



**Rail**  
**\$193 million**



**Water Utilities**  
**\$277 million**



**Road**  
**\$1,1 billion**



*Expected value of \$6,2 billion for Australia, \$1,4 billion for New Zealand and a total of \$7,6 billion for both countries over 30 years. SouthPAN has economic benefits across a range of sectors (Australia and New Zealand): Agriculture - \$2,2 billion; Aviation - \$404 million; Construction - \$1,2 billion; Consumer - \$34 million; Maritime - \$588 million; Resources - \$1,58 billion; Rail - \$193 million; Road - \$1,1 billion; Water utilities - \$277 million*

# GMV boosts air-to-air refueling efficiency

GMV is taking part in a European Defence Agency (EDA) project to endow these operations with greater autonomy



ose and drogue in-flight refueling procedures have hardly changed over the last 70 years. A certain amount of automation has by now been phased in to make life easier for the operator but there is still a large manual input, both for the refueled plane and the refueling plane.

Studies conducted by various users show that, although operations are by now largely successful, failures still represent a sizeable proportion. This could impinge adversely on the whole operation and jeopardize the various





agents involved. The continuing role of the human operator makes it difficult for refueling procedures of this type to be applied to unmanned aircraft, more commonly known as drones or UAVs among military personnel.

The tanker aircraft par excellence both in Europe and worldwide is nowadays the Airbus A330 Multi Role Tanker Transport (MRTT).

MRTT boom-refueling operations have by now been almost entirely automated, but some of the refueled aircraft still depend on the hose and drogue system.

This automation chimes in with the roadmap of the European Defence Agency (EDA), whose CapTech takes in the interests of the various member states. The recent kickoff of the Automatic Air-to-Air Refueling – Hose & Drogue, Phase 1 (A3R H&D1) project aims to boost the degree of autonomy of this operation.

In November Getafe's Airbus Defense and Space Campus hosted the first project meetup. GMV was there on hand to present the project's technical capabilities and activities, prime among which is the fitting of

behavior-recording hose and drogue sensors. GMV will be developing the hardware to be fitted in the drogue; both simulation- and flight-test-data will be analyzed afterwards to obtain precise relative positioning between the tanker and the hose and drogue, with the aim of providing precise visual-monitoring positioning data to boost overall system precision and integrity.

GMV's participation in this project will enhance its capabilities within the development of onboard and certifiable equipment.



# SATNUS signs contract for Phase 1B of its European FCAS defense program



■ The contract for the next phase of the NGWS/FCAS program was awarded on 15 December, marking the start of Phase 1B – technological demonstration. Formed by GMV, Sener Aeroespacial, and TecnoBit-Grupo Oesía, SATNUS Technologies, SL is leading all the activities of the Remote Carrier Technology Pillar for the Next Generation Weapons System (NGWS) in the Future Combat Air System (FCAS).

This ambitious program brings together numerous industries from Spain, France, and Germany to create a “system of systems” that integrates both manned

and unmanned aerial platforms. Spain has been a program partner since 2019.

The Remote Carrier Technology Pillar, led by SATNUS, is focused on developing new concepts and technologies in coordination with the new manned combat aircraft of the NGWS/FCAS using a set of unmanned vehicles.

The main aim of this pillar is to bring technologies to maturity and minimize development risks for all variants pre-selected in the joint concept study conducted in an earlier phase. This phase will end with a preliminary

design review (PDR) and, in the particular case of SATNUS, will include the first of the experimental flight campaigns.

The overall contract, which is valued at around €8 billion, will seek to prepare and conduct demonstrations of the various next generation weapons systems. One of the most eagerly awaited milestones of these demonstrations will be the first flight of the New Generation Fighter demonstrator.

These demonstrations will make it possible to validate the concepts and technologies for the operational NGWS, the development of which will start in the late 2020s. The value of the first phase of this contract, covering some 36 months of activities, exceeds €3 billion. This is set out in the agreement signed by France, Germany, and Spain on 30 August 2021, for which La Direction Générale de l’Armement acted as the contracting authority for the three countries.

## GMV at the 6<sup>th</sup> Air Summit Portugal

■ From October 12-15, GMV participated in the 6<sup>th</sup> Air Summit Portugal, which is considered to be “the biggest aeronautical summit” in the Iberian Peninsula.

At the Ponte de Sor Municipal Aerodrome, the 4-day event featured numerous debates on aeronautical, aerospace, air transport and defense themes, as well as exhibitions and demonstrations of products in the sector, and air shows. This year’s event was the biggest ever, with an increase in partners of around 70%, an

exhibition area twice as large as the last time, and a static exhibition with more than 40 aircraft.

José Neves, Director of Homeland Security & Defense at GMV in Portugal, was one of the guests on a panel on the use of Artificial Intelligence in the aviation sector, coordinated by Vieira de Almeida and with the participation of EASA. José Neves presented the challenges that this technology faces and highlighted the requirements for the aeronautical

certification process of systems with Artificial Intelligence and its impacts on new business models such as urban air mobility.

On the second day of Air Summit Portugal, João Lousada, GMV’s ISS Flight Director, took part in the conversation about space careers.

GMV’s in-house developments in response to an emerging technological niche were also featured at the summit.



# GMV and Embraer sign a memorandum of understanding

■ The Brazilian aeronautics company Embraer, specializing in designing, developing, manufacturing, and selling aircraft and systems, and GMV have recently signed a memorandum of understanding.

The cooperation between the two companies focuses on the areas of development and integration of navigation systems for defense products and services. The development program for the A-29 Super Tucano is the current flagship of this collaboration.

The A-29 Super Tucano military aircraft is used by 15 air forces around the world, including the United States, the armed forces of Mali, Mauritania, Nigeria,

Burkina Faso, and Angola. Embraer has already delivered more than 260 aircraft of this model and has now trained its subsidiary in Portugal, OGMA S.A., to perform A-29 Super Tucano support and maintenance, in addition to future modifications to the aircraft that meet current and future customers' requirements in the region.

GMV in Portugal and Embraer already have a partnership in Research and Development of IMA (Integrated Modular Avionics) that goes back more than 15 years, also including European Union projects. This new memorandum of understanding aims to expand these cooperation ties with new business, new technological

developments, and to define new defense strategies.

Outside Brazil, Portugal remains the country whose industrial capacity benefits most from Embraer investments, reinforcing its commitment to the development of its aerospace and defense ecosystem.

GMV wants to continue promoting this key business line of developing and enhancing defense-and-security aeronautics. In-house solutions and engineering services for the development of the most advanced systems and programs are part of the aeronautical sector's portfolio, always with the highest level of quality criteria.



# GMV, a key provider for advanced positioning services in Australia and New Zealand

GMV will be developing two core elements of the Southern Positioning Augmentation Network (SouthPAN) system, which is a joint initiative of the Australian and New Zealand governments to provide the two countries with satellite navigation and precise positioning services

**G** MV has signed an agreement with Lockheed Martin Corporation to develop the processing and control centers for the Southern Positioning Augmentation Network system, known as SouthPAN. This project is a joint initiative of the Australian and New Zealand governments with the purpose of providing a satellite-based augmentation system (SBAS) for navigation and precise point positioning (PPP) services. GMV will also be responsible for monitoring both of these services in the region and for ensuring compliance with the committed performance levels.

SBAS and PPP systems have applications in industries as diverse as agriculture and road, air, maritime, and

rail transportation, as well as in the field of geomatics, and SouthPAN will therefore accelerate the development of applications in all of these areas.

SouthPAN is also the first system with these characteristics available in the Southern Hemisphere. With this new program, Australia and New Zealand will be contributing to improved global coverage and interoperability for services of this type, by joining the list of countries and regions that already have their own SBAS system, such as the USA (WAAS), Europe (EGNOS), India (GAGAN), and Japan (MSAS).

In Australia, the development, entry into service, and operation of the SouthPAN system are being supervised by the Australian government's geoscience agency, Geoscience

Australia, in collaboration with New Zealand's equivalent agency, known as Toit Te Whenua Land Information New Zealand. In 2020, the two agencies signed the Australia New Zealand Science, Research and Innovation Cooperation Agreement (ANZSRICA). Over the next 20 years, the Australian government will be contributing 1.4 billion Australian dollars to the SouthPAN project.

On September 26th, just two weeks after the agreement was signed, the first services were provided by activating transmission of the system's first signals. This was a very significant milestone, because SouthPAN is the first project where an industry consortium provides an SBAS system as a service, rather than as a turnkey system.





GMV will be responsible for developing two key subsystems for SouthPAN: the Corrections Processing Facility (CPF) and the Ground Control Centre (GCC). The company will also be responsible for monitoring the system in the region and for ensuring that it complies with the committed performance levels. In addition, GMV will be providing support for the system's operation and maintenance. The CPF is in charge of generating

correction messages for the signals being transmitted by the GPS and Galileo satellites. This is a process that improves precision for the system's users by producing accuracy to as little as 10 centimeters. The CPF is also responsible for detecting malfunctions in the satellites and generating warnings for the users. This will allow use of SouthPAN by civilian aircraft as a navigation system during various flight operations,

including precision approaches to runways for landing. Safety-of-life services such as these will be available in 2028. The control center, in turn, remains in operation 24 hours a day, 7 days a week, and it will perform all the functions needed to monitor and control the system. It will also provide information to the community of users about the system's operation and availability of its services.

# Low-orbit satellites for positioning, navigation and timing



■ With about 6500 million receivers around the world and a global market of devices, applications and services valued at about 150 billion euros, Global Navigation Satellite Systems (GNSS) represent probably the biggest space technology-transfer success story.

Most of today's GNSSs involve constellations of about thirty medium

orbit (MEO) satellites at a height of about 25,000 Km to give global coverage, backed up by a few satellites in geosynchronous orbit (a height of 36,000 Km) to provide additional services at regional level.

Low orbit (LEO) satellites were initially ruled out for GNSSs due to the high number of satellites, several hundred, that would be necessary for providing

positioning services. In recent years, however, a series of LEO navigation initiatives has been launched, both governmental (China, United States) and private (e.g.; Xonospace, Geespace, Centispace).

Despite this high-number drawback, LEO-positioning constellations could be deployed very efficient; witness the mega communications constellations of Oneweb or Starlink. This development has come to be called NewSpace, an aerospace trend for the development of quicker and cheaper deployment systems, largely driven by commercial motives.

Keen not to fall behind in this new space race, Europe has now set up several initiatives under the leadership of the European Space Agency (ESA). In 2022 two parallel studies were launched (ELCANO<sup>2</sup>), one of them primed by GMV, for the initial definition of a LEO-based positioning system. The next step will be an in-orbit proof of concept under the dedicated program (LEOPNT), approved a in November.

The technology developed under this demonstrator will pave the way for provision of an operational LEO navigation service, making use of the future European constellation IRIS<sup>2</sup> (Infrastructure for Resilience, Interconnection & Security by Satellites), soon to join the roster of Europe's space structure together with Galileo and Copernicus.

This new development bodes well for the future of satellite navigation, in which GMV looks bound to play a spearheading role.



# GMV provides EUTELSAT with the planning system for its whole satellite fleet

This system will enable operators to gain advanced knowledge of the activities to be carried out on the 35-satellite fleet

**G** MV has been selected as supplier of EUTELSAT's satellite fleet planning system.

This planning system will give EUTELSAT advanced notice of the activities to be carried out on its whole fleet (currently numbering 35 satellites) during the operational shifts. A specific display component will also be designed to be kept permanently on view in EUTELSAT's fleet control room in its Paris head office, keeping a constant track of the

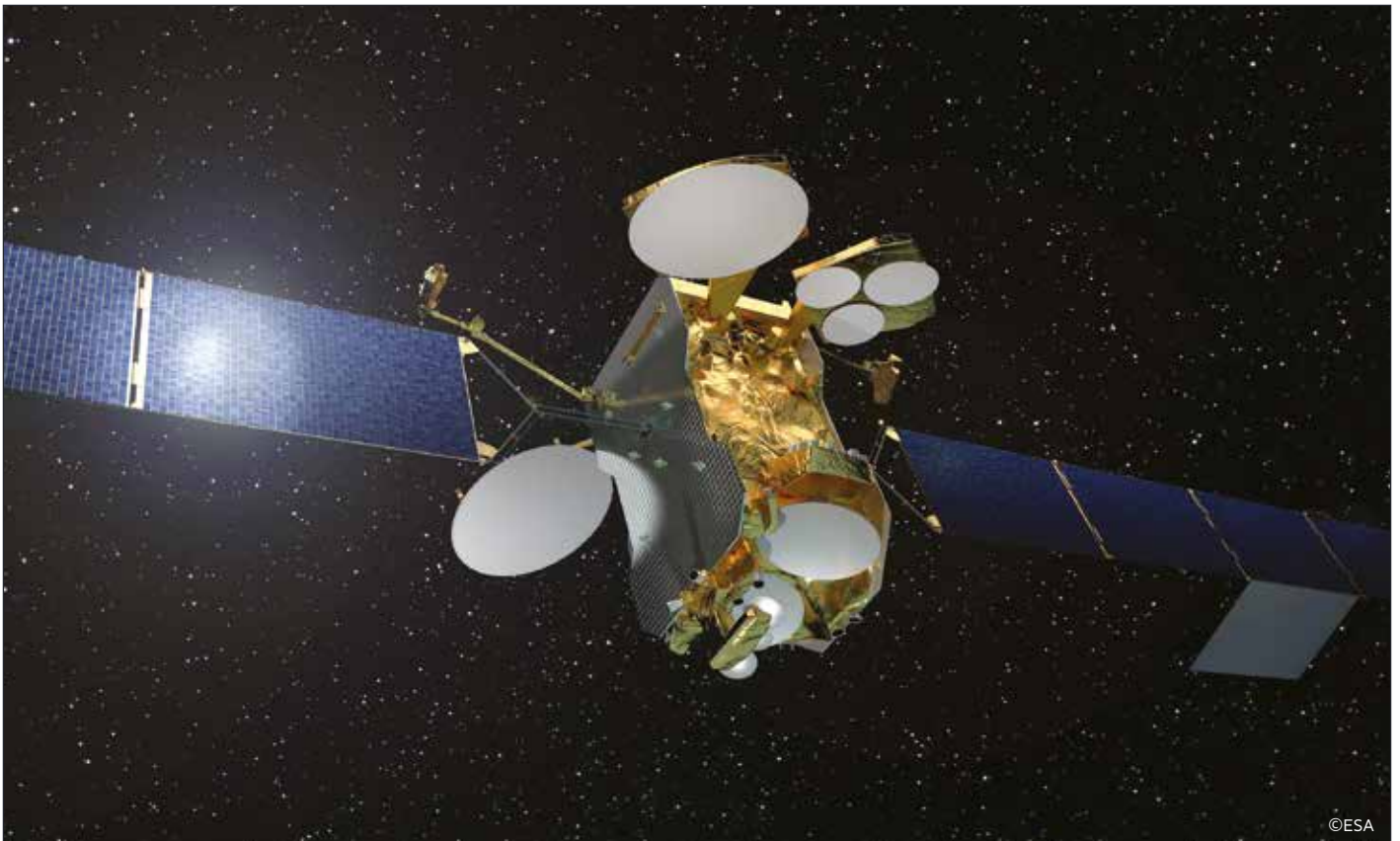
state of operations. This component will be fitted with alarms and visual cues to help operators carry out the most critical activities.

The system will be able to generate beforehand an activity plan comprising EUTELSAT's complete fleet operations. It will also cater for various activity-planning options based on concurrence of both scheduled events and celestial events, plus definition of maneuvering periods. There will likewise be various action- and constraint-definition

possibilities to deal with any conflicts.

The system will be designed and developed from scratch, tapping into GMV's wealth of experience in the design and development of operational mission planning systems. Cutting-edge display technology will also be employed, with the additional possibility of cloud hosting.

User interaction will involve a state-of-the-art web interface enabled for any computer running with a web browser like Chrome or Firefox.



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# GMV to supply the ground systems of EUTELSAT's new satellites

■ EUTELSAT turns yet again to GMV for the development of its control center known as NEO, a version for EUTELSAT of GMV's inhouse **hifly**® product as well as the FOCUS flight dynamics system based on the **FocusSuite**® family of products for its next two missions: EUTELSAT 10B and EUTELSAT 36D.

EUTELSAT 10B belongs to the Spacebus Neo family of products built by Thales Alenia Space, while EUTELSAT 36D forms part of the Eurostar Neo family built by Airbus Defence and Space.

