News

No. 80

gmv INNOVATING SOLUTIONS

The Galileo Ground Control Segment challenge brought to a reality

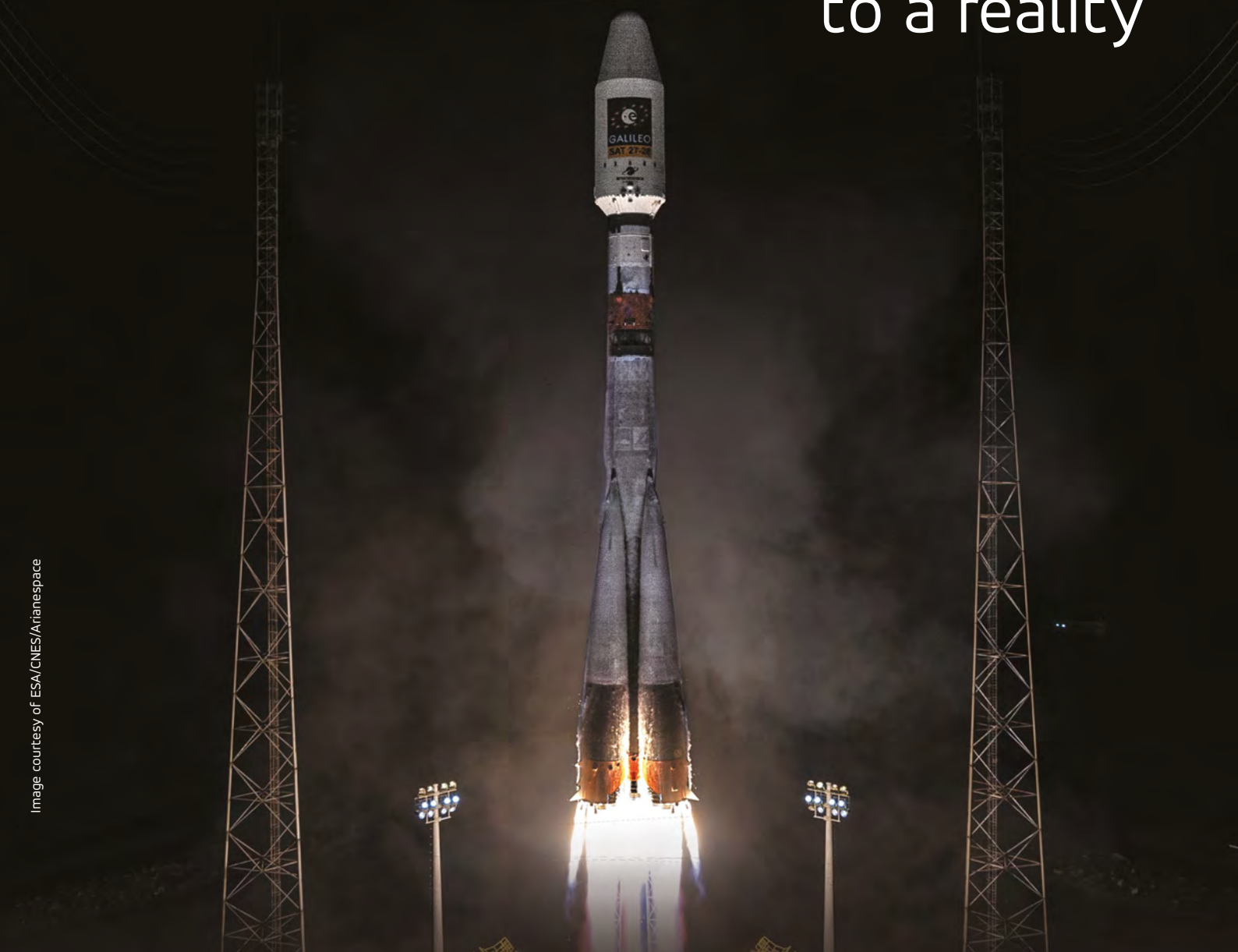

Image courtesy of ESA/CNES/Arianespace

INTERVIEW
Esperanza Casteleiro Llamazares
Secretary of State for Defense

INTERVIEW
María José Rallo del Olmo
Secretary General of Transport and Mobility

GMV hosts the next edition of ICSSA

GMV is to host the 3rd International Academy of Astronautics Conference on Space Situational Awareness (ICSSA), organized by Florida University's Department of Mechanical and Aerospace Engineering with the support of the International Academy of Astronautics (IAA) and the American Institute of Aeronautics and Astronautics.

From 4 to 6 April top Space Situational Awareness (SSA) renowned experts will meet up in GMV's site in Tres Cantos, Madrid, to deal with a wide range of matters related to the detection, identification, prediction, monitoring and removal of space debris plus liability and insurance issues.

To find out more and sign up:
https://reg.conferences.dce.ufl.edu/ICSSA

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Letter from the president

2021 has been another difficult year. Many families endured painful situations, caused directly or indirectly by the pandemic, which is still keeping us all guessing. We have had to adapt to continually changing circumstances that hit us hard at home and work, shutting down many activities but also bringing out the true worth of values like fellow-feeling and collaboration, essential to overcome the pandemic.

Collaboration has also been crucial in the many successes we can celebrate in GMV this year. Direct and close collaboration with clients enables us to pinpoint needs in order to come up with the best solutions. Witness the Galileo Control Centre (GCC): the roll-out of the latest GCC version has been a resounding success, resulting from intense cooperation with the responsible agencies and the operators of Galileo. Collaboration is key also in the development of automotive cybersecurity systems with and for FICOSA; to provide the Spanish army with unmanned aircraft together with Aurea Avionics; or to build up AI-based big data platforms, joining forces with hospitals, universities and pharma firms for research into new forms of cancer treatment.

