

C4ISR systems, the keystone of international cooperation in defense

INTERVIEW

Emilio Fajardo

Director Industry, Synergies & Enablers (ISE),
European Defence Agency (EDA)





Groundbreaking defense solutions to face twenty-first century challenges

Today's defense and security is a forbidding world fraught with ever-changing challenges of a worldwide scope. We at GMV take on our clients' challenges as our own, turning them into a chance to showcase our innovation skills and our ability to come up with solutions to meet their particular needs.

GMV, 35 years working alongside the armed forces on behalf of defense and security.

www.gmv.com
marketing.defense@gmv.com



Letter from the president

GMV has reached an agreement for merging Nottingham Scientific Limited (NSL), British leader in satellite navigation and critical applications, with our UK company, knitting it seamlessly into GMV group. The resulting new company, GMV NSL, will have an 80-strong staff, more than doubling our UK personnel so far. And NSL, formerly a SME, will now be part of a powerful business group, capable of taking on the most ambitious challenges set by Britain's post-Brexit space market.

In the 5-year period running from 2014 to 2019 GMV doubled its turnover. In the same period our subsidiaries trading outside Spain more than tripled their own. Internationalization brings us many benefits. It widens our trawl of opportunities and brings us

closer to clients outside Spain. This latter advantage has been especially important during the travel restrictions of this pandemic lockdown. But the greatest benefit of internationalization for us is access to a bigger pool of talent, a scarce resource that has to be sought and nurtured wherever it is.

The pandemic has not been able to hinder our negotiations with NSL, which have all happened online. It helped that our teams already know each other well. NSL has a 22-year track record, proving its mettle also in several projects we have worked in together. From these experiences we know that we share the same company values of technological excellence applied to the same objective of always delivering only the best possible solution to our clients.

Mónica Martínez

Nº 75

CONTENTS

Published
GMV

Editorship-Coordination
Marta Jimeno, Marta del Pozo

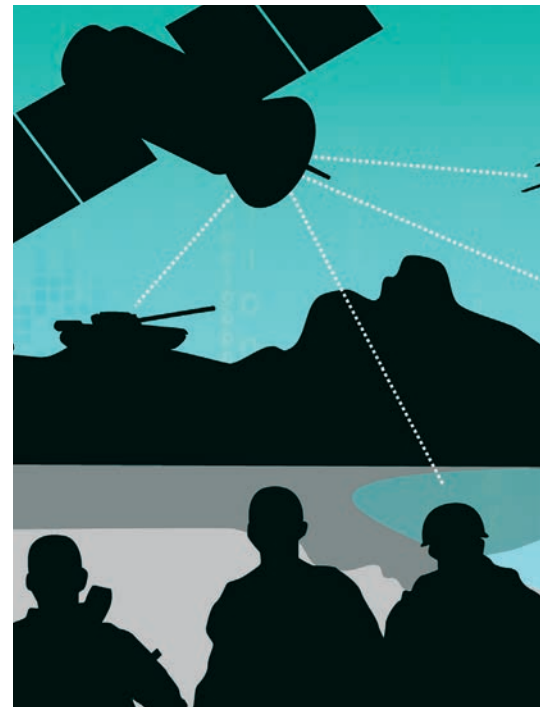
Area Heads
Antonio Hernández, Miguel Ángel Molina,
José Prieto, Javier Zubieta

Writing
Carlos Barredo, María Jesús Calvo, Javier Carro,
Jesús Cegarra, Pablo Colmenarejo, José Luis
Delgado, Maole Cerezo, Cristian Corneliu, Neusa
de Almeida Cunha, Joaquín Estremera, Raquel
Fernández, Hugo Garzón, Alberto Nicolás Gentil,
Javier Gómez, Mariella Graziano, Sara Gutiérrez,
Rafal Krzysiak, María Dolores Laínez, Fátima
López, Jaime Fernández, Pedro López, Gerard
Margarit, Alfredo Martín, José María Martínez,
María del Mar Millán, Rahman Momeni, Daniel
Montero, Cristina Muñoz, José Neves, António
Nunes, Jorge Ocón, Andrea Pellacani, Eric
Polvorosa, José Prieto, Beatriz Revilla, Irma
Rodríguez, Almudena Sánchez, Javier Sanz, João
Sequeira, Tatiana Teresa, Jesús Tírado, Guillermo
Tobías, María Victoria Toledano, Manuel Toledo,
Marta Vilar, Julia Yagüe

Art, design and layout
Paloma Casero, Verónica Arribas.

MÁS INFORMACIÓN
marketing@gmv.com
+34 91 807 21 00

Magazine Nº. 75. Third quarter of 2020
© GMV, 2020



3 LETTER FROM THE PRESIDENT

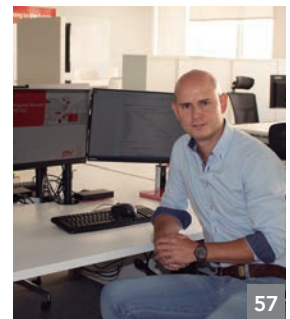
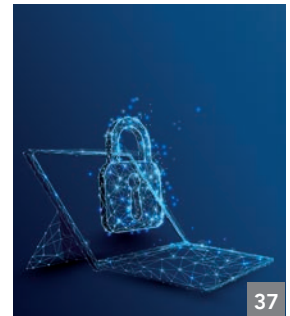
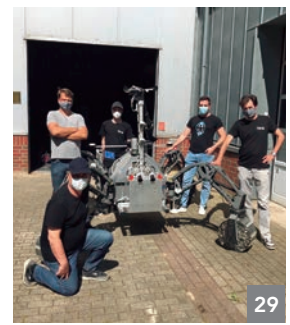
6 ARTICLE

*C4ISR systems, the keystone of
international cooperation in defense*

12 INTERVIEW

Emilio Fajardo

*Director Industry, Synergies & Enablers
(ISE), European Defence Agency (EDA)*



17 AERONAUTICS

GMV an interlocutor in the working meeting on the initiatives of the AIRBUS-Government agreement

18 SPACE

Renewal of Copernicus's precise orbit determination service

28 ROBOTICS

ADE successfully passes its terrestrial and planetary preliminary tests

30 DEFENSE & SECURITY

GMV pulls of an eye-catching result in EDIDP Program

36 CYBERSECURITY

uTile, striking the right balance between privacy and data usability

39 HEALTHCARE

Antari Home Care to improve the treatment and prognosis of neck- or low-back-pain sufferers

42 ITS

AMTEGA takes up GMV's new ITS SUITE platform

49 AUTOMOTIVE & MOBILITY

GMV rolls out its information management system and passes TISAX's assessment with flying colors

53 TIC

Artificial intelligence and vision to redefine industrial production

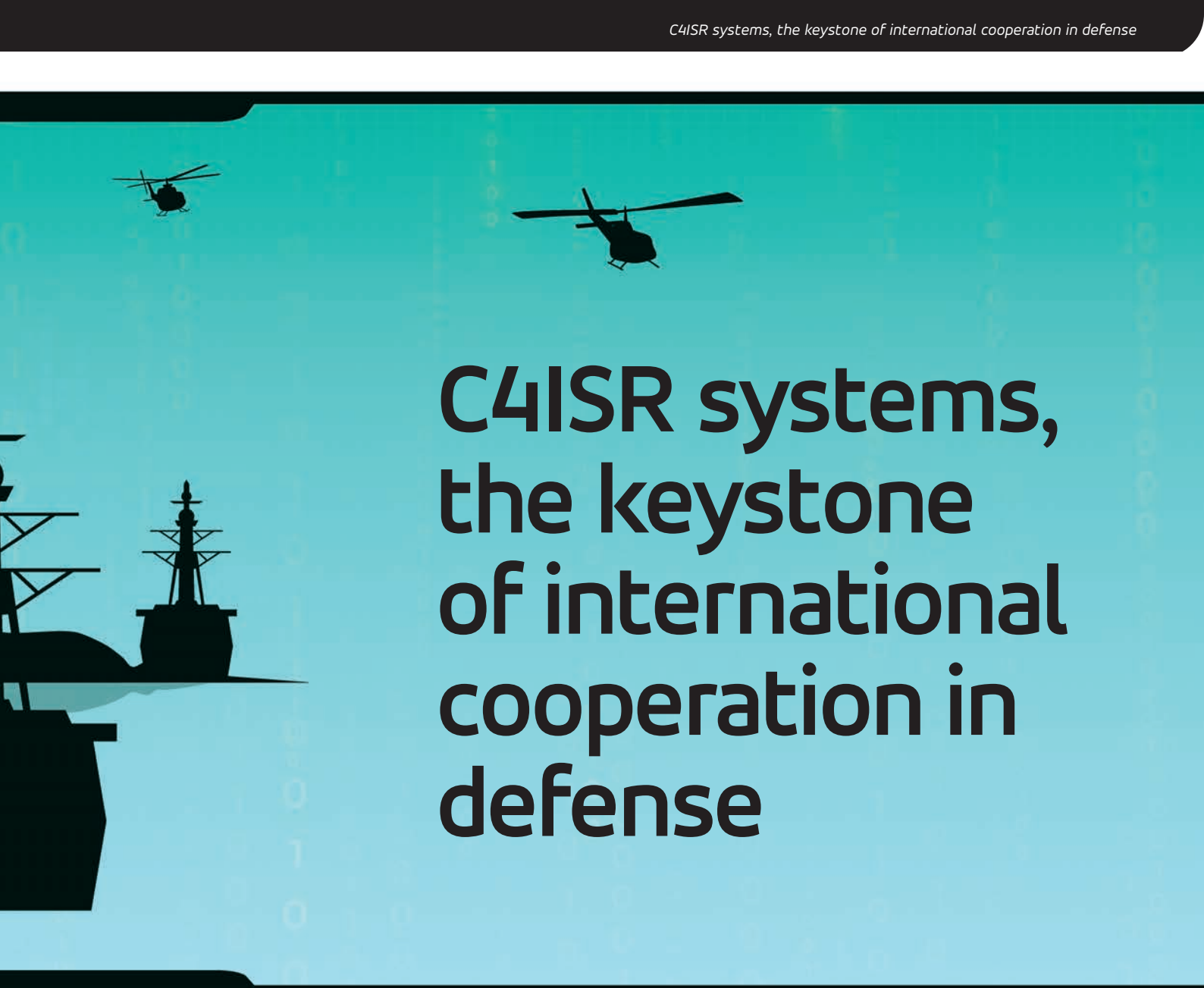
56 CORPORATE INFORMATION

GMV merges its UK Company with NSL

61 TALENT

Jose Luis Delgado Gamella: "In every team I've worked with during these years I've had the chance of working with brilliant workmates"





C4ISR systems, the keystone of international cooperation in defense

Recent decades have shown that command, control communications, computers, intelligence, surveillance and reconnaissance (C4ISR) systems are key features of today's battlefields. Not only do they act as force multipliers of the component military platforms, allowing them to add up to more than the sum of their parts, but also as a nexus between the various services (land, sea, air and, more recently, space and cyberspace).

C4ISR systems also have another feature, around which this whole article revolves. They make it possible for forces from different countries to work together, favoring their interconnection and interoperability

and hence a more efficient use of military resources all round. In other words, the design, development, deployment, operation and maintenance of C4ISR systems is intrinsically linked to an associated effort of international cooperation, suitably capitalized, representing an excellent opportunity for international projection.

The main objectives of these systems include improvement of situational awareness at all levels of military command. This concept takes in all the following: information on the placement and state of enemy and friendly forces, tactical communications, logistics, personnel, identification and achievement of objectives, intelligence, etc. A desired knock-on effect of

improving situational awareness is achievement of so-called information superiority, i.e. “the relative information advantage of one opponent over another in the command and control of its forces”.

As well as providing a formal information-exchanging structure, C4ISR systems are also used for drawing up plans and then monitoring them tactically, keeping up the “Common Operational Picture”, developing lines of action and drawing up intelligence products.

A priori the workings of these systems do not seem to be very complicated. Even so, their design, development and deployment do pose considerable difficulties that call for advanced technological solutions and set up a formidable barrier to sector entry. Factors that should not be lost sight of here include non-functional aspects such as communications bandwidth, latencies, information security, information integrity in replication of the various databases, etc, all of which can render a system based on a theoretically acceptable design completely useless in practice.

C4ISR SYSTEMS FOR THE MANAGEMENT OF VIRTUAL ENTITIES

Special mention here must be made of cyberspace command and control systems. Does the classic conception of C4ISR systems make any sense when it comes to running virtual entities?

Conventional battlefield C4ISR systems are based on the existence of cells at each level of command. There is, for example, an operations cell (OPS), an intelligence cell (INT), a logistics cell (LOG), etc. These are all physical cells

in different sites, so it is not possible to be in more than one cell at once. Although there is some interaction between the various cells, the detailed information contained in each one is different; only a summary of this information can really be sent from one cell to another, for example the Intelligence Picture or Operational Picture.

The organizational model of cyberdefense is based on virtual cells (also referred to as logical cells), in an analogous way to the abovementioned physical cells, with the difference that these cells reside in cyberspace rather than a physical command post. A cyber-soldier can therefore be present in several virtual cells at once. This affords a very interesting level of abstraction, opening up new innovation vectors. To a certain extent it sidesteps the need of hierarchical reporting to obtain situational awareness information.

It is however possible to integrate cyberdefense operations into a conventional organizational structure in a perfectly natural way, conserving the habitual control and command chain and implementing a somewhat laxer organizational structure for running cyber-operations.

INTERNATIONAL COOPERATION IN C4ISR SYSTEMS

As already pointed out the importance of cross-border cooperation lies in these systems’ capacity of permitting joint operations by armed forces from different countries.

Practically all of today’s national and international organizations would argue that the most common-sense option is an approach that brings together all military-capacity

planning elements, sitting government institutions and industry round the same table.

Nonetheless, the interest in C4ISR systems as a key element in conducting international military



operations has soared in the last 30 years. Beforehand, attention had centered mainly on these systems'

- performance features, downplaying or even

corresponding mitigating measures to suit. In other words, the systems were designed to fulfil the requirements established for each particular mission while no importance was granted to the capacity of sharing information and interoperating with external actors under the domain of each mission.

Under the influence of this outdated approach, C4ISR systems were designed and developed to solve problems that were deemed to be independent of each other, giving rise to designs that consolidate independent operation systems (stove-pipe) based on proprietary hardware/software solutions and closed architectures.

Fortunately, today's scenario is completely different. The change of mindset in recent decades, motivated in part by the exponential growth of decision-making data to be processed by operational commands, has brought about a radical transformation in the development paradigm of C4ISR systems:

- Open, independent software-and-hardware implementation architectures are defined and adopted (agnostic HW/SW), using common terminology, components and interfaces. In general, it is the public institutions themselves that are the proprietors of these architectures.
- A big investment is made in the development of standards (involving both the public and private sector); these standards provide technical specifications for

the various elements defined in the abovementioned architectures.

- Scalable and modular reference designs are established for general takeup by industry as a whole, allowing for the phasing in of incrementally agile development strategies.
- Cybersecurity is built into the system from the design up, allowing the establishment of organic, native and multilayered cyberdefense rather than a final tag-on.
- Creation of forums bringing together operators, technologists, procurement managers and industry professionals to define the agile development of solutions that meet technical and operational requirements.

As well as adopting these points as crucial features in the sustainable development of C4ISR systems, organizations in charge of procurement processes avoid purchasing procedures based on monolithic, multiannual contracts with a main contractor and a plethora of subcontractors. Today's tendering process, on the contrary, are usually based on the procurement of smaller, modular systems with open interfaces, supplied incrementally using agile development methods. This then lays down a solid industrial base for phasing in new technology as soon as it becomes available. This approach ensures that the industrial technological base provides the solutions best suited to each particular moment.

This is the main reason for the importance of international cooperation in the development of C4ISR systems: the creation of an open, plug and play development ecosystem designed to meet the needs of operational units, thus echoing to a certain extent the development scheme of the civil sector. Interoperability is no longer considered as a tag-on but as an essential factor throughout the whole development process from the bottom up.

overlooking the knock-on effects of this approach. At most, any possible imperfections of these systems were addressed in the form of Lanchester equations for estimating the negative effects these shortfalls might cause, establishing the



The bulk of GMV's international defense-and-security projects in recent years have a common denominator: C4ISR functionality as an important component or even accounting for the whole project. Large among them feature:

Projects for the European Defence Agency

GMV was one of only three European companies to win two contracts under the Joint Investment Program in Force Protection

Multi Sensor Anti Sniper System (**MUSAS**)

Surveillance in an Urban Environment Using Mobile Sensors (**SUM**). This integrates data from four different types of sensors -radiometric, radar, infrared and optical - and fuses the data received with application of complex anomaly-detecting

In the Preparatory Action on Defence Research (PADR)

Development of a Generic Open Soldier System Reference Architecture (**GOSSRA**) that will set system guidelines, standards and structures to facilitate the development, integration and interoperability of systems based on this architecture

OCEAN2020. Groundbreaking maritime surveillance and interdiction solutions, drawing on unmanned platforms of different types (fixed wing, rotary wing, surface and underwater) integrated with naval units' command and control centers, allowing for data exchange via satellite link with command and control centers on land

Projects from EDA's operating budget

STandard Architecture for Soldier Systems (**STASS-II**)

Reference Architecture for Mission Networks within EU-led Missions and Operations (**RAMNET**)

Command Control & Communication Applied to Multinational Medical Support (**MEDICAL C2**)

Artificial Intelligence and Big Data for Decision Making in C4ISR (**ABIDE**): applying big data and artificial intelligence solutions to C4ISR systems, with the aim of improving their performance and boosting their capabilities

GMV'S EXPERIENCE

By 2016 GMV's international defense-and-security turnover was outperforming the home market; this consolidated its benchmark position within a group of go-getting firms in the main capability-development programs.

Over recent years GMV has made a painstaking selection not only of its industrial partners and research centers

but also the members of its supply chain with whom it tackles the stiffest technological challenges. In liaison with public institutions, GMV thus contributes towards the creation and strengthening of the aforementioned industrial technological base.

This success abroad is partly due to GMV's track record as leader in the development of C4ISR systems plus a knock-on effect of the international exposure of its inhouse developments, for the reasons explained in this article.



European Defence Investment Program (EDIDP) projects

Europe's strategic command and control system (**ESC2**), which will reinforce EU's command and control capability for its participation in joint international missions involving its member states

Integrated Modular Unmanned Ground System (**iMUGS**), which explores new development in manned-unmanned teaming (MUT), including swarms

GEODE: development of a positioning, navigation and timing (PNT) system for defense applications, based on Galileo's public regulated service (PRS)

The **PANDORA** project for enhancing EU's cyberdefense capability on the strength of a detection and threat-response solution, allowing member states to share important information

European Commission projects

Maritime Integrated Surveillance Awareness (**MARISA**)

Driving Innovation in Crisis Management for European Resilience (**DRIVER**)

Collaborative evaluation Of border Surveillance technologies in maritime Environment by pre-operational validation of innovative solutions (**CLOSEYE**)

EUCISE2020 a system for preoperational vetting of the information exchange system between Europe's maritime authorities according to the Common Information Sharing Environment (CISE)

Design and development of a European Command and Control Information System (**EUCCIS**), used by EEAS on its missions outside Europe

Design, development, rollout and maintenance of the EUROSUR Network for FRONTEX. The **EUROSUR network** provides a platform on which each member state (through its corresponding National Coordination Center: NCC) and Frontex can exchange information on EU external border surveillance

The **SAPIEM Suite**, installed in NATO BICES y US-BICES, pools information from several sources in different formats, providing intelligence analysts with the necessary wherewithal for exchanging ISR information and performing workflows that allow interaction in all JISR phases

Intelligence Exploitation System (Sistema de explotación de Inteligencia: **SEISMO**)

Coalition Shared Database (**CSD**)

Atenea (**IRM&CM Tool**)

ISR sensor simulator (**COLLECTOR**)

After over three decades experience in C4ISR technological innovation, GMV has won itself an exalted position in the main international C4ISR programs. The company's strategy, based on

capitalizing acquired experience to build up a loyal client base, has cemented GMV's international position, winning it a place among the main sector players. Riding the wave of the current drive toward a common European defense and security policy and NATO's capability development plan, GMV now confidently expects to consolidate this international presence in the mid-term, thus ensuring sustained growth into the future.