Both satellites, together with the EUTELSAT missions Hotbird 13F and 13G recently launched with success, are based on Europe's NEO platform, which has been developed under the aegis of the European Space Agency (ESA), together with France's space agency CNES, plus other agencies from the whole of Europe.

EUTELSAT, one of GMV's benchmark clients, runs GMV-developed systems for controlling its fleet of over 35 satellites.

The cast-iron, longstanding relationship between GMV and EUTELSAT, dating back to 1993, was forged largely on the unflinching effort of a large number of people who have drawn on all their knowhow to pull off top-quality results. During this period this team has grown considerably, managing not only to keep up this effort but even to increase the number of developments

and activities carried out for EUTELSAT in other areas such as new advanced payload management and mission planning systems.

GMV's systems under this contract will take on the management of the ground operations of these two new satellites, EUTELSAT 10B launched on 23 November while EUTELSAT 36D is scheduled for 2024.



## GMV participates in APSCC 2022

GMV was present at the Asia-Pacific Satellite Communications Council (APSCC) Conference and Exhibition, a benchmark space event in the Asia-Pacific region, held in Seoul, South Korea from 18 to 20 October.

After two years of pandemic, this 23rd conference was held once more onsite. It has been specially designed to bring together the main satellite operators, satellite manufacturers, service providers, consultants, government

personnel plus final users and the key stakeholders of the space industry.

Under the banner theme "Reuniting Space in Asia", APSCC 2022 brought together over 400 professionals and leaders of the space industry and has been able to identify new business lines and share knowledge of a constantly growing market.

GMV ran a stand displaying its space products and services to the Asian

market. Furthermore, Enrique Fraga, general manager of EST (Earth Observation, Exploration, Science, Space Safety, Telecom and Transportation) Space Systems, took part in the discussion panel dealing with "Ground Systems and Equipment", highlighting GMV's starring role in ground control systems, the technological advantages recently brought into GMV's products and services as well as the further upgrades planned for coming years.

# GMV collaborates with HALOSPACE to bring space tourism closer

■ The concept of space tourism is continuing to advance thanks to a project led by the Spanish company HALO Space, with GMV playing a key role. The aim of this project is to offer a 6 hour stratospheric flight experience that will reach an altitude of 30 to 40 km above sea level. The company is planning to offer about 400 commercial trips each year by 2029, carrying a total of 3,000 passengers, all with zero emissions.

As a first-level partner in the HALO Space industrial consortium, GMV is currently responsible for the ground control centers that will house the flight planning systems and the systems for monitoring the onboard elements (capsule, balloon, parachute, and parafoil). It will also offer navigation support for the pilots. In addition, GMV's collaboration involves definition of the flight profiles and other operational aspects, so that these can be certified during later phases of the project.

GMV began working closely with the HALO Space project soon after it was initiated in 2021, with the other principal members of the consortium being CT Ingenieros and Aciturri Aeronáutica. During the first phase, efforts were focused on defining the business concept and mission. To summarize, the mission consists of offering flights inside a pressurized capsule with eight passengers and a pilot. The capsule will be lifted upward by a balloon filled with helium (or hydrogen in the future), to an altitude high enough to allow the space tourists to enjoy views of the atmospheric blue halo and the curvature of the earth, all against the black background of space.

To complete the flight, the balloon and capsule will slowly descend to an altitude of 8 km, where the balloon will separate from the capsule. A parafoil is then launched by the capsule, which allows it to glide back to earth and land at one of the predefined locations. During the initial studies and concept discussions, GMV was able to contribute its experience in flight dynamics analysis, radiofrequency communications, and development of control centers.

On December 7th, HALO Space and the Tata Institute of Fundamental Research (TIFR), with operational on-site support from GMV during the flight and remote support from Spain and Romania, successfully completed the first test flight. The first prototype capsule was elevated to an altitude of 37 km, during a flight that lasted approximately 4 hours.

As the next flights are being prepared, GMV is already working in parallel to define the project's next phases. This will include compiling and preparing all of the information needed to begin the certification processes for the complete system, which is a fundamental requirement before the first passengers will be allowed to fly.



## GMV attends Made for Space

On 22 and 23 November GMV took part in Made for Space, the UK conference that looks at the opportunities offered by the space sector, organized jointly by the Satellite Applications Catapult and the Manufacturing Technology Centre.

Sessions dealt with key issues such as the manufacture of components and materials for the space industry, the development of the supply chain, the return to the future and space and orbit operations. Made for Space brought together international experts from the space sectors and specialist manufacture.

Juan Bevan, GMV's UK Head of Space Systems - Flight Segment & Robotics, took part in the "Out of this World" session with a paper entitled "The Future for Robotics in Space".

Analyzing these questions, Bevan argued that future robotic systems will be highly autonomous, reducing human intervention in the most repetitive and tedious tasks. Robots will be capable of completing maneuvers at a macro and micro level from the biggest to the smallest, facilitating in-orbit assembly and manufacture. Juan Beván also stressed that GMV's developments clearly identify the technology blocks to be developed chronologically to make this future vision come true.

# Cutting-edge technology to fight environmental crime



■ September saw the kickoff of EMERITUS, a project cofinanced by Europe's Horizon research and innovation program under Grant Agreement No. 101073874 ). EMERITUS seeks a protocol for effective multiple-data-source investigation of waste-related environmental crimes.

The 3-year, €5-million project will be run by a GMV-coordinated consortium of 20 partners from 8 different countries.

EMERITUS aims to create a single-entry-point platform integrating state-of-the-art monitoring and analysis technology (drones, satellite data,

virtual sensors, geointelligence data, etc), rounded out by a training program designed to hone the investigation and intelligence skills of environmental control authorities at both national and cross-border level.

EMERITUS's environmental-authority training scheme centers on heading off and investigating crimes of this type, doing so by pooling theory and use-case-based simulation exercises in order to teach final users how to handle the platform itself and any related technology. Said exercises will validate the platform protocol by means of simulations based on 4 real heterogeneous use cases of growing complexity.

Platform and protocol validation will result in a set of evidence-based recommendations for environmental decision/policy makers.

As well as coordinating the project GMV is also responsible for databases and for carrying out use cases based on machine-learning image processing.

## GMV present at Space Tech Expo Europe to show its developments in ground and space segments

From 15 to 17 November the German city of Bremen hosted Space Tech Expo Europe, which defines itself as a crucial meeting point for the space supply chain, attracting a large number of exhibiting firms.

Lectures dealt with such matters as space exploration, sustainability, the New Space market, downmarket services and applications,

cybersecurity, manufacturing capacity, an industry overview, onboard connectivity and 5G capacities for the satellite industry.

GMV ran a stand displaying its complete portfolio of ground segment and space segment activities, highlighting the company's inhouse developments in the area of state-of-the-art fully flexible

telecommunications and payload management.

GMV also showed its latest guidance, navigation and control developments applied both to satellites and launch vehicles, featuring the artificial intelligence and autonomy capabilities built into these systems, such as developments under the HERA mission, currently underway.



# Successful launch of MTG-I1, METEOSAT's first new-generation satellite

This satellite forms part of the Meteosat Third Generation (MTG) series, one of the most complex and trailblazing geostationary meteorological satellite systems ever created

**Y**esterday, December 13, an Ariane-5 rocket successfully blasted off from Europe's spaceport in French Guiana carrying into space the satellite MTG-I1, the first METEOSAT Third Generation (MTG) satellite.

Fruit of longstanding cooperation between ESA and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), MTG is one of the most complex and groundbreaking geostationary meteorological satellites ever built. The complete constellation comprises six satellites: four imager satellites and two sounder satellites (which will be the first to enter an operational geostationary orbit).

Under the MTG program GMV is responsible for the procurement of the Mission Operation Facility (MOF), which includes the main components of the ground segment for commanding and controlling EUMETSAT's fleet of next-generation geostationary satellites; the mission control system (MCS); the mission planning system (MPS) and the flight dynamic system (FDS). GMV is also involved in critical activities related to the processing and analysis of the data generated by MTG-I1's onboard payload, being responsible for the instrument data simulator, the development of the processors and

supporting the integration of these processors into the operational chain of EUMETSAT's ground segment.

All these systems are backed up by a set of operational tools for automation, operations-preparation and configuration management.

This new generation of meteorological satellites is designed to revolutionize weather forecasting, allowing for a more accurate monitoring of the earth's atmosphere, land and sea, and greatly

enhancing image-generating capabilities as compared to METEOSAT Second Generation (MSG).

The MTG satellites' observations will drive development of performance-enhancing products and services in all the following areas: fire extinguishment, air-quality prediction, air traffic control, search and rescue missions, disaster risk reduction, farming yield, marine and coastal management, sustainable-energy production and many more.



## GMV, present at the latest AMOS Conference

At the end of September the island of Maui in Hawaii hosted the latest Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference, one of the world's flagship space situational awareness/space domain awareness conferences.

GMV took part in this event with the aim of giving a long-term view of space surveillance and also to feature its own inhouse developments designed to deal with the future challenges opening up in this area.

The event presented several papers from the Industrial PhD syllabus between GMV and Universidad Carlos III de Madrid (UC3M), focusing on space-debris research.

One of these paper, under the title "Catalogue-based Atmosphere Uncertainty Quantification", set out a new methodology for improving the calculation of orbital uncertainty (covariance) in the orbit determination process, as applied to the catalogue of LEO objects, enabling estimation of parametric uncertainty models in atmospheric density.

Another paper, called "Early Identification and Tracking of Fragments from Break-up Events", looked at the track-to-track association model based on early optical observation to allow for automatic detection of fragments from break-up events.

GMV also presented a study on Passive Ranging Solution Design to Improve CA Services, explaining GMV's ongoing support for collision avoidance services with passive ranging observations.

# GMV is detecting oil-spill events from Space for EOPORT Platform

■ Since 2021 KSAT has been operating the EOPORT Cloud Platform, which presents a bulging portfolio of near real-time Earth Observation (EO) services and information to cut down bringing-to-market times and trim costs.

KSAT has recently initiated a procedure (under the umbrella of the ESA Best Practices component) to extend this open and dynamic portfolio by phasing in new services that exploit the unquestionable advantages of AI/ML. GMV's proposal of an automatic EO-driven marine oil-spill detection and segmentation service fully grounded in AI analytics was duly selected as one of these new services.

The idea is to use Sentinel-1 SAR images for the detection and segmentation of oil-spill events in offshore marine environments. The traditional service is enhanced with AI analytics in order to achieve full workflow automation, competitive processing times, high sensitivity

towards oil-spill elements, and reliable segmentation in different observation conditions. The goal is the conception of an automatic real-time oil-spill monitoring service that can work at a continental level and providing decision-makers with early warning and statistics reports. The upshot is more efficient resource deployment and exploitation, while law verification and enhancement are also possible in support of sustainable exploitation of marine resources.

The project works towards the operationalization of a currently available analytics module. The module exploits the specific reflectivity patterns that oil generates in SAR images to differentiate them from the background. AI analytics are introduced to make this step more efficient against processing time and false-alike that can might impair performance. The module is encapsulated in docker technology and offered as Software As a Service (SaaS) within EOPORT so that users can transparently exploit it as a black box.



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# Microcarb, the mission that revolutionizes the fight against climate change

■ MicroCarb is the first European mission designed to monitor the flows of atmospheric carbon dioxide and contribute towards the global readings of CO<sub>2</sub>. MicroCarb is being run by UK's Space Agency (UKSA) and France's National Center of Space Studies (CNES in French initials), coordinating a consortium formed by GMV, UK's National Physics Lab (NPL), the National Centre of Earth Observation (NCEO), Leicester University, Edinburgh University, Airbus Defence and Space, Thales Alenia Space and RAL Space.

Carbon dioxide is an essential compound for life on earth. It forms part of the biogeochemical cycle that enables the exchange of chemical compounds between the environment and living beings, keeping the planet in sustainable balance. CO<sub>2</sub> is a subproduct that is generated constantly in natural processes like breathing, the breakdown of organic matter and the fermentation of sugars. But it is also generated

artificially by human action; and there lies the rub. Since the industrial revolution CO<sub>2</sub> emissions have fallen out of balance due to the activities of human beings (deriving from transport, energy production and industrial processes). By now this gas has become the main driver of the greenhouse effect.

MicroCarb has the technological ability to measure with a high degree of precision CO<sub>2</sub> emissions from both natural processes and anthropogenic activity, as well as ecosystems' CO<sub>2</sub> absorption capacity. It will also map the distribution of this gas in built-up areas to increase our knowledge of emission sources and aid decision making.

GMV UK is responsible for designing, implementing and guaranteeing the quality of MicroCarb's operational processors and algorithms as well as integrating these processors into the

processing infrastructure of CNES and EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites). Once integrated, these processors will translate the data recorded by MicroCarb's scientific instrument into values that can then be mined together with climate data in scientific studies of various types.

MicroCarb's data will no doubt be of great value for fighting climate change. It will make a significant contribution to the Paris agreement reached in 2015 during COP21, and help to achieve the carbon neutral targets set by the EU for 2050 while also supporting the various Net Zero campaigns initiated by diverse governments and organizations of the public and private sector.

The satellite is currently in assembly and integration phase in the UK, before moving on to the testing phase. Its launch is scheduled for 2024.

## GMV, present at Silicon Valley Space Week

GMV was present at Silicon Valley Space Week from 11 to 14 October, under the aegis of which the sixth Satellite Innovation Conference was held and the Second MilSat Symposium in Silicon Valley's Computer History Museum.

This yearly, innovation-centered event brought together SatCom leaders and experts to talk about latest industry trends, exploring the future of space-based business solutions and debating the latest approaches and most groundbreaking ideas.

Silicon Valley Space Week also hosted the second MilSat Symposium,

which aims to encourage new communication channels between space-defense and the industry to streamline the contracting methodology and improve defense technology.

Space operations play a critical role in the interconnection of services and an increasingly prominent role too in the defense of space assets. The MilSat Symposium fosters debate on these connections, both newly-fledged and in the pipeline, while also tackling the necessary financial, logistic and technological knowledge to build next-generation space defense.

GMV took this chance of displaying its portfolio of solutions for supporting the operations of different types of missions from smallsats to major satellite constellations.

GMV is currently world number-one in ground systems for the control of telecommunications satellites; its systems have now been taken up by over 35 global operators, such as EUTELSAT, Inmarsat and Hispasat. It is also European leader in data processing systems and ground control of earth observation systems.



# Earth Observation to face agricultural production challenges



■ Agricultural development is a sine qua non of ending poverty in developing countries. Growth in the agriculture sector is a very effective way of raising income among the poorest. Due to climate change, however, amongst other factors, agricultural growth is at risk.

Agricultural production also has unique characteristics that differ from other forms of production; several random phenomena, with a high degree of spatial and temporal variability, especially climate, may adversely affect crop and cattle production. Agricultural production is at the forefront of climate change and population growth impacts as the ecosystems on which it relies are increasingly degraded and the availability of suitable land for food production declines.

In order to help combat the threatening pressures of climate change there is an urgent need for accurate and consistent information for well-informed risk-assessment and decision-making and governance at many levels. Earth Observation (EO) technology has become a regular tool in the large-scale agricultural production systems of industrialized and emergent countries.

In this context and under the Global Development Assistance (GDA) Programme ESA is funding the GDA Agriculture (GDA Agri) project.

Led by GMV in cooperation with CGI Italia, tapping into unique land use and VITO Remote Sensing procedures, GDA Agri aims to provide International

Financial Institutions and their Client Countries with EO services in response to the recurrent challenges they face in risk assessment and monitoring, medium- and long-term planning, food production monitoring and forecasting and assessment of development priorities, while also supporting mitigation actions in the agricultural sector.

The project is targeting the following uses cases: Carbon farming; Reduction of rice methane emission; Irrigation management performance; Resilient and sustainable agricultural production; Food Security financing; Food system value chains; Locust monitoring; and Agro-Climatic Resilience.

# GMV contributes to the development and improvement of food security in Africa

■ The AfriCultuReS Food Security project final meeting and event was held in Kigali, Rwanda on October 25 and 26, as a sideline of the African Association of Remote Sensing of the Environment Conference (AARSE2022). The meeting's main objective was to discuss the opportunities for following up the work done since 2017, doing so with the aim of ensuring long term sustainability, and, therefore wider impact of the project outputs. It was agreed that AfriCultuReS will continue as a partnership on remote sensing for food security in Africa, building on the strengths of our African partners. First step towards sustaining AfriCultuReS is the December takeover of the platform and services by the Kenya Space Agency in order to serve the Kenyan agricultural development and food security sectors.