GMV has proven its competence to lead major international projects collaborating with top firms and institutions. We have grown during 2021 in both staff and turnover and we start 2022 with a bulging portfolio of contracts and new opportunities in the pipeline that will enable us to accelerate this growth. The pandemic has highlighted the importance of science and technology as a source of solutions for society's most pressing problems, and current supply problems underline the need of developing these solutions in Europe.

Mónica Martínez

No. 80

Published
GMV

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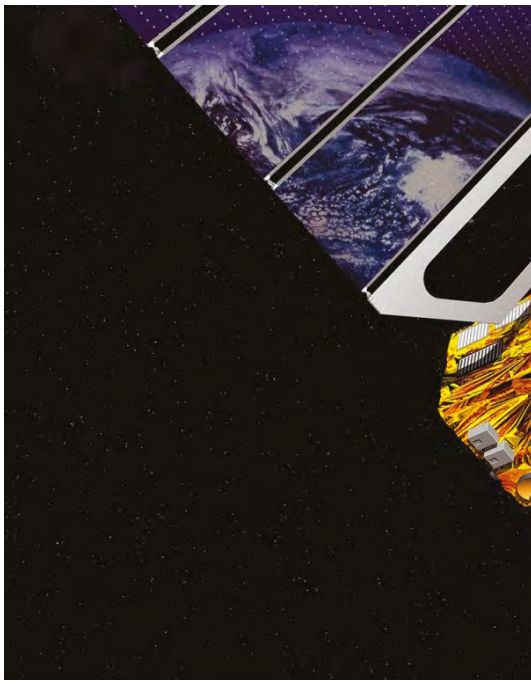
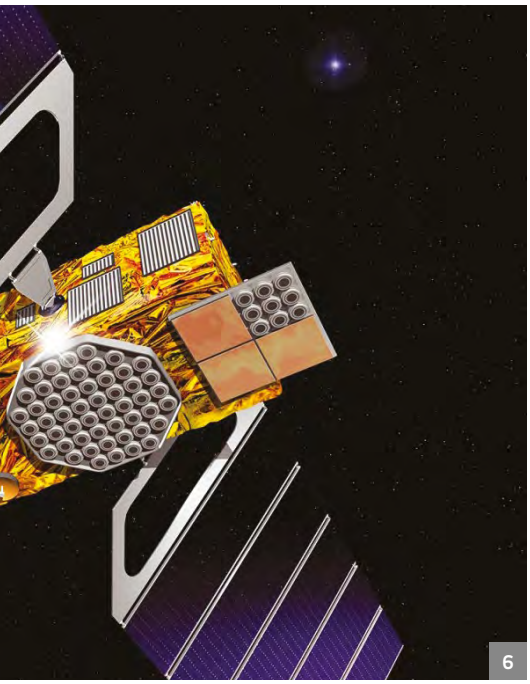
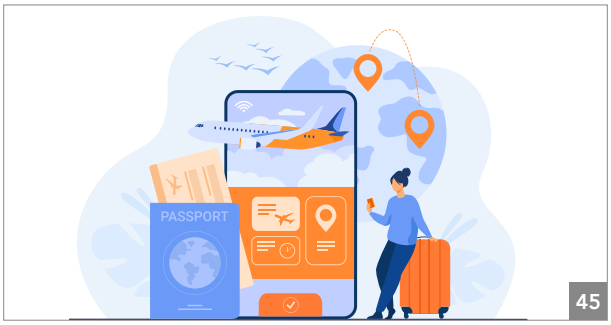
Magazine No. 80. Fourth quarter of 2021

CONTENTS







The Galileo Ground Control Segment challenge brought to a reality

Once upon a time a mid-sized Spanish company embarked on an uncertain and difficult adventure in the Company's growth strategy, facing the strongest space companies in Europe in the competition for the Galileo GCS within the Galileo Exploitation Phase, the so-called FOC2 phase.

This came as no real surprise, however. GMV's Galileo adventure started before Galileo was named Galileo. Practically since GMV was founded, nearly 40 years ago, the company started contributing to the advent of GNSS activities in Europe. Since then, GMV has been growing with firm strides in the GNSS domain, becoming a key partner first in EGNOS, then developing critical elements of the Galileo navigation provision within the Galileo GMS.

This growth was consolidated with the leadership of the Galileo Service Centre Infrastructure, the Time and Geodesy Validation facility and the Galileo Reference Centre.