Emilio Fajardo

Director Industry, Synergies & Enablers (ISE)
European Defence Agency (EDA)

Emilio Fajardo joined the Naval Academy in 1977, graduated as a Navy Officer in 1982 and served as operational officer in several warships before obtaining the Electronics qualification in 1987.

In 1992 he graduated as Naval and Oceanic Engineer (Master in Naval Architecture) from the *Universidad Politécnica de Madrid* (Polytechnic University of Madrid), then joining the navy's engineer corps, where he initially worked in the office of the F-100 Frigates programme during the feasibility and definition phases.

In 1995 he was appointed member of the NATO CALS Program ("Continuous Acquisition and Life-Cycle Support") and later (1999) was promoted by the Steering Committee to Director of the Program Office. During this period, he chaired and led the creation of the NATO Group in "Life Cycle Management".

From 2000 to 2005 he held several positions in Spain's Directorate General of Armaments and Material (*Dirección General de Armamento y Material*: DGAM). In 2004 he took over Spanish leadership in the NATO "Improvised Explosives Devices (IEDs)" initiative under NATO's Defence Against Terrorism Programme of Work.

As Armaments Councillor (2005) in the Spanish Permanent Representation at NATO and COPS (EU), he honed his international skills representing DGAM before NATO and the European Defence Agency (EDA) while also helping to run a number of defense cooperation initiatives and multinational programs.

From 2009 to 2014 he was head of DGAM's Multilateral Affairs Unit (*Unidad Asuntos Multilaterales*) for liaison with NATO, EDA and OCCAR.

In 2014 he was appointed manager of the El Pardo Hydrodynamics Model Basin Research Centre (*Canal de Experiencias Hidrodinámicas de El Pardo*: CEHIPAR) helping to integrate this center with the National Institute of Aerospace Technologies (*Instituto Nacional de Técnica Aeroespacial*: INTA), before moving on to the post of Deputy Director General of Naval Systems.

In January 2019 he was appointed EDA's Industry, Synergies & Enablers (ISE) Director by the High Representative and Vice President of the European Commission at that time, Federica Mogherini.

What are your responsibilities as the helm of the Industry, Synergies & Enablers Directorate?

The Industry, Synergies & Enablers (ISE) Directorate I run is one of EDA's three operational directorates and came on stream just when I joined EDA in January 2019. It was set up during the latest EDA reorganization and was created with the main remit of strengthening relations with Europe's defense industry, thereby driving international cooperation and opening up access to Europe's structural and investment funds.

One important aspect of my work is linked to our participation in the European Air Traffic Management modernisation initiative called Single European Sky and its technological activities under SESAR. In the last 5 years we have supported the presentation of military projects by 7 countries, raising 93 million euros of SESAR funding. There are other initiatives underway in this same area, dealing with the integration of drones into the airspace.

We take on management and maintenance of databases and tools

dealing with best practices under military standards, airworthiness certification (EMARS) and test centers and testbeds. For that purpose, of course, we lead the activities of all national expert groups related to these areas.

My field of responsibility also takes in management of two projects providing support to EU's civil and military operations. The first one, the EU SatCom Market, with 34 members among countries, missions and EU Agencies, facilitates communications and satellite services capped at €50 million

during a 4-year period. The second is called AIRMEDEVAC and provides fixed- and rotary-wing aeromedical evacuation services in Europe and Africa. Recently set up to run for 4 years, it has an expenditure ceiling of €120 million.

At the moment what are the main liaison vectors with member states of EDA in general and ISE in particular?

EDA is an inter-governmental agency set up to support member states in developing Europe's defense capabilities; its mission is enshrined in the EU treaties. EDA belongs to the European Council that through a Council decision establishes its organization and functions. EDA's decision-making body is the Steering Board in defense ministers of member states formation and chaired by the High Representative of the European Commission, currently Josep Borrell.

It is participating Member States that set EDA's working lines and top-priority activities, through three management committees, firstly, of national armaments directors, secondly of research and technology and lastly of national defense capability directors. Liaison with these national organizations is close and continuous through expert groups and direct contacts.

My directorate is responsible for EDA's relations with defense industries. This is normally carried out through the AeroSpace and Defence Industries Association of Europe (ASD) and the national associations of defense

industries (in Spain, TEDAE and AESMIDE), although we also keep up direct contacts on specific matters to support SME initiatives.

It is also worth noting here that EDA holds prime position for coordination with other European institutions. ISE maintains an excellent relation with several directorates general of the European Commission; this vantage point enables us to uphold military interests in European policies likely to impinge on European defense and pinpoint defense-project funding opportunities.

For example we have very close relationships with the European Commission's new Directorate General, DG DEFIS (Defence Industry and Space), responsible for running Europe's defense funds. At the moment EDA is running a European funded energy-efficiency project and by the end of 2020 we are due to start another on the circular economy in defense.

At a time when member states, European institutions, industry and associations are all working to define the defense sector's future capabilities and financing methods, what role is EDA playing in this scenario?

As already pointed out, EDA enjoys a splendid vantage point for developing defense capabilities and facilitating access to all the EU's opportunity-rich financing instruments, especially those involving dual technologies.

All the available arrangements for identifying Europe's top-priority capabilities, not only operational but also industrial and R&T, have been developed by EDA in close cooperation with member states and the industry, as well as with other European defense organizations. I am referring here to the Capability Development Plan (CDP), the Overarching Strategic Research Agenda (OSRA) and Key Strategic Activities (KSA).

EDA acts as the secretariat jointly with the European Military Staff (EUMS) and

the European External Action Service on two high-profile initiatives, the Permanent Structured Cooperation (PESCO) and the Coordinated Annual Review on Defence, which offers every two years information on the countries' state of development of military capabilities and multinational cooperation opportunities.

What role do you see the Permanent Structured Cooperation (PESCO) and European Defence Fund (EDF) playing in the development of the European defense industry's capabilities?

A crucial and fundamental role, without a shadow of a doubt, for underpinning the whole development of the EU's future defense capabilities. When speaking about "capabilities" I'm referring not only to military capabilities, but also industrial and technological capabilities reckoned to be cutting edge and essential for keeping up a proper strategic autonomy.

Implementation of PESCO, already foreshadowed in the EU Treaty, goes well beyond the projects that are currently underway. It also takes in 20 specific commitments by participating Member States to develop defense capabilities, including the goal of reinforcing Europe's technological and industrial base.

The European Defence Fund (EDF) was set up by the European Commission to boost military capabilities by granting funds to industrial consortia for co-financing of defense projects. PESCO projects carry an additional funding bonus of 10% and are of course first in line for obtaining these European funds.

What wherewithal can ISE call on for its management tasks?

To carry out all the abovementioned activities and furnish member state experts with the proper tools, we have set up several continually-updated databases and software programs. Under the standardization umbrella there are EDSTAR (European Defence Standards Reference System), EMARS (European Military

EDA holds prime position for coordination with other European institutions

Airworthiness Requirements) and DTEB (Defence Test and Evaluation Base).

We can also draw on several online applications to give information and support national and multinational defense projects that are looking for European Commission financing opportunities derived from specific defense financing instruments (EDIDP, EDF) and other wider European policies (Structured Funds, Horizon 2020, Environment, etc).

We also run a website “EU funding Gateway” (<https://eda.europa.eu/eufunding>) giving very precise information on all available European funds, including a link to another online site called “Identifunding”. Here, a questionnaire enables us to send out specific European-funding proposals to suit the companies’ particular needs in each case. Another online application on EDA’s website is the “B2B, Business to Business” platform (<https://b2bplatform.eda.europa.eu/>), which helps companies create consortia geared towards the companies’ particular interests to participate in specific projects.

This is only some highlights of our work, however I would like to stress the excellent team my Directorate is lucky enough to work with, made up by highly-skilled, hard-working experts. The 40-odd people making up the ISE Directorate have all been selected following a very competitive EDA selection process.

Which initiative would you pick out from EDA’s program for the next few years, and in particular for ISE?

I believe there are several destined to play a crucial role in the future cooperation of European defense, each one in a different field. Prime among them feature all the initiatives related to the identification of top priorities for European defense, as already referred to above, and EDA’s support for countries carrying out PESCO projects and the projects financed from European funds, both in preparing and then running them.



In ISE we are now running cross-the-board standardization and certification initiatives. These have always flown under the radar somewhat, but I believe they will be fundamental in facilitating multinational cooperation and guaranteeing the interoperability of armed forces, not just in Europe but with NATO allies. The new technologies and the development of new systems, especially unmanned systems, are going to call for a huge effort.

Another aspect I would highlight over coming years is ISE’s ongoing work as catalyst of relations with the European Commission in a moment when a new technological and industrial revolution is upon us. Research, therefore, now increasingly needs to

be groundbreaking, while cutting-edge technology comes from a growing number of stakeholders, many of them SMEs and companies that have not traditionally been linked to the defense sector.

Which would you hold up as the main challenges for Europe’s cooperative defense programs in the coming years?

The main future challenges involve financing and complexity, to which must be added European industry’s capacity for developing autonomously the technology that will be necessary for new military capabilities without relying on the industry of non-EU countries. In my opinion, looking at the medium- to long-term, a great outlay should be made in research



and skills training, in order to keep up the necessary knowhow to guarantee security in the supply of industrial capabilities regarded as strategically important.

Without getting into details of the political uncertainties of European defense, another important short-term challenge is the financing of these cooperative programs. It is true

that a great stride forward has been made with the availability of the new European Defence Fund (EDF), but it is important to bear in mind here that the EDF inputs will range from 20% financing for skills development projects to 80% for research projects. In other words, if EDF is thinking of inputting 7 billion euros from 2021 to 2027, the countries will have to chip in with a budget tantamount to 3 to 5 times this amount. In these times of crises and looming budget cutbacks this will force them to be very selective in setting their priorities.

Although the European defense-cooperation panorama has changed radically in recent years, do you think it is yet possible to talk of a “European defense market” or is there still some way to go before this happens?

For the first time ever the EU’s defense policy has included the creation of specific European funds for the development of defense capabilities; it has also opened up structural and investment funds, which were practically a no-go area until recently. This has helped to boost competitiveness and is clearly conducive to the formation of European industrial consortia that might well be the germ of future business alliances.

In the legislative area the European Commission brokered the so-called “Defense Package” a few years ago, comprising one Communication and two Directives, covering defense procurements and simplification of community defense-article transfers. These two Directives helped to boost competitiveness abroad and build up a more solid defense industry.

All these measures represent significant progress in the right direction in recent years, but I don’t believe we can yet speak of a “European defense market”. There is still some way to go and I think the final outcome will depend on the future evolution of Europe’s defense policy and on the financial incentives set up for developing new capabilities.

GMV an interlocutor in the working meeting on the initiatives of the AIRBUS-Government agreement

GMV was present at the working meeting that reaffirmed the aeronautic industry's support for the agreements reached in July by the Government of Spain and Airbus and which will help to preserve the sector's technological and industrial capabilities

On 17 September, as representative of the aeronautics industry, GMV's CEO Jesús Serrano took part in the working meeting held in Madrid between the Spanish Association of Defense, Security, Aeronautics and Space Association (*Asociación Española de Tecnologías de Defensa, Seguridad, Aeronáutica y Espacio: TEDAE*), Airbus and the main company members of TEDAE, plus representatives of trade unions and employers' associations.

The meeting reaffirmed industry support for the initiatives agreed by the Spanish Government and Airbus at the end of last June. The initiatives will preserve technological and industrial capabilities while reinforcing the sector and its auxiliary industries and minimizing COVID-19's job impact in aeronautics, defense and space companies in Spain.

Under the agreement signed with Airbus the Spanish Government reaffirms the crucial importance of aeronautics as a strategic sector, accounting for 7.3% of the industrial GDP and a turnover of €13.040 billion. Its business, moreover, has doubled in the last ten years, generating over 150,000 jobs, including 57,618 direct jobs in over 696 productive centers.

After over three decades of technological innovation in the aeronautics sector, GMV has won itself pole position in the main programs both at home and abroad.

GMV is a company of proven skills in this sector, supplying products and rendering services for the main aeronautics manufacturers, for air-navigation-service providers and regulatory authorities like ENAIRE, ICAO and EUROCONTROL. GMV takes

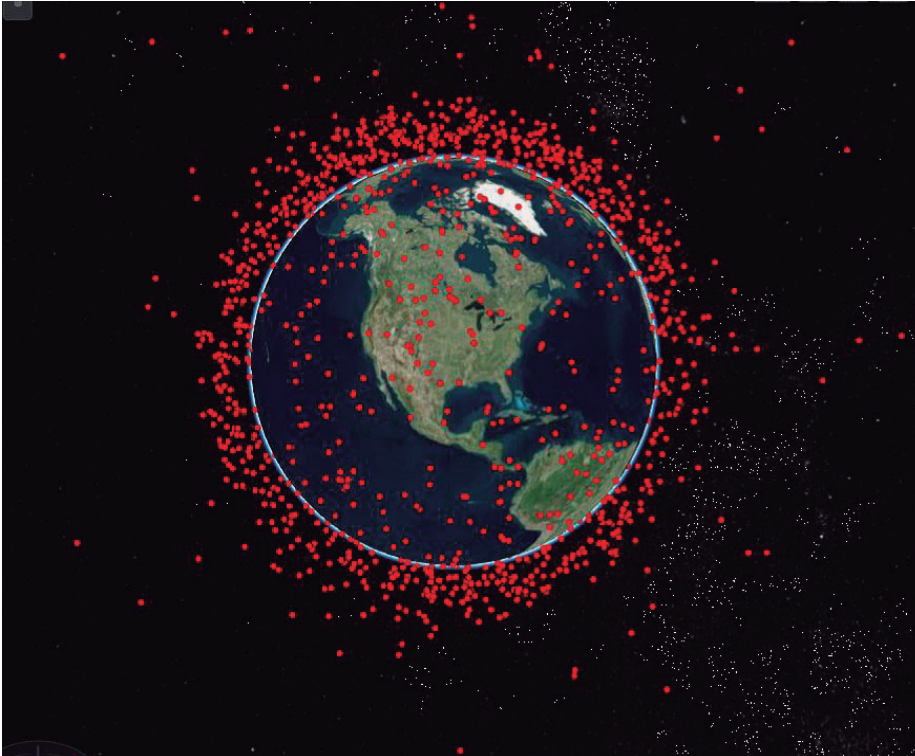
part in the main aeronautics programs, providing engineering services and developing groundbreaking systems and subsystems, complying with the most stringent quality standards. In particular, GMV is a trailblazer in the development of approach and landing systems based on global navigation satellite systems (GNSS); it is also one of the few European companies boasting a complete knowledge of cutting-edge avionics architectures, testbeds and associated standards.

The company's strategy, based on capitalization of its acquired experience and building up customer loyalty, has managed to up its profile continuously, winning the company a place among the main sector players and enabling it to keep up a sustained growth in spite of the COVID-19 pandemic and the structural crisis likely to take place in upcoming years.



From left to right: Pedro Luis Hojas, Secretary General of the Industry Federation of the trade-union UGT; Antonio Lasaga, Human Resources Manager of Airbus in Spain; Antonio Gómez Guillamón, CEO of Aertec Solutions; Jesús Serrano, CEO of GMV; Manuel Huertas, President of Airbus Operations in Spain; Fernando Abril-Martorell, President of Indra.

New milestone in the European Space Agency's space-debris surveillance and tracking activities



■ Ever since the starting gun for the space race with the launch of Sputnik back in 1957, hundreds of launches have placed in orbit thousands of artificial satellites. Only about 2000 of them are still active today, operating in an increasingly cluttered environment that jeopardizes their current operations and future access to space for others.

Mindful of this hazard, the European Space Agency (ESA) launched in 2009 its Space Situational Awareness (SSA) program, an ambitious bid to develop space-debris tracking technology.

Under this program GMV has participated over the last decade (and will continue to do so into the future)

in over 20 projects, holding responsibility for development of the main data processing systems, including orbit determination from radar-, telescope- and laser-data, the planning of all these sensors, collision forecasting and avoidance, reentry monitoring, analysis of fragments in orbit, 2D/3D visualization of space debris, etc.

Since 2016 GMV has been leading integration of the SST segment with the SSA program, developing space-debris surveillance and tracking systems and providing expert support in this area.

Late June saw acceptance of the project, the main object of which is integration of the various subsystems making up the core of the SST software. Since the project kicked off, all the SST subsystems have been improved, harmonized and integrated with each other.

GMV is a worldwide leading light in the study and tracking of space debris and prevention of its proliferation. Small wonder, when it has been working in this field for over 20 years now and currently boasts a roster of 40 engineers working in 7 different countries (Spain, France, Germany, UK, Poland, Romania and Portugal).

GMV holds a webinar under the title “Satellite navigation for aviation: employability”

On 8 July GMV held a webinar under the title “Satellite navigation for aviation; employability”, in online mode due to the COVID-19 pandemic.

The seminar was given by José Caro, head of GMV's GNSS Augmentation Systems and Services Division, who first gave a technical introduction to

satellite navigation systems for civil aviation. He then went on to describe the multidisciplinary environment in which satellite navigation systems are developed, while also highlighting the job opportunities in this sector.

For her part, Marta García, from GMV's People Strategy & Culture team, gave

an introduction to the company, explaining its day to day reality and hiring procedure.

The webinar audience of nearly 120 were then able to raise their queries about satellite navigation systems and also ask about the company.

Renewal of Copernicus's precise orbit determination service

The GMV-developed service has been run from the company's Tres Cantos head office since 2014, when the first satellite of the Copernicus constellation, Sentinel-1A, was launched



G MV has recently won a contract for renewal of the precise orbit determination (POD) service of the Copernicus program of the European Commission and the European Space Agency (ESA).

This inhouse service has been run from GMV's Tres Cantos site since 2014, when Copernicus's first satellite, the Sentinel-1A, was launched. GMV is now calculating the precise orbit of six satellites, two for each of the following missions: Sentinel-1 (providing images with Synthetic Aperture Radar), Sentinel-2 (providing images in several bandwidths), and Sentinel-3 (containing, among other items, an altimeter).

Among other milestones this renewal includes two significant changes on the original contract. Firstly, GMV will be providing the precise GPS and Galileo clocks and orbits for precise orbit determination, a task that had previously been outsourced. GMV's service will now allow the performance to be honed and improved over time.

Secondly, a new satellite is brought into the fold, Sentinel-6A, a EUMETSAT-operated altimeter to be launched by SpaceX in November 2020. This satellite includes the first geodetic receiver to use Galileo as well as GPS.

GMV is also providing round-the-clock monitoring of the operational systems

and is responsible for cybersecurity as well as management and maintenance of the infrastructure hosted in a public cloud.

Renewal of this contract represents endorsement of GMV's excellent work over the last 6 years. It is due to run until late 2021, on which date the European Commission funding arrangement is ending.

This renewal, as well as the excellent track record of recent years, wins GMV pole position for achieving new renewals in the future and collaborating in this fascinating earth-monitoring and -surveillance project.