On the strength of its experience in under AfriCultuReS, GMV is participating in two new projects in Africa, ANIN and Afri4Cast. Both projects are funded by ESA within the EO AFRICA initiative. EO AFRICA stands for African Framework for Research, Innovation, Communities and Applications – building an African-European R&D partnership. EO AFRICA fosters an African-European R&D partnership, facilitating the sustainable adoption of Earth Observation and related space technology in Africa – following an African user driven approach with a long-term (>10 years) vision for the digital era in Africa.

GMV is leading the EO AFRICA National Incubators Project (ANIN), which kicked off in September with the aim of developing and validating innovative Earth Observation-based solutions addressing agricultural

drought monitoring in South Africa. ANIN will involve South African end-user entities and experts throughout the project and facilitate integration of the developed solutions into their current operational working practices demonstrating the achieved benefits. ANIN will fully exploit the capacity offered by ESA EO and Copernicus missions in synergy with state-of-the-art models and non-EO data and leverage on cutting edge information technologies.

GMV is also contributing to the AgroApps (GR)-led EO AFRICA Explorers Afri4Cast project that will develop a modeling platform making

full exploitation of satellite remote sensing of PRISMA and ECOSTRESS sensors for climate change impact analyses on agriculture. Afri4Cast will provide national (Uganda and Kenya), regional-, parcel-, pixel-specific in-season production estimates, mycotoxin formation risk and disease outbreak probability. Apart from the in-season yield forecast production line, Afri4CAST will execute seasonal and long-term model simulations for multiannual yield predictions and mycotoxigenic fungi contamination risk under various climate scenarios at a coarse spatial scale. Afri4Cast's kickoff meeting was held on October 19.





# GMV participates in Space & Defense Industry Summit 2022

■ On 22 and 23 November Seville (Spain) hosted the third Space & Defense Industry Summit 2022, held onsite this year for the first time since the pandemic hit. GMV took part in the summit together with other space and defense organizations to analyze the new challenges posed by security, defense and space, bringing out the technological capacity and skills of a national and European business fabric capable of successfully taking on the various challenges posed in the future.

The event was opened by an online address from Spain's president Pedro

Sánchez and an onsite address by the Mayor of Seville, president of the summit. Other participants included the European Commission's Director General for Defence Industry and Space, Timo Pesonen; Spain's Secretary of State for Defense, María Amparo Valcarce; and GMV's CEO, Jesús B. Serrano.

The GMV CEO's speech dwelt on the company's past as an innovation powerhouse, arguing that technology always plays a key role in space missions and activities such as satellite navigation and space traffic management. He likewise spoke

about technology's critical role in the defense sector.

Jorge Potti, GMV's corporate strategy manager, and Mariella Graziano, GMV's executive director of strategy and commercial development of space transport, exploration and science of EST space systems, took part respectively in the panel discussions dealing with "Space as a central thrust of global and industrial development" and "Incorporation of the woman's view into the defense, space and technological development sector".





## GMV participates in the initiative “O Espaço vai à Escola 2022”

■ During World Space Week, held annually from 4 to 10 October, ESERO Portugal carried out the initiative “O Espaço vai à Escola” (Space goes to school).

ESERO (European Space Education Resource Office) is an educational program of the European Space Agency (ESA) that aims to make Space a true inspiration for the new generations, focusing on stimulating the learning of science, technology, and mathematics.

With 350 lectures for 10,000 students and with the engagement of 650 teachers, the initiative aims to provide a new learning experience and encourage a lively interest in science and space among young people. Researchers, scientists, engineers, and other professionals from the Space sector are invited to go to schools across the country and share their experiences with students.

This year, GMV in Portugal participated in the 9th event of the series, with around 10 lectures, including “Space



Probes: Looking at the Stars Riding a Comet”, promoted by Rui Barradas Pereira Quality Manager at GMV in Portugal, “Navigation by satellite: how does it work and where does it go?”, presented by Teresa Ferreira, Director of GMV’s Space sector in Portugal and Pedro Fernandes, Division Head GNSS Signal Technologies (GST) at GMV in Portugal, and “HERA & DART Mission: How to Protect Earth from an Asteroid Impact” with Francisco Cabral, Technical

Lead in Interplanetary Mission Analysis at GMV in Portugal.

GMV has a great deal of experience and dynamics in promoting STEM topics in the early stages to enthuse students. Having access to information, and motivating the ability to innovate and be technologically fluent is vitally important and one of the main paths into the future.

## GMV’s space-sustainability work features at the Paris Peace Forum 2022

On 11 and 12 November GMV attended the fifth two-day Paris Peace Forum 2022, held under the banner theme “Riding Out the Multicrisis”. Since 2018 this forum has been featuring those projects and initiatives that are taking on such global challenges as population crises, armed conflicts, climate change, ethics and security in the digital world or space sustainability, among others.

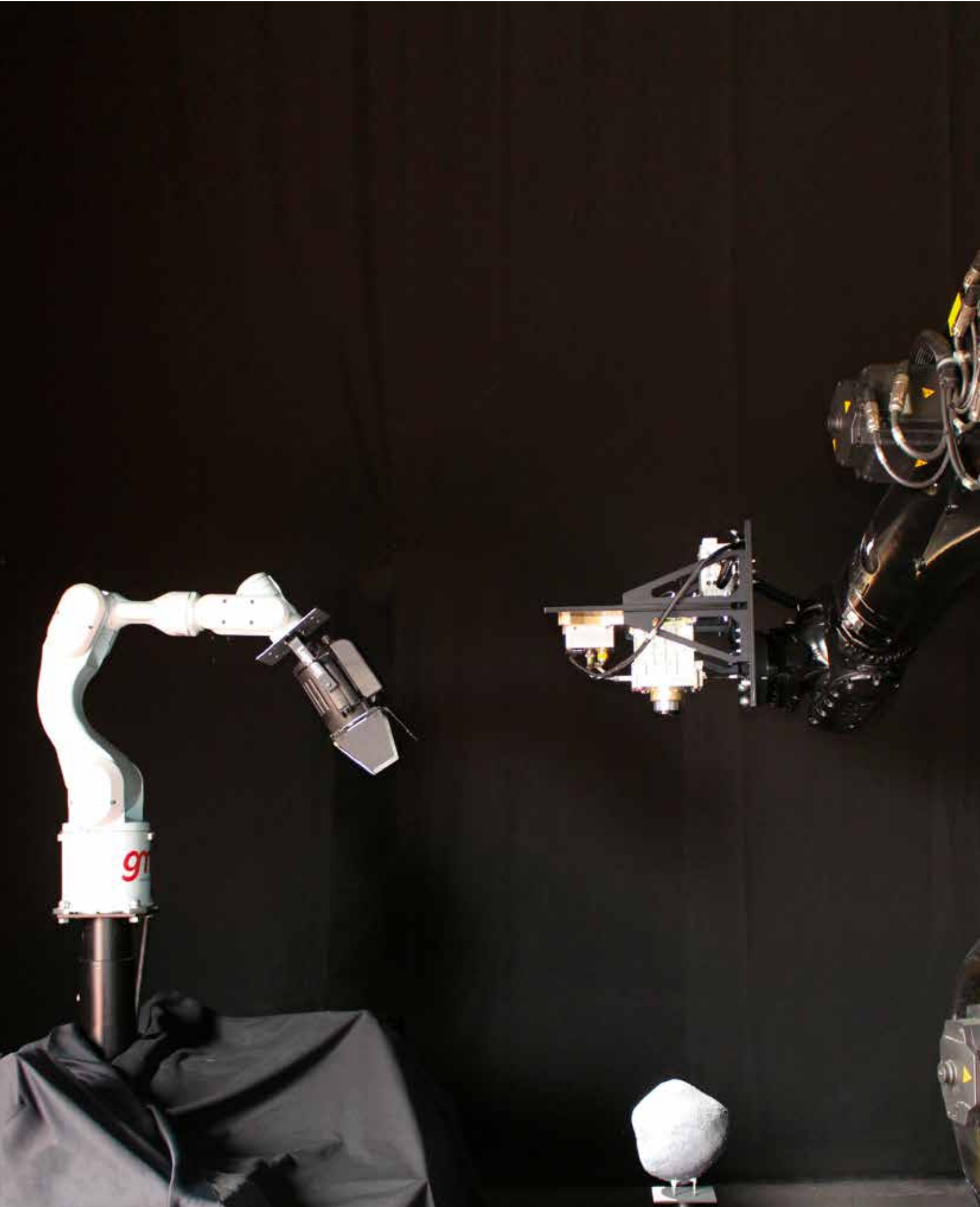
Miguel Ángel Molina, deputy general manager of EST Space Systems, and

Marius Stanciu-Manolescu, coordinator of GMV’s SST&STM Policies and Regulation, took part in the discussion panels dealing with the Net Zero Space initiative, to which GMV is signatory.

Paris Peace Forum 2022 celebrated the first anniversary of the Net Zero Space initiative, taking stock of the latest developments of the initiative and the working results of the last twelve months. The remit of Net Zero Space is

none other than to protect the earth’s orbital environment and encourage a concerted political approach to the global emergency around space rights.

GMV signed up to Net Zero Space in February 2022, a platform that involves key stakeholders within the value chain of any space mission and calls for an urgent and coherent approach to growing orbital contamination, with specific solutions in place by 2030.





# Successful completion of EROSS+ tests on Platform-art<sup>®</sup>

Within these tests GMV has been supporting the integration and demonstration of the various software components involved in the space encounter operations

**E**arly December saw successful completion of the testing phase of the European R&D EROSS+ project, on GMV's advanced robotic testbed **Platform-art<sup>®</sup>**, housed in GMV's head office in Madrid (Spain).

EROSS+ (European Robotic Orbital Support Services +) forms part of the third phase of the PERASPERA (Plan European Roadmap and Activities for Space Exploitation of Robotics and Autonomy) project. EROSS+'s remit is to design an approach-demonstration mission (in space or on orbit rendezvous) and for on orbit support services for future European commercial robotics missions. Under this project, a solution will be created for service providers with LEO and GEO satellites, integrating advanced robotics technologies developed with support from the European Commission, ESA, and other European organizations. The purpose of the mission is to vet the capacity of performing on orbit support operations for future missions, including capture and servicing operations (refueling, payload replacement, and repairs), as well as on orbit assembly work.

GMV forms part of a six-partner consortium led by Thales Alenia Space France; the company's project activities focus on three areas: developing the guidance function for the guidance, navigation, and control (GNC) system, in

order to generate reference trajectories to be followed during orbital rendezvous; developing the image processing function, as a means of providing the position and attitude readings needed by the GNC system's navigation function; and developing the function, which is responsible for guiding and supervising the robotic operations during on-orbit capture and servicing operations.

GMV's **Platform-art<sup>®</sup>** tests provided support for integrating and demonstrating the various space-*rendezvous* software components. The idea is to use a representative environment to validate the most important functions from the orbital rendezvous phase, in order to facilitate the on-orbit servicing operations.

The consortium selected GMV's robotics testbed for this test phase because of its capacity for real-time validation of spacecraft GNC technologies. The testbed has also been fitted with the associated measuring equipment and sensors in a dynamic environment, while offering the possibility of performing closed-loop tests under representative flight conditions. The net upshot is an increase in the technology readiness level (TRL) of the testing components.

The EROSS+ project is being carried out under the European Union's H2020 research and innovation program (grant agreement No. 101004346).





# The versatility of autonomous robotics in the field

■ The farming sector is now at a watershed moment. New technological advances are coming on stream, like robotics and artificial intelligence, for the development of crop-monitoring drones, autonomous vehicles for performing tasks in the field and collaborative robotics for sowing crops, among other options. The main aim of automation and robot technology is to tackle farming's simplest and most repetitive tasks in order to boost yields and offset labor shortages.

To address these issues, HispaRob hosted a discussion panel in the Global Robot Expo (held from 30 November to 1 December) under the title "AI and Robotics for more sustainable farming: from education to game-changing projects". Participants included Ángel C. Lázaro, GMV's head of robotics and automation of the industry sector,

giving GMV's take as a firm and showing examples of robotics projects carried out with public-private collaboration including universities and research centers.

The panelists set forward real cases of how automation and robots are forging a path towards sustainable, more efficient farming on the strength of STEM education advances, new technology and software and production systems. Witness **uPathWay**, a cloud-based mobile autonomous robot solution developed by GMV, which trains up software algorithms and data for performing a huge array of outdoor tasks, such as olive picking or deciding when a vineyard crop has reached maturity.

Artificial vision and machine learning are both crucial for adapting robotics to the various farming environments where

the harvesting and picking process has traditionally been time-consuming and laborious. Harvesting automation often calls for robotics arms with calipers or grippers, which must be mobile enough to reach the foliage without damaging the product.

In the AgrarIA project, for example, this technology is being employed in pilot tests for carrying out tasks of transport, logistics, handling, maintenance and inspection within the farming value chain. AgrarIA is funded under the Artificial intelligence R&D missions program of the Secretary of State for Digitalization and Artificial intelligence (SEDIA in Spanish initials) of the Ministry of Economic Affairs and Digital Transformation (file No. MIA.2021.M01.0004), corresponding to the funds earmarked for the Transformation, Resilience and Recovery Plan.

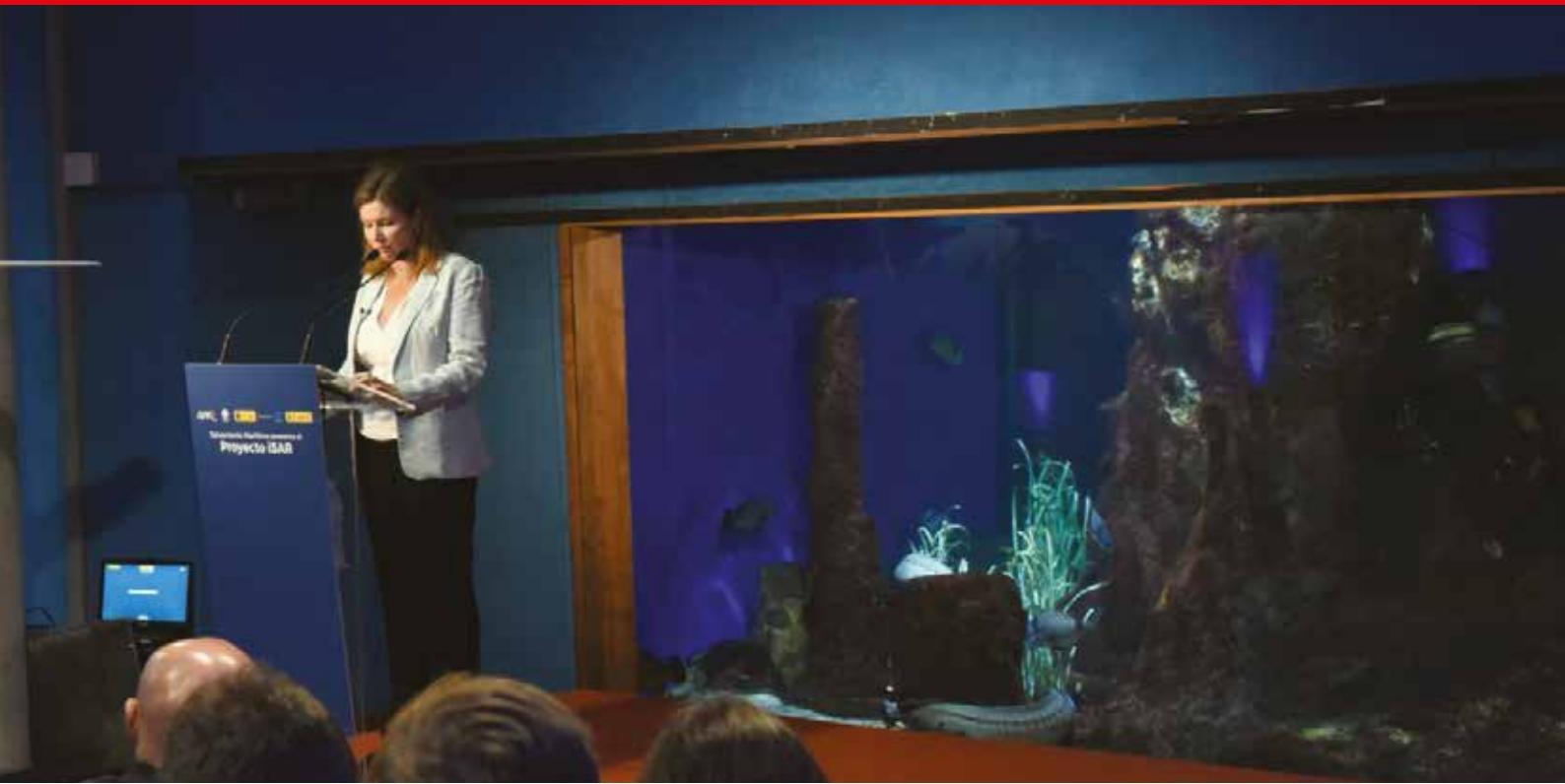




# GMV, a key participant in technological innovation project for Maritime Rescue

GMV will be applying its know how and experience in areas such as command and control systems and the merging of data and artificial intelligence





**G** MV will be playing an essential role in the project known as the Integrated Innovation Program for Maritime Rescue, or iSAR. This is an ambitious program led by Spain's Maritime Rescue and Safety Society (Sociedad de Salvamento y Seguridad Marítima or SASEMAR) and it will allow that public entity to solidify its status as a leading international provider of search and rescue services, while also improving maritime security and fighting pollution.