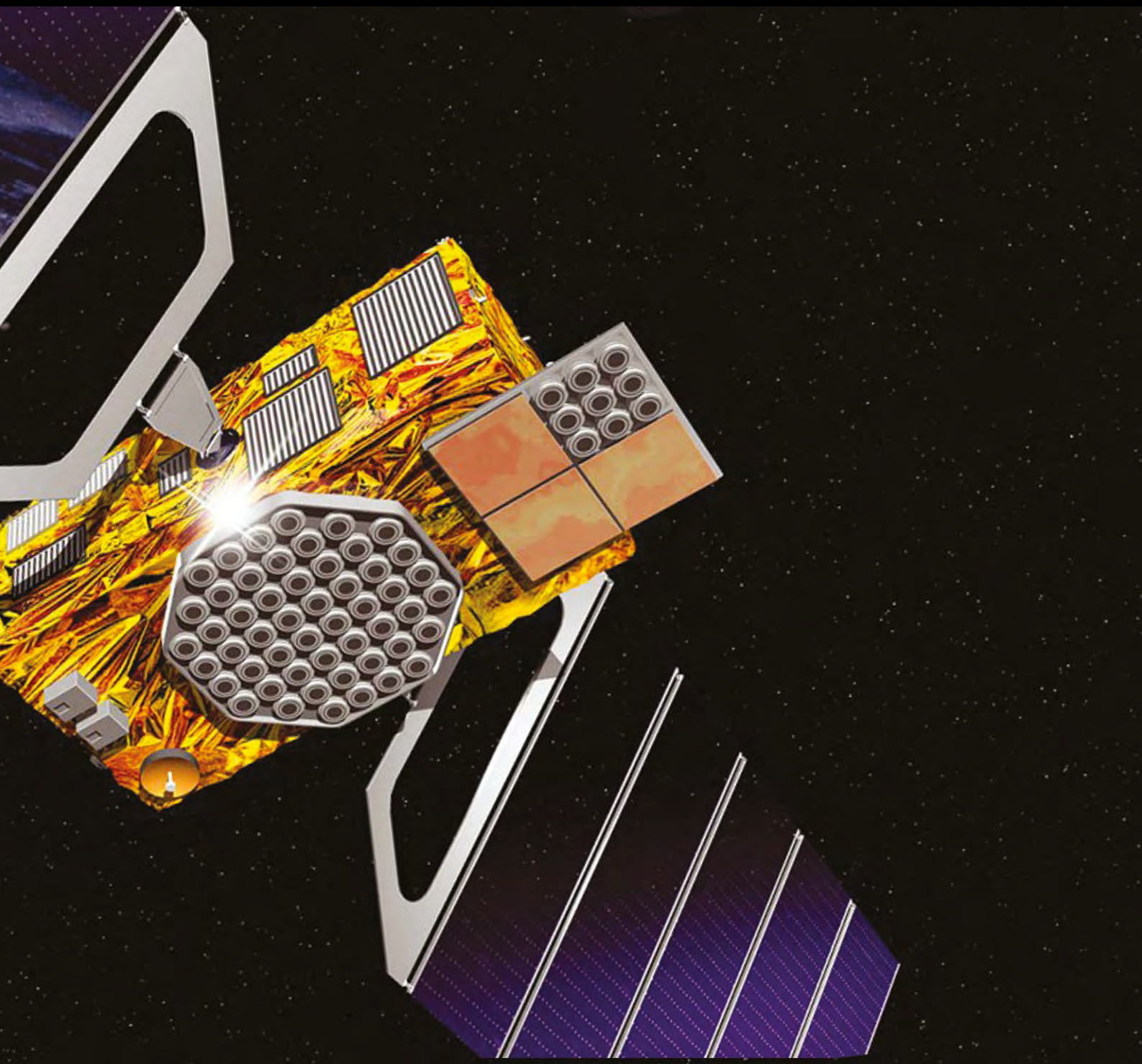
The solid Galileo background combined with GMV's decade-plus leadership in Satellite Ground Control Centers, both in the Institutional and Commercial sectors.

This unique combination set the basis for the next challenge. This time the issue was not so much to convince ourselves that we were the best to face this challenge, but to convince Europe.

Building a solid and credible proposal for such a project was an enormous challenge that required thousands of hours of work, which materialized in thousands of pages in the proposal volumes plus dozens of accompanying documents. But this was not the largest difficulty in the process.

The big deal was how we could be able to synthesize what GMV wanted to bring anew to the Galileo Program, what were the values we wanted to guide our work and what was the difference that GMV could and wanted to make.

GMV's values are deeply engraved within the DNA of GMV employees, but how to present them and make them visible to external evaluators; that took a lot of thought and brainstorming sessions.



Finally, bearing out the adage that one image is worth a thousand words, this synthesis took the form of a short video clip of hardly three minutes in which we set out clearly the keynote changes we intended to bring in: not so much a change of contractor but rather a change in attitude and proactivity: Talent, Strength, Commitment and Awareness.

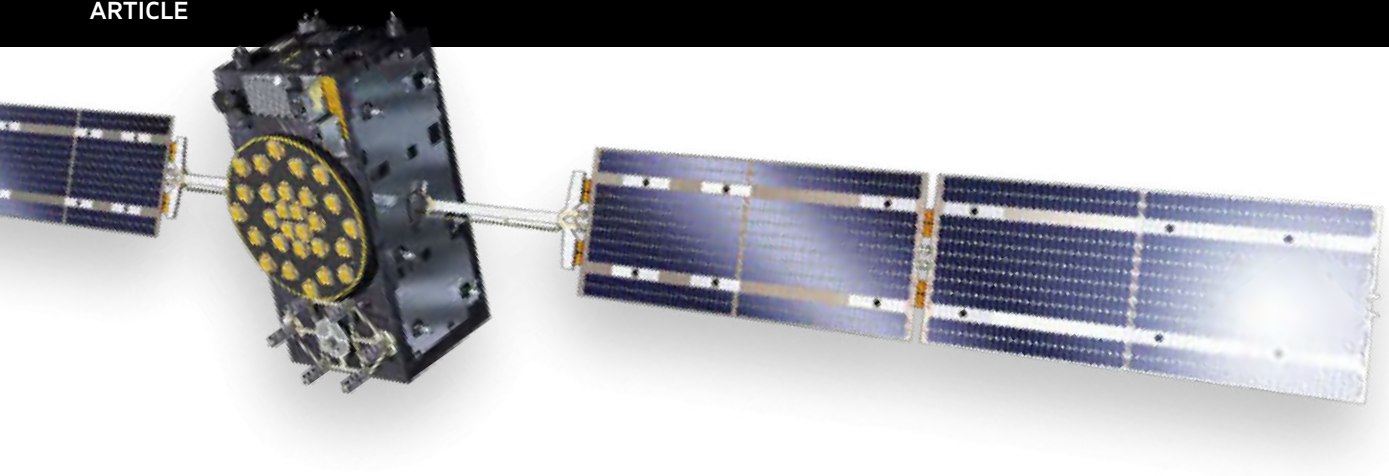
Here you can watch the video: https://www.youtube.com/watch?v=Vkcm0LOKML0

Well, the result was that GMV was awarded the contract, GMV joined the major league of Space in Europe and we got the largest contract signed by a Spanish company in Space at that time.