GMV reinforces its space surveillance and tracking capability

GMV's leadership in the main national projects deriving from the European Commission's EUSST program, as well as other recently initiated activities, has enabled it to strengthen its skillset in this area

The security and safeguarding of Europe's economies, societies and citizens depend on a host of space applications like communications, navigation and observation. Due to the growing complexity of the space environment, however, the satellites providing all the abovementioned services run an ever-higher risk of collision with space debris or even other satellites. Another aspect that also has to be considered here is the possible impact of these satellites (or fragments) on people or property on the earth's surface in the event of uncontrolled reentry.

To minimize these risks it is now necessary to build up a complete and updated catalogue of all objects orbiting the earth (whole satellites or debris). This catalogue will then enable applications to be developed to keep track of and weigh up the risks posed by these objects at each moment for the various space stakeholders

(satellites, launch vehicles, etc) and alert the operators involved in due time and form.

EUSST is a European Commission Space Surveillance and Tracking (SST) program set up in 2014 with the participation of 5 countries (Germany, Spain, France, Italy and the UK), joined in 2018 by Poland, Portugal and Romania. EUSST's remit, as its name suggests, is to build Europe's SST capability and autonomy.

The consortium members are institutions of each member country (CDTI/Spain, CNES/France, ROSA/Romania, etc). GMV is participating through its various subsidiaries, coordinated at industrial level, to complement the national action of these various institutions in the different countries.

GMV is currently the main EU-SST contractor in Spain, France and Romania, while also gaining headway

in the UK. GMV's leadership in the main EUSST-derived national projects plus activities begun recently have all allowed it to strengthen its space surveillance and tracking capabilities.

GMV renews its SST support contract with CNES

■ Since late 2012 GMV has been working on Space Surveillance and Tracking (SST) activities as a benchmark industrial partner with France's Centre National d'Études Spatiales (CNES).

Throughout 2017 SST activities for CNES were extended to create a new working group to look into new collision-risk calculation algorithms. By 2018

GMV's work had enabled CNES to produce an excellent study of the cost-efficiency factors of the various sensor network configurations (telescopes, radars and lasers); this then enabled it to take over leadership of the EUSST project together with Spain. In 2020 all GMV's CNES activities were brought together in a single 5-year contract.

These activities, pooled under the ACCIOME-SST project, break down into several subprojects:

- BAS3E/BIBOR, in which it is working with a 10-person team to design, implement and maintain a space-observation sensor simulator (optical telescopes, lasers and radars).
- AT_COLL, in which it is currently working with a 4-person team to develop new space-debris collision detection algorithms and applications.

Renewal of the contract in 2020 for a 5-year term allows GMV to guarantee work for a large number of company

members, step up its commercial efforts elsewhere and build up a stable of increasingly skilled and experience personnel to take on any new projects that may crop up in the future.

New space surveillance and tracking contract with the Romanian Space Agency

■ Under the aegis of the European Union Space Surveillance and Tracking (EUSST) initiative the Romanian Space Agency (ROSA) has awarded GMV the contract for processing of raw SST data from Romania's optical telescopes.

In this project GMV will be helping ROSA, as Romania's representative entity in the EU Space Surveillance and Tracking (SST) consortium,

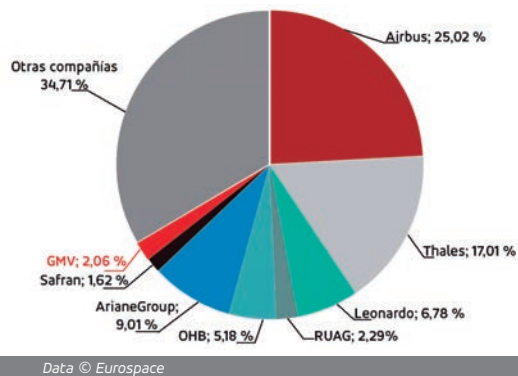
to fulfill its SST data provision objectives.

GMV will be operating its existing COTS solutions (Gendared and Sstod) to automatically process images in FITS format from the Romanian optical telescopes included in the EUSST framework and generate quality-checked TDM files for the observed objects.

GMV will perform this activity as prime contractor; its subcontractor will be the Astronomical Institute of the Romanian Academy (AIRA). This will strengthen the optical-telescope and data-processing activities to ensure a smooth implementation of the current operational framework towards the fully automatic processing chain. It will likewise allow for a fast optimization of the process to boost capabilities and improve operational performance.

The project draws on GMV's wealth of SST experience, where it has worked for such marquee clients as the EU, ESA, CNES and DLR.

GMV, the seventh biggest employer in Europe's space sector



■ Eurospace's 24th Facts & figures annual report on Europe's space industry highlights the role played by the technology multinational GMV over recent years, accounting for 2.06% of full time employment in 2019 out of total of 47,895 workers (+5.7%). From the employment point of view, therefore, GMV is disputing with RUAG the sixth ranking in Europe's space

sector, behind the big firms like Airbus, Thales, Ariane, Leonardo and OHB. Eurospace's yearly survey is backed by all major space firms and gives a faithful snapshot of the sector.

Although the big three (Airbus, Thales y Leonardo) are directly responsible for nearly half of the total jobs, companies like GMV are generating more and more jobs while adding to Europe's space skillset. In 2019 Europe's space sector chalked up total sales worth 8.756 billion euros (a 2.6% increase).

2019 was an exceptional year for GMV's space business. It managed to up its turnover by 30% on the previous year, topping 140 million euros. Since 2015 GMV has multiplied its business by 2.5 with

a corresponding influx of new professionals.

This growth has been across the board too, taking in all business areas, which grew between 15 and 40%, and most of the countries where the company does space business. Worthy of particular note is the striking growth rate in Spain itself, the consolidation of Germany as the second country within the group and the sharp growth rates also recorded by France, Portugal, Romania and the UK.

Among the operations that have contributed to these record figures, pride of place goes to Galileo and Copernicus, OneWeb's megaconstellation and developments for EUMETSAT, space surveillance and planetary defense and exploration.

GMV helps to improve the signal quality of Eutelsat's fleet



■ Eutelsat has selected GMV for the development of a new software solution (IRIS) in charge of performing data analysis activities and quality assurance of the communication service at carrier level on the Eutelsat satellite fleet.

With the increase of missions and users, the current system has achieved its maximum capacity.

Eutelsat has therefore decided to move to an improved, modern and scalable solution to meet current and future customer needs.

IRIS will manage the equipment of the Eutelsat's remote sites to lock the different carriers and decode the channel information. It will also store and process the data provided by the measurement units. The equipment

in each remote site will be configured by IRIS thanks to a measurement plan generated and maintained also in the system.

Additionally, IRIS will allow carrier data to be analysed, by comparing expected parameters against measures and generating alarms. It will also facilitate searches by different factors, generating reports and exporting information to Business Intelligence tools. The new system will provide trending analysis and perform reports based on highly customizable templates together with user management through different levels of privileges.

The project covers the full life cycle for the implementation of a brand new software solution based on an iterative development in close collaboration with Eutelsat.

GMV leads development of ESA's COVID-19 Space Hunting Platform

The purpose of the platform is to facilitate access to and processing of COVID-19 datasets for epidemiological-study and then round them out with data from ESA's earth observation satellites



■ The European Space Agency (ESA) has recently launched an internal initiative to cull ideas for supporting its member states in the study and analysis of the COVID-19 pandemic. Under this initiative ESAC's Galileo Navigation Science Office has managed to get one of its ideas taken up under the name of the "COVID-19 Space Hunting Platform".

The platform's remit is to facilitate access to and processing of some of the existing COVID-19 databases for epidemiological studies, topping them up with data from ESA's earth observation satellites. The aim is then to tap into artificial intelligence procedures to look for any correlations between COVID-19 spread and environmental parameters, such as humidity, temperature, etc.

The hope is thereby to help researchers generate products and stats that might be useful for decision-making purposes in terms of protection measures and lockdown, while also vetting the efficiency of the measures taken.

Development of the COVID-19 Space Hunting Platform is to be primed by GMV. The Universidad Politécnica de Valencia will also be weighing in with support for processing, data analysis and interaction with diverse epidemiological research groups.

In the medium term the COVID-19 Space Hunting Platform could help in setting up a collaborative COVID-19 website for scientists to analyze existing data more efficiently, benefitting too from ESA's data-processing software packages.

The project will be carried out around the GNSS Science Support Centre (GSSC) platform, which hosts and indexes COVID-19 data. The three-month process will analyze public COVID-19 data and make this information available to the science community. This will lead to a first version with basic pandemic-propagation algorithms, to be updated thereafter to ensure the information is always precise and bang up to date.

GMV features in the virtual ION GNSS Symposium

GMV was present at the 33rd ION-GNSS Symposium, organized by the Institute of Navigation of the United States, held from 21 to 25 September, online this year due to the COVID pandemic.

ION-GNSS is regarded as the world's largest technical meeting and showcase of GNSS technology, products and services. Each year the world's leading experts of GNSS and other PNT fields meet up to present new research, introduce new technology, discuss current policies, showcase products and swap ideas.

In keeping with GMV's leadership position in the satellite navigation market, the company featured even more prominently in this year's congress than in years past.

Ten GMV professionals attended the event, participating in 11 sessions to talk about the company's current crop of projects, taking in such diverse technology as state-of-the-art autonomous vehicle applications, correction and integrity systems, high-precision GNSS positioning, phasing GNSS into 5G, GNSS for LEO POD applications, future SBAS services or Galileo RLS among others. Furthermore, Miguel Azaola, GNSS Integrity expert, and Enrique Domínguez, GNSS expert in Localization Systems for autonomous driving, moderated the sessions on "Land-based Applications" and "Autonomous Applications" respectively.

Earth observation for monitoring the impact of coronavirus lockdowns

■ GMV participates in the Rapid Action COVID-19 Earth observation initiative (RACE).

This initiative is a joint venture between ESA and the EC and aims at demonstrating how Earth Observation data can be used to monitor the changes linked to the coronavirus pandemic in social and economic environments. The RACE dashboard depicts the effects of the COVID-19 lockdown and also the recovery evolution after some economic sectors resumed their activities.

Under GMV lead and partnered with Planetek, the consortium developed a service to show how Very High Resolution (VHR) satellite data can

be used to assess the waste volume changes at industrial sites and urban peripheries during the first months of the COVID-19 outbreak. Using the VHR satellite images together with advanced image analysis techniques, relevant information related with landfill sites was produced, focused on quantitative changes in waste volume and activities levels, before and after the COVID-19 crisis and on possible illegal waste dump locations. The service resulted in the detection, delineation and monitoring of waste sites, classification of the dump sites (legal / illegal) and characterization of the waste materials (solid, metal, plastic and mixed).

In one of the analysed sites (Caserta, Italy), the results showed that

during the peak of new COVID-19 cases occurring in March, there was an increase in waste deposits. This might be related with the regional and national lockdown imposed by the Italian government to limit the spread of the COVID-19, and that had an impact on the normal waste collections activities (image below).

An article from the United Nations environment programme, highlights the importance of the waste management in this regard: “Unsound management of this waste could cause unforeseen “knock-on” effects on human health and the environment. The safe handling, and final disposal of this waste is therefore a vital element in an effective emergency response¹”.



Evolution of waste volume changes detected in Caserta, Italy (Image source (<https://race.esa.int>))

¹<https://www.unenvironment.org/news-and-stories/press-and-stories/press-release/waste-management-essential-public-service-fight-beat-covid-19>

Provision of operational services for studying the carbon dynamic and its impact on climate change

GMV is leading the European Space Agency (ESA)'s World Soils project, which sets out to draw up a worldwide map of the soil's organic-carbon content

G MV-led consortium has won a European Space Agency (ESA) contract for worldwide Soil Organic Carbon Mapping.

The project, called "World Soils", forms part of ESA's "World" initiative for developing methodologies, designing processing chains and producing services conducive to worldwide mapping of essential parameters for understanding earth's dynamic and the short- to medium-term changes it is now undergoing. The parameters considered are Land Cover, Ocean, Water, Cereal and Soil.

The soil's organic carbon content is an essential factor in any assessment of the carbon dynamic in the environment as a whole, to gain a realistic picture of carbon sequestration and release. This can help us to understand the impact of climate change on soil makeup and how it affects soil's capacity for maintaining carbon balance in the atmosphere. World Soils, as the last project of the "World" initiative, is crucial for helping governments and public authorities to draw up climate-change-mitigating policies.

The GMV-led team includes recognized soil experts at European level, such as Belgium's Université catholique de Louvain, Germany's GFZ and DLR, ISRIC in the Netherlands, Aristotle University of Thessaloniki in Greece,

the Natural Studies Center of the Czech Republic and Tel Aviv University in Israel.

Over 30 months the team will be working to develop worldwide organic carbon soil maps with a resolution of 100x100 m and a version for Europe at a resolution of 50x50 m. To do so the historical series of the Sentinel archive of the Copernicus program will be tapped into while merging intermediate indices with the outputs to be provided by certain soil models.

Once requirements have been settled and a preliminary map drawn up, in March 2021 the system will be

implemented with a series of pilot schemes to weigh up the capabilities, performance, reliability and precision of the design so far. Final maps are due by 2022.

GMV's role in this project is global leader and manager, leading too the particular phase of system testing and implementation on the basis of documentation to be developed during the initial project phase. It will also be running liaison with stakeholders and the committee of experts, who will be supporting the project with occasional inputs of certain key documents and advice on how to tackle certain tasks.



GMV presents the preliminary results of HumMingBird



■ Satellite data is a particularly valuable resource in migration analysis, facilitating as it does systematic, consistent and accurate monitoring of areas affected by conflicts or by anthropic/natural hazards. The effects of climate change-related disasters can increasingly be identified and monitored by Earth Observation satellites.

GMV is one of the sixteen partners of the Horizon 2020 HumMingBird consortium. GMV is leading WP4 of HumMingBird which aims to demonstrate how satellite-based holistic analyses support a better migration understanding in Somalia, a

country long affected by climate change effects and with high migration rates since 2015.

GMV presented the modus operandi and preliminary results of HumMingBird at IMISCOE's 17th Annual Conference, held on 1 and 2 July online due to the coronavirus pandemic.

As a part of WP4, GMV demonstrates the potential of remote sensing in a long-term monitoring and damage assessment exercise for three different types of extreme events coinciding in Somalia: floods, drought and a cyclone. Moreover, GMV is automating

the generation of the most important products in order to continue the periodic monitoring during 2021. Expected outputs include showcasing of satellites' potential as a big-data source that provides sound evidence for the analysis of migration, based on a close spatio-temporal monitoring. Important datasets and information will also be generated for crosschecking against other big data sources and further analyzed within other WPs for the discovery of any hidden patterns and trends. These patterns, once understood, will give rise to models that will improve preparedness, resilience building, policy making and management.

Forestry challenges and solutions based on earth observation

■ On 1 July as part of the training seminars and skills-training workshops of the MySustainableForest project, a webinar was held to present the project's geo-information products for a more integrated, efficient and sustainable forestry.

MySustainableForest (MSF) is an EU-funded, Horizon 2020 program. Run by a GMV-led, 10-member consortium, it aims to facilitate woodland management by systematic use of satellite-, LiDAR- and sonic-data, together with data recorded in situ. The platform of services

and products developed under the program provides woodland owners and forestry managers with new data favorable to considerable progress in woodland production practices: updating of inventories, evaluation of biotic damage, timber density and resource accountability are some of the products now available.

The event was held on line due to the COVID-19 pandemic. Organized by GMV and EFI, the webinar centered on the catalogue of products vetted by user members of the consortium, who detailed the current forestry

challenges and the way MSF products have come up with an efficient response for Portugal's eucalyptus plantations or the Landes pinewoods in France, the oakwoods of Croatia and the Czech Republic and the firwoods of Lithuania.

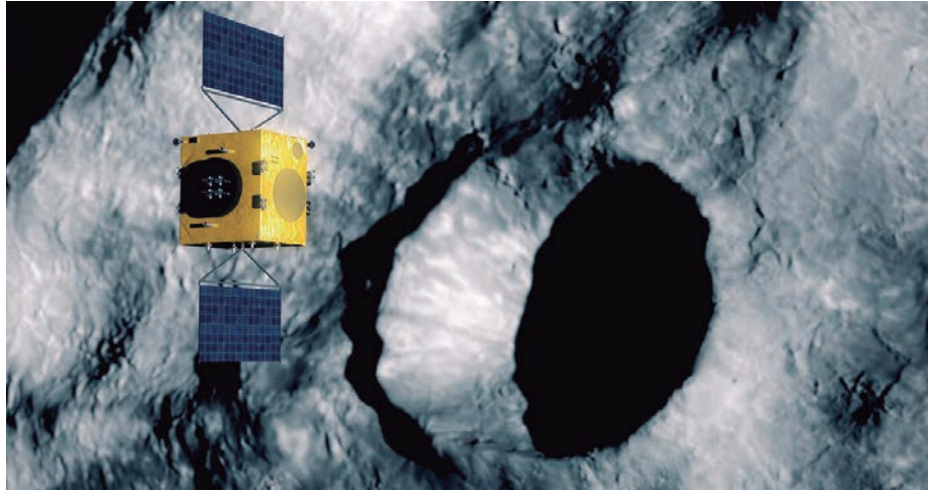
The debate between the providers and users of MSF's portfolio of products looked at the advantages of bringing remote-observation information into the decision-making procedures, the protocols and the daily operations of the various stakeholders taking part in the silviculture chain.

GMV to carry out the development phase of the GNC system to guide the HERA mission

■ On 15 September the European Space Agency (ESA) signed with the German company OHB the €129.4-million contract covering the detailed design, manufacturing and testing of the HERA mission. This mission, ESA's first ever planetary defense mission, will be Europe's contribution to an international asteroid deflection effort carried out jointly with NASA and due for lift-off in October 2024. The contract takes in the complete design of the interplanetary probe, integration and tests, including an advanced Guidance, Navigation and Control (GNC) system that has been awarded to GMV as subcontractor of OHB.

Asteroid approach and rendezvous operations are extremely demanding tasks. Their small size and mass, together with their irregular shapes and the unknown environment of deep space are all factors that make it very difficult to ensure safe control of spacecraft around asteroids. To cope with all these challenges GMV has developed an autonomous GNC system, providing this additional safety to guarantee mission success.

GMV is European GNC leader and ranks among the world's pioneers in planetary and asteroid exploration missions. The company's portfolio of European projects,



featuring AIM, Marco POLO, Neoshield2, SYSNOVA-BEAST and Rosetta, has won GMV leadership in this field. The company's portfolio of European projects, featuring AIM, Marco POLO, Neoshield2, SYSNOVA-BEAST and Rosetta, has won GMV leadership in this field.

The GNC system developed by GMV for HERA autonomously runs the flight plan defined by human controllers on Earth, incrementally stepping up its autonomy level until it is calculating on board the maneuvers for flying at a certain altitude or executing an escape maneuver in case of potential collision risk. Both of these features are fundamental innovations of HERA's GNC.

The tests to certify the technological readiness of GMV's autonomous GNC system were carried out using a camera designed to work in space and a scale model of the Didymain-Dimorphos binary asteroid system. To ensure these tests were as realistic as possible, the deep space darkness conditions in which HERA will be working have been reproduced on ground. The April 2020 ground validation tests of the GNC system were first conducted in GMV's optical laboratory and afterwards in GMV's robotic laboratory called **Platform-art**® in Tres Cantos, Madrid, one of Europe's most advanced robotic testbeds for validating GNC systems.



New in-orbit satellite repair and updating technology

■ The Multi-arm Installation Robot for Reaching project (MIRROR), is being run by a GMV-led consortium. Its remit is to develop a multi-arm robot for orbiting space telescopes. It kicked off on 18 May, in a digital encounter, and on 24 July passed its first major checkpoint, the system requirements review (SRR).