To execute the iSAR program, SASEMAR will make use of Camcopter S 100 unmanned helicopters provided by the Austrian company Schiebel. The aim is to further develop maritime search and rescue (SAR) capabilities by achieving a higher level of automation. Schiebel's Camcopter S 100 will incorporate advanced sensors that can detect vessels in distress and drifting objects, locate pollution sources in the water and air and identify explosive atmospheres.

Schiebel will be relying upon GMV to provide the plug and play network infrastructure, which will allow for real-time communications between maritime

vessels and aircraft on the high seas and coordination centers on land.

The project is based on implementing innovative solutions, on the maritime vessels and aircraft as well as at the coordination centers. This is being done by incorporating the latest technologies for communications and connectivity, along with smart sensors, artificial intelligence and new platforms. This combination will produce a powerful response system for maritime emergencies, improving the efficiency and effectiveness of surveillance operations and the ability to react to emergency situations on the high seas. It will also address a range of needs related to search and rescue services and for detection of spills, hazardous substances and objects that represent navigational hazards.

The iSAR project includes three challenges. The first is related to developing a mission system, or systems, for platforms on aircraft and maritime vessels. This is based on a series of smart sensors that can detect the presence of vessels in distress or objects that represent navigational

hazards, both during daylight hours and at night. The second challenge consists of developing high-performance unmanned aircraft with as much range and autonomy as possible.

The third challenge, for which GMV will be entirely responsible, is to establish an information network by integrating the mission systems and a smart connectivity system with adaptation for stations on land. GMV will be developing the command and control systems for the coordination centers, as well as for the mobile units (consisting of three ships, one airplane, and one helicopter). All of these systems will also be connected through a satellite communication network, so that interconnection can be maintained at all times.

With a budget of €20,977,920, the iSAR project is being partly funded by Spain's Ministry of Transportation, Mobility and the Urban Agenda, with 85% of the funding also coming from the European Regional Development Fund (ERDF), through more than €17 million in assistance granted to Spain's Ministry of Science and Innovation.

# IRIS system developed by GMV demonstrates its versatility during NATO's REPMUS exercise



■ The IRIS system, developed by the multinational technology firm GMV for the Spanish Ministry of Defense, has demonstrated outstanding performance during NATO's REPMUS 22 exercise.

REPMUS (Robotic Experimentation and Prototyping Augmented by Maritime Unmanned Systems) is the largest military exercise organized by NATO with experimental participation by unmanned maritime systems (aerial, ground, and underwater). Its objectives

include demonstrating the current and potential technological and operational capabilities of NATO and the various allied nations and providing experimentation and development opportunities for C4I command and control systems, with support from the participating industries.

The latest edition of the exercise, known as REPMUS 22, was led by the Portuguese Navy, and it took place in that country from September 5 to 23 in the area of the Troia Peninsula and Sesimbra. The IRIS system has demonstrated its versatility and level of interoperability, for integrating the unmanned vehicles (UxVs) of the participating Spanish companies (ALPHA, SWARMING, and AIRFOX) with the rest of the command and control systems. This has allowed for monitoring and use of the information at the command stations and facilitated its use in a variety of operational scenarios.

The IRIS system, which has been developed by GMV as part of the Spanish

Directorate General of Weapons and Material's RAPAZ program, under the Subdirector General of Planning, Technology, and Innovation, currently offers a high capacity for ISR (intelligence, surveillance, and reconnaissance) interoperability, which are essential aspects of any military operation. IRIS is also contributing to development and maintenance of the required level of situational awareness. It provides information and intelligence for those making decisions, as well as for those executing those decisions during operations. It offers a simplified interface that allows integration of sensors and platforms into the command and control and intelligence network, providing interoperability with other C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) systems and media for Spain and its allies. In addition, it allows integration of additional UxV media for the participants in the REPMUS exercise, which will culminate in 2023.

## GMV present at the Inauguration of the CEMTEX

On October 20, during the celebration of Army Day in Portugal, the subsidiary of GMV this country participated in the event "Innovation and Technological Modernization in the Army".

The event agenda included Inauguration of the Army's new Experimentation and Technological Modernization Center (*Centro de Experimentação e Modernização Tecnológica do Exército*: CEMTEX), an innovation unit created by the Portuguese Army.

While increasing its operational capacity; it is also equipped with technology developed and tested in Portugal, in partnership with Portuguese technology companies.

The event was attended by Helena Carreiras, Minister of National Defense, among other leading figures such as the Secretary of State for National Defense, Marco Capitão Ferreira.

Guests were also able to visit the exhibition of solutions from several

defense companies. GMV presented its major defense projects and ran a demo of **Talos**, a modern command-and-control system that supports the coordination and execution of integrated military actions. GMV also demonstrated how defense and space solutions might be combined to provide cutting-edge Earth Observation systems that help to respond to any insecurity situation and prevent, mitigate, and recover from the consequences.

# GMV upgrades the Spanish MoD's JISR



■ GMV has won the contract for upgrading the Joint Intelligence, Surveillance and Reconnaissance (JISR) intelligence systems of the Subdirectorate General (SDG) of the Spanish MoD's Directorate General of Armaments and Material (DGAM). After the R&D phase this new contract will aim to upgrade and adapt the SAPIIEM JISR suite for implementation in Spain's armed forces. The overall aim is to ensure national interoperability of Spain's JISR with its allies, in keeping with NATO standards.

SAPIIEM provides the armed forces with joint ISR capability, ensuring

synchronization and planning and employment integration of all information-obtaining resources with the resulting information and intelligence processing, mining and dissemination resources, doing so in a timely manner and in the right format. It has been developed on the basis of JISR interoperability concepts, in line with the architecture defined in the Multi-Intelligence All-Source Joint Intelligence Surveillance and Reconnaissance Interoperability Coalition (MAJIIC2) and taking into account the standards, procedures and processes agreed in said program for subsequent adaptation to the NATO standard STANAG 4559.

As well as upgrading the SAPIIEM suite to bring it into service, under this project GMV will be providing the armed forces with technical support in national and international exercises involving all the following; training and instruction of MoD personal and JISR units; technical support for JISR operation and maintenance and dealing with any incidents; and creating a testing model within the JISR Resource Program Office.

This project will help to consolidate SAPIIEM at national level and project it further afield, confirming GMV as a JISR powerhouse both in Spain and among NATO allies.



# Training in the EU Command Control and Information System (EUCCIS)

■ In June 2016 GMV signed a framework contract with the European External Action Service (EEAS) for maintenance and upgrading of the EU Command



Control and Information System (EUCCIS).

In the context of the current war in Ukraine, the Council of the European Union has decided to set up the European Union Assistance Mission Ukraine (EUMAM Ukraine), to enhance the military capability of the Ukrainian Armed Forces, allowing them to defend Ukraine's territorial integrity and sovereignty within its internationally recognized borders, effectively exercise its sovereignty and protect the civil population.

In response to Ukraine's request for military support, EUMAM Ukraine will provide Ukraine's armed forces with individual, collective and specialist training, including its territorial defense forces; it will also be coordinating and synchronizing the activities of member

states in support of this training. This information will be given by EEAS's Military Planning and Conduct Capability (MPCC) group.

In this context, in November several GMV teams trained up the MPCC on the main EUCCIS modules (tactical visor, collaborative web portal, planning tools) with further information on system installation, setup and maintenance.

This mission represents a significant milestone in the development of MPCC, and the keenness to give such training underlines the importance granted to Europe's far-reaching peace-keeping and security-safeguarding capacity inside and outside its borders.

GMV's experience stands it in good stead for carrying out such activities as one of EEAS's most stalwart suppliers.

## Promenade conducts the trials prior to real-environment demos

■ In the last week of November the PROMENADE (ImPROved Maritime awareNess by means of AI and BD mEthods), project carried out its simulations prior to real-environment demonstrations.

Co-funded by the European Union under the Horizon 2020 framework programme, PROMENADE aims to improve vessel tracking systems and develop artificial-intelligence tools for automatic detection of any anomalous behavior.

This is no bagatelle. Every day about 12,000 vessels are plying European waters, sharing their position to avoid collisions and facilitate maritime traffic management. Hence the importance of ensuring that this huge volume of information does not

overwhelm operators and prevent them from the taking right decision at each moment.

The main problems faced by this project are threefold. Firstly to incorporate additional, groundbreaking and information-enhancing data sources, for that purpose tapping into information from satellites, open sources, information from European networks like CISE, vessel risk registers, beacons and historical records. Secondly, to merge all this heterogeneous information so as to rule out all non-useful information and eliminate overlaps, improving the individual data of each sensor. Thirdly, and crucially, to detect any anomalous behavior with enough advanced notice to trigger an early warning and head off the threat.

Under this project GMV is responsible for solution design, project innovation management, the development of satellite-image analysis, mining and fusion services while leading technological development of the Spanish exercise to be held in the Alboran sea, in which it will be working with the Justice, Fiscal and Frontiers departments of the Guardia Civil, rolling out its inhouse **Socrates** solution.

These trials, which proved to be a resounding success, defined a series of scenarios, GMV then checking and verifying that all services to be used in the real demos worked properly in the various phases of interface testing and functional testing, to be held next year in the Alboran Sea, the Baltic and the Ionic Sea.

# GMV takes part in the final iMUGS demo

■ On 15 December the Lehmin maneuvers field in Brück (Potsdam, Germany) hosted the sixth and last of the programmed six demonstrations under iMUGS (Integrated Modular Unmanned Ground System) to present the final results of this European project.

iMUGS responds to the European Commission's aim of boosting the EU's defensive and strategic autonomy capabilities, doing so through the EDIDP. iMUGS has consisted of the development of a scalable architecture and design for application in both manned and unmanned land and air vehicles. The overall idea is to standardize Europe's command and control, communications, sensor, payload and autonomy-algorithm systems.

GMV forms part of a 13-firm consortium led by Milrem Robotics, taking on responsibility for coordinating the C4ISR interoperability command and control subproject, under which it has developed the C2ISR tactical component, which will cater for planning and carrying out manned-unmanned teaming (MUT) operations and mining and distributing the unmanned ground vehicle's sensor data, ensuring interface interoperability and standardization with C2 systems, C4I databases and existing ISR networks.

This series of demos has put the command, control and communication systems and autonomous mobility software through its paces in different operational scenarios. This particular demonstration focused on swarming capabilities and ISR missions.

iMUGS kicked off in late 2020 and is due to run for 30 months. Falling under the European Commission's European Defence Industrial Development

Programme (EDIDP), it is financed by the European Defence Fund (2017-2020).

The next phases of the project will focus on improving the architecture and

design on the basis of lessons learned during the demos, before carrying out a final event to highlight iMUGS' main capabilities. This event has been penciled in for late April 2023 in Madrid.





## ENISE

On 19 and 20 October GMV took part in the International Information Security Encounter (*Encuentro Internacional de Seguridad de la Información: ENISE*), put on by Spain's National Cybersecurity Institute (*Instituto Nacional de Ciberseguridad: INCIBE*) in León.

For yet another year GMV showed its support of the congress as one of the official sponsors. Furthermore, Luis Fernando Álvarez-Gascón, general manager of GMV's Secure e-Solutions sector and vice president of AMETIC, presented the Working Group 2 advances of the National Cybersecurity Forum (*Foro Nacional de Ciberseguridad*) to increase the weight of Spain's cybersecurity industry in the European and world market, while also stimulating cybersecurity R&D with public-private collaboration.

Patricia Moreno, GMV's Defense and Security project engineer, took part in the round table on cooperation between defense- and cybersecurity-supplier firms, talking about GMV's studies to analyze the possibility of integrating a classified information system in the cloud, citing the example of a real risk-analysis case carried out in 2021.

## PENTEIO CISO Meeting

On 25 and 26 October Zaragoza hosted PENTEIO's third CISO Meeting to analyze cybersecurity market trends and highlight the role of the Chief Information Security Officer (CISO).

PENTEIO invited Javier Zubieta, Marketing and Communications Manager of GMV's Secure e-Solutions sector and president of AMETIC's Cybersecurity Committee to present a paper on how to turn cybersecurity into a comprehensible subject.

# GMV and Wizink Bank cater for the protection of digital banks



■ From 4 to 6 October Madrid hosted the 33rd Global Congress of Cybersecurity, Information Security and Privacy (XXXII Congreso Global de Ciberseguridad, Seguridad de la Información y Privacidad: Securmática 2022), organized by the trade review SIC. Over 40 speakers explained their cybersecurity projects and strategies to a turnout of 400.

GMV and Wizink Bank gave a joint lecture in which Luis Ballesteros, CISO of WiZink Bank; Juan Acosta, BISO of WiZink Bank and David Rubio, GMV's security auditor and ethical hacker explained how to

protect a totally digital organization with processes and analyses for continuous improvement.

The speakers between them outlined the steps to be taken from the original conception of a project until it is removed or replaced, taking in the stages of commissioning and subsequent maintenance, becoming in the end one more asset of the bank. Their exposition took in audits, automated controls and the various security reviews. They also showed how GMV's knowhow helps to pinpoint the areas of continual improvement and process optimization.

## London's BankSec brings together finance cybersecurity experts

■ This annual encounter with clients and partners is a must event for GMV. BankSec is the finance sector's main ATM, means of payment and cybersecurity conference. Held in London in early October, BankSec boasted a notable roster of top speakers, inputting the viewpoints of the main banks, solution providers and diverse bodies of the industry.

As event sponsor GMV ran a stand in the exhibition area to field questions on its inhouse **Checker ATM Security®**, a top-level cybersecurity solution that has by now been taken up in over 250,000 ATMs in 40 different countries, plus other technological solutions for the finance sector.



# Intelligent and secure management of communication network control centers

Under the Smart NOC project, GMV will be applying artificial intelligence to improve the management and automation of Network Operations Centers (NOCs)

**S**mart NOC (research into emerging technology for smart management of Network Operation Centers) is a multi-sector and multidisciplinary R&D consortium made up by six effectively collaborating, top-level telecommunications and technology firms (Retevisión, Gsertel, GMV, Optare, Taiger and Scope), primed by Retevisión (Cellnex) and supported by four of Spain's top research centers.

Smart NOC's remit is to research into diverse technology, techniques, tools, methodologies and knowledge geared towards the development of technological solutions for the smart and secure management of Network Operation Centers (NOCs), both for public communication operators and Industry 4.0 private network, smart cities or critical infrastructure.

New digital technology is now being massively taken up in practically all socioeconomic sectors, including industry, farming, healthcare, defense, construction and global public service management. Furthermore, the digital technology itself is being constantly developed, providing new and better solutions. All this boils down to a huge improvement in the management of practically all socioeconomic processes, cutting costs, improving quality, generating new services, democratizing information and enhancing user experience.

This high level of digitalization means NOCs have by now become highly critical components of our society, facing sterling challenges such as exponential data traffic growth (especially media data), the incorporation of new technology and the cybercrime boom.

It is now therefore essential to rise to these challenges by researching into emerging technology such as artificial intelligence (AI), data science, dynamic user interfaces, storage systems, augmented /virtual reality, cybersecurity or video decoding. It is equally vital to bring NOCs up to a higher level of efficacy, efficiency and security.