It is difficult to ascertain how far the expression of our values in the clip helped to achieve such a success. Nonetheless, it was clear for the entire team that the messages presented were not just "propaganda" but they represented the guidelines for our work and the benchmarks against which we wanted to measure our day-to-day work.

Today, a little more than three years have passed since the show started, with half this time living under the Damocles' sword of the COVID-19 pandemic, affecting our way of working, our capability to perform critical activities and the physical and mental health of all participants.

Yet throughout this long path, our values and the spirit we reflected in our proposal have endured and grown even firmer.



Talent

Already in anticipation of a potential contract award, GMV started to gather and concentrate Talent, and the process was fast-tracked immediately after the award was announced.

The best of GMV's personnel stemming from different GMV areas converged into the WP3X project. Many by directly joining the project, but many others played a role nearly as important, by assuming higher responsibility in their own areas thus covering for those who moved into the WP3X project, and helping GMV to face the largest challenge ever in its history, while making sure that GMV commitments in running projects remained unscathed.

And this was not a one-day wonder. Since the project started, GMV has incorporated and continues to incorporate new staff to work for Galileo WP3X activities. As of today, about 200 new jobs have been created covering a wide span of activities, from project office and support staff to highly specialized engineers and managers.

These rapid and decided actions allowed GMV to gather the required resources and expertise to take over in hardly no time at all both Segment and Element activities, including the new elements falling under GMV's responsibility, with a seamless maintenance transition from the previous contractor in less than two months after contract signature.

The talent was secured not only within GMV but also through the entire industrial consortium, through the rapid activation of advance contracts with all key partners, bringing into the process the experience of the existing teams, including hiring critical staff working for the previous incumbents and ensuring the support of previous incumbent companies into the handover process.

Strength

Needless to say that the WP3X path has not been precisely a well-paved highway; it often looked more like an entangled, half-hidden, rainforest trail... and on occasions we felt like being inside a labyrinth far from any marked path.

It would be hard to list the many the different situations where the different GMV departments and teams have overcome the problems and come up trumps, from building the biggest team within GMV almost from scratch, ramping up all the different teams while the design and qualification were being performed, to the final operational deployment.

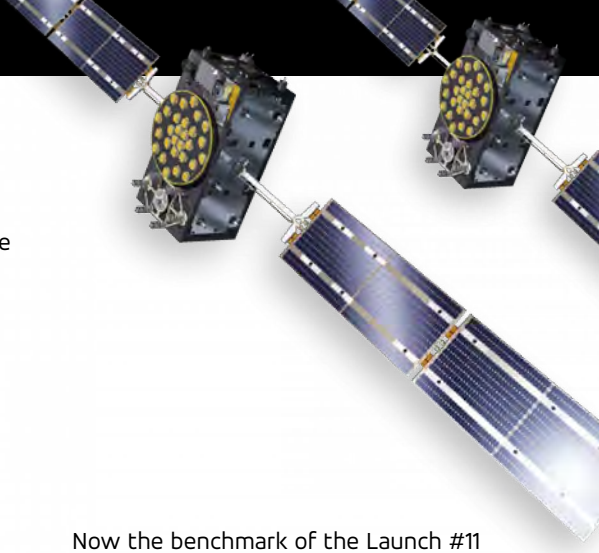
As well as the intrinsic difficulties and obstacles of the normal work, we have to factor in too the additional difficulties, fears and restrictions brought about by COVID-19. Throughout such hard periods it has been the sheer will power of all stakeholders, not just GMV, but also customers and subcontractors, that has helped us surmount the difficulties, get us back to our feet and continue in pursuit of the final success.

Mention must also go to those common departments in all the involved companies, who have made it possible to change overnight the ways of working, who have been able to provide the means and the tools to continue working effectively, who have secured connectivity and access, often risking their personal well-being. And we should not forget the brave staff that had to confront the pandemic risks, staying on company premises to do laboratory work or to manage classified material and documentation, or having to travel to support the deployment activities, which started in the midst of the first COVID wave, and extended through subsequent waves until summer 2021.

It is hard times like these that really bring out our companies' true mettle, the backbone qualities that underlay all our work. We can only thank all the personnel them for the great job done and their ongoing work into the future, for this situation is unfortunately far from over.

Commitment

One of the outstanding highlights on this path was the Launch #11 we have just successfully completed, achieving the fundamental goal of putting in the hands of the Galileo Operators a fully renewed Galileo GCS capable of performing LEOP operations.



Of course, along the way, many secondary goals have popped up that for some time seemed even to eclipse this key objective, threatening to divert most needed efforts from the main path to those byways.

Fortunately, the shining light of the key objective has been always a safe and reassuring mark, well embedded into the working agenda of our customers (thanks Sonia and Sara!), battened down into all the layers of the project, until all teams' commitment was driven by the Launch #11 mantra, walking together as one, firmly and oblivious to obstacles, to reach the goal.

We at GMV are proud of our customer-oriented values. But in the Galileo GCS project this virtue has been really come into its own. Very few projects can compete with the level of openness, transparency, flexibility and commitment experienced in the relationship between GMV and our customers and consortium. And this can be earmarked as one of the keys of success.

This attitude we promised back in 2018, and to this attitude we have been faithful even if sometimes we may have suffered from such openness and radical honesty. And to this attitude we intend to be faithful in the years to come.

Awareness

It might well be thought that with such a tight schedule and so many difficulties, there was hardly any time to raise our heads from the day-to-day work and watch the surrounding fields in search of improved paths and new ideas for the future.