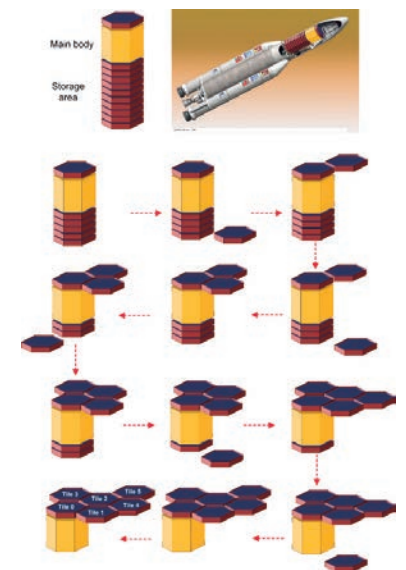
MIRROR's general aim is to come up with technological solutions for such aspects as structure, system kinematics, data- and electrical-architecture, sensors, control implementation, operations and Fault Detection, Isolation, and Recovery (FDIR). The resulting robotic system will thus be able to manipulate, transport and assemble segments or

modules, for the task of repairing and updating orbiting satellites performing a wide range of operational missions.

Within this project GMV has taken on responsibility for establishing the manufacturing-, assembly-, integration- and testing-requirements, as well as developing the project-vetting test bed.

MIRROR takes in the design of a multi-arm robot prototype for system validation in a laboratory environment, plus a multi-arm robot for the flight system.

The preliminary design and modeling review is due to be held in November, consolidating MIRROR's requirements



and ushering in the implementation and design phase.

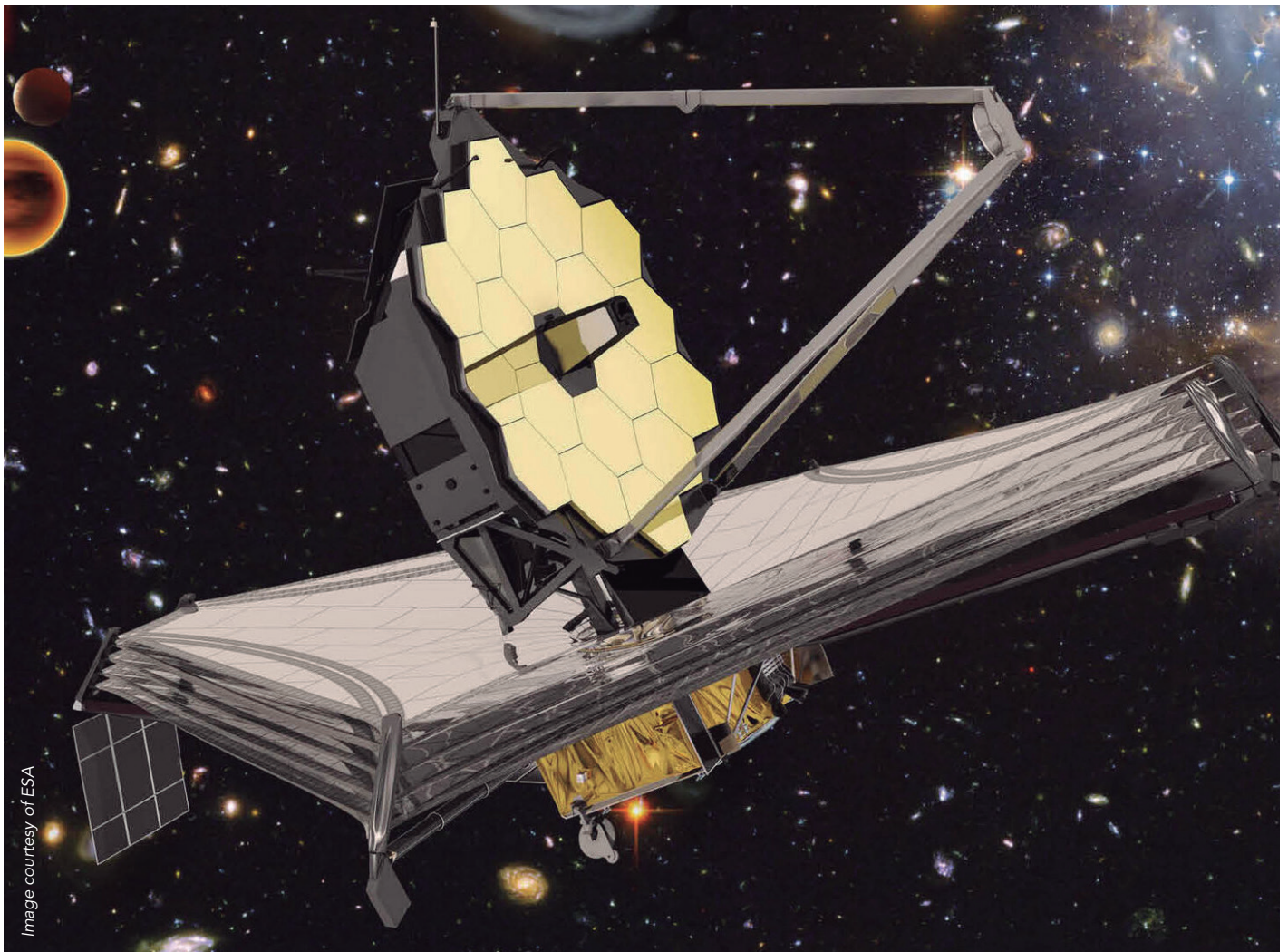


Image courtesy of ESA

ADE successfully passes its terrestrial and planetary preliminary tests

Autonomous Decision making in very long traverses (ADE) is a GMV-led Horizon 2020 project funded by the European Commission; its objective is to design, integrate and test a robotic system suitable for autonomous long-traverse exploration



In July ADE's preliminary tests were held. The aim was to validate the developed components in two scenarios: firstly a simulation of a Mars sample-fetching mission and secondly a mockup nuclear plant in decommissioning.

ADE (Autonomous Decision making in very long traverses) is an H2020 project, led by GMV and financed by the European Commission; its objective is to design, integrate and test a unique system suitable for autonomous long-traverse exploration. ADE will try out the technology in two different scenarios: a planetary exploration mission inspired by the Mars sample-fetching and a terrestrial spin-off in nuclear plant decommissioning.

The first test, using GMV's Foxizirc platform, were held at GMV's Grisolia

site in Tres Cantos, Madrid. The aim was to validate some the autonomous capabilities for the nuclear plant decommissioning activities. The rover was able to autonomously traverse while avoiding hazards and map the plant. Simulated radiation level were measured along the traverse and recorded, where the radiation levels were simulated with red cardboards. The data generated was recorded in a control center and assessed for correctness. A large number of images were obtained with a high-resolution camera for the training of scientific detectors, which shall detect anomalies in the plant such as spills of water.

The second test, using DFKI's SHERPA TT rover, were conducted in late July on DFKI's Bremen site. The aim was to validate the ADE avionics and

autonomous capabilities for planetary exploration. The newly designed ADE avionics was successfully integrated on SherpaTT, with all its components correctly running. The rover was able to autonomously perform short traverses and robotic arm operations. The PTU and cameras for visual perception and localization were correctly calibrated and operated. The rover operations were commanded from the Ground Control Station that also logged the results of the on-board operations.

The ADE's preliminary tests were largely successful. They allowed to validate the integration of the different components, and to identify issues and possible optimizations. A second round of preliminary tests is set to take place, for both scenarios, in Madrid in September and October.

GMV pulls of an eye-catching result in EDIDP Program

GMV wins four of the 16 projects of the first call of the European Defence Investment Program (EDIDP). The awarded projects center on the development of command-and-control, navigation, unmanned-vehicle and cyberdefense capabilities

G MV will be taking part in four of the sixteen projects selected in the first call selected by the European Defence Fund within the first EDIDP call. The European Defence Industrial Development Programme (EDIDP) is a two-year program that sets out to boost the EU's defense competitiveness, thus helping to build EU's strategic autonomy.

The program aims to support the EU defense industry's equipment- and technology-development efforts, working with CU co-financing and a 500 million euro budget for 2019 and



2020 (245 million for 2019 and 255 for 2020). The four projects account for 155 million euros, over 50 % of the total budget of this first EDIDP call. All of them, falling under the Permanent Structured Cooperation (PESCO), are strategically important EU projects.

GMV has focused on areas where it has built up a wealth of expertise and international experience, helping all projects in which it is participating to make the cut. The awarded projects, centering on the development of command and control, navigation, unmanned vehicle and cyberdefense capabilities.

Europe's strategic command and control system (ESC2), which will reinforce EU's command and control capability for its participation in joint international missions involving its member states. Since 2016 GMV has been involved in the EU's command, control and information system (EUCCIS) and will play a key role in the development of this system.

The GEODE (Galileo for EU Defence) project for development of the Positioning, Navigation and Timing (PNT) system for defense applications, based on Galileo's Public Regulated Service (PRS), where GMV has long been playing a key part in adapting it for various domains. In GEODE Spain is developing the navigation systems for naval uses, including PRS receivers, where GMV is responsible for the functions of signal processing, navigation and timing.

Integrated Modular Unmanned Ground System (iMUGS), which explores new development in manned-unmanned teaming (MUT), including swarms. GMV will be coordinator of the command and control and interoperability project (C4ISR), bringing to the table its wealth of experience in C2 ground systems and JISR interoperability (Joint Intelligence, Surveillance and Reconnaissance).

The PANDORA project for enhancing EU's cyberdefense capability on the strength of a detection and threat-response solution, allowing member states to share important information. GMV will be helping to implement the software platform for situation monitoring and the exchange of information between agencies and states.

These awards win GMV pole position for the second European Defense Fund phase, due to kick off in 2021; this second phase will significantly

boost the European Commission's defense outlay and defense collaboration between member states.

GMV provides PRS Navigation and Timing solutions for the GEODE project

■ The European Commission's European Defence Industrial Development Program (EDIDP) has allocated 44 million euros to the GEODE project for developing a positioning, navigation and timing (PNT) system for defense applications.

The GEODE project aims to boost the EU industry's competitiveness in the highly strategic domain of military positioning, navigation, timing and synchronisation (PNT) and to endow EU military forces with Galileo Public Regulated Service (PRS) capacity. The project will be

implemented by a Consortium of 30 undertakings from 14 EU countries, including GMV as part of the Spanish participation.

GEODE will provide the EU Industry with an even playing field in the Defence PNT market where Military GPS's essentialness at the moment ensures US Industry's supremacy. It will also reinforce EU military capability and autonomy and maximize the benefits of the Galileo program by promoting adoption of its crucial PRS service.

Following an initial specification and standardization phase, the project will then prototype, test and qualify all the elements of a complete PRS solution: PRS Security Modules, PRS receivers, GPS/Galileo PRS compatible Controlled Radiation Pattern Antennas and a common and standardized test environment. In addition, a PRS solution for spacecraft will be also designed and prototyped. Complementarily, a PRS infrastructure will be developed to ensure the availability of the security assets necessary for operational testing.



Military operational field testing will be organized on military Naval and Land platforms, RPAS, and a Timing and Synchronisation system. Within the Spanish industrial team, responsible for development of the solution for the military Naval Platforms (GNSS/PRS Receiver with Security Module and CRPA antenna), GMV is responsible for integration of the GNSS/PRS Receiver system, and in particular for the development of the Receiver of all the signal processing, navigation and timing service functions.

Cyber defense platform for real-time threat hunting, incident response and information sharing

■ Information technologies are now being widely taken up by military units and command structures. The downside of this is that cyber threats and possible incidents in the defense capacities of the European Union (EU) member states have now become increasingly likely. It is essential to head them off, since a cybernetics incident can compromise the security and integrity of countries and even lead to the loss of human lives.

The PANDORA project (Cyber Defence Platform For Real-Time Threat Hunting, Incident Response

and Information Sharing) aims to contribute towards the EU's cyber defense capacity building, by designing and implementing an open technical solution for real-time threat hunting and incident response, focusing on endpoint protection, as well as information sharing. The PANDORA system aims also to promptly detect and classify known and unknown threats, enforce policies on-the-fly to counter these threats, and also exchange threat intelligence information with third parties, at both national and international level. The technical solution developed

in PANDORA will be integrated and assessed in a pre-operational environment against two important use cases: warship security and military sensor network security.

Funded under the European EDIDP Program, this auspicious project will involve several leading technological stakeholders from the different Member States including, from Portugal, GMV, INESC TEC - Institute for Systems and Computer Engineering, Technology and Science and CINAMIL (Center of Investigation, Development and Innovation of the Military Academy).

GMV participates in the European Defense Programa for the development of an unmanned ground vehicle

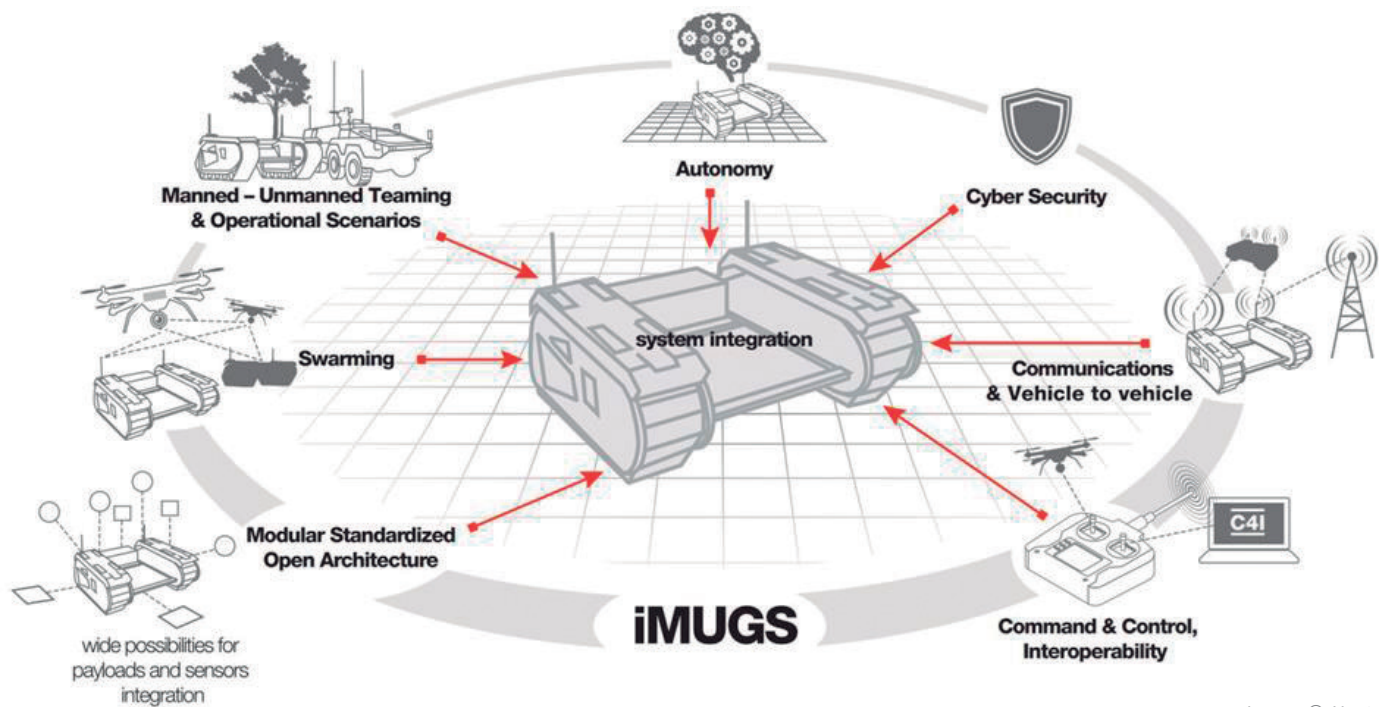


Image © Nexter

■ The European Commission's European Defence Industrial Development Programme (EDIDP) has assigned 30.6 million euros to the iMUGS project for the development of an unmanned ground system. This makes it one of the European Commission's biggest defense investments to date.

The Integrated Modular Unmanned Ground System (iMUGS) project will be carried out by a consortium primed by Milrem Robotics, with another 11 hi-tech defense firms, including GMV.

GMV's participation in iMUGS is based on the experience it has built up in C2 ground systems, dismounted soldier C2 systems and JISR interoperability, areas where GMV is one of the leading companies in Europe. GMV is the leading supplier of Artillery and Dismounted Soldier Command and Control Systems for the Spanish MoD. Since 2016 it has been responsible for maintenance and upgrading of the

EUCCIS C2 system of the European External Action Service (EEAS).

The common development of the vehicle will build from Milrem Robotics's previous program called THEMis, with the addition of various mission systems and autonomy solutions. The aim is to develop a valid scalable architecture applicable to both manned and unmanned vehicles, with the idea of standardizing Europe's ground and air systems and its command and control and communications systems, sensors, payloads and autonomy algorithms.

The system will consist of a robust and modular ground vehicle fitted with an electronic-warfare-resistant command, control and communications system and secure autonomous mobility software to allow the operator to control many different ground and air platforms securely and simultaneously. iMUGS will include several components:

system cybersecurity, autonomous mobility, advanced communications systems and further driving-related developments plus manned-unmanned teaming (MUT) including swarms.

GMV will be coordinator of the command and control and C4ISR interoperability subproject. GMV is bringing to the table its wealth of experience in C2 ground systems and JISR interoperability (JISR = Joint Intelligence, Surveillance and Reconnaissance). The overall aim is to develop the C2ISR tactical component for planning and carrying out joint manned and unmanned systems operations, using and distributing sensor data from the unmanned ground vehicle.

With this joint initiative the European Defence Fund meets member states' requirements and draws on the skills of Europe's industry to boost defense capabilities and strategic autonomy.

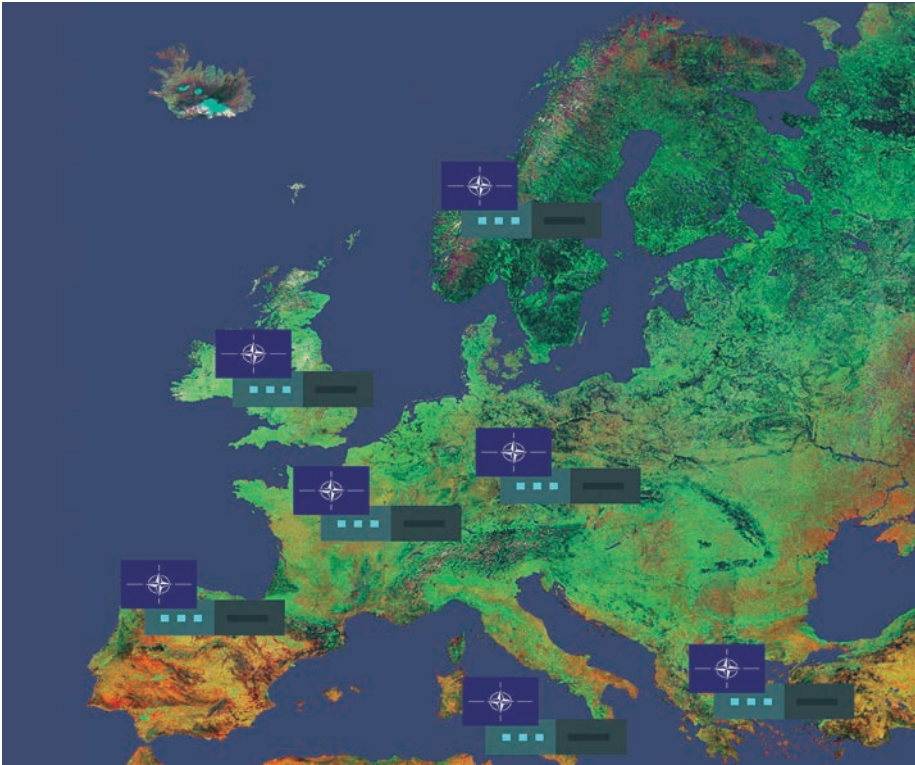
GMV passes the Test Readiness Review of the NATO-CSD system

■ On 6 and 7 July GMV's Tres Cantos site hosted the Test Readiness Review (TRR) of the NATO-CSD system being developed by GMV. This milestone is a contractual obligation in order to take stock of the candidate system version

and then be able to proceed with factory tests and pinpoint any associated risks.