GMV will be applying artificial-intelligence techniques to NOC management and alerts, thus improving management and automation and providing services with a competitive edge. From a technological point of view GMV aims to enhance knowledge of artificial intelligence for IT operations (AIOps) and swell its portfolio of AI solutions.

This 5.84-million-euro, 42-month project, financed under Spain's Science and Innovation Ministry through the Industrial Technology Development Center (CDTI in Spanish initials), under reference number IDI-20210856, sets its sights on an ambitious incentivizing effect for all participating firms.



# GMV, GOLD member of the National SOC Network

■ Spain's National Cryptology Center (*Centro Criptológico Nacional: CCN-CERT*) has driven the creation of a National SOC network (RNS in Spanish initials), which brings together the main national centers, both public and private, in order to increase collaboration and communication between the various Security Operations Centers (SOCs) serving Spain's public bodies.

The RNS currently boasts 49 members, about half of which are private. GMV in particular is a GOLD level member on the strength of its active participation in RNS, allowing it to receive real-time indicators and take part in joint research projects.

GMV's Specialized Security Operations Center (*Centro Especializado de Operaciones de Seguridad*) is run by a

team of experts who are responsible for developing preventive and reactive measures to cope with information-system security incidents in a global way and on a 24x7 basis. For some years now it has been recognized as one of the main security incident response centers by the top international forums such as ENISA, FIRST and CSIRT.es.



## GMV at ISMS Forum's 24<sup>th</sup> International Information Security Conference

Under the banner theme "Next Level Cyber Security: main actors and boardroom" the 24<sup>th</sup> International Information Security Conference (XXIV *Jornada Internacional de Seguridad de la Información*) was held in Madrid on 17 November.

Within the block dedicated to cloud security, IoT and business continuity, Mariano J. Benito, GMV's Cybersecurity Ambassador and coordinator of the Operational Technical Committee of

Cloud Security Alliance Spain, took part in the panel "What do I do with my on-premise IT when I'm in the cloud?"

The discussion panel included representatives from Mediaset, Ferrovial, Mapfre and Telefónica, to tackle the various practices to be taken on by organizations that are adopting cloud services as compared with classic on-premise systems. Aspects dealt with included performance-improving processes and services after moving

to the cloud or which services undergo no changes in this move. GMV's representative stressed the importance of developing professional security and information technology teams to deal with this adoption.

The discussion panel wound up with several questions from the floor and the participants' conclusions. GMV argued that all organizations will depend on cloud services in the future, so security and IT needs to develop in line with this change.

Opinion

# Today's Financial Fraud

**A**ny attack on a finance institution has a sky-high cost for the victim. It dents the bank's image and undermines client confidence, with a direct knock-on effect on income and profits.

Banks have long been contending with the current concerns and trends: phishing campaigns and malware, mule accounts and, of course, something that is as hard to control as insider fraud. On many occasions the fraud is difficult to detect and anticipate, since it is the client itself that carries out the transaction through its digital channels.

The fight against fraud poses stiff challenges for finance institutions, which have to implement a strategy to detect and prevent this wrongdoing. It is very hard to do this while maintaining privacy and handling huge volumes of data from many different sources and applying the corresponding technology, among other complicating aspects. Data forecasting models are now increasingly the order of the day, using artificial-intelligence and machine-learning techniques to aid decision making and gain a realistic overview.

Just as the fraudsters obey no borders, the banks also have to think globally while acting locally. It is also important for the bank to tell clients how the fraud was perpetrated in order to raise awareness and foster good practices among clients, boosting their trust in the bank concerned.

The good news is that the fight against fraud is constantly evolving and a huge amount of resources are spent on remediating it. This ongoing resilience means an increasing number of the would-be fraudster's attempts can now be stymied beforehand.

The bad news is that this will never end. The trend is upwards and we will continue to see new attacks on value chains and our own pockets. The metaverse is also coming into its own in the form of bitcoins and of course the warzone known as the DarkWeb, which is the current hotbed of all this wrongdoing. For instance, a vector that banks are now keeping a close eye on is the bizum payment platforms, instant payments that can all too easily become a honeypot for cybercriminals.



David Lora  
Business Partner of  
GMV's Secure e-Solutions sector

"The fight against fraud poses stiff challenges for finance institutions, which have to implement a strategy to detect and prevent this wrongdoing"





# Silver economy: the healthcare needs of the elder population



■ According to the World Health Organization (WHO) the ageing process “is a complex process of biological and psychological changes of individuals in constant interaction with the communities’ social, economic, cultural and ecological life over the passing of time. It represents a last-minute social and biographical construction over the course of human life.

For its part Spain’s National Ageing Center (*Centro Nacional de Envejecimiento*) argues that the way of experiencing the ageing process has now changed. Factors such as a longer life expectancy at an

acceptable quality, keeping up physical and mental activity and achieving economic solvency all affect the way people age and their demands on the health system. Indeed, according to a European Commission report drawn up by the Technopolis Group and Oxford Economics, the silver economy’s consumption of products and services in Europe could add up to €5.7 trillion by 2025.

Carlos Royo, healthcare strategy manager of GMV’s Secure e-Solutions sector, took part last October in the silver economy event organized by the Social Innovation

and Depopulation delegation of the Provincial Council of Malaga, arguing that “the concept of old age in today’s medicine does not come into play until 80 or 85, while in my beginnings as a country doctor our reports classed a 60-year old as ancient. We are living longer, and although the rate of old-age illnesses does increase in the final years of life, this does not mean that old age is synonymous with illness or frailty”.

He pointed out that “we Europeans are living longer and better; that said, 45% of us are becoming chronic patients, impinging directly on sustainability of health systems”.

GMV’s inhouse digital healthcare telemedicine systems like **Antari** can help to lessen this pressure on health systems, coming into its own for the care of elderly frail people, who can be monitored remotely in their own homes. Indeed, projects in which GMV has participated have proven that these systems help to delay the onset of frailty when patients are monitored on a daily basis.

## 3<sup>rd</sup> Healthcare Observatory Symposium

In late September GMV took part in the 3<sup>rd</sup> Healthcare Observatory, organized by the newspaper El Español and Invertia, tackling the theme “Looking to the future of the health system”.

Inaugurated by the Spanish Health Minister, Carolina Darias, the symposium’s participants included Carlos Royo, healthcare strategy manager of GMV’s Secure e-Solutions sector, who ran through the company’s portfolio of healthcare services and solutions as

part of its ongoing contribution to the transformation of the national health system.

The executive’s speech also stressed the urgency of effecting healthcare’s digital transformation to deal with such challenges as the increase in chronic illnesses as a result of increasing longevity; the generational handover of clinicians; the need of much more detailed and accessible clinical records, plus the need of measuring healthcare results

and the real application of personalized, precision medicine.

Other participants included Cristóbal Belda, director of the Carlos III Health Institute; Silvia Calzón, Secretary of State for Health; María Neira, Director of the Department of Public Health and Environment at the World Health Organization (WHO); Raquel Yotti, Secretary General of Research, and María Jesús Lamas, Director of the Spanish Agency of Healthcare Products and Medicines.

# The HARMONY Alliance draws to an end

Identifying nearly 120,000 datasets to draw up the first ever European map of hematological neoplasias

**T**he HARMONY Alliance, comprising the HARMONY and HARMONY PLUS projects, formalized under the European Union's Innovating Medicines Initiative, has by now identified over 119,622 patient datasets to draw up Europe's first map of hematological neoplasias. Its researchers have also concluded the Delphi surveys, conducted to compile datasets of the basic results of these tumors. The upshot will be more cohesive clinical trials in the future.

Harmony Alliance's database is one of the biggest of its kind; it has been drawn up from European hospital's data and also from pharma labs. To enable clinicians and researchers to carry out their research, GMV standardized this data under the common data model of the Observational Medical Outcomes Partnership (OMOP), which allows for systematic analysis of disparate observation databases. It has also drawn on its technological skills to develop the project's Big Data platform.

Standardized data from various sources enables analysts to work with swathes of information that far exceed the volume that can be obtained from the various organizations individually. The results of these analyses will now guide scientists' research, honing the precision of their medical treatment. This will have a direct knock-on

benefit for patients, producing a more exact profile of the state of their disease, better treatment and a higher chance of recovery. This data can also be used to train up machine learning models and develop algorithms in order to improve clinician's decision making and offer new possibilities for future clinical trials.

In the words of Miguel Ferreiro, health analyst of GMV's Secure e-Solutions sector, and Laura Tur, data scientist of GMV's Secure e-Solutions sector, there is still some way to go in improving patients' prognosis. Several phases of further scientific progress need to be ticked off yet: "from data collection at source, quality control and harmonization work, operation procedures and law compliance ranging right through to advanced analyses and scientists' research". All this is important for achieving the goal in sight, which is none other than "to learn from patients of the past in the interests of offering better treatment for patients of the future".

Ferreiro pointed out that one of HARMONY Alliance's biggest challenges is to produce a complete map of the illness. The polygenic origin of hematological cancers makes it very

difficult for clinicians and researchers to pinpoint the best treatment in each case". He therefore argues that "increasing the store of available information brings the solution to this problem much closer". Comparing the genetic information of thousands of patients "shows which genes weigh most heavily in disease prognosis and helps to rule out those that are no more than a footnote in this story".



# Technology and leadership for sustainability of the national health system

**D**igitalization and technology like artificial intelligence or Big data, including the Internet of Things, are by now ready for application to personalized precision medicine. This involves a holistic study of each patient, treating and preventing illness in view of the patients' genetic background, environmental factors and lifestyle. The downside is that medical application, and therefore the improvement of persons' health, tends to fall behind the pace of new healthcare-improving developments, which are largely the result of groundbreaking innovation.

This claim, among others, is made in the Fundación IDIS study that identifies the barriers to be surmounted for full incorporation of innovative healthcare technology. This document argues that over 80% of

the National Health System's clinical practice guides have fallen behind the times with no systematic procedure for updating hospital technology. According to other recent reports, 60% of hospital equipment in Spain is over 10 years old; Spain in fact ranks last of all the 27 European countries in terms of magnetic resonance equipment obsolescence. The situation is also found wanting in computerized tomography and the worst of all in conventional radiology.

The long life expectancy of Spain's population means the country is the second longest lived in the world. The rise in chronic illnesses, therefore, exacerbated by the shortage of doctors (in the last ten years 18,000 doctors have emigrated while another 80,000 are approaching retirement) spells out a tricky panorama. Urgent measures are now needed if we want to maintain a National Health

System that safeguards the principles of accessibility, fairness, cohesion, universality, efficiency, fellow feeling, financial and healthcare sufficiency with an evident improvement in terms of structure and governance.

A higher healthcare outlay could help them to check the deterioration in the quality of health services. But it is no panacea or silver bullet. There is also a pressing need to solve the grave problems affecting the system; full digital transformation needs to be brought in with the same intensity as in other sectors like finance. Likewise, there needs to be a systematic modernization of processes and procedures to keep up with this technological revolution.

## Courage and leadership

This situation calls for leadership by healthcare managers and politicians.



## The health sector stands in need of a thoroughgoing digital transformation, to match those already carried out in other sectors

The former have to pinpoint needs and room for improvement in order to boost the efficiency of primary healthcare, specialist healthcare and emergencies. A sine qua non of this is bringing this healthcare into line with real needs, effecting the digital transformation while modernizing processes and procedures. Among other things such a transformation will bring in online healthcare for specific patients, thus helping to improve ongoing monitoring and head off adverse events, while also ensuring a firmer adherence to treatment and relieving some of the growing pressure on healthcare, among many other benefits. Digital development of the system will also be conducive to better healthcare training, with game-changing knock-on effects in efficiency, versatility and accessibility.

As for the decision makers in charge of digital transformation, they need to leave their comfort zones and shrug

off routine and inertia, accept the need for proactive change involving all stakeholders, backed up by unflinching and genuine indicator- and result-based commitment.

The challenges facing politicians here are considerable. For example patchiness in interoperability from one region to another means the system as a whole falls behind the nonstop technological advance. This affects the main system beneficiaries, the patients themselves, who are the ones who suffer most from the tortuous and often non-existent implementation between the two public and private systems of healthcare provision and assurance.

Overlapping treatment and the reiteration of diagnostic tests, problems of fairness and access in the form of long waiting lists are all factors that act as a drag on Spain's National Health System, not forgetting the technological



*Maole Cerezo  
Head of digital healthcare communication and  
marketing of GMV's Secure e-Solutions sector*

obsolescence brought out by so many expert reports.

It is now up to healthcare system managers to hit a few homers and we trust they will be brave enough to step up to the plate.

## GMV sponsors the 17<sup>th</sup> Healthcare Reporters Congress

The 17<sup>th</sup> Healthcare Reporters Congress (XVII Congreso Nacional de Informadores de la Salud: ANIS) was held last October in Deusto University. Experts at working with data and their application to science and health reflected on the importance of this discipline to head off possible threats in the future.

GMV was one of the congress sponsors, also giving a paper on the role of data in the GMV-led Tartaglia project. This paper, given by Miguel Vázquez, Doctor in Bioinformatics and leader of the Genomic Informatics Unit of the National Supercomputing Center, talked the congress through the various working stages involved in setting up the first federated data network for speeding up clinical and healthcare research with artificial intelligence (AI).

Another of the congress speakers was Antoni Baena, Doctor in Psychology and director of the Master of Digital Healthcare of the Open University of Catalunya (Universitat Oberta de Catalunya: UOC), who explained the key role of roboethics in heading off risks in healthcare technological advances. He argued that “the use of software for data analysis and decision making has to be fair, eschewing human bias and feelings, reducing errors and improving quality; unfortunately, this is not always the case. It is therefore necessary to follow an ethical construction model as robust, transparent and revisable as possible, going well beyond the current algorithm black box”.

## The Regional Authority of Andalusia pursues its public purchase of healthcare innovation program

■ The public purchase of health innovation seeks innovating, healthcare-enhancing solutions that do not currently exist on the market. Rising to this very challenge, and with the goal of driving digital transformation projects in Andalusia’s health system, Andalusia’s Regional Ministry of Healthcare and Consumer Affairs (*Consejería de Salud y Consumo de la Junta de Andalucía*) has recently set up a new Public Purchase of Healthcare Innovation Program (*Compra Pública de Innovación en Salud: CPI*).

The new CPI Program was presented in October in Almería’s Torrecárdenas Hospital, with the participation of the Secretary General of Public Health and Healthcare R&D, Isaac Túnez, plus the regional delegate of health and consumer affairs of Almería, Juan de la Cruz Belmonte, and the General Manager of Hospital Universitario Torrecárdenas, Manuel Vida. GMV was represented by Carlos Royo, healthcare strategy manager of GMV’s Secure e-Solutions sector, who shared his knowledge of projects of this kind and some of the initiatives he has become involved in as President of AMETIC’s Digital Healthcare Committee. These included the digital healthcare proyecto tractor (major lodestar

project driving innovation and R&D), from which several ideas have been extracted for setting up the cutting-edge healthcare Strategic Projects for Economic Transformation and Recovery (*Proyectos Estratégicos para la Recuperación y Transformación Económica: PERTE*) for the Government’s Recovery Plan, which, as indicated in its presentation document “includes agreements with the Regional Authorities in the framework of the National Health System’s Digital Health Strategy, to drive the digital transformation of primary and community healthcare”.

The CPI Program is broken down into four strategic lines: precision medicine, biomedical engineering, digital transformation and the healthcare environment. Carlos Royo, responding to one of the goals of CPI Health — mapping needs for improving healthcare results — pinpointed some of the challenges faced by the National Health System, highlighting «the essential role of digital transformation in tackling them, developing country projects with a OneHealth approach. He also argued that EU Next Generation Funds give Spain the chance to redirect the current heading of Spain’s National Health System.



# GMV to supply ridership counting sensors on Granada's urban buses

**G**ranada city council has already contracted from GMV the fleet management and ticketing systems for its 220-bus fleet, at present being set up. It has now turned once more to GMV for phasing ridership counting sensors into the already contracted onboard system.

These sensors, to be fitted on each bus door, will give both drivers and the control center exact and precise information on the bus occupancy levels at each moment. This will enable controllers to launch relief vehicles in good time if the number of passengers exceeds certain threshold values.

These are high-precision, 3D-image-construction sensors that keep track of the number of passengers crossing a certain virtual line, breaking them down into those leaving and entering the bus.

The sensors will be fitted in free space at the top of the door so as not to hinder passenger access and also to avoid passenger obstruction of the sensor and cut down the chances of any vandalism or sabotage.