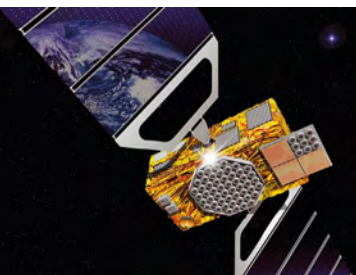
Quite the opposite: while marching steadily towards the objective, the WP3X teams, as well as the rest of the stakeholders, did not forget to keep an eye out for improvements, to apply innovative ideas and to pave the way for the next versions to come.

On top of the contractual baseline work, major upgrades were brought into the Galileo GCS. A few of the more salient examples are the start of SECMON implementation, the insertion of important operational improvements including the formalization of many ad-hoc tools developed to support operations or the on-the-fly resolution of unexpected obsolescence events.

And in parallel to the development and deployment, many workshops with customers and operators have been held; new improvement ideas have been explored and many of the issues highlighted in those exercises have been added into the portfolio of the objectives for future versions of the GCS, because today is only a preamble of the future.

Now the benchmark of the Launch #11 is in our past, although new launches will soon come. But we already see the next goals as the new lighthouse we need to follow and this is to build a fully renewed and completely equivalent GCS infrastructure in both Control Centers with the deployment of the GCS V3.1.

And this is just the start that shall set the path for the next huge challenge in front of us, one that we are also looking forward to tackling and accomplishing: i.e., adaptation of the GCS infrastructure to the operation of the new Galileo Second Generation satellites. Next tick in our calendars: 2024.



And here we are

Maybe very few, five years ago, would have betted much on GMV succeeding in its quest of the Galileo GCS FOC2 WP3X contract. Even after getting the contract, it would not have surprised many to have seen GMV unable to achieve goals and milestones in time. Especially having to cope with COVID-19 on top of everything else.

But GMV has stayed faithful to our trademark and values, and this has helped us steadily climb the apparently inaccessible mountain, pitch our basecamps, tie solid guy ropes on sheer cliffs and build bridges spanning the crevasses across our route.

In August 2021, just three years after the Wp3X contract was signed, the new GCS V3.0 operational infrastructure, deployed at the Galileo Control Centre in Oberpfaffenhofen, Germany, was handed over to the Galileo Operator.

Since then, it has been continuously used to control and operate the whole Galileo Satellite Constellation and shortly afterwards, by mid-September, the GCS V3.0, was also deployed at the second Ground Control Centre in Fucino.

The new GCS not only offers state-of-the-art infrastructure and technology, but it also presents largely improved reliability and security. New key services and improved operability are now available to the operator.

And the icing on the cake is the brand new capability to support the LEOP campaigns for the new Satellite launches, available from the Galileo Control Centres for the first time and successfully used to complete the LEOP for the recent Launch #11 that has set in orbit the first 2 satellites of the Galileo Batch #3 set.

This event, the success of the Galileo Launch#11 LEOP, has made in recent weeks a big splash all around Europe; not only was it the first time the LEOP has been performed from the GCC, but also the first time that the Design and Development of the LEOP Infrastructure has been performed by industry and not by an agency, in this case, performed by GMV. Thanks to this successful launch performed from Kourou on 5 December, the satellites 27-28 of the Constellation are now on their way to their final position controlled with a GCS fully designed and developed under GMV flagship.

Many companies and individuals have made this possible. Within GMV many different areas and departments have become part of this big project. Outside of GMV a large consortium composed of the most relevant European Space companies have strongly contributed to this success, just to mention some of the most important: Thales SIX-GTS, Thales Deutschland, Thales Alenia Space, Indra, CGI Deutschland, Telespazio Germany, DLR-GfR.

And special mention must be made of the process-long hard work, guidance and support provided by the European Space Agency (ESA) as Galileo System Design Authority and Technical Manager of the GCS contract and the European Union Agency for Space Programme, as ultimate responsible for Galileo Service Provision.

We have suffered and rejoiced, we have stumbled and picked ourselves up, but we have fought to preserve our belief that GMV deserved to be here and that yesterday's dreams would become today's reality. That there is nothing impossible, when we, at GMV, think big and believe in ourselves, because the sky's the limit, and in this endeavour, this saying is literal.

Talent, Strength, Commitment and Awareness are key ingredients. But Galileo feeds on another fundamental ingredient, namely the clear focus of all the stakeholders, institutions, industry, users, to achieve hand in hand a common goal.

To work together... to dream together for the present and for the future of Galileo.

The views expressed in this article can in no way be taken to reflect the opinion of the European Union and/or ESA. "Galileo" is registered as a trademark in the database of the European Union Intellectual Property Office (n° 002742237)

Flexibility is our strength!

An incredible year has come to an end. Starting with a snow storm in Madrid and ending with the launch of 2 satellites with LEOP performed with GCS v3.0. The road from VAL deployment completion at the end of last year, through operational validation and OPE migration has been paved with trials, and the pressure to succeed has been very high.

The commitment, flexibility and team spirit that has been shown by the GMV-led team is what has brought us here today. It was a year full of challenges, with COVID always present and a very tight schedule to secure Launch 11 in 2021. Only through the intense effort of each individual and the willingness to solve issues and move forward as a team has this been made possible. To the point that hand-back to the new GCS v3.0 in GCC-D was achieved a week ahead of schedule!

And in parallel to this achievement the activities for the next version is progressing as well. The version 3.1 will be the version where we apply the lessons learned from GCS v3.0 and excel even farther. Looking forward to a fruitful 2022 together!

Sara Gidlund
Head of ESA Galileo G1 Ground Control Segment Management Service

Effort, commitment and professionalism!

In July 2018, an important decision was taken by the Galileo Program for the future of the Galileo Ground Control Segment: The WP3X Contract, comprising critical upgrades of the current infrastructure in operations, for the monitoring and control of the Galileo Constellation, was awarded to GMV Spain.

Although it is now one year since I left the Galileo Ground Control Segment team at ESA, I still remember this important date and this important decision as one of the key milestones of the Galileo Program.