The Test Readiness Review is designed to demonstrate the system's internal functional requirements. It will now

be followed by the System Integration Tests (SIT), the Security Tests, the System Acceptance Tests, and finally the NATO Independent Verification & Validation Process, which clears the system for operational NATO deployment.



The TRR, carried out with client personnel, involved a check of the scope, objectives and success criteria of the event, the testing strategy, configuration management aspects and change management, documentation available for factory testing, availability of the software version, including results during internal tests, traced back to requirements and the test supporting team. After the successful TRR factory tests were conducted from 15 to 24 July, proving suitable system availability for approval as candidate version to move on to the next batch of tests (System Integration Tests and Security Tests) scheduled for September 2020.

Successful completion of factory testing clears the way for approval of the Candidate Product Baseline (CPB), one of the project's main milestones.

Europa makes headway in the management of its medical capabilities

■ Pending presentation of the result of the Project Team Medical, the first phase of the two-year EDA framework contract to develop a platform for managing medical support capabilities in European operations has now been brought to completion.

This first phase entailed definition of the user community's requirements by holding a set of workshops with expert groups of EDA's Project Team Medical and the European Union Military Staff (EUMS). This resulted in the design of a powerful and modern system to

optimize user experience by employing state-of-the-art technology. The project now continues with system development under a second contract to start before the end of the year. The next step will be provision of training and instruction services for system users as well as maintenance and support after system rollout.

The platform, to be made available to all member states, will facilitate the pooling and sharing strategy of member states' medical capabilities by integrating the various healthcare

modules to set up a special multinational medical corps for EU's crisis management operations.

This initiative represents a new stride forward for GMV in its work within the field of medical command and control and crisis management systems, building on the work began back in 2014 with projects like EDA's Command, Control and Communication Applied to Multinational Medical Support (C3AM2S) and the DRIVER project (Driving Innovation in Crisis Management for European Resilience).

GMV wins the contract for supplying the navigation system of the F-110 frigates

■ GMV and Navantia have signed a contract for supply of the SENDA navigation system of the future F-110 Frigates. The contract, including development and supply of five SENDA systems, bears out the trust already placed in GMV by the Spanish MoD on the strength of the fine work carried out in the development of a system prototype within the PROTEC F-110 programs.

The SENDA navigation system is GMV's advanced naval navigation and timing solution. It provides positioning, speed, attitude and timing data in various formats, offering an all-in timing and navigation system.

The various F-110 systems call for a continuous, precise and trustworthy positioning, speed and

attitude source. With this purpose in mind, SENDA incorporates multi-constellation (GPS, Galileo) satellite navigation technology compatible with both civil and military signals (incorporating Galileo PRS and GPS SAASM receivers), plus DGNSS corrections. SENDA also hybridizes its own GNSS data with data received from external sensors, such as inertial navigation systems (INS), pitometer logs, etc., and includes state-of-the-art algorithms to provide robust navigation in contested GNSS scenarios.

SENDA also includes a timing server that generates highly precise and stable timing signals, allowing the ship's systems to synchronize with GPS time. A rubidium oscillator guarantees timing reference stability

and negligible drift, even during prolonged periods of GPS downtime.

Last but not least, SENDA is a totally redundant system with two complete functional subsystems working in active-active configuration, together with redundant GNSS signal distribution. Both systems, monitored in real time, exchange information to provide the overall system with the best possible solution.

The complete SENDA system, taken together with GMV's range of military navigation products, makes GMV a national navigation-system benchmark, with tried and tested experience in the aeronautics, land and naval sectors in platforms like the unmanned aircraft ATLANTE, the 8x8 Dragon vehicle and now the F-110 frigates.



DevOps, safe application lifecycle optimization



■ The digital transformation is now picking up speed, with cloud native architectures making use of microservices, containers, cloud services, APIs or serverless architectures. Due consideration now has to be given to the new threats opened up by this whole process. Traditional security can no longer cope with this glut of cyberthreats; it is now necessary to work with design-up security from the earliest phases of applications' lifecycle.

In a traditional lifecycle the normal procedure is to tackle the issue of security only in the final implementation stage, entrusting this task to a specialist cybersecurity team working in isolation from the rest of the project's stakeholders. This approach forfeits the

responsiveness that can be achieved with the DevOps methodology, since any security problems that might crop up mean a return to the earliest stages of the development cycle. The solution to this problem is a cultural change, with the security teams being integrated with all the other well-defined teams like automation, monitoring and processes. This new approach, going under the name of DevSecOps, sees security as a responsibility shared by all team members, running right through the project from start to finish. In the initial stages a threat model needs to be defined, enabling checks, tests and security applications to be phased in automatically and transparently thereafter, in the development, handover and operation of the applications.

GMV has now chalked up more than a decade automating software-deployment, -verification and -development processes. Over these years a DevOps methodology has been drawn up, cutting down the time employed on development, configuration, deployment and delivery. Cybersecurity is also one of the firm's hallmark traits, so safe development practices have naturally been brought in with an early automation-based identification of vulnerabilities and other cybersecurity practices throughout the whole application lifecycle. It is important here to realize that security does not balk responsiveness; rather does it add value through all the project's lifecycle phases.

uTile, striking the right balance between privacy and data usability

GMV's solution means that confidential data can now be tapped into in order to improve analytical models and machine-learning algorithms while complying at all times with organizational requirements

Data ethics and privacy are sine qua nons of a trustworthy use of artificial intelligence (AI). To quicken AI takeup by all the various sectors and harness its full potential we need to improve machine-learning algorithms without thereby undermining data confidentiality. Striking the right balance between privacy and data use is no longer a pipedream. The technology multinational GMV has just presented ***uTile PET*** (Privacy-Enhancing Technology): a solution capable of carrying out secure private calculations on distributed data,

without exposing it or moving it from organizations.

uTile harnesses confidential data in order to improve machine learning algorithms and analytical models, complying at all times with organizational remits, data-privacy obligations and current law. Advanced cryptographic methods keep the data encrypted while all necessary computation is carried out. ***uTile*** hence guarantees that organizations' sensitive data is never exposed or transferred through departments, organizations or countries. Furthermore, data subjects do not

even have to entrust their data to third parties. This data always remains protected between the organization's own internal controls, whether on-premise or in the cloud, and the sensitive information remains private throughout the whole computation process.

Under the overarching program of Spain's Ministry of Economics and Digital Technology Enabling firms (*Ministerio de Economía y Empresa de Tecnologías Habilitadoras Digitales*), GMV has carried out the use case involving comparison of clinical treatment efficiency, in which hospitals, clinics, research centers and the pharmaceutical industry need to cross check healthcare results in the interests of drawing better treatment-efficiency conclusions. Patient data, however, enjoys special protection under GDPR, complemented in Spain by the Patient Autonomy Law (*Ley de Autonomía del Paciente*). ***uTile*** makes it possible to share clinical-treatment information as useful as survival rates, the value of biomarkers, prognoses, the mean age of patients, etc.

In short, all organizations can benefit from ***uTile*** (which strikes the right balance between data-privacy and -use), by sharing and even monetizing in a secure way the data-based knowledge, thanks to encrypted computing, complying with distributed data source privacy and facilitating secure information exchange.



AENOR issues GMV with Spain's first ISO 27701 Privacy Information Management certification



■ Spain's standardization and certification association, AENOR, has handed out to GMV Secure e-Solutions the first certificate based on the privacy information management standard ISO/IEC 27701, a privacy extension to the information security standard ISO/IEC 27001 and the security control standard ISO/IEC 27002.

Working from the principle of proactive responsibility, ISO/IEC 27701 certification, helps organizations to comply with the principles and obligations laid down by data protection and privacy legislation, such as the European Data Protection Regulation (GDPR) and Spain's Data Protection and Guarantee of Digital Rights Law (*Ley Orgánica de Protección de Datos y Garantía de los Derechos Digitales: LOPDGD*).

This certification represents for GMV an improvement in its management system, with all the knock-on benefits that entails. It also gives the company a special competitive edge, bringing privacy into a synergistic package along with confidentiality, integrity and availability. Becoming the first company in Spain to obtain this certification, in the words of Mariano J. Benito, CISO/security manager of GMV's Secure e-Solutions

sector, "is part of our ongoing strategy of obtaining international standards, looking for continual improvement and innovation in fields like privacy and data protection, which have not as yet been fully integrated into all organizations' processes".

According to Boris Delgado, AENOR's ICT manager, "society is increasingly expecting organizations to show due diligence in data management and demonstrate this in practice. Leading organizations like GMV mark out the path to follow for all go-getting companies".

The setting up of a privacy management system under ISO 27701 has been carried out wholly by GMV, drawing on its experience, methodologies and experts in management cybersecurity and data protection.

How cybersecurity can be crucial during epidemics

The coronavirus pandemic has forced companies to look for new ways of working and propose networking models to debate some important issues.

Events and conferences have moved massively towards the virtual; the media also found here a safe and effective way to invite companies and business managers to talk about a specific subject that could reach a higher number of people.

Taking up this cue, one of Portugal's most important daily economic newspapers promoted several debates during this period. GMV was one of the companies invited to take part in the Cybersecurity and Internet of Things debate, promoted by the *Jornal Económico* newspaper. This web talk discussed the challenges

companies faced in this difficult, world-changing moment, dealing with some of the risks and the necessary solutions that allowed companies to adapt to these challenging times.

The intervention of João Sequeira, Director of GMV Secure e-Solutions sector

in Portugal, highlighted the importance of a company's readiness for a critical scenario with a good and efficient technological system in place, as well as the importance of prevention when we need to change our way of working from one day to the next without any kind of downtime.

JE editors

• TALKS •

CIBERSEGURANÇA E IOT
(INTERNET OF THINGS)

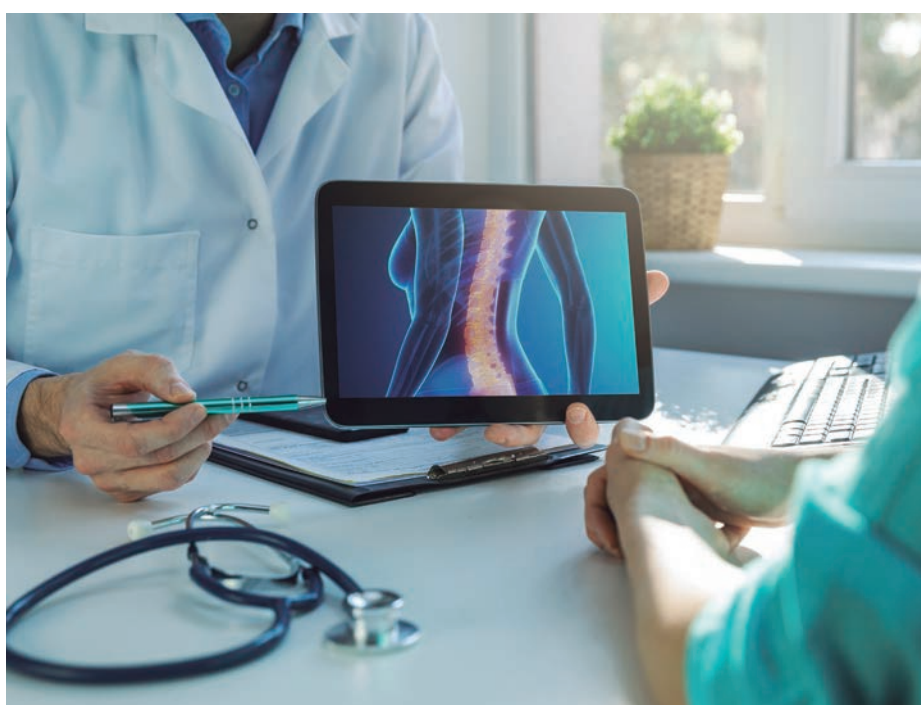
Antari Home Care to improve the treatment and prognosis of neck- or low-back-pain sufferers

GMV is taking part in the European Union Back-UP project as industrial leader and technology partner. Back-UP's remit is to develop technology for a more efficient management and monitoring of patients suffering from neck and low-back pain

Several European Studies have flagged up neck- or low-back pain as the world's prime cause of incapacity. Seventy percent of adults report neck- or low-back pain at some moment of their lives, making this illness the commonest cause of daily incapacity. Healthcare professionals, on the other side of the equation, need better monitoring information to be able to predict with any certainty a treatment result.

This situation has prompted the European Union to include and drive within its recent programs the Back-UP project [1] (Personalised Prognostic Models to Improve Well-being and Return to Work After Neck and Low Back Pain) with the aim of developing a more efficient monitoring procedure of neck- and low-back-pain patients. Back-UP, coordinated in Spain by the Valencia Biomechanics Institute (*Instituto de Biomecánica de Valencia*), involves a total of 11 organizations, featuring GMV as industrial leader and technology partner.

Javier Téllez, Innovation Manager of GMV's Secure e-Solutions sector, has announced the company's recent rollout of its telemedicine platform **Antari Home Care**, "incorporating predictive models that allow clinicians to assess patients' risk of back-pain onset in the next 2 to 6 months, forecasting their degree of functional incapacity and the probability of sick leave in this six-month period". The



platform developed by GMV records the data of patients with neck- or low-back-pain, harmonizes it and offers clinicians conclusions for designing personalized treatment and monitoring the trend of the illness.

Back-UP is expected to maximize treatment benefits while reducing overtreatment and concomitant damage of low-risk patients. Back-UP will also reduce neck- or low-back pain healthcare costs and, equally notably, increase worker productivity with the consequent knock-on benefits of efficiency and competitiveness.

In the words of Javier Téllez "GMV's platform has been adapted to suit

the Back-UP project, incorporating data and inputs from the various project members. It provides prognosis data of pain, incapacity, functionality as well as support for an efficient rehabilitation to help get the patient back to work, with a co-responsibility pain management plan personalized for each particular situation".

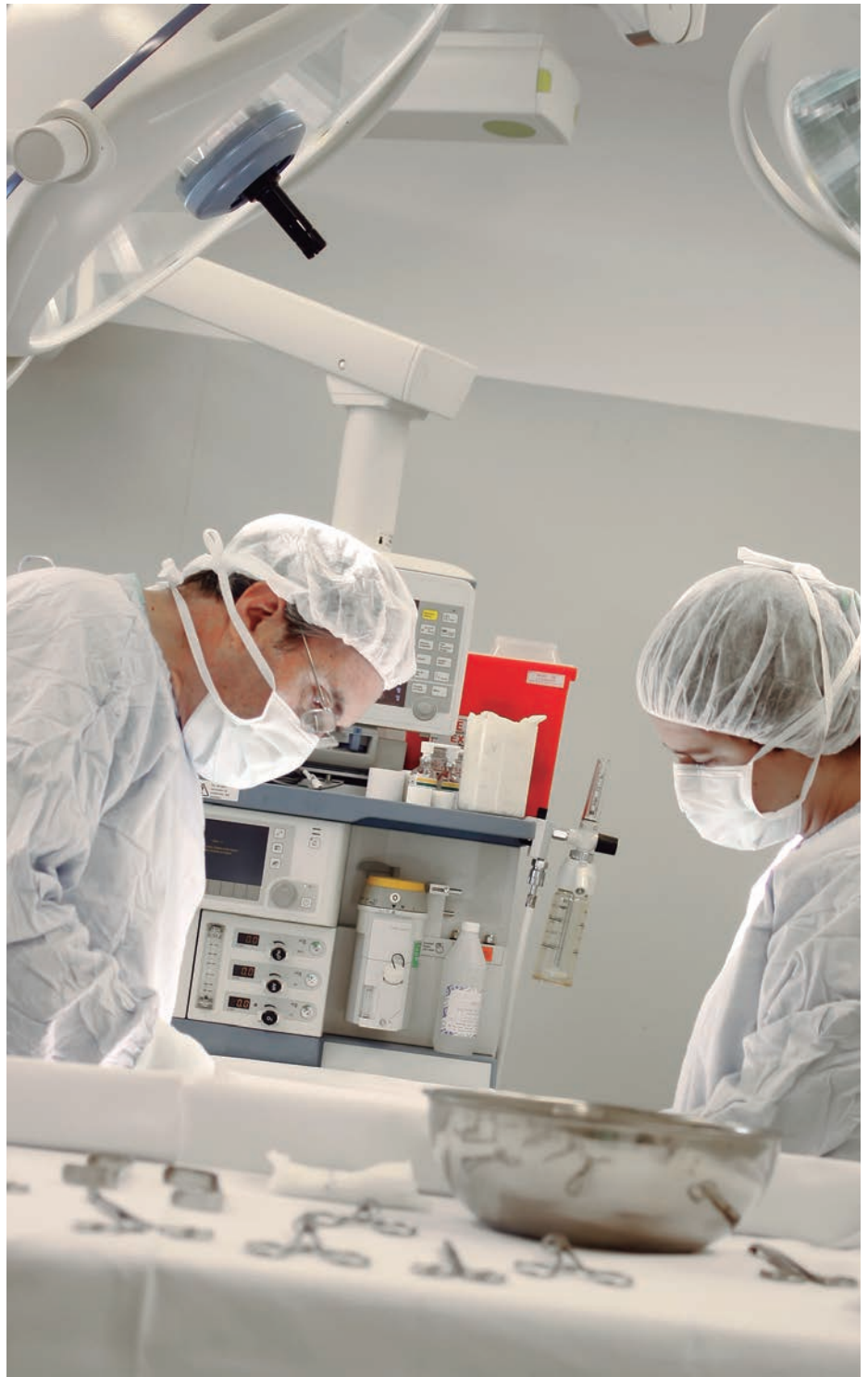
It draws on machine-learning-based artificial intelligence to create prognosis models and in-silico assessments of possible interventions (simulations, modeling, experiments or analyses carried out with simulation algorithms). The overall aim is to glean data-based evidence from clinical information of a varied nature arising from different sources.

Second NAVIPHY meeting to review progress in 2019

■ In June 2020 a meeting was held to review progress during 2019 in the NAVIPHY project, “Navigation, Physical Simulation and Imaging in Intraoperative Procedures”. Brokered by the State Research Agency (*Agencia Estatal de Investigación*) and the European Regional Development Fund (ERDF), NAVIPHY’s consortium is made up by Research Institute of the Hospital Universitario La Paz (IdiPAZ), the Virtual Reality and Modelling Group (*Grupo de Modelado y Realidad Virtual: GMRV*) of the Universidad Rey Juan Carlos and the Canary Island Healthcare Research Foundation (*Fundación Canaria de Investigación Sanitaria: FUNCANIS*), with GMV as leader.

NAVIPHY’s purpose is to achieve greater precision in brain, breast and maxillofacial surgery while also combining them with intraoperative radiotherapy and brachytherapy. With this overarching aim in mind, surgical simulation algorithms are now being developed, while the use of intraoperative imaging is also being explored in order to upgrade GMV’s inhouse surgical navigation demonstrator.