As well as the sensors themselves this project also includes all the following: communication switches; updating of onboard equipment firmware for

integration of the counting sensors, which then pass this information onto the control center while also displaying ridership levels on the drivers' screen; updating of the control center's fleet management application to cope with the new sensors' additional information plus display of ridership figures on traffic inspectors' operating posts; updating of certain operating reports to show occupancy on each line, route and at each stop and, lastly, the fitting and resetting tasks of the whole fleet's onboard equipment.

This system is due to come into production by the end of 2023.







# Barcelona metropolitan transportation authority awards GMV contract for new multi-fleet CAD/AVL system

The contract, worth over €7 million, includes the supply, installation, and deployment of the multi-operator, multi-fleet CAD/AVL systems for 916 buses and 27 operators



**B** arcelona's metropolitan transportation authority (ATM) has once again turned to technology multinational GMV for its multi-fleet, multi-operator computer-aided dispatch / automatic vehicle location (CAD/AVL) system, to be installed on 916 buses. This new project will enable GMV to upgrade the CAD/AVL system currently being used by the 27 ATM operators, which was also provided by GMV and is now undergoing maintenance. The contract is worth over €7 million and includes the supply, installation, and deployment of the abovementioned system, as well as a four-year warranty.

GMV's information systems fulfill the needs of both users and transit operators and authorities. The company's systems enable operators to make decisions and

monitor their services in real time, in order to improve service performance by correcting possible operational irregularities. To this end, GMV will outfit ATM buses with onboard equipment offering CAD/AVL and passenger information features, as well as modular setups allowing for onboard passenger counting, video recording and IP cameras. The passenger information system onboard the buses will display information to passengers on a TFT panel.

GMV will scale the CAD/AVL equipment it delivers to ATM to the needs of each operator, providing two different types. The advanced equipment option will include an onboard video surveillance system (CCTV) and a passenger counting system. Onboard CCTV improves passenger safety, reduces potential risks,

and provides vital information on past accidents to prevent them from happening again. The video signal is sent in real time to the control center and is also stored on the buses. Any emergency detected by the system automatically triggers a call to the relevant emergency response service. Passenger counting is carried out by sensors installed on the bus. The system collects this information and sends it to the operations control center so that the best decisions can be made regarding bus occupancy in real time or route design.

An interface layer has also been added to allow integration with external systems from other transportation authorities, such as Àrea Metropolitana de Barcelona (AMB), via an information export mechanism based on the SIRI and GTFS standards.



## New enlargements to Cyprus's ITS



■ The transport operator EMEL has won from the Ministry of Transport, Communications and Public Works of the Republic of Cyprus the concession for running Limassol's public transport bus system, including Limassol city itself and the interurban and rural lines of the whole district.

EMEL, together with the Ministry, turned to GMV as the main onboard technology supplier for the concession's new buses, reinforcing

GMV's position as one of Cyprus's top ITS suppliers.

EMEL and the Ministry have now asked GMV to enlarge this system to cater for the 180 buses to run on these routes, including fitting of the buses' onboard fleet-management, ticketing and passenger-information systems. The system will also be integrated with the onboard video-surveillance cameras, with the CANBUS system (to ensure proper operation of the ecodriving system) and

with other systems such as onboard panels and ridership counters.

The system is to be fitted in 177 new buses recently procured by EMEL from King Long and other local suppliers. Part of the onboard equipment will be transferred from the buses already running on the line and another part will be newly fitted.

EMEL is the fifth Cyprus operator (from a total of seven) to turn to GMV for supply of its onboard equipment.

## GMV takes part in the 14<sup>th</sup> edition of FIAA

The International Bus and Coach Tradefair (*Feria Internacional del Autobús y el Autocar*: FIAA) is Spain's flagship road passenger transport event. After a five-year gap since the last FIAA the 14<sup>th</sup> fair has at last been held, with GMV presence.

FIAA 2022 was put on by IFEMA MADRID from 18 to 21 October with over 70 exhibiting firms from fifteen countries and a total turnout of

7023 professionals from 28 different countries, 15% of them international. The opening address was given by María Jose Rallo, Secretary General of Transport and Mobility of the Spanish Government, who stressed this industry's proven innovating prowess.

GMV's stand displayed its latest inhouse ITS developments, such as its new onboard bus fleet management equipment, ecodriving systems, onboard

passenger information systems and onboard video-surveillance.

Also on show were its state-of-the-art onboard ticketing systems, automatic station or bus-stop ticket-vending and farecard-recharging equipment, the autonomous ecodriving system, the passenger information app, with service data and bus-stop times, among others, plus the new **ITS Suite** for fleet management and control.



# Onboard equipment for CAF trains and trams

■ The train and tram manufacturer *Construcciones y Auxiliar de Ferrocarriles (CAF)* has awarded GMV several ITS supply projects to be fitted to the new trains and trams to run in the cities of Granada and Zaragoza and on the island of Mallorca.

The projects comprise supply of ITS equipment for a total of fifteen trains to run in the abovementioned cities, taking in the passenger information system, the PA and intercom system and onboard video-surveillance (CCTV) system. These trains will also be fitted with the onboard communications Ethernet.

Passenger information will be displayed on side and front LED panels, connected to the system controller; inside there will be 21.5" LCD panels and 17" TFT panels distributed throughout the whole train. The onboard control equipment will generate both service

information and programmed publicity content, enhancing passengers' overall traveling experience. The PA system, running through the whole tram, is mainly digital, including 12 door-side IP intercoms per train, ensuring that any emergency passenger incident can be dealt with promptly.

The CCTV system, lastly, is also based on digital architecture, integrating a Network Video Recorder (NVR) with IP cameras of various types (inside, front-mounted, etc). All these systems will be synched with the train control and monitoring system in order to receive necessary control information and report states and alarms. The contract, notably, also takes in the corresponding control center applications, enabling the client to edit routes, update audiovisual content, display the content of each camera and analyze the videos recorded by each train's CCTV, among many other functions.

## GMV present at Rail Live 2022

From 29 November to 1 December Malaga's Tradefair and Congress Hall (Palacio de Ferias y Congresos) hosted Rail Live 2022. GMV was present at this railway event, which features the latest local, long-haul and high-speed railway technology and projects.

The banner themes this year were sustainability, railway-market deregulation and industry digitalization, as well as the quest for a net-zero future.

Over 250 speakers and more than 100 exhibitors of worldwide infrastructure and network operators, private sponsor firms and industry associations all took part at the event. Guided tours of local cutting-edge railway technology sites were also organized.

GMV, as market leader in the design, development and rollout of railway intelligent transportation systems, could hardly miss this event, running a stand to showcase its latest developments in ticketing systems plus the new features now phased into its inhouse railway fleet management system **SAE-R**®. This suite of applications has by now become a byword in railway Automatic Vehicle Location Systems (AVLSs).



## GMV a prizewinner at Smart City Poland Awards

■ GMV has won first prize in the transport category of the Smart City Poland Awards on the strength of its fleet-management and passenger-information modernization and extension project set up by the company in the city of Toruń (Poland). This award scheme, held this year for the fourth time, showcases each year the most groundbreaking projects set up in the whole country.

This award hails the innovative character of the winning project and the qualitative improvement it has brought in throughout Toruń's public transport network. Under this project, funded by Toruń's City Council Economy Directorate, GMV has fitted 115 buses of the Toruń Municipal Transport Authority (MZK) with driver consoles and onboard computers with GPS. It has also set up its inhouse fleet management system together with its **GMV Planner** planning module and the dynamic passenger information system, including delivery and installation of 73 new LED RGB passenger information displays at bus-stops.



These GMV solutions are now bringing the public transport fleet management system fully into line with the city's real traffic situation and available resources. Furthermore, the dynamic passenger information system will provide all would-be passengers with real time service information.

Rafał Krzysiak, GMV's Intelligent Transportation System Business Development Manager in Poland,

picked up the award in the prize-giving gala held on 25 October in Smart City Expo Poland in Łódź.

This year's Smart City Poland handed out awards in seven more categories besides the abovementioned transport category: electronic services, environmental protection, innovative economy, protection of public health and projects geared towards disabled people, urban infrastructure, public security and smart cities.

## GSM telephony for Guaguas Municipales

■ Guaguas Municipales has enhanced its fleet management system, awarding to GMV the contract for renewal of its GSM telephony system on its 256-bus fleet.

GMV will be supplying all necessary onboard and control-center hardware for supplying Guaguas Municipales' voice communications system, including fitting and commissioning all components throughout the whole fleet.

With the supplied peripherals (micro-audio, microphone, ambient microphone and loudspeaker) GMV ensures proper

adaptation of the modem's input and output signals with the communication peripherals, plus any amplification that might be necessary to ensure the driver can clearly hear the conversation with the engine running, with maximum passenger load and analogically so that the control center can hear both the driver's microphone communications and the ambient microphone.

The contract as awarded includes a four-year warranty and maintenance services based on remote technical assistance, preventive maintenance,

first- and third-level corrective maintenance, material stock, transport cost, 7x24x365 on-call service and all necessary maintenance to ensure the contracted service level is met.

GMV's solution maintains current fleet-management operations in terms of end-to-end functions for fleet management controllers and bus drivers; this is completely compatible with the current fleet management system in order to make the least possible impact on day-to-day operations and general system use.

# Chapel Hill, NC CAD/AVL Contract Award



■ Chapel Hill, North Carolina is home to the main University of North Carolina campus, where basketball great Michael Jordan launched his career. The Town of Chapel Hill will be launching the SYNC Computer Aided Dispatch / Automatic Vehicle Location system in 2023 under a new contract recently signed with GMV. This software-as-a-service solution, the flagship transit product of GMV in the United States, will help modernize and expand the technology capabilities of Chapel Hill's fleet of 100 buses and improve service for passengers.

The system includes an array of transit technologies, including mobile data terminal, custom branded mobile app for real-time passenger information, automatic passenger counter, onboard announcements, headsign integration, and voice over IP radio system. The project's initial value is over \$1,000,000 and includes an annual subscription of more than \$100,000 per year.

Chapel Hill is one of eight cities in North Carolina that joined together on a single procurement

to select new CAD/AVL technology. The consortium chose GMV as its technology partner, and the company has already implemented three other projects in North Carolina through the partnership.

With 8 operators and almost 300 buses between them, North Carolina is the second largest concentration of GMV clients in the United States, behind only the company's headquarters region of Southern California.

## GMV completed the implementation of CAD/AVL system in Roanoke, Virginia

■ In August, GMV completed the implementation of an expansion of the CAD/AVL system in Roanoke, Virginia – a city of 100,000 people located in the beautiful Blue Ridge Mountains.

Initially deployed as a pilot project of 12 vehicles in 2016, the technology system has expanded to the full Valley Metro fleet.

Through a combination of new vehicle acquisitions that included GMV technology

installed at the bus factory and a retrofit installation of 23 remaining vehicles, GMV systems are now live on the full 45 bus fleet.

The project scope of work features a wide range on-vehicle system, including mobile data terminal, Wi-Fi router, onboard announcements, automatic passenger counting, integration with headsign and farebox, and dual infotainment screens for multimedia passenger

communication. The final deployment phase of the project was valued at \$700,000 and increased the annual subscription fees to over \$80,000 per year.

The expansion of the system is a credit to GMV's excellent customer service and support during the project's early years. This established our credibility and gave the customer confidence to expand our project as additional funding became available.



# Updating of EMTUSA's ITSs



■ Gijón's urban transport corporation, EMTUSA, has contracted from GMV incorporation of the onboard fleet management system in the ticketing equipment also previously supplied by GMV, plus updating of all backoffice fleet management software. This will enable EMTUSA to bring new functions into its operation and place it at the cutting edge of new ITS technology. These are upgrades of the system contracted from GMV back in 2021, under the umbrella of the connected city project, funded by Spain's Recovery, Transformation and Resilience Plan (*Plan de Recuperación, Transformación y Resiliencia*: PRTR).

This new EMTUSA contract confirms GMV as one of today's go-to firms of Gijón's public transport system. The project takes in commissioning of a "fixed fare" EMV Transit system, allowing passengers to board buses with their physical or virtual bank card on their smartphones, plus an eco-driving system throughout EMTUSA's whole 83-bus fleet.

The project also comprises the supply of other technological updates, such as bringing into the operation the new farecard of the Asturias Transport Consortium (Consortio de

Transportes de Asturias: CTA) with direct communication to EMTUSA's backoffice and the supply of eight inspection handhelds, together with corresponding software, complying with all EMTUSA's requirements for inspecting the ticketing equipment's travel entitlements.

Also included in the contract is procurement of 800 engineering hours for developing the necessary integrations arising from the analysis and requirements of the digital platform "Connected Cities" of which Gijón itself is a member.

## GMV at Australasia Bus & Coach Expo 2022

From 5 to 6 October GMV took part in Australasia Bus & Coach Expo 2022, held in The Dome & Halls at Sydney Showground, Sydney Olympic Park in Australia.

The event, brokered by the Bus & Coach Association of New South Wales,

represented a unique chance for bus operators and sector providers to swap notes on various ITS solutions and breaking news and also forge even closer bonds of collaboration.

GMV ran a stand displaying its inhouse products and services and explaining

the company's most recent projects in the country, such as the Sydney Light Rail Fleet Management System (**SAE-R**®), now up and running on lines 2 and 3 of said light rail network and providing diverse functions such as passenger information, messaging service or service management.

# GMV's secure and precise positioning system now on the roads

New vehicle models incorporating automated driving functions rely on trustworthy, accurate and safe GMV's positioning technology

**G** MV's secure and reliable, high-precision positioning technology has recently chalked up a red-letter feat: it is now to be fitted on the vehicles of the premium German carmaker BMW. GMV's positioning technology has two components: the onboard positioning software (Positioning Engine or PE) and the GNSS Correction Service (CS). The CS provides BMW Group's vehicles with the necessary corrections in the transmission of ephemerids for the various GNSS constellations, augmentation data to offset local atmospheric effects and security-related information for trustworthy calculation of the user's position. The PE built into the vehicle's on-board

unit uses the corrections together with GNSS signals and information collected from other sensors to reliably calculate the vehicle's position, speed and heading.

Both the CS and PE have been developed, validated and honed over recent years to meet the requirements set by the various GNSS-based high-precision positioning markets, including the car market. The latter has been the most recent challenge faced by GMV's positioning system, obliging it to meet the strictest standards of the automotive sector such as ISO 26262, while also abiding by the highest quality standards for critical software.

As well as the software, GMV's solution features a secure and redundant infrastructure. GMV owns and runs a worldwide network of GNSS stations that input the raw GNSS data needed for the CS to generate its corrections. These corrections are calculated in two datacenters that are completely independent of each other and provide GMV's solution with the necessary availability levels for automated driving applications.

This production milestone brings automated driving functions into GMV's portfolio of positioning solutions, consolidating the company as byword of high-precision positioning solutions based on worldwide GNSS.





## GMV and Bip & Drive kick off a pilot scheme for applying new road user charging technology



■ Road User Charging (RUC) is a means of contributing to road construction and upkeep as a complement to other financing sources. RUC systems also facilitate implementation of mobility management policies on roads and in cities, such as congestion control in city centers or encouraging the use of more sustainable vehicles.

On a worldwide level there are many different RUC technologies, ranging from physical payment at traditional toll booths to the use of DSRC devices such as Vía-T or free-flow systems

based on license-plate recognition. This technology, however, does suffer from some flexibility constraints. Roadside infrastructure needs to be set up and the number of fare policies that can be set up is limited too.

Use of GNSS technology for RUC systems overcomes all these flexibility constraints. GMV and Bip & Drive —a mobility services payment platform and Spanish number one in the e-tolling sector— have therefore put their heads together to run a joint pilot scheme for implementing an RUC system

based on the distance covered, tapping into GNSS capacities and smartphone communications.

The pilot schemes, to be conducted on a controlled environment of over 100 km of highway, will input priceless information for identifying the key aspects of technology, operation and user experience. These will then serve as reference for setting up a system of this type for real and, in the future, for rollout within the vehicles themselves once fitted with the necessary communication and positioning capacity.



# GMV and u-blox come together to meet the new generation's safe and secure positioning needs

■ GMV has reached an agreement with u-blox, a worldwide supplier of top-level wireless communication and positioning services and technology, to provide joint solutions of precise and reliable positioning solutions based on GMV's inhouse solution, already tried and tested in the domain of autonomous driving.