Three years after July 2018, it has been shown to be the right decision. Following a huge effort, unwavering commitment and professionalism by the GMV team lead by Néstor and Victor and the support of their Industrial partners, the new Galileo Ground Control Segment was ready in the Operational chains of the two Galileo Control Centres, ready for the 11th Galileo Launch in December 2021.

Personally, it has been a pleasure to work during these challenging times with the GMV team: their enthusiasm, winning mind-set and success-oriented attitude have been a very positive experience for the ESA team and all the Galileo stakeholders, including the European Commission. I wish you all the best for the new adventures ahead of us in the GNSS arena and I hope our paths will cross again in the future.

Sonia Toribio
ESA- Head of the Ground Mission Segment and Ground Segment Security Management Service

Esperanza Casteleiro Llamazares

Secretary of State for Defense

Esperanza Casteleiro Llamazares has been Secretary of State for Defense since July 2020.

After graduating in Philosophy and Sciences of Education from *Universidad Complutense de Madrid*, Casteleiro has spent most of her career in Spain's intelligence services, first in the Higher Defense Information Center (*Centro Superior de Información de la Defensa*: CESID) and then in the National Intelligence Center (*Centro Nacional de Inteligencia*: CNI), of which she was secretary general.

Since 2018 she has worked for the Spanish MoD, first as manager of the Cabinet of the Minister of Defense, Margarita Robles, and then as Secretary of State for Defense, the post she still holds today.

How does the Secretariat of State for Defense fit into the whole Defense Ministry jigsaw?

Under current law the Secretariat of State for Defense is the highest body of the department, with responsibility for managing, driving and running all the following defense policies: armaments and material; research, development and innovation; industrial and economic policies; infrastructure; environmental matters and systems; technology and information security; it also sees to the ministry's digital transformation process.

We also take part in defense planning, mainly through our material and financial resource management remit.

How do you participate in defense planning? Do you think Spain's standing in Europe's defense sector befits its status? In which aspects or areas should the government or industry be working to increase this standing?

Spain boasts a technological and industrial base capable of adapting itself to suit the sector's needs and hold its own at European level in many technological fields. We do need, however, to continue supporting Spain's industrial and technological base to help it increase its skillsets and make sure it is capable of taking such chances as might open up within the European Union's initiatives.

Since the launch of the European Commission's European Defence Action Plan (EDAP) in November 2016, the State Secretariat has striven constantly, together with the rest of the ministers, to give active support to our defense industry, all with the idea of maximizing the benefits of its participation in the initiative and claiming a high standing for the industrial technology base of Spain's defense.

The results of the European Defence Industrial Development Programme (EDIDP)'s two calls in 2019 and 2020 have been very upbeat in terms of the level of Spanish firms' participation, with over 80 organizations leading 8 of the 42 winning projects and participating in 70% of those led by other countries.

The first call of the European Defence Fund in 2021 favored greater cohesion of the investments to be carried out by the European Commission, geared towards major, long-term projects in order to achieve greater interoperability and convergence of the necessary skills by member states.

Although we have featured prominently in previous calls, there is certainly no room for complacency. To ensure an important role in Europe we need to establish a common posture of Spain's central government in the interests of increasing the financing of EDF projects and maximizing the benefits of this initiative, liaising and combining properly with other state policies such as industry, innovation and technology.

Satellite navigation in general and Galileo in particular arose from the pressing need of coming up with innovation designed to meet the growing needs of a booming services and applications industry. What is your take on the defense and security role satnav is currently playing?

Satellite navigation systems have a crucial defense and security role. They are, after all, a key component in running military operations. Satellite navigation gives us precise positioning capability for deploying our troops in operation zones, improves situational awareness of our own and the foe's facilities and forces and speeds up rescue operations.

Although there are other navigation systems, such as inertial navigation or ground radio-navigation systems, satellite navigation systems have proven to be most suitable, and as such irreplaceable, in conducting military operations.

Satellite navigation systems are especially crucial in precision-guided munitions, as well as in land- sea- and air-navigation, especially in remotely piloted aerial systems, now being

Satellite navigation systems have a crucial defense and security role. They are, after all, a key component in running military operations

increasingly used in intelligence, surveillance and reconnaissance activities.

Neither should it be forgotten that navigation systems are used not only for positioning and navigation purposes but also for the essential timing functions of our telecommunications systems.

There are many security applications we could cite here too, such as border control and surveillance, management and aid in natural disasters, maritime traffic control or the advanced and autonomous working of unmanned systems.

Galileo means Europe now has its own operational satellite navigation system; this is fundamental for various sectors including defense and security. What is your own take on why Galileo is so important for the defense sector?

Military command and control and intelligence, surveillance, target acquisition, and reconnaissance capabilities are highly dependent on the availability and operation of positioning, navigation and timing services, so Galileo can be seen as a capability multiplier. This is precisely why Galileo's availability and integrity are so important in the defense sector.

Galileo provides the Public Regulated Service (PRS), especially designed for crisis situations in which there might be a degradation or outage of satellite navigation systems, something that has sometimes occurred in GPS. This makes the PRS ideal for military use.

Which integral parts of the Galileo program is Spain concentrating on, from the defense and security sector's point of view?

Spain's full commitment to Galileo has been evident right from the start. As well as taking part in the very first designs and developments of Galileo's PRS receivers, apt for integration in the different platforms of the armed forces, Spain is one of the countries hosting most Galileo infrastructure, such as the GNSS Service Centre (GSC), in Torrejón de Ardoz (Madrid), and Galileo Security Monitoring Centre (GSMC) in San Martín de la Vega (Madrid).

Galileo's PRS will play a decisive role in defensive and offensive operations to ensure positioning, navigation and timing (PNT) information via the coordinated use of space, cyberspace and electronic warfare, i.e., in actions embracing the NAVWAR concept, the aim of which is to achieve PNT confrontation superiority.