The stocktaking meeting looked into the progress made during 2019 in all the various aspects of the research: surgical simulation, intraoperative imaging, navigation and interoperability. The meeting also recognized the significant progress made in the analysis of clinical needs, including the first developments in those areas. The healthcare experts from the various specialties involved in the project stressed the huge benefits of the technology under development, not only in terms of surgery and radiotherapy but also in the combination of both disciplines. They argued that the work now performed will bring about a substantial change in how these interventions are addressed in the future.



The technical team made up by the Universidad Rey Juan Carlos (URJC) and GMV were also congratulated on their work, with special recognition going to the biomedical engineers expressly hired to carry out the NAVIPHY project.

In the words of Carlos Illana, product manager of GMVs Secure e-Solutions sector, “the readiness and willingness of the healthcare personnel has exceeded all our expectations, allowing us to make much greater headway in the year than we had dared to hope for beforehand”.

The European Commission hails GMV's technology for early detection of Alzheimer's Disease



■ The European project MOPEAD (Models of Patient Engagement for Alzheimer's Disease), coordinated in Spain by *Fundació ACE* (Barcelona Alzheimer Treatment & Research Center) and backed by the Innovative Medicines Initiative (IMI), a public-private consortium run as a partnership by the EU and the European Federation of Pharmaceutical Industries and Associations (EFPIA), has been hailed in an article published by the Community Research and Development Information Service (CORDIS).

Under the title "Diagnosis of incipient Alzheimer's Disease", the article details MOPEAD's four models for promoting citizen participation in early

dementia detection, thus bringing to light hidden cases of dementia. These four models are: answering an online questionnaire, voluntary participation in a *Fundación ACE* medical check and taking primary and tertiary healthcare tests.

Dr. Mercè Boada, medical director of *Fundació ACE* and project coordinator, affirms that "the MOPEAD experience has been very positive. It is vital to find new ways of early-stage Alzheimer's detection while the symptoms are still slight". She also asserted that "the digital technology and big data developed by the project's technology partner, GMV, has proven crucial for capturing patients by means of online marketing strategies. It has also performed

excellently in extracting clinical evidence. They have done a fine job.

MOPEAD's main remit is to consolidate an early-stage AD diagnosis system on the strength of active citizen participation while also raising public awareness of the importance of this research and defining new forms of treatment to check Alzheimer's disease. Dementia now affects 50 million people worldwide, a figure that is expected to rise to 152 million by 2050. Alzheimer's is therefore an illness that is affecting more and more people around the world and there is as yet no known treatment or effective cure. Experts have therefore been focusing in recent years on early detection of the disease, when intervention is most effective.

GMV participates in the 20th ITS España Congress

GMV has once more taken part as sponsor in the Spanish Intelligent Transportation Systems Congress (Congreso Español sobre Sistemas Inteligentes de Transporte), organized by ITS España and held in Madrid from 14 to 16 July. This year's congress, due to the COVID pandemic, was held in mixed onsite-online mode, chalking up a fine turnout in both arrangements.

ITS España is a non-profit organization founded in 2002 with the aim of bringing together the public, private and academic ITS sector to make the moving of people and freight safer and more sustainable, using the various means of transport.

GMV featured prominently in several sessions of the congress:

- Passenger and freight transport logistic trends: where GMV spoke about the renewal of Metro de Barcelona's onboard video-surveillance system.
- In-vehicle ITS: where GMV presented the high-precision and -integrity positioning system for autonomous driving, giving details about its architecture and technical concept and excellent performance features of this inhouse GMV product.
- EMV technology in public transport: where GMV, accompanied by Grupo ALSA, gave details about setting up the bankcard payment system for the urban bus fleet of Almería city.

The congress was warmly received by all attendees in this trailblazing, mixed format event.



AMTEGA takes up GMV's new ITS SUITE platform

The Agency for Technological Modernization of Galicia (*Axencia para a Modernización Tecnolóxica de Galicia*: AMTEGA) is the first client to turn to GMV's ITS SUITE, a cloud computing-native product that fits in perfectly with the requirements of modern cloud-hosted applications as against the traditional fleet-management models



In recent years GMV has reorganized its whole organization to set up a specific Product department, as part of a thoroughgoing commitment to new product generation. One of the first fruits of this endeavor is the ITS SUITE platform.

The Agency for Technological Modernization of Galicia (*Axencia para a Modernización Tecnolóxica de Galicia: AMTEGA*) is the first client to turn to GMV's fleet management system for the mobility of Galicia. AMTEGA's remit includes the design and running of all information technology and systems supporting the region's across-the-board operations. In particular it supports Galicia's passenger transport system.

The project includes supply of the fleet-management system for the mobility of Galicia plus the support, operation and maintenance of Galicia's Mobility Operation Center (*Centro Operativo de Movilidad de Galicia: COMGA*).

The modernization plan of the scheduled public-transport concessions calls for the setting up of a fleet-management system for all the scheduled public transport services that began to be awarded in December 2019.

Concession operators are bound to set up a local fleet control center with permanent COMGA connection, i.e., with the ITS SUITE. GMV, in turn, is already being contracted as a provider of a local fleet-management and ticketing system for the transport concession operators.

COMGA will watch over the services rendered by the transport operators and export reports to analyze the degree of actual compliance with scheduled service commitments. The system will manage the information of about 170 public transport contracts and about 3000 vehicles.

The ITS SUITE represents a great leap forward in fleet management

systems. It is a cloud computing-native product based on a micro-service approach and a Docker containerization platform on a Kubernetes orchestrator, which fits in perfectly with all requirements of responsiveness, scalability and trustworthiness of modern cloud applications as against traditional models. The latter, which call for an entire application-testing and -integration cycle every time any component is modified, cannot cope with the sheer speed of development cycles nowadays or the current availability requirements. Moreover, these microservices have helped major technology firms to be more responsive and innovative.

The ITS Suite also involves reorganization of ITS applications in a single, uniform environment for the whole working cycle (configuration, real-time or reporting) with special emphasis on the UX (dark mode, based on Material Design, etc).

GMV awarded the PA system for Talgo trains in Uzbekistan



■ The Spain train and rolling-stock manufacturer Talgo has awarded GMV the contract for supplying the public-address system for its trains manufactured for its Uzbekistan project. This new contract award shows Talgo's ongoing trust in GMV's expertise for systems of this type.

The project consists of the supply of the complete system for fitting 15-car trains pulled by two locomotives. The

distribution of the cars is similar to Talgo's other projects, incorporating tourist, preferential and café-restaurant cars, some of them also including zones for persons of reduced mobility.

The public address system planned for this project has the same architecture as the one used in other projects like Mecca-Medina (Haramain project), the 30 high speed (AVE) trains for Spain's national operator, RENFE, and the

RENFE project for remodeling of the Hotel Train.

This project is mainly a digital system connected up to the train's Ethernet backbone. Should this system fail, the system can fall back on a degraded mode on the classic analog UIC 568 running throughout the whole train. This project's PA system comprises the following components:

- One PA control center per car to deal with all communications and amplify audio before sending it on to the loudspeakers.
- Voice-input points fitted in the drivers' cab and some passenger cars, allowing the crew to communicate with each other and pass on notices and alerts to passengers.
- Loudspeakers in all passenger cars
- Push buttons for persons of reduced mobility fitted in certain zones allowing passengers to seek the crew's help as need be.

Incorporation of this system vouches for the successful operation of GMV's technology in Talgo's projects.

Renewal of Castilla y León's demand-response transport system

■ At the end of 2020 the tender will be held for renewal and maintenance of Castilla y León's demand-response transport system. Meanwhile, the regional authority (Junta) of Castilla y León has prolonged operation and maintenance of the current system.

The demand-response system is now providing a service for almost 1,000,000 people and over 3000 localities, giving these residents of scattered rural areas affordable access to basic services like healthcare.

Today's service has now become a byword for comfort and safety among Castilla y León's rural passengers. By means of a simple phone call they can book a bus journey to the nearest health center or anywhere else they may have to travel to. Many of these rural residents are elderly without any other means of transport and this demand-response system represents a huge boost to their quality of life.

The Regional Authority of Castilla y León organizes the region into various

zones, then defining the routes and timetable to suit user needs in each one.

Users then request the service with a simple, free phone call to the booking center located in GMV's Boecillo office, which then arranges the bus service accordingly. These bookings are then passed onto the transport operators by three different vectors: cellphone text message, onboard message console or the demand-response website.

GMV phases new passenger information panels into TMB's bus fleet

■ Halfway through 2020 Metropolitan Barcelona Transport (*Transports Metropolitans de Barcelona*: TMB) once again turned to GMV for upgrading of the metropolitan buses' passenger information system. The main purpose of this system is to give passengers top-quality information on the route of each bus, the runs and any incidents in Barcelona's transport system.

TMB's bus fleet runs with different vendor components in the various bus models. Such is the case of the bus-front information panels. The functions of these passenger-information panels are therefore patchy and, hitherto, could not be integrated into the Onboard Bus Network (*Red Embarcada de Buses*: REB).

The REB comprises various onboard information systems, including several developed by GMV in previous collaborations with TMB and catering for given functions onboard the bus.

Two years ago GMV ran a pilot scheme that included an analysis of the current state of the bus-front information panels and the functional and technical possibilities of integrating them in the REB.

The pilot scheme set out to ascertain if the functions were compatible with the various components of the different vendors or models fitted on the buses. A functionality matrix was also drawn up to assess the degree of

integration with the rest of the bus's systems.

This new collaboration corresponds to a second phase of the route map for integrating the passenger information system for the 1200-bus fleet. In this phase those functions not catered for by any vendor/model will be implemented and completely integrated into the REB.

The integrated passenger information system, implementing all the functions defined in the project, will give passengers higher-quality, more potent information, thereby gaining greater control over these peripherals and optimizing TMB's updating and maintenance resources.



ATM renews GMV's fleet-management and passenger information system

■ GMV has won the contract for renewal of fleet-management equipment and any transfers that may occur among the operators included in the fleet-management system, plus annual renewal of maintenance of the passenger information panels for the Metropolitan Transport Authority (*Autoridad de Transporte Metropolitana: ATM*).

The first award involves renewal of the fleet-management equipment in three different formats: procurement of a completely new fleet-management system; procurement of a new fleet-management system in light mode and transfer of the fleet-management system from one vehicle to another of the same operator.

In the second award GMV is responsible for maintenance of the passenger information panels within the fleet-management system. These panels are fitted at bus-stops to give ETAs.

The information panels use LCD and LED technology; communications are by GPRS.

Preventive maintenance consists of a general bimonthly, in situ check of all passenger information panels according to a defined check-list.

This maintenance will involve a check of the state of telecommunications between the panel and ATM's control

center, to be carried out remotely from GMV's headquarters by a remote-connection application. The client therefore has to give GMV the necessary access clearance.

First-level corrective maintenance involves the on-the-spot diagnosis and solution of any detected incidents or breakdowns, dipping into the stock of spare parts as necessary. The second level, on the other hand, concerns repair of any faulty equipment or components detected in first-level interventions.

GMV will draw up a bimonthly report describing all panel-maintenance information.

GMV once more responsible for maintenance of Malta's ITS

■ In July GMV renewed the maintenance contract for Malta Public Transport (MPT). This contract includes maintenance of the fleet-management and CCTV system and the electronic fare collection system on the 409-bus fleet.

GMV's maintenance is based on remote support to clear up any software incidents in the control centers' applications and the firmware in the onboard equipment of the fleet-management-CCTV system and

ticketing equipment. It also takes in third-level maintenance, i.e., repair of onboard hardware supplied by the company.

The fleet-management-CCTV system is made up by GPS-, 3G- and WiFi-enabled onboard equipment with door sensors, connection to 1440 onboard video-surveillance cameras with a recording system and real time streaming.

It also includes a complex fare-collection system formed by ticket-

vending machines with QR code reader and integration with Malta's "Tallinja card", a 7-point recharging and customer-attention network, SMS coupons for online recharging plus a web portal for online recharging requests and checking remaining travel credits.

This latter system needs optimum maintenance to cater for over 1800 daily online recharges (70% of total recharges) distributed over the whole bus fleet in real time.



Alstom awards GMV the contract for adapting its video-surveillance system to Barcelona Metro's CCTV system



■ GMV has won an Alstom contract for modifying the onboard video-surveillance (CCTV) system fitted on the whole fleet of Barcelona Metropolitan Transport (*Transports Metropolitans de Barcelona*: TMB). The purpose of this contract is to bring the operation into line with the requirements of the new train supply contract.

In 2019 TMB awarded Alstom a contract for the manufacture of 42 new trains to run on metro lines L1 and L3, to replace

the trains being removed by TMB due to asbestos problems. Alstom is now at work on supplying TMB with two 18- and 24-train lots awarded in a public tender.

Alstom's contract also includes supply of diverse safety systems to be fitted on these new trains. Among them features GMV's onboard video-surveillance (CCTV) system.

GMV's system has already been fitted to the rest of the 149 vehicles of TMB's

metro fleet. To meet the specs of this new train supply contract Alstom needs to add new functions to the current CCTV and tweak some of the existing features. Alstom has now turned to GMV for help in this project.

These modifications include such features as increasing the number of cameras, bringing in new camera models, audio recording of the train intercom and adjustments in the system's communication nodes.

Onboard systems for new MPK buses in Nowy Sącz

■ GMV will provide a set of onboard devices for 6 brand new city buses manufactured by Solaris for the Municipal Transport Company (MPK) in Nowy Sącz.

The complete vehicle equipment delivered by GMV includes the REC30 auto computer, which controls the onboard systems, provides wireless GPRS/Wifi communication with the control center and makes it possible to determine a current position of the bus thanks to the GPS module. The passenger information system is made up of three energy-efficient LED destination panels, which inform passengers about the number and destination of the line.

The information displayed on the panels is transmitted directly from the fleet-management system dispatcher system, which has been up and running in MPK since 2012. A 23.6" LCD monitor inside the vehicle gives information on any transportation task being carried out, subsequent stops along the route, planned arrival time or interesting facilities along the route, all updated in real time. This visual internal passenger information is supported by automatic voice announcements.

Drivers have a 10.4" touch screen at their disposal, where they will find, among other things, continuously updated information about late or early running, subsequent stops or the status of the onboard devices. From the driver's console, it is possible to make a voice call to the dispatcher, send a predefined text message to the central office or even block the validators during ticket inspection. Each new bus will be equipped with four CTC-911 dual validators, which cater for both traditional paper tickets and electronic tickets encoded on contactless cards.

These devices are equipped with 5.7" touch screens ensuring appropriate convenience and visibility for the passengers. An adequate priority of travel at junctions will be ensured by a short-range device integrated with the traffic control system.

The buses will appear on the streets of Nowy Sącz in the third quarter of 2020. The onboard computers with GPS locators, delivered by GMV, were installed in the public transport buses in Nowy Sącz back in 2012. The drivers' cockpit log-in system makes it possible to estimate the arrival of the vehicles at the stops.

These ETAs are then passed on to potential passengers in Nowy Sącz (and in the neighboring communes included in the Nowy Sącz transport system) by means of electronic stop displays and a webpage. The management-system data, processed by fleet managers, is also used to improve the punctuality of the entire bus network, to the benefit all public transport users.

In Nowy Sącz there is also a ticketing system with GMV software, which allows the configuration, from the central level, of the ticket fare, of passenger profiles and of the reduced fares applied to them. Contactless cards used by the inhabitants of Nowy Sącz may serve both as season tickets and as single tickets operating under the "pre-paid" system, whereby the corresponding amount for the trip is collected on the basis of the travelled route (recorded by bringing the card close to the validators when getting on and getting off the buses).

In 2019 GMV delivered onboard systems for 30 brand new MAN vehicles. Currently, more than 85 public transport buses are being controlled by GMV's system in the colors of the Nowy Sącz MPK.



GMV rolls out its information management system and passes TISAX's assessment with flying colors

TISAX certification vouches for the continuous improvement in GMV's range of inhouse automotive projects

G MV has a long and successful track record of setting up sensitive- or confidential-information protection measures, in keeping with its ongoing commitment to information-integrity, -confidentiality and -availability. In particular it has adopted the information security assessment (ISA) criteria drawn up by the German Automotive Industry Association (VDA), which in turn applies the checks laid down by the standard ISO/IEC 27001 (requirements for an Information Security Management System).

The ENX Association (an association of European vehicle manufacturers, suppliers and organizations), on behalf of

VDA, has taken on the responsibility for running the Trusted Information Security Assessment Exchange (TISAX). All TISAX assessments are conducted regularly by qualified auditing firms, albeit without the results ever being made public.

TÜV Rheinland is the auditing firm that has carried out the TISAX assessment for the goal "Connection to 3rd Parties with Very High Protection Level" on GMV's Madrid site, and its result has been made available only on the ENX portal: <https://portal.enx.com/en-US/TISAX/tisaxassessmentresults>.

The assessment process will soon be extended to GMV's Valladolid and Lisbon offices.

This result vouches for the continuous improvement in the processes behind GMV's automotive projects. This improvement began with the setting up and rollout of an ISMS in GMV's Intelligent Transportation Systems sector (specifically in the automotive business) with the TISAX assessment as a complementary and derivative component.

The result represents a new milestone in the ITS company's information security management system, bringing a series of benefits to clients' information management and guaranteeing a total alignment with the automotive sector's supplier requirements.



TISAX

Further headway made by TachogrAPP, the study analyzing the possibility of using a smartphone as tachograph

■ GMV is taking part in the TachogrAPP study sought by EC’s Directorate General of Mobility and Transport (DG-MOVE). The study’s remit is to analyze the possibility of using a smartphone as tachograph.

The introduction of the digital tachograph and, afterwards, the smart tachograph has brought in new sensors and safety measures to fend off fraud and improper use. Despite these developments, the workings of the tachograph have not really changed too much in recent years. DG-MOVE’s aim in this study, therefore, is to weigh up the possibilities of improving this crucial road-transport device, the purpose of which is to ensure that current heavy vehicle regulations are met and thereby improve road safety for one and all.

Smartphones are the most groundbreaking and rapidly developing

technological device of recent years. The blending of processing, communications and information-presentation capacity, interaction with users and integration of sensors in a portable platform offers many chances to develop advanced functions and render many services in a single device.

GMV, as a member of the 5-company consortium, has taken part in the analysis of the possibilities of tapping into smartphone advances for application to road-transport safety.

At the moment of writing an analysis of current and in-the-pipeline regulation (such as the European Commission’s mobility packages 1 and 2) has already been carried out plus the possibility of implementing all this regulation by means of currently available technology.

The conclusion drawn from this analysis is that, although it is not yet possible to use an application in any market device and thereby offer equivalent safety conditions to those offered by state-of-the-art devices, it is nonetheless possible to design an alternative device based on smartphone technology that would indeed offer an improvement on currently deployed systems and put forward several alternatives for tackling the problem. In the next phase these alternatives will then be assessed from various viewpoints (technological, social, regulatory and economic).

In July the results of the first six months of the study will be sent up to DG-MOVE, which has approved the preliminary results and given the go-ahead for the assessment work to continue in order to ascertain which alternatives might come good in the future.