GMV boasts over 30 years' experience in GNSS and a strong automotive legacy while also providing this sector with software for over 20 years. Its bulging portfolio of high-precision services offers its clients reliable, safe and high-precision positioning services. This

particular twofold solution comprises onboard software (Positioning Engine or PE) and a GNSS Correction Service (CS). Used jointly these two components boost the users' performance features; as standalones, they can be used on a multivendor basis.

Although GMV's high-precision service is currently marketed for many user domains (precision farming, robotics, space missions, etc.), one of its biggest and most promising markets is the automotive sector, meeting as it does the stringent performance features demanded by automated driving applications. The aim of this collaboration

is therefore to develop a complete, integrated and up-and-ready solution. The combination of GMV's wealth of experience in high-precision and safe positioning with u-Blox's leadership position in positioning hardware bodes well for GMV's ongoing strength and prowess in the world of Advanced Driver Assistance Systems (ADAS).

This joint effort will enable clients to save integration effort and speed up bring-to-market times, while they enjoy the advantages of a secure and reliable positioning solution at a very affordable price. Watch this space for more details in the first quarter of 2023.



# GMV wins the Smart & Safe prize in CLEPA's innovation award scheme

■ **GMV GSharp**, GMV's inhouse integral and precise, GNSS-based positioning system, has been awarded the Smart & Safe prize in the 7th Innovation Award



Scheme of the European Association of Automotive Suppliers (CLEPA).

The CLEPA Innovation Awards represent yearly recognition of European automotive supplier's ongoing commitment of smart, safe and sustainable mobility. They hail the most outstanding achievements in two categories: Smart & Safe and Clean & Sustainable. The eight prizewinners were selected by an international jury made up by 28 experts from both the automotive supply industry and research centers, who evaluated 93 applications. The prize-giving ceremony was held on Thursday 13 October in Brussels.

This event hails every year the top feats of the automotive industry, which is EU's

biggest private investor, spending about 30 billion euros a year on the future's mobility.

**GMV GSharp**, already up and running in autonomous vehicles of the main carmakers (OEMs), won the jury's praise for its groundbreaking solution comprising highly precise and integral positioning information. GMV boasts a wealth of experience in the supply of automotive software, working closely with OEMs and Tier-1 suppliers. Its 30+-year track record in GNSS-based technology and 20+-year work on precise and integral positioning systems in diverse sectors have by now won it pole position in positioning technology for autonomous vehicles.

# GMV in the first yearly monitoring meeting of the R3CAV project

■ On 1 December, with the participation of Spain's Industrial Technology Development Center (CDTI in Spanish initials) Renault Group's Valladolid R&D Center hosted the first yearly monitoring meeting of the R3CAV project (Robust, reliable and resilient connected and Automated Vehicle for people transport).

R3CAV is a CDTI-subsidized project financed by the European Union under Next Generation EU funds and supported by the Ministry of Science and Innovation. The project consortium, led by Renault Group, is made up by the firms ALSA, GMV, Indra, Masermic, MásMóvil, and Sigma.

This trailblazing project is looking into the technology and architecture needed

for developing this new autonomous vehicle. GMV's participation takes in the following areas with integration of autonomous driving algorithms in a vehicle platform:

- Development of an IDPS platform for security hardening of internal vehicle communications.
- Implementation of cooperative services based on V2X communications, integrating new security hardening technology
- Development and optimization of precise positioning algorithms based on multi-constellation, multi-frequency GNSS advanced

hybridization of sensors applied to the automotive field;

- Research into and development of new GNSS correction transmission services for precise positioning, optimizing its use for dissemination of atmospheric models.

The meeting then moved on to a review of activities and progress in the various tasks, itemizing the challenges that have cropped up during this first year of the project and ticking off the goals already met. It then wound up by presenting the prevision and scope of work planned for 2022. Renault Group's Valladolid R&D center.

# GMV begins the extended operation period of the Galileo Green Lane platform

■ After development and implementation of the improved version of the Galileo Green Lane platform for the monitoring of freight transit across European borders, the European Union Agency for the Space Programme (EUSPA) has awarded GMV the contract for maintenance and operation of the platform for a six-month tag-on.

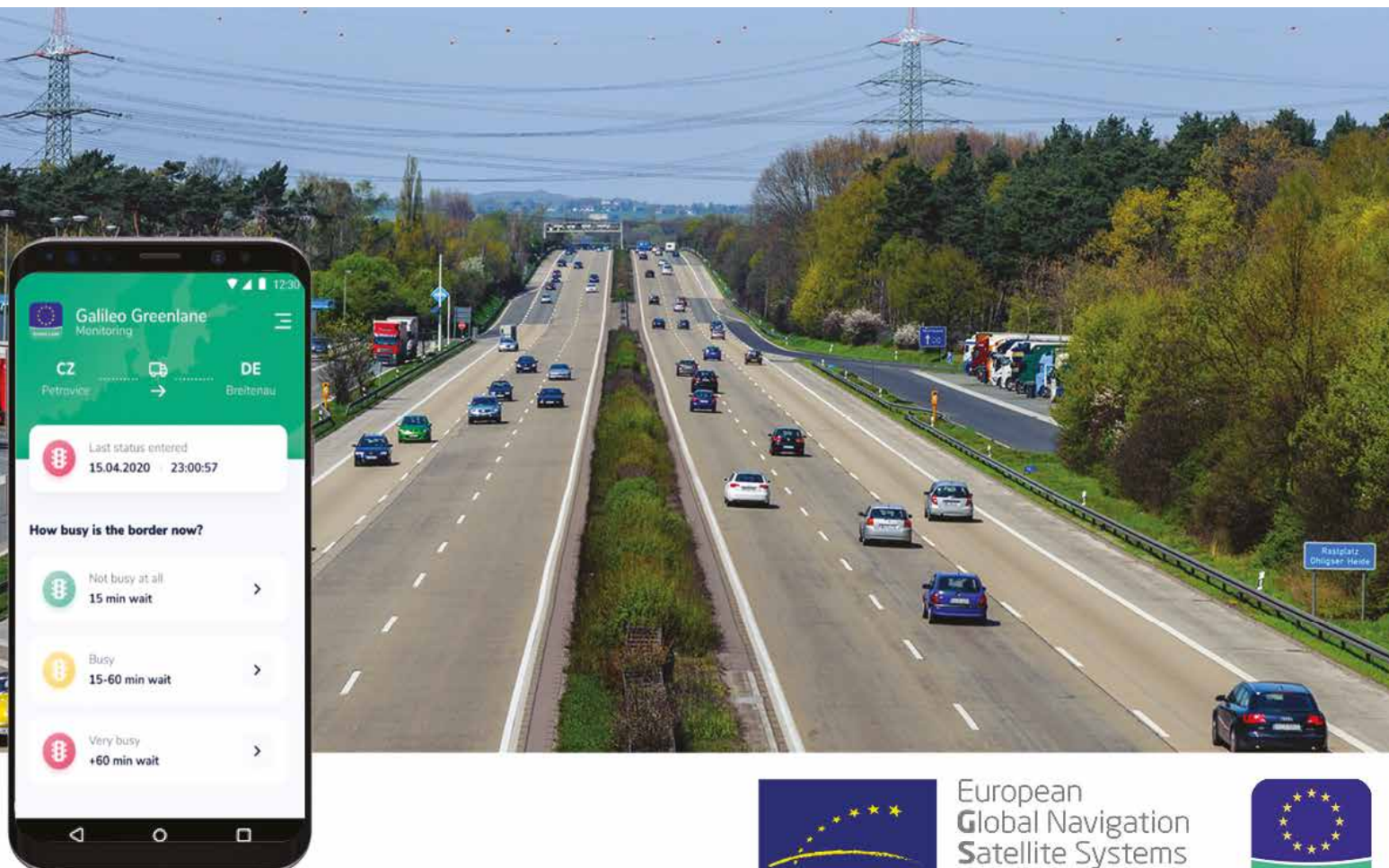
The Galileo Green Lane system was set up by the European Commission during the COVID pandemic to safeguard the free flow of essential goods and medicines between member states. The system monitors truck drivers' border-crossing

times to keep them below 15 minutes in all cases. It also takes all necessary measures to guarantee compliance with Communication C (2020) 1897 of the Commission on the implementation of the Green Lane under the Guidelines for border management measures to protect health and ensure the availability of goods and essential services.

In the current post-pandemic scenario and in view of the need of ensuring a swift response to any future emergency of a healthcare, humanitarian or any other nature, EUSPA has awarded GMV a six-month extension of system operation

with the additional possibility of extending the operation and maintenance contract even further into the future later on.

The platform's modular design will also allow for extension of the system in other directions in the future: for example for integrating additional data sources, such as service stations, rest areas, logistic zones, or for including new types of information on other means of transport, such as maritime freight transport, information from river- or seaports or the monitoring of railway transport.



European  
Global Navigation  
Satellite Systems  
Agency





# Artificial intelligence applied to robotics in the farming value chain



**A**rtificial intelligence (AI) applied to robotics can be a game-changer in any sector, automating tasks that cannot be deterministically defined by engineers and driving the efficient, productive and sustainable transformation of processes in order to save an increasingly valuable asset: time. This is no longer science fiction; it has become instead a present-day reality. Many of us, for example, now clean our houses with robot vacuum cleaners using a smart cleaning system.

Applications are even clearer in the industrial field, focusing not only on streamlining process lines but also improving workers' living conditions, freeing them from the most dangerous, repetitive and tedious tasks. Witness merchandise movements and between warehouses and production plants plus

“Drones, harvesters, smart tractors and a whole host of autonomous or collaborative robots can bring about swingeing changes in how fieldwork is carried out”

the last mile delivery. But there are other applications calling for special attention in order to drive key sectors of Spain's economy such as farming. Artificial intelligence in farming is now managing to close the digital breach, with robots guided by artificial vision now choosing when to apply phytosanitary products or ascertaining fruit maturity.

A shining example here is the AgrarIA project, carried out by a GMV-coordinated consortium of 24 public and private organizations. AgrarIA looks into the use of artificial intelligence in the farming value chain, specifically in production, transformation and distribution. Within these initiatives, GMV is developing a cloud robotics system that enables firms to carry out all sorts of mobility-intensive outdoor tasks by means of autonomous robots,

freeing them from all the team control logistics and implementing pay per use procedures. To do so we drew not only on the application of AI as system control technology but also 5G for the transmission of huge amounts of data and control commands.

Drones, harvesters, smart tractors and a whole host of autonomous or collaborative robots can bring about swingeing changes in how we work in the field, optimizing both tasks and consumables and radically transforming our way of conceiving farming work. The tasks that can be carried out by robots are endless; the sky's the limit; and they will in time be present throughout the complete farming value chain.

AgrarIA is funded under the Artificial intelligence R&D missions program of the Secretary of State for Digitalization and



*Ángel Lázaro  
Head of industry robotics and automation  
of GMV's Secure e-Solutions sector*

Artificial intelligence (SEDIA in Spanish initials) of the Ministry of Economic Affairs and Digital Transformation, corresponding to the funds earmarked for the Transformation, Resilience and Recovery Plan.

# GMV among the finalists of PET prizes in the UK and US

■ The UK and US governments have announced the twelve first-phase winners of the Privacy-Enhancing Technology (PET) prizes. This select group of firms includes GMV, after the presentation of **uTile PET** as a solution for making secure and private calculations on distributed data, without exposing said data or moving it from its original site.

GMV's inhouse solution enables confidential and private data to be mined and harnessed for training up machine-learning algorithms and analytical models without jeopardizing data privacy and while complying at all times with any company's own data-privacy rules and current law.

All participants are developing solutions that cater for the training of artificial intelligence (AI) models with sensitive data without the data subjects having



to reveal, share or combine its raw data. These solutions are expected to improve privacy and the perceived trustworthiness of AI, respecting human rights and civil liberties.

The winning solutions of the challenge will be exhibited in the second summit to be called by President Joe Biden in the first half of 2023. The challenge is financed and run by the National Institute

of Standards and Technology (NIST) and the National Science Foundation (NSF).

The twelve prizewinning technical projects were selected from among 76 candidatures that pertain to one or both of the two aspects of the challenge: the use of PETs to improve detection of financial crime or the prevision of an individual's infection risk during a pandemic.

## Innovation, profitability and sustainability: keynote themes for a more competitive industry

■ Technological advances like 5G, IoT, artificial intelligence or robotics featured prominently in the Smart Energy Congress. Speakers hailed technologies of this type as the main levers for achieving the energy transition and digital transformation in cities and industries, while also stressing the importance of an ongoing and systematic search for innovating and sustainable solutions.

Within this overall context Almudena Nieto de Castro, GMV's head of the business development of the Energy and Utilities, focused on innovation, profitability and sustainability as keynote themes for bringing in a more competitive industry. During

her congress speech she cited some examples of the projects of this type that GMV is currently working on: the corobot for removal of laboratory samples to improve efficiency and reinforce worker safety; digitalization of the aircraft fuel-boarding system making use of mobile apps and the cloud to optimize the whole process and cut down the administrative load and waste; or the digital transformation of the farming value chain using artificial intelligence to make the whole process more technological, innovative, sustainable and energy-efficient.

For his part, Ángel Lázaro, Head of industry robotics and automation

of GMV's Secure e-Solutions sector, presented a paper explaining how everything is set to change in the new era of artificial intelligence and 5G. In this new digital era, advanced connectivity is an essential enabler of digital transformations, driving efficiency through automation and enabling technology that depends on high-quality connectivity, such as cloud computing and IoT. All this will be a game-changer. Furthermore, consumer experiences improve on the strength of a significantly higher quality service, enabling persons to work remotely, accessing services calling for a high bandwidth or transmitting higher-quality contents.



# CUCO a prizewinner in the D+I Innovation Awards



■ On 10 November “Disruptors and Innovators”, the leading portal in innovation, digitalization, startups and new technology frontiers, held its second prize-giving ceremony “D+I Innovation Awards” in Madrid’s Real Fábrica de Tapices. This has now become a must-attend event for Spain’s innovators, handing out the most headline-grabbing recognition of groundbreaking innovation in the Spanish-speaking world, marking out the digitalization path with the most brilliant projects and persons of the time.

The D+I Innovation Awards jury is made up by independent analysts, top executives, academics, etc, working through a double filter to guarantee maximum transparency, honesty and independence; it has by now built up a cast-iron reputation as one of the world’s best award schemes in this area.

The CUCO project won the prize for the “Best major company digitalization project” and has been classed as the first great quantum computing project of a national and business level, with goal of making further progress in the scientific

and technological knowledge of quantum computing algorithms, working with public-private collaboration.

CUCO is being carried out by seven firms (Amatech, BBVA, DAS Photonics, GMV, Multiverse computing, Qilimanjaro Quantum Tech and Repsol), with the support of five research centers (BSC, CSIC, DIPC, ICFO and TecNALIA) and one public university (*Universitat Politècnica de València*); its target is quantum computing applied to strategically important industries of Spain’s economy: energy, finance, space, defense and logistics.

## Data Justice and Law

From 17 to 18 October Salamanca hosted a symposium organized by Salamanca University and the Spanish Ministry of Justice under the banner theme “The role of data as enabler and driving force of the transformation of justice and the law”, bringing together jurists, academics, experts in artificial intelligence and data, among others, to analyze the role of data as one of the mainstays of the digital transformation of justice and the enforcement of law.

In this first symposium on data justice and law, José Carlos Baquero Triguero, director of the Artificial intelligence and Big Data division of GMV’s Secure e Solutions sector, gave a paper on “The challenge of safe data sharing between organizations” in which he explained how cutting-edge cryptographic techniques might help to surmount the barriers set up by privacy and confidentiality in the mining and processing of data.

For this very purpose, GMV has developed **utile PET** (Privacy-Enhancing

Technologies), a solution that enables calculations to be made securely and in privacy on distributed data without exposing this data or moving it from the organizations concerned. GMV’s inhouse solution enables confidential and private data to be mined and harnessed for training up machine-learning algorithms and analytical models without jeopardizing data privacy and while complying at all times with any company’s own data-privacy rules and current law.

## Fruit Attraction, knowledge and innovation center for the fruit and vegetable sector

■ From 4 to 6 October Madrid hosted Fruit Attraction, a marquee trade fair in the fruit and vegetable world

GMV took part in the event's discussion panel "Digitalization and Sustainability in Fruit and Vegetables" organized by AMETIC, where Ángel Lázaro, Head of industry robotics and automation of GMV's Secure e-Solutions sector explained how to drive innovation, sustainability and digitalization as key features of growth in this sector, one of the most important in Spain's economy.