The estimated earliest date for Galileo's PRS to reach initial capacity, European infrastructure permitting, is 2023. National industry therefore needs to be encouraged to achieve the design and manufacture of operational PRS receiver prototypes, of national sovereignty.

In the international sphere, the Directorate General of Armaments and Material (*Dirección General de Armamento y Material*), together with other ministerial departments, is working busily in diverse European Commission Galileo working groups plus R&D projects co-funded by the European Defence Industrial Development Programme (EDIDP) to support the design and creation of Galileo PRS navigation receiver prototypes.

In the medium term, it will be vital to participate in the second generation of Galileo satellites (G2G), to ensure this new generation meets the future needs of our armed forces. We also need to continue promoting an industrial policy that favors the participation of Spain's industry in processing of the Galileo PRS signal and in the generational handover of the system.

The current Multiannual Plan, running up to 2032, is driving three major projects, namely the VCR 8x8 vehicle, the F 110 Frigate development program and modernization of the Eurofighter. These three programs will have a big ripple effect throughout the economy as a well as a significant knock-on effect on Spain's defense industry in particular. What opportunities does this open up for the industry specializing in satellite navigation technology?

Implementation in the armed forces of Galileo's PRS signal satellite navigation is an operational need included in planning of the 2019-2024 cycle. The Spanish Chief of Staff (JEMAD in Spanish initials) has recently validated Staff requirements for acquisition of a robust PNT capacity, based mainly on Galileo PRS. During the coming year, therefore, work will be carried out for determining the alternatives for this acquisition.

The first Galileo PRS receiver designs and developments are being developed according to the requirements of the platforms being used by the armed forces. The new projects and programs underway today (8x8, F-110, Eurofighter) will therefore be favored by the adoption of modern navigation systems including the latest receiver breakthroughs.

Given that the plan runs up to 2032, it is likely that platform projects will be favored by the new receiver developments designed in European cooperation projects, such as Galileo for Defense (GEODE) of EDIDP 2019, in which various Spanish organizations will be taking on responsibility for developing the naval receiver, and weighing heavily within the whole consortium.

What opportunities and challenges do you think Galileo's keynote services, such as the Public Regulated Service (PRS) or the High Accuracy Service (HAS), open up for the defense and security sector. Do you think Spain's industrial fabric has enough technical capability to take it on?

Europe has gone in a big way for development of PRS capabilities for military use and Spain supports this initiative. Under the EU's Permanent Structured Cooperation (PESCO) in defense matters, Spain is participating in the EU Radionavigation Solution (EURAS) project for developing EU's military PNT capabilities, harnessing Galileo's PRS.

Under EURAS the GEODE has recently been launched. It is being co-funded by the European Commission through the European Defence Industrial Development Programme (EDIDP), for developing diverse PRS receivers, doing so by pooling the requirements of the various user communities of the participating countries, in which Spain, with the support of its MoD, is also doing its bit with the development of a PRS maritime receiver.

The armed force's evident interest in obtaining Galileo PRS capabilities represents a great chance for Spain's defense and security sector, which I consider to be more than capable of manufacturing the PRS receivers, on the back of its ongoing R&D efforts.

As for the challenges, one of the most important will be to build up the capacity of miniaturizing the specific PRS receiver circuits, i.e., PRS chips, for their use in more consumer-intensive and bigger applications,

Military command and control and intelligence, surveillance, target acquisition, and reconnaissance capabilities are highly dependent on the availability and operation of positioning, navigation and timing services

such as the portable communications systems or in guided munitions. This calls for acquiring the capacity of accrediting the chips designed for security and defense applications. This in turn calls for close control over their manufacturing process.

The dominant chip-manufacturing countries today are the US, Taiwan and South Korea. In Spain, although we do have a certain microelectronics expertise, we cannot yet accredit microelectronic devices for use in secure applications. It will therefore be necessary to achieve this capacity and bring ourselves up to the level of other comparable countries like France, Germany or Italy, which are now running their own chip foundries.

Apart from satellite navigation, which other fields of activity or technologies do you think will be vital for the future of Spain's defense?

The technological component looks set to be vital in the development of many fields of future defense operations.

In recent years we have seen how cyberspace has been recognized as a new field of military operations; the whole cognitive idea looks set to be the next cab off the rank.

Such factors as the trend towards multi-domain operations, the growing hyper-connectivity between elements in operation zones and the mining of the vast amount of variegated sensor data mean that all technology classed as emerging and disruptive will be vital for the future of Spain's defense.

Spain's Innovation and Technology Strategy of Defense 2020 (*Estrategia de Tecnología e Innovación para la Defensa* 2020) puts forward a set of specific defense R&D lines that need strengthening, including munitions guidance, cyberdefense or electronic warfare, plus others of dual use but with a strong defense component such as asymmetric threats, the energy sustainability of defense missions and harnessing of the civil technological drive. This will all be done by tapping into recent advances such as artificial intelligence, the new materials or robotics or upskilling of personnel, to cite only a few.

María José
Rallo del Olmo

Secretary General of Transport and Mobility

Born in Castellón, she graduated as civil engineer from *Universidad Politécnica de Madrid* and also took an economics degree in Spain's open university (UNED). She also holds a Master's degree in Public Policy Management and Analysis from Universidad Carlos III and has taken IESE's Public Management Leadership Program course.

Since 1998 she has belonged to the civil engineers corps and has worked for her whole career to date in the current Transport, Mobility and the Urban Agenda Ministry (*Ministerio de Transportes, Movilidad y Agenda Urbana*).