GMV takes part in the online cooperative systems conference

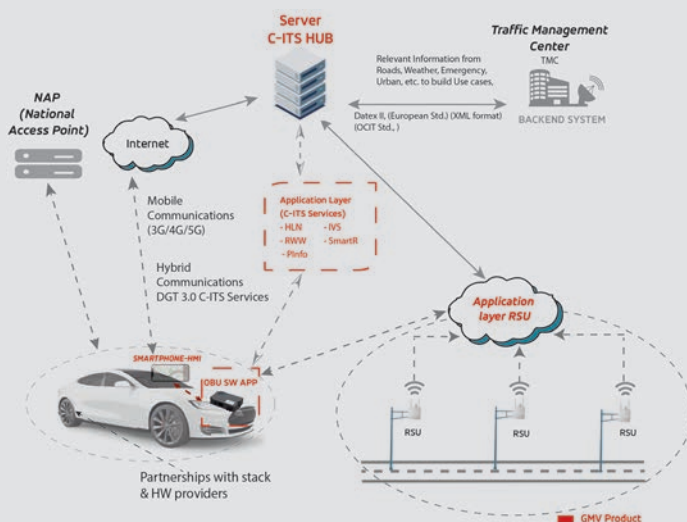
On 2 July GMV took part in the “Online Cooperative Systems Conference”, organized by ITS España. Its presentation detailed one of the main components of cooperative systems, the On Board Unit (OBU).

GMV boasts a wealth of experience in this advanced technology, having developed such services as advanced connected autonomous vehicle systems and cybersecurity applied to the automotive sector.

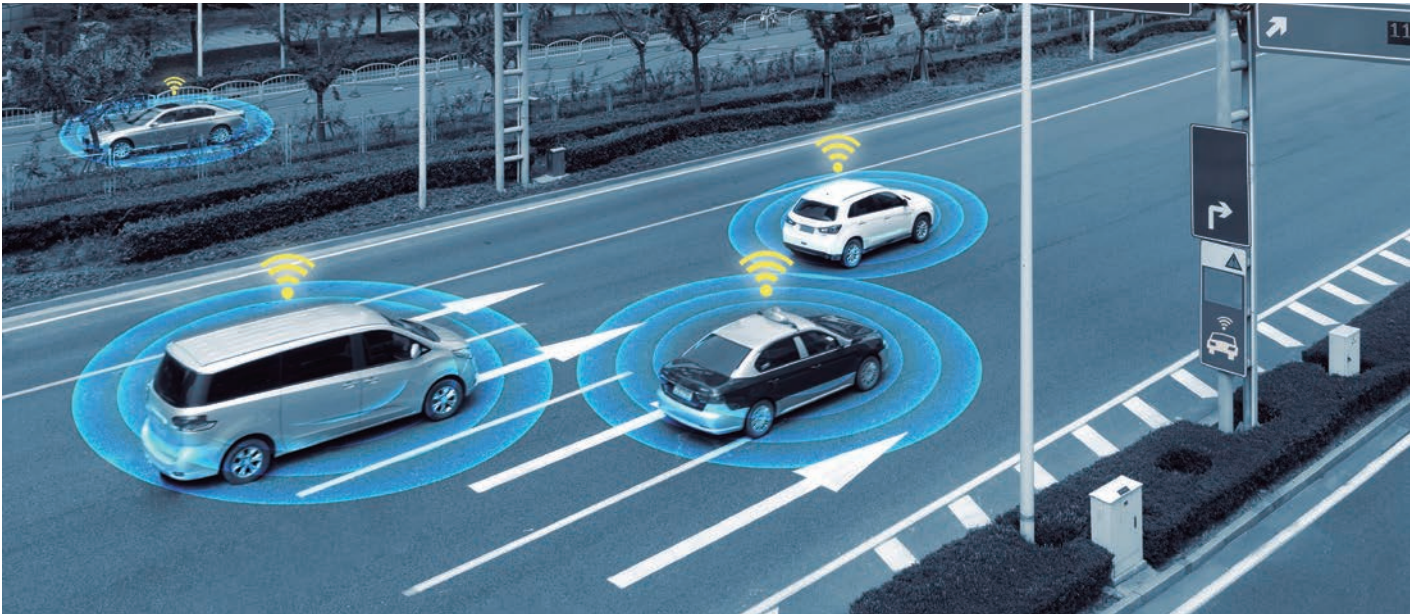
The purpose of C-ITS architecture, based on V2X communications systems, is the rollout of safety-boosting, emission-reducing and comfort- and efficiency-improvement services on the road.

The presentation gave an introduction to fundamental OBU features in global ITS architecture, dealing with such crucial aspects as OBU standards, software and hardware architecture plus messages and protocols applied to devices of this type.

An account was also given at application level of OBU services and use cases and interaction with users through a smartphone as driver HMI. Mention was also made of other alternatives like 802.11p for V2X communications.



Under the C-ROADS project GMV develops smartphone Apps for the DGT 3.0 platform



■ The DGT 3.0 connected vehicle cloud platform is an initiative of the Spanish Traffic Authority (Dirección General de Tráfico: DGT), chasing the goal of 0 deaths, 0 injuries, 0 congestion and 0 emissions.

One of GMV's main objectives as a company is to improve road-safety and traffic-efficiency and cut down emissions, turning to cooperative systems to do so. This platform keeps the various road users in contact in real time, offering them instant traffic information to achieve safer and smarter mobility.

C-ROADS is a European initiative for setting up Europe-wide, harmonized and interoperable C-ITS services. GMV's Spanish and Portuguese companies are both taking part in the project. The DGT 3.0 pilot scheme provides a service for about 12,270 kms of Spanish roads. GMV is developing a smartphone App allowing the the DGT 3.0 to receive information from any kilometric point, thus keeping road users informed of upcoming events and allowing them to prepare for these events beforehand.

On 14 July 2020 the DGT 3.0 platform was successfully integrated with V-16-

signal and virtual-message-panel use cases.

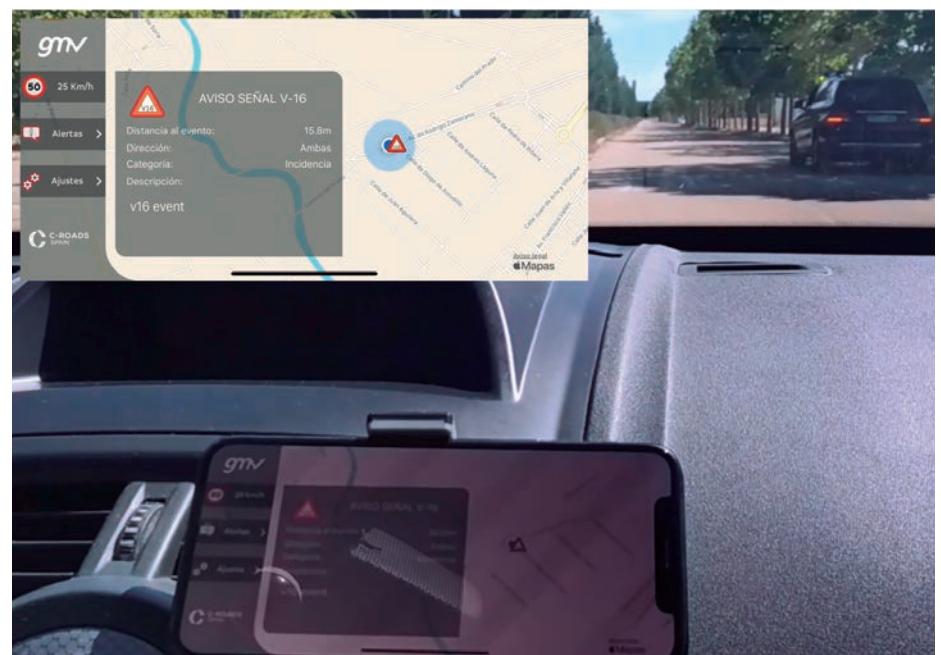
The virtual-message-panel certification refers to it as a smartphone App enabling vehicle drivers to receive any type of DGT 3.0 information that may be of relevance to them.

The V-16 signal, for its part, is a luminous device designed to replace emergency triangles for giving warnings of any road

accidents, breakdowns and emergencies.

The certification tests proved that a roadside car giving out the V-16 signal was able to connect up to the DGT 3.0 platform and thereby give approaching drivers due warning of the upcoming obstruction.

GMV will continue to integrate the DGT 3.0 platform by increasing the roster of available services such as warning of roadworks and detected incidents through DGT's traffic management center.



Kickoff of SATELISE® pilot tests in Portugal

■ Pilot tests of SATELISE®, the trailblazing initiative of Cintra and GMV for cellphone-based pay-per use of toll roads, kicked off in August with real users on Portugal's A-28 Norte-Litoral toll road, which runs for a total of 119 km along the northeast coast.

The application, already in use in Catalunya in Autema (the toll road running from Terrasa to Manresa), was originally designed with the idea of using smartphone-based satellite positioning technology for pay-per use tolling without having to set up gantries or any additional infrastructure.

Under this system users only have to sign up to the system and enable the App in their handheld (iOS or Android).

The system then taps into the phone's satellite positioning capacity to detect the vehicle's passage through a series of virtual toll gantries or zones, thereby triggering the toll collection process just as though the vehicle had passed through a real booth.

The App is user friendly, allowing drivers to use the toll road without needing to stop to pay. Neither would they have to buy an electronic tolling device (VIA-T in Spain). It also offers additional information on the cellphone itself, and gives access to discounts.

Another advantage of the system is that it is completely global and can hence be rolled out in any part of the world simply by updating the system's parametrized configuration, which is

then passed on to the mobile Apps. Several tests have now been run in various EU and USA countries.

After several upgrades and the construction of a new cloud-hosted backend, the next step for SATELISE® is pilot tests to be run with real users in Portugal. In this case the main obstacle to the new rollout was not technological but administrative. Before being used it has to be type-approved by the powers-that-be as a payment method (tantamount to a credit card or VIA-T).

After successful completion of the internal tests and obtainment of the required approval, the tests have been launched with end users who can already run on the Norte-Litoral toll road paying directly on their cellphones.



Artificial intelligence and vision to redefine industrial production

GMV develops **uSpot**, a solution underpinned by artificial intelligence and robotic technology to provide new ways of working and greater precision in manufacturing operations

Covid-19 has changed society's relation with technology, altering our lifestyles, our businesses, and ushering in a more digitized world. The moot point now is to find out how technology might help companies come out of this crisis stronger.

Industry's progress is always technology driven, picking up on the best ideas from other sectors. Robotization and artificial intelligence have really come into their own in this juncture, allowing manufacturing to continue despite constraints on mobility and on-site worker availability. We at GMV are working with industrial and collaborative robotics as well as autonomous systems to provide new ways of working that favor automation of the least value-adding processes like packaging, assembling or other routine operations or activities that represent a hazard for workers like bolting and screwing, sealing or handling, among others.

GMV also boasts a wealth of experience in developing technology for automating quality controls, detection of flaws of all types, product classification, metrology and predictive maintenance, using artificial-vision and data-analysis technology, allowing industry to cut costs and boost customer satisfaction.

Artificial vision is the most effective and groundbreaking smart and

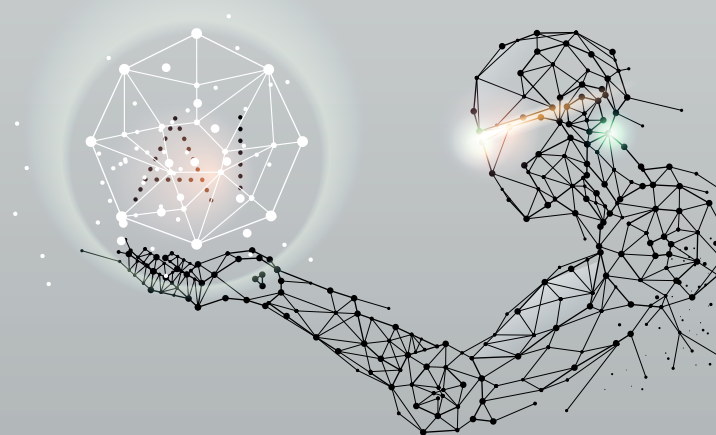
automated method for acquiring, analyzing and processing images. This technology, capable of high precision and great consistency, adapts perfectly to an already established production process, plus a whole range of extraordinary functions within an industrial digitization strategy. GMV's inhouse **uSpot** development provides more accurate site inspection to ensure manufacturing operations are working properly and the final products are flawless.

In any production plant there are many surface- and component-transforming processes likely to contain defects or anomalies (welds, bodywork, plastic parts). As a solution to this challenge, **uSpot** analyzes products dynamically as they come along the line to carry out control checks and pinpoint any faulty components. **uSpot** facilitates an automatic analysis of the state of all types of mechanisms and systems to be used in production processes (cranes, conveyor belts, tracks) for detecting any faults or even anticipating them predictively. It doesn't stop with inspection

tasks, however; it also uses context information (line speed, ambient temperature, time since last defect) to increase the precision and stability of the whole process.

Another of **uSpot's** use scenarios is classification tasks, ranging from raw materials to the finished product, in order to determine type and quality.

The key to further progress in this technology now and in the future is the proven worth of artificial vision as an essential tool in Machine Learning, based on Deep Learning and drawing on the huge amount of information that can be gleaned from any image.



uQuery: Language processing technology



■ Natural language processing is an artificial-intelligence and applied-linguistics subfield that studies the interaction between computers and human language. GMV's Artificial Intelligence and Big Data division has

developed the natural language processing solution **uQuery**.

Over 50% of our data, all of which we have to understand and process in a brief period of time after receiving

it, ends up in unstructured form, replete with irrelevant texts, aesthetic elements, repeated data, obsolete information, etc.

Based on language technology, **uQuery** is able to render hordes of documents into understandable and structured results, helping to enrich available information. Drawing on Deep Learning, Latent Dirichlet Allocation (LDA) and ontological technology, **uQuery** offers a very intuitive interface that facilitates information-access and -analysis, drawing full value from data in less time. Among its functions feature unsupervised and supervised document classification, identification of negations, gender management and spelling mistakes, word annotation, text summaries, reports and visualization of results.

The major challenges for AI development

■ In July AMETIC, Spain's digital-industry employers' association, held its 3rd Artificial Intelligence Encounter under the banner theme "Artificial Intelligence to digitize the world".

In her opening address the Secretary of State for Digitization and Artificial Intelligence, Carme Artigas, referred to the role of digitization in the country's economic recovery and stressed Spain's overriding need to develop a great AI industry based on four great mainstays: technological, legislative, ethical and social.

For yet another year GMV was one of the participating firms. José Carlos Baquero, Artificial Intelligence and Big Data manager of GMV's Secure e-Solutions sector, took part in the panel discussion on "ethics and privacy for a trustworthy AI". In his speech he stressed how GMV's Privacy-Enhancing Technology (PET) called **uTile** can make sure the right balance is struck between privacy and data harnessing.

GMV's inhouse **uTile** development taps into confidential data to improve

machine-learning algorithms and analytical models, complying at all times with organizational and data-privacy requirements and current law. All organizations can benefit from **uTile** (striking the right balance between privacy and data harnessing) by sharing and even monetizing in a secure way all data-based knowledge, doing so on the strength of encrypted computing, complying with the privacy of distributed data sources and facilitating secure information exchange.

Technological innovation, the vaccine for a safe tourism

Tourism, Spain's main driver of income and jobs, is one of the sectors hardest hit by the COVID-19 pandemic; it now needs to tackle one of the stiffest challenges in its history. As in other sectors, technology is coming into its own in this endeavor, helping to bring about a safer, quicker and more customer-centered recovery.

Last June, to address this situation, representatives from the tourism sector and the technology world came together in a discussion panel under the title "Technological innovation, the vaccine for a safe tourism" to take stock of the sector's current state, the problems it faces and the possible technological solutions.

Participants in the event included Álvaro Carrillo de Albornoz, CEO of Spain's Technological Hospitality Institute (*Instituto Tecnológico Hotelero: ITH*); Tomeu Fiol, Global Hotel Technologies Director at Meliá Hotels International; Joan Antoni Malonda, GMV's Tourism Business Developer; and Jesús Vega, regional sales manager for Iberia-Imperva.

The post-quantum reality needs to be addressed now

Pundits tell us that quantum computation is set to invade our lives in the next 10 years, once it has reached the necessary level of potency and reliability. Even today, however, we can anticipate the impact of this game-changing technology on such aspects as the confidentiality of current information.

Today's information-encryption methods are algorithm based. The strength of these algorithms depends on the current computation capacity. As things stand today, for example, internet encryption uses algorithms like RSA, which are based on the difficulty of factorizing very big prime numbers. Current computers would need millions of processing years to factorize these numbers. It is estimated that the quantum algorithm Shor, run in a quantum computer, could break encryption of this type in a few seconds.

The problem we face now is not only that this encryption method will be useless once quantum computers are here but also the backdated problem of all the information encrypted in the past, which will now be exposed! We are therefore warning of the need to

invest now in a new type of post-quantum cryptography, which will only be resistant today but also in the near future when the much-vaunted "quantum supremacy" is here.

At an international level several initiatives are cropping up to cope with the abovementioned situation. In 2016 the National Institute of Standards and Technology (NIST) held a tender to define a new cryptographic scheme to kick-start a standardization process. For its part the Internet Engineering Task Force (IETF), a large open community of network designers, operators, vendors, and researchers, concerned about the architecture and proper functioning of internet, is also working on several draft projects, one of them to update TLS, the key exchange protocol, one of internet's security mainstays, to ensure it is resistant to quantum computers.

As company managers and informed citizens we are duty bound to take due stock of the risk entailed in a technological change of this magnitude. We must be aware of the type of data we are holding and the span of time it needs to be kept secret. The transition to a new



Pedro López Peña
Deputy general manager
GMV's Secure e-Solutions sector

Investment now needs to be made in a new type of post-quantum cryptography, which will not only be resistant now but also in the near future when the much-vaunted "quantum supremacy" is here.

cryptographic scheme will take years to bring in. Until that happens hackers can steal data and store it for future decryption. The post-quantum world is already here, well before quantum computation actually arrives.


 The logo for GMV NSL, featuring the word 'gmv' in a lowercase, rounded, sans-serif font, followed by 'NSL' in a larger, uppercase, bold, sans-serif font. A registered trademark symbol (®) is positioned between the two parts.

GMV merges its UK Company with NSL

This merger reinforces GMV's position in UK's space sector while also cementing its worldwide leadership in satellite navigation and critical applications, earth observation, telecommunications and new technologies

G MV Innovating Solutions Limited, the UK aerospace company belonging to GMV, has signed a merger agreement with Nottingham Scientific Limited (NSL). GMV trades in the aerospace, defense, ICT and intelligent-transportation-systems markets while NSL is UK leader in satellite navigation and critical applications. After the agreement GMV becomes sole shareholder of NSL and sets up the company GMV NSL, to be integrated seamlessly into GMV's set of companies.

Back in 2013, as part of its international expansion, GMV rolled out a business development strategy in the UK. This involved setting up a new company, which came on stream in late 2014 to join the suite of companies and offices in Spain, USA, Germany, France, Poland, Portugal, Romania, The Netherlands, Malaysia and Colombia. Working from its Harwell innovation center in Oxfordshire, GMV's main UK business is earth observation, space debris tracking, mission planning, flight dynamics, navigation, autonomy and robotics. Its principal clients include the European Space Agency (ESA) and the European Commission (EC), as well as UK's space agency (UKSA), the Defence Science and Technology Laboratory (DSTL), Innovate UK, ASUK, Satellite applications Catapult and the Science Technology Facility Council (STFC).

Set up in 1998 and boasting a solid and acknowledged track record in hi-tech projects, NSL is a UK-based SME specializing in satellite navigation and critical applications. From its Nottingham head office in the East Midlands, NSL offers GNSS-based services, systems, solutions and intellectual property, helping to ensure that navigation and positioning are precise and reliable, secure and protected, resistant and robust. NSL's major clients include UK Space Agency, ESA, UK Government departments, QinetiQ, Inmarsat, and the European Commission.

GMV NSL, 80-strong, will be integrated into GMV's set of companies, which closed 2019 with a staff of 2,176 and a turnover of more than €236 million. GMV NSL will be able to rise to even greater challenges and tap into the opportunities offered by the UK market, especially the space market, not only in satellite navigation and in critical applications, but also in earth observation, telecommunications and new technologies, with the overarching aim of winning pole position in Britain's space sector.