During the debate, Lázaro cited some prime examples such as precise tractor and harvester positioning systems and other systems working autonomously in the field applying artificial intelligence as the system control technology and 5G for the transmission of huge amounts of data and control commands. He also spoke about data platforms for the control of irrigation water quality and earth observation for crop optimization focusing on parameters such the impact of certain weather conditions on yield forecasts, risk of plagues, selection of varieties, etc.

The AgrarIA project, carried out by a consortium of 24 public and private



organizations coordinated by GMV, was one of the examples brought up in the debate as an initiative for studying the use of artificial intelligence in the farming value chain, in particular production, transformation and distribution.

Under this project GMV is developing a cloud robotics system that enables firms to carry out all sorts of mobility-intensive outdoor tasks by means of autonomous robots,

freeing them from all the team control logistics and implementing pay per use procedures.



## Robotics and automation at the service of farming

On 30 September Miguel Hormigo Ruiz, Industry director of GMV's Secure e-Solutions sector, took part in the panel "Innovation in the farming industry: opportunities for the application of robotics and Artificial intelligence" part of the Startup Europe Smart Agrifood Summit.

Hormigo's speech gave an overview of what is now on foot in the farming sector and the advantages to be offered by autonomous robotics, precise navigation, cloud computing, 5G communications and artificial intelligence.

For his part, Antonio Tabasco, head of the Remote Sensing and Geospatial Services

of GMV's EST Space Services, took part in the panel on "Precision farming: use of the new platforms" reminding his audience that the sheer availability of so much data should not blind us to the importance of processing this data, with the collaboration of specialists from both universities and businesses, agreeing that integration is the key to this question.

# AgrarIA turns to AWS to speed up the digital transformation of the farming sector



■ The AgrarIA project aims to drive the digital innovation of Spain's farming sector by means of cloud services. This strategic initiative sets out to speed up the digital transformation of the farming value chain by means of the cloud-based technological platform Amazon Web Services (AWS), which caters for initiatives to improve user services and define new farming production methods.

The AgrarIA project aims to set up a platform based on services of artificial intelligence, machine learning, the Internet of Things and data analyses of AWS, such as AWS IoT Core, Amazon SageMaker and Amazon Athena, among others, integrating all necessary

models and components of the farming sector's value chain (production, transformation and distribution). This platform will favor definition of process flows as integrated with the necessary technology for their development, plus other enabling digital technology to roll out singular initiatives of concrete use cases that drive a rapid, efficient, productive and sustainable farming system in the medium term.

Project aims include the development of new natural plague- and illness-controlling products, application of digital twinning to refrigerating and photovoltaic plants (to improve energy efficiency and reduction of the carbon footprint), smart and

global management of large arable-farming plots, the development of an autonomous robot with a cloud-hosted robot brain interacting through 5G (Cloud Robotics) and quantum-computing research into the management of satellite images to optimize farming yield.

AgrarIA is funded under the Artificial intelligence R&D missions program of the Secretary of State for Digitalization and Artificial intelligence (SEDIA in Spanish initials) of the Ministry of Economic Affairs and Digital Transformation (file No. MIA.2021. M01.0004), corresponding to the funds earmarked for the Transformation, Resilience and Recovery Plan.



## CEPSA and GMV winners at the enerTIC Awards



■ On 15 December the Secretariat of State for Digitalization and Artificial Intelligence hosted the prize-giving ceremony of the enerTIC Prizes to Projects and Executives of the 10th #enerTIC Awards.

The #enerTIC Awards hail and reward success stories and good practices, bringing them to wider notice as benchmark examples of the need to drive digitalization in cities, industries,

datacenters, etc, all with the support of energy companies and under the umbrella of open innovation.

CEPSA and GMV won their prize in the Smart Energy Operations category for a project involving the successful use of a collaborative robot, COBOT in CEPSA's laboratory of La Rábida Energy Park in Palos de la Frontera (Huelva). This project, carried out by CEPSA as user and GMV as technology partner, represents the first time CEPSA has used a Cobot. It helps to strengthen worker safety and boosts efficiency and productivity, while also contributing to the advance of production processes based on circular economy techniques by automating the elimination of samples and recycling of packaging.

The prize was picked up by Almudena Nieto, head of energy and utilities business development of GMV's Secure e-Solutions sector; Berta Aramburu, head of CEPSA's analytical services; and Víctor García, CEPSA's head of industrial innovation and technology.

## A look ahead at automation- and 5G-driven industry

The event Collaborate People & Data 2022, put on by Atlas Tecnológico in Valencia at the end of September, brought together over 200 top industry-4.0 executives in Spain around the data economy and the challenges posed by the confluence of the physical and digital world.

In his speech Ángel C. Lázaro, GMV's head of industry robotics and automation, argued that "obtaining value from data is very important, but equally crucial here is the means we use to obtain them as well as their application to industrial processes".

The expert mentioned the 5G-use trend and claimed that "this technology offers us a huge chance to exploit its many advantages: higher speed; greater connection and lower latency, with a concomitant increase in battery life; the capacity of producing huge amounts of data and the setting up of springboards for IoT (internet of things), Edge Computing and other technology enabling new business models".

Automation in industrial processes traditionally presents a recurring pyramid. At present, However "it has

turned into a fog where new networks and application models loom, such as data, intelligence, and artificial vision platforms."

Lázaro's speech also brought out examples of automation lines in which 5G acts as an enabler, such as the cloud-based, high-precision outdoor navigation system for collaborative robotics, and the solution for deploying, managing, and securely operating the control systems involved in an industrial plant's operation and control network.

# GMV participates in the AMETIC report Quantum Spain 2022: a business view

■ The Spanish Association of Electronics, Digital Contents and ICT Companies (*Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales*; AMETIC) has presented the latest version of its report Quantum Spain 2022: a business view, together with co-author firms of the stature of GMV. In the presentation, Luis Fernando Álvarez-Gascón, general manager of GMV's Secure e-Solutions sector and president of AMETIC's Innovation Committee, presented the conclusions of this report, which marks yet another milestone for the Working

Group in Quantum Technology set up by Spain's Digital Industry Association. This eminently business-based working group, a national and European benchmark, has now been working for five years to facilitate access to information and collaborate in the creation and consolidation of Spain's quantum technology business.

This handy document helps firms keep track of the current state of quantum technology, while also offering information and tools to help them bring this technology into their business processes.



## GMV analyzes the digital transformation of the farming sector

On 10 and 11 November El Ejido (Almería) hosted the 5th Datagri Forum 2022.

This year's forum analyzed in various formats the main digital transformation trend in the farming sector and the success stories that are speeding up this process along the whole value chain.

The opening speech by the Spanish Minister of Farming Fishery and Food gave a nod towards the venue of this fifth forum, pointing out that they were in the very hub of Europe's intensive farming with a yield last year of 3.8 million tons worth 4 billion euros. This translates into a turnover worth 5.5 billion euros, bearing in mind Almería's whole farming ecosystem.

The main sessions dealt with such issues as preharvests, fertigation and handling, digital harvesting, post-harvesting and industry and marketing, digitalization and the consumer. Miguel Hormigo Ruiz, director of GMV's industry sector, argued for the need of improving yields and brought out the problem of talent management to drive the sector.

Hormigo talked about GMV's experience in the farming sector and underlined the importance of cybersecurity in the digitalization of this strategically important sector within Spain's economy. He also cited AgrarIA as a fine example of a project involving 24 organizations, including major firms, SMEs and research centers, all with the common interest of strengthening the yield of Spain's farming sector by application of artificial intelligence to the value chain.



# GMV fighting climate change

■ A wind sled, a six-person crew, four weeks and the glacier of Greenland. These were the main features of SOS ARCTIC 2022, an expedition that for the first time ever followed a route of over 1000 kilometers in the south of Greenland to monitor climate change and raise public awareness of the danger of thawing polar icecaps.

GMV has collaborated with this project as a sponsor that is totally in tune with the remit of SOS ARCTIC 2022: using science and innovation to raise awareness of climate change and improve the future of our planet. The chemist and science popularizer Lucía Hortal was responsible for coordinating all the expedition's science activities.

Two scientific projects were carried out under SOS ARCTIC 2022. The first, under the aegis of Universidad Autónoma de Madrid, was Microairpolar-2 to collect samples of airborne microorganisms and study



their distribution and biogeography to forecast possible effects of deglaciation.

The second, for the Astrobiological Center (dependent on INTA-CSIC), trialed the Signs Of Life Detector (SOLID) instrument, designed to detect signs of life through identification of microbes and biochemical compounds by means of in situ analysis of solid and liquid samples. SOLID's purpose

is to be used on scientific space exploration missions.

These two projects were carried out in an incomparable scenario for studying the effects of climate change in one of the hardest-hit parts of the world. The groundbreaking wind sled is the first zero-emission polar exploration vehicle, which has by now clocked up 20,000 kilometers on 10 expeditions in Greenland and the Antarctic.

# GMV's charitable work is a prizewinner

■ Valladolid was the venue for the gala of the 16<sup>th</sup> Castilla y León Económica Awards, in which GMV was prizewinner under the category of Best Social Action. On 3 November the business publication Castilla y León Económica held this award ceremony, put on yearly to feature the best development-driving initiatives of Castilla y León's business fabric. Ignacio Ramos Gorostiola, GMV's People Strategy and Infrastructures Corporate Director picked up the prize on behalf of the firm.

With this award Castilla y León Económica's has recognized the value of GMV's charitable work over the last two years. Pride of place here goes to the initiatives designed to offset the effects

of the COVID-19 pandemic and help Ukraine in its conflict with Russia. Both GMV itself and its staff have participated in both initiatives.

Furthermore, as a declaration of its commitment to sustainable development, GMV joined in 2022 the United Nation's World Pact, thereby expressing its ongoing aim of enhancing business sustainability and driving activity in various SDG (Sustainable Development Goals) areas.

This sixteenth prize-giving ceremony attracted 1241 candidatures. During the gala, Castilla y León Económica gave out nine more awards in the various prizewinning categories: best strategy

in overseas markets, best business operation, most innovating product, best communication strategy, best human-resources management, best sustainable environment strategy, best rural company and best young company. A mention of honor was also made to the businessperson who has generated most jobs and wealth within the region.

The prize-giving jury was made up by representatives from La Caixa bank, the Global Reporting Initiative (GRI) initiative, Valladolid's Economist College, the regional authority of Castilla y León and the trade review Castilla y León Económica itself, among others.



# GMV's office parties bid farewell to 2022

After 2 years of COVID-induced social distancing, GMV is once again bringing the whole team together in an onsite event

**G**MV closed 2022 with very upbeat figures, with new colleagues onboard, huge projects in hand and an undimmed zeal and challenge-defying energy ahead of the new year. To celebrate this and bid farewell to 2022, GMV has once more organized onsite office parties to bring our whole staff together in their respective workplaces. This year's parties were particularly eagerly

awaited after all the social distancing and constraints of COVID-19.

The head-office party was broadcast live to all other GMV offices. Mónica Martínez, GMV President, and Jesús Serrano GMV CEO, accompanied by the executive team from each of GMV's sector-based divisions, gave a quick recap of 2022 and also ran through the prospects for 2023, thanking all company members for

their unflinching work and effort.

Long-service prizes were also handed out to our stalwarts who have clocked up ten and twenty years with the company. Toddlers once more held center stage too, with the prizes handed out for the winners of the restored annual Christmas card competition, backed up by robot workshops and a display of all the Christmas card competition entries.





# The importance of camaraderie

■ Sport and camaraderie come into their own each year, especially in an increasingly popular sporting event in Spain: the Company Race. Every year GMV teams from various Spanish cities toe the starting line. In November and December personnel from Seville, Valladolid and Madrid dressed in GMV colors to take part in the race held in each of these cities.

On the morning of the first Sunday of November, Seville's fifth company race

attracted a turnout of 531 runners from different firms, team GMV among them. The 8k route wound through the Isla de La Cartuja, where the Cartuja Science and Technology Park houses GMV's Seville office.

On the next Sunday Valladolid held its sixth company race with 450 runners ready to demonstrate the power of team effort. The particular idiosyncrasy of this city's company

race is that the runners cover the course and cross the finishing line as a team. GMV entered 3 teams, all of which completed the 6-k route through Valladolid's streets.

On 18 December came the turn of Madrid's 23rd Company Race, attracting a bumper turnout this year: 156 competitors shared out in 47 teams ran though the very center of Madrid in both the 6 k and 10 k races.



# Opportunity-generating changes

Each path has its own idiosyncrasies but “the important thing is not always the final destination but the path towards it”

**I**f we describe a career as the stage that starts when formal education ends, we find a bewildering array of paths, more than there are persons to follow them.

Each of these paths has its own idiosyncrasies, ranging from necessary, second-wind refueling stops to changes

of mind and swerving diversions. But as the poet Constantino Cavafis says in his poem Ítaca, “the important thing is not always the final destination but the path towards it”.

Opportunities crop up not only at certain watershed or crossroad moments; they can at times be driven by persons within the team, capable

of getting the best out of each team member; people who are not scared to make crucial decisions, helping each member of the GMV family to build his or her own path in keeping with the company’s goals and missions. Here we’d like to share the paths of two colleagues whose work has been unanimously hailed by the whole company.





## Guillermo Tobías

Business Development and Strategy. Satellite Navigation Systems



It's not easy to sum up a 15-year career in a few words; it's even trickier, if anything, to cast your mind back and remember what GMV was like on that starting date of 6 August 2007, mentally running again along the path that separates it from what it has become today and reflecting on how we both have changed in this period. I remember those first days

vividly: empty, summer-holiday offices; satellite-navigation books on the table; programming notes on the shelves; and a boss fresh in from Toulouse who was ready to listen to all my doubts, sometimes responding directly, sometimes asking counter questions but always setting me challenges. This word "challenges" is not alien to any GMV member; neither is "passion" or "camaraderie", all of them values that imbue GMV in all its business lines.

These years have given me the chance to become a small cog in the whole gearbox, leading one project, coordinating several, taking on responsibility for the career development of several colleagues, taking part in bids, contributing to the design, implementation and marketing

of GMV's inhouse developments and, today, making such a rewarding contribution to the strategy and business development of a key sector. I'd like to think that at each stage of this sinuous path I've helped to build a better company, which has by now become one of the go-to contractors of space giants like Airbus or Thales, or competing with them on an equal footing. A firm that has not only developed third-party software but has also invested heavily in R&D to devise its own inhouse solutions for many applications including autonomous driving. Today I see GMV's fresh recruits and I envy the experience they have in front of them, all the opportunities and career chances that GMV will offer them, blithely unaware as they may be now of this future bonanza.

## María José Brazal

Division Manager. Space Systems EST



I began to work for GMV in 2000, joining the data processing department, where I've continued to this day. If I look back now at my career like a film, what I see is a path on which I've grown personally and professionally, learning more at each step. I have in fact passed through all the company's stages and categories; this enables me to understand the difficulties, feats and joys of each member

of the team I manage and share in their experience.

I was given the chance to go to Poland and build up a team from scratch; this completely changed my way of thinking. Poland was a country I didn't know, a different culture. It had only recently joined the European Space Agency (ESA), and this threw up many chances and challenges I was thrilled to bring my own experience to. The Poland office was smaller so I had to turn my hand to everything, from opening the door in order to receive a parcel to fitting cables in the server room following cell-phone instructions. This was a quid pro quo, helping while being helped, and everything was more appreciated and cherished in a new country.

My return from Poland represented a great change in my remit and tasks. I

threw myself into this without reserve and still hope fervently to continue advancing in my own career by being useful to everyone else.

I think you learn more and more quickly from a difficult path than from a smooth one; you have to be proactive, never shrink from or shirk these difficulties because, once you're surmounted them, you realize just how much you've learned.

I'd like to share with you an ethical principle that is called the golden rule: "Treat others as you'd like to be treated yourself" or, conversely "don't do to others anything you wouldn't like to be done to yourself". I try to abide by this rule, both in my personal and professional relations, and when I do, everything seems to come out better.



## Find career challenges that bring out the best in you

If you're looking for a job in which you can grow as a professional and do your bit for society, look no further. In GMV you'll find daily challenges within the most trailblazing sectors.

Check out our vacancies at:  
[gmv.com/talent](https://gmv.com/talent)

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