The sheer quality of both teams and the like-mindedness of GMV and NSL on company values, heritage, technological excellence and client satisfaction were all deal clinchers in this merger agreement.



“This merger will enable the resultant firm to tap into significant commercial, technological and operational synergies, boosting GMV NSL's rate of growth and winning it a place in the space programs of both the UK and Europe as a whole”.

Jesús B. Serrano
CEO of GMV



“In our different ways, GMV and NSL are regarded as world leading space companies and this agreement will expand our capabilities and capacity enabling us to successfully tackle even greater challenges and consolidate GMV NSL's position as the benchmark space company”.

Mark Dumville
Co-founder and Director of NSL



GMV maintains its ongoing success and leadership in Europe's innovation scene

■ Spain's Industrial Technology Development Center (CDTI in Spanish initials) has recently published the provisional results (2014–2019) of Spain's participation in HORIZON 2020 (H2020). GMV is one of the Spanish organizations boasting the biggest return in these R&D financing funds.

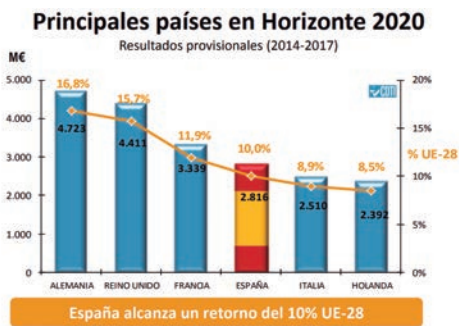
In overall terms Spain's return under this European framework program holds onto fourth place, provisionally

obtaining 10.1% of the total financing for the 2014–2019 period, i.e., receiving through its funded participants total non-refundable transfers adding up to €4.7616 billion, accumulated over this 6-year period.

GMV is continuing to drive Spain's industrial leadership under this program, with a mean 24.7% success rate over the period, doubling the European mean of 12.2%.

and encouraging them to carry out original, top-notch, inspiring, talent-packed projects. The private investment under these projects helps to multiply the beneficial effect of public aid, allowing the various innovation stakeholders to come up with competitive solutions that hit the market earlier.

We at GMV applaud and hail the effort and support of Europe's public institutions and Spain's ministry of science and innovation and CDTI, who between them have helped to muster the necessary resources and encourage investment in promising technologies for the global competitiveness of Spain's innovation agents. GMV's ongoing R&D-centered business outlook has now nurtured nearly 50 up-and-running projects in its various European offices.



The upshot is that GMV maintains its ongoing success and leadership in Europe's innovation scene. Year after year the company has managed to transform Europe's co-funding opportunities into groundbreaking solutions that generate value for our clients, galvanizing an innovation setup made up by public and private agents, including SMEs,

Summer 2020 Internship Scheme

■ GMV keeps up a close contact with universities and study centers around the world, offering a year-round internship scheme, taking part in conferences, encounters and employment events to attract the best talent.

For the last 20 years this ongoing endeavor has included a summer internship scheme, giving undergraduates the chance to

learn from GMV's top experts while completing their education in a working environment during July, August and September.

Nothing daunted by the coronavirus pandemic, this year's internship scheme kicked off on 20 July with an intake of seven top-notch first-year masters' students in aeronautical engineering from the Universidad Politécnica de Madrid (UPM). Given the present circumstances,

however, in the interests of the students' own safety, their internship will be performed as a combination of online and onsite learning.

Until September, mentored by their appointed tutor, these students will be able to take part in groundbreaking, international projects that will give them the chance to continue learning and hone their skills while putting their academic studies to the test.



Álvarez-Gascón invited to La Moncloa to present the country's economic recovery measures



■ In a session chaired by Spain's President, Pedro Sánchez, the general manager of GMV's Secure e-Solutions sector, Luis Fernando Álvarez-Gascón, acting as president of the Innovating Firms Forum (*Foro de Empresas Innovadoras: FEI*) explained in La Moncloa (official residence and workplace of the Prime Minister of Spain) FEI's innovation-based ideas for Spain's economic recovery, presenting the "Plan for reinforcing the science, technology and innovation system".

Spain's science, technology and innovation strategy is part and parcel of the country's whole Science, Technology and Innovation System, honing skillsets, favoring fruitful collaboration between all stakeholders and boosting economic and social returns from R&D investments. It upholds the importance of scientific and technological progress as an essential part of social progress.

Along the same lines, the *Foro de Empresas Innovadoras*, in the manifesto "Ideas for the rebuilding of a sustainable economy", lays down the

bases for a new more prosperous and sustainable production model for Spain, underpinned by innovation, science and industry. In his speech before the government, Álvarez-Gascón explained the main thrusts of its ideas: the best way to tackle the economic recovery, how the measures should be knitted together and what role should be played by entrepreneurship and innovation. The chosen economic model "has to be more resilient and inclusive, driving us towards a fairer and more prosperous welfare society".

Economic reactivation depends on a revitalized, digitized industry, which should reach 20% of the country's GDP. As the FEI has recently pointed out "we need a bigger industrial content to our economy, reversing the recent trend whereby it has fallen in the last decade to only 14% of Spain's GDP and about 12.5% of jobs. Industrial policy should give a different treatment to those sectors in which Spain boasts competitive advantages but are currently somewhat listless and those highly dynamic sectors where Spain's industry has yet to feature".

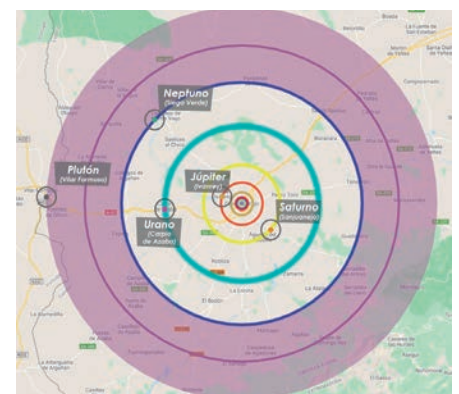
GMV supports Ciudad Rodrigo's scaled-down Solar System model

■ The association called Astróbriga has set up a project for building a scaled-down solar system in the district of Ciudad Rodrigo. The aims of this model, the first of its type ever set up in Spain, include science education and awareness-raising as well as boosting Ciudad Rodrigo's tourism.

GMV has joined in with this initiative, supporting its construction, making it the first major company to take part in the project directly; it is also the first private organization outside Ciudad Rodrigo to collaborate in the project.

This project will produce a scaled-down model of our planetary system. The sun, built up by about 2000 hand-made tin parts, will measure nearly 5 meters in diameter. The planets and their moons, reproduced in detail by 3D printing technology, will float in monoliths of steel and armored glass. A solar-panel-fed internal lighting system means it can be viewed at nighttime too.

The project has also received a subsidy from the Spanish Science and Technology Foundation (*Fundación Española para la Ciencia y la Tecnología: FECYT*), dependent on Spain's Ministry of Science and Innovation (*Ministerio de Ciencia e Innovación*). On behalf of Astróbriga, its President, Nicolás Cahén, has thanked GMV for its collaboration and helping to raise the project's profile and make it better known.



GMV hailed as Southern Europe's Best Service Provider

■ GMV has won Hewlett Packard Enterprise (HPE)'s "Southern Europe Service Provider of year 2020" prize. HPE's Partner Growth Summit 2020 award scheme recognizes the year's best-performing channel partners in terms of results and achievements, level of commitment and development of value in clients, plus a focus on growth and innovation.

With this award HPE puts on record the close collaboration between both companies, a relation that has gone from strength to strength over the last 10 years or more.

GMV has used HPE technology on all types of projects with IT infrastructure across its whole business range. In general, GMV integrates HPE computation, storage and networking solutions in all projects in which it is bound to provide its customers of various sectors (defense, government authorities, telecommunications, space, cybersecurity, etc) with trustworthy solutions in projects posing the most stringent requirements in terms of performance, availability and security. Internally, too, GMV also uses varied HPE technology in an infrastructure hosting about 1800 virtual machines underpinning its product-development procedure.



From left to right: José María de la Torre, president and CEO of HPE Spain and HPE president of Southern Europe; José María Martínez Fadrique, GMV's SPASS manager; and José María Díaz-Zorita, HPE channel and alliance manager for Southern Europe.

The clinching factor in this whole process was GMV's winning of the project for maintenance and upgrading of the ground control segment of Galileo's satellites. Based on HPE Simplivity, it represents the biggest project with this technology run as a single operation on HPE's southern European channel (Israel, Greece, Italy, Portugal and Spain).

In view of the COVID-19 pandemic and its aftermath, the winners of this year's award scheme were recognized during the "HPE Partner Growth Summit Virtual Experience 2020", held at the end of June. On 16 July José María Martínez Fadrique, GMV's SPASS manager, picked up the award at HPE's Madrid headquarters.

"Getting ready for a new start"

GMV was one of the invited firms to take part in the online lectures "SLOT Cyber Talks" promoted by SLOT, a Portuguese human resources company.

On 1 July Marta Vilar, GMV's Talent Development manager, held a talk on "Getting ready for a new start", highlighting the way GMV itself has tackled the challenge of the COVID-19 pandemic.

Marta Vilar's talk explained how GMV stole a march on all the lockdowns

imposed in the various countries the company trades in. Thanks GMV's DNA based on its technological expertise and experience, the company was instantly able to set up remote working for most of the staff during the lockdown, while ensuring safety, personal protection devices and social distancing in situations where onsite working was essential.

As for communications, GMV developed and implemented from

the word go a solid communication strategy based on continuous internal communication and the deployment of GMV@Home, a new communication platform.

As for learning and development, GMV also launched different online learning contents for career development and soft skills-training, also promoting diverse virtual-meeting initiatives to allow all staff to keep in touch even at a distance.

Jose Luis Delgado Gamella

“In every team I’ve worked with during these years I’ve had the chance of working with brilliant workmates”

My GMV story starts in summer 2007, just after I returned from Germany. I studied telecommunications engineering at Universidad Politécnica de Madrid (UPM). As well as a very good university academically, UPM also offers its students exchange schemes with other European universities. This suited me fine because I’ve always loved traveling and seeing how others live. So I was lucky enough to be able to take a double degree at the Technische Universität Darmstadt. In fact it was in Germany, precisely in Darmstadt, where I first heard of GMV from some colleagues who’d been posted there to work in the European Space Operations Centre (ESOC). After nearly two years, I mulled over the possibility of looking for work in Germany or doing a PhD at Fraunhofer IGD, where I had carried out the spadework for my end-of-degree project (Studienarbeit) and worked as an intern. After careful thought, however, I decided to return to Spain to begin my engineering career.

I applied for a job on GMV’s website, sat the interviews and soon afterwards I joined GMV’s defense area, where I’ve now been working for the last 13 years. My first job was as software developer for 3 years in the Future Dismounted Soldier (*Combatiente del Futuro*: COMFUT) project for the Spanish MoD. This was an ambitious consortium project with other major sector companies that had just kicked off at that time. It turned out to be an excellent start, largely because of the project team I was working with, ranging from my developer colleagues through interns and right up to project heads and managers. I was able to tap into one of the biggest advantage

GMV offers, i.e. participation in all project stages and deliverables to gain an overview of what was going on. For me it’s very rewarding to see the results of systems I’ve been working on and their takeup by the respective clients. The project ended and the experience built up allowed GMV to take on joint responsibility for the new development relaunched by the MoD in 2017. This new program allowed us to apply the knowledge gained and lessons learned in soldier-system-standardization in projects for the European Defence Agency (EDA) and the European Commission, in which we had been working with leading companies in systems of this type, such as Rheinmetall (Germany), TNO (The Netherlands) and Leonardo (Italy).

From COMFUT I moved on to several briefer projects for clients like Spain’s airport operating authority, AENA, and AIRBUS. For AENA we developed an aeronautics bands management system. As for AIRBUS I was posted

there for several months as system integration engineer. In 2012 I then joined the Intelligence Surveillance and Reconnaissance (ISR) team.

This new stage was highly rewarding. I was able to take on more technical and team-management responsibility and learned a lot in the four years I was working there full time. One of GMV’s trademark working traits, the one I most highly value today, is the fine working environment on each and every one of the projects I’ve been working on. After all, we do spend a good chunk of our lives at work, so a pleasant working environment is a great boon. I personally would hail this as one of the finest points of GMV’s culture. It grows, of course from the combined efforts of one and all but also the uplifting spirit of competitiveness, which filters down from the high-ups throughout the whole of middle management.

When I joined the ISR team the project had already been up and running



JOB: Section head / Homeland Security & Defense

DOB: 7 March 1983

FURTHER EDUCATION: Telecommunications engineer (Universidad Politécnica de Madrid)
Elektrotechnik und Informationstechnik (Technische Universität Darmstadt)
Executive MBA (IE)

GMV START DATE: August 2007

GMV OFFICE: Madrid, Tres Cantos

HOBBIES: music, traveling, basketball, paddle tennis, tennis, running

DEFINES HIMSELF AS: inquisitive, committed



for some time, but a new contract had just been won, involving the development of new systems under NATO's Multi-Intelligence All-Source Joint Intelligence Surveillance and Reconnaissance Interoperability Coalition (MAJIIC2) program. This sparked off a time of much traveling, but the flexibility built into GMV's system has always made even the toughest times easier to bear. We began to work with many European firms and to take part in international working groups to develop combined and joint ISR interoperability, a pre-requisite of effective collaboration between different armies and countries. This challenging environment brought out anew something that had already struck me while I was studying in Germany. For some cultural reason we always tend to downplay our own capabilities when competing with other European countries. The truth is, in my own experience, that we are capable of pulling off results that are at least as good as our main European competitors. Our work on the MAJIIC2 program was yet further proof of this fact.

After these 4 years in the ISR division, the company once more gave me another vote of confidence by asking me to take on new duties in the management of national and international projects. Two of the main projects at national level, still ongoing, were the new Dismounted Soldier System (follow-on from the abovementioned COMFUT), in which we developed the software and robusticized personal computer, and a project in which we developed part of GMV's input to Spain's 8x8 Wheeled Combat Vehicle (*Vehículo de Combate a Ruedas 8x8: VCR8x8*). Other EDA projects we carried out had to do with standardization of soldier systems and command systems and control for military medical support.

Fast forward two years and they offered me yet another opportunity, to run a new section and take on new challenges, including renewed collaboration with the ISR division through a major NATO project that had been awarded to GMV. All these challenges were a great motivation to me, and I have been able to tackle them supported by another

of GMV's hallmark features. In every team I've worked with during these years I've had the chance of working with brilliant workmates (not only technically but also personally). These colleagues have been a constant source of ongoing insights and I try to make sure this learning process is mutual, a challenge that keeps me permanently on my toes.

The current boom in European-level defense initiatives means we are currently spending most of our time on them. Indeed, we are starting new European Commission projects, developing command and control systems for unmanned vehicles and Field-Programmable Gate Array (FPGA) technology for defense. We are also developing for EDA a cloud-hosted software platform to aid in decision making, based on artificial intelligence and big data.

This has been my GMV story so far. As for the future, I'll continue working to ensure personal growth and career development within the company and strive never to fall short of expectations.



uTile, how to improve your algorithms without undermining data privacy

uTile is GMV's inhouse solution for harnessing confidential data in order to improve analytical models and machine-learning algorithms while complying at all times with organizational requirements:

- It ensures that participants' data is neither exposed nor transferred, safeguarding data privacy and confidentiality
- It lever advanced encryption methods that keep data encrypted while being processed during computation
- Data remains protected during internal checks, whether on-premise or cloud hosted

Thanks to *uTile* organizations can now share and even safely monetize their data insights, on the strength of encrypted computation, complying with the privacy of distributed data sources and facilitating safe information exchange.

marketing.TIC@gmv.com
gmv.com

SPAIN

Headquarters

Isaac Newton 11 P.T.M. Tres Cantos - 28760 Madrid
Tel.: +34 91 807 21 00 Fax: +34 91 807 21 99

Santiago Grisolia, 4 P.T.M. Tres Cantos - 28760 Madrid
Tel.: 91 807 21 00 Fax: 91 807 21 99

Juan de Herrera nº17 P.T.Boecillo - 47151 Valladolid
Tel.: +34 983 54 65 54 Fax: +34 983 54 65 53

Albert Einstein, s/n 5ª Planta, Módulo 2 Edificio Insur Cartuja - 41092 Seville
Tel.: +34 95 408 80 60 Fax.: +34 95 408 12 33

Edificio Nova Gran Via, Avda. de la Granvia 16-20, 2ª planta
Hospitalet de Llobregat, 08902 Barcelona
Tel.: +34 932 721 848 Fax: +34 932 156 187

Mas Dorca 13, Nave 5 Pol. Ind. L'Ametlla Park L'Ametlla del Vallés - 08480 Barcelona
Tel.: +34 93 845 79 00 - +34 93 845 79 10 Fax: + 34 93 781 16 61

Edificio Sorolla Center, Nivel 1 Local 7, Av. Cortes Valencianas, 58 - 46015 Valencia
Tel.: +34 963 323 900 Fax: +34 963 323 901

Parque Empresarial Dinamiza. Avda. Ranillas, 1D - Edificio Dinamiza 1D, planta 3ª,
oficinas B y C - 50018 Zaragoza
Tel.: +34 976 50 68 08 Fax: +34 976 74 08 09

COLOMBIA

Capital Tower Bogotá, Calle 100 n.º 7-33, Torre 1, Planta 14- Bogotá
Ph.: +57 (1) 6467399 Fax: +57 (1) 6461101

FRANCE

17, rue Hermès - 31520 Ramonville St. Agne. Toulouse
Ph.: +33 (0) 534314261 Fax: +33 (0) 562067963

GERMANY

Münchener Straße 20 - 82234 Weßling
Ph.: +49 (0) 8153 28 1822 Fax: +49 (0) 8153 28 1885

Friedrichshafener Straße 7 - 82205 Gilching
Ph.: +49 (0) 8105 77670 160 Fax: +49 (0) 8153 28 1885

Europaplatz 2, 5. OG, D-64293 Darmstadt
Ph.: +49 (0) 6151 3972970 Fax: +49 (0) 6151 8609415

MALAYSIA

Level 8, Pavilion KL 168, Jalan Bukit Bintang, 55100 Kuala Lumpur
Ph.: (+603) 9205 8440 Fax: (+603) 9205 7788

POLAND

Ul. Hrubieszowska 2, 01-209 Warsaw
Ph.: +48 22 395 51 65 Fax: +48 22 395 51 67

PORTUGAL

Alameda dos Oceanos, 115, 1990-392 Lisbon
Ph.: +351 21 382 93 66 Fax: +351 21 386 64 93

ROMANIA

SkyTower, 246C Calea Floreasca, 32nd Floor, District 1, postal code 014476, Bucharest
Ph.: +40 318 242 800 Fax: +40 318 242 801

UNITED KINGDOM

GMV NSL

HQ Building, Bldg 77.1st floor. Thomson Avenue, Harwell Science and
Innovation Campus, Didcot, Oxfordshire OX11 0QG
Ph: +44 (0) 1865954477 Fax: +44 (0) 1865954473

GMV NSL

Sir Colin Campbell Building. Innovation Park. Triumph Road
Nottingham NG7 2TU
Ph: +44 (0) 1157486800 Fax: +44 (0) 1159682961

USA

2400 Research Blvd, Ste 390 Rockville, MD 20850
Ph.: +1 (240) 252-2320 Fax: +1 (240) 252-2321

523 W 6th St Suite 444 Los Angeles, 90014
Ph.: +1 (310) 728-6997 Fax: +1 (310) 734-6831