Since June 2018 she has held the post of Secretary General of Transport in the Ministry of Public Works (*Ministerio de Fomento*), previously holding, among others, the posts of Head of the Technical Cabinet of the Secretary General of Transport, Deputy Director General of Studies and Projects of the Directorate General of Roads and Adviser in the Cabinet of the Secretary of State of Infrastructure and Planning.

One of the strongest initial driving forces behind satellite navigation in general and Galileo in particular was to come up with cutting-edge innovation to meet the needs of the booming transport applications and services industry. Which areas do you think have been most strongly impacted? And where do you see these applications and services going in the coming years?

Transport applications sit right in the middle of satnav design; they witness the importance of these applications for GNSS. The US GPS system, initially born with military ends in view, has a National Executive Committee in charge of coordinating the system rollout and development, co-chaired by the Secretary of State for Defense and by the Secretary of State for Transport. In other words, even a system originally conceived for military uses recognizes the overriding importance of transport applications.

Within these transport applications it is the aeronautics sector that has most heavily harnessed the benefits of satellite navigation. GNSS mean that aircraft no longer depend on ground infrastructure for orientation. This enables them to follow more direct pathways between origin and destination, cutting flight times, fuel consumption and concomitant CO2 emissions. Satellite-based augmentation systems like EGNOS and GBAS enable landing and approach tasks to continue even in adverse weather conditions. Satellite navigation is ushering in brand new air-navigation concepts; in particular it is facilitating the development and takeup of performance based navigation (PBN) in Spain. PBN optimizes en-route navigation procedures as well as airport landings and takeoffs. This in turn boosts the capability and efficiency of the air traffic management (ATM) system while also improving the operations of airports set in an awkward lie-of-the-land or beset by unfavorable weather conditions. By 2030 the whole airspace of Spain and Europe will be based on satellite navigation.

Similarly, the maritime sector has also benefited from GNSSs. The sheer precision of these GNSSs helps to boost the capacity of maritime pathways and keep ports going during periods of thick fog or storms. Neither should we forget, of course, the benefits of satellite navigation for land transport and mobility, not only for fleet management but also every time we use our own private cars.

Looking ahead, the potential of two sectors looms large. Firstly the drone sector, where an exponential growth of all types of applications is already underway. Secondly, autonomous vehicles, whether by land, sea or air. Here, ongoing progress in GNSS accuracy and robustness is crucial. Two Galileo services feature prominently here: the High Accuracy Service and the Authentication Service. The combination of both will enable the receiver's location to be ascertained much more accurately, as well as guaranteeing that the known position is authentic; this is fundamental for the aforementioned self-driving applications. Galileo will be the first GNSS to have these services operational, placing Europe at the spearhead of progress in this area.

In the late nineties the Spanish Air Navigation Authority then known as AENA (nowadays ENAIRE) decided to put itself firmly behind the development of Galileo's forerunner EGNOS. The transport ministry of that time, the Ministry of Public Works (Ministerio de Fomento) gave its wholehearted support to Europe's satellite navigation program, the Ministry of Transport then taking up the baton. How would you rate this role?

Indeed, the transport ministry's wholehearted support for satellite navigation, ongoing today in the Transport, Mobility and the Urban Agenda Ministry (*Ministerio de Transportes, Movilidad y Agenda Urbana*: MITMA), has been nonstop since the nineties. ENAIRE alone has spent over 60 million euros on the European program for development and implementation of EGNOS, Spain being the European country hosting most EGNOS infrastructure. Spain has been chosen too to host one of the new EGNOS version's two control centers as well as the EGNOS Service Center. ENAIRE is also founding member of the EGNOS Service Provider ESSP, which is currently European Union Agency for the Space Programme (EUSPA)'s concessionaire for running EGNOS services, and also looking likely to operate under the next contract running up to 2030.

It is worth noting here that EGNOS and Galileo represent the EU's first own infrastructure. It is no longer a case of national infrastructure forming part of the Transeuropean Transport Network but rather 100% EU infrastructure. We are firm upholders of European integration; as such we are keen to drive this flagship from Spain.

It doesn't stop with mere support, however. The leadership of various institutions within the MITMA group (Directorate General of Civil Aviation, AESA, ENAIRE and AENA) has generated ongoing trust from community authorities. Hence the choice of Spain to host not only the aforementioned future EGNOS infrastructure but also the current version (Control Centre, Service Provision Unit, Performance Analysis Laboratory and RIMS stations scattered about the whole of Spain, etc.).

EGNOS and GALILEO have helped to make air-navigation safer and bring down operational costs. What are the Secretariat's plans for bringing satellite navigation into Spain's airspace?

Transport applications sit right in the middle of satnav design

We take part in all important international working groups for the standardization, development and implementation of the new Galileo based satnav systems

As far as air navigation goes, we should not forget that GNSS itself come under the umbrella of the Single European Sky strategy.

Advantages of all types are rife: a bigger airspace capacity, lower fuel consumption, lower noise levels around airports, due to fewer missed approaches. And of course, as you've alluded to in the question itself, a huge contribution to safety. Gradual rationalization of ground infrastructure will also lead to a lower service cost.

EGNOS has by now greatly improved airport availability, even when the airport in question is not fitted with ground navigation aids.

As already pointed out the ENAIRE-led PBN Implementation Plan is now underway nationwide, to bring Spanish airports into line with current European standards and ensure that all Spanish airports' instrumental runways will have been fitted with satnav-based landing, takeoff and approach procedures by 2024. The idea is to bring in by 2030 a totally GNSS-based airspace in all flight phases, using conventional navigation systems as fallback only.

And we are now preparing ourselves for flying with Galileo. Second-generation augmentation systems, all of them multi-constellation (GPS, Galileo mainly) and multi-frequency, are under design as we speak. We take part in all important international working groups for the standardization, development and implementation of the new Galileo-based satnav systems.

Galileo will not only be a boon for air transport. Satellite navigation is also transforming overland transport and land- and sea-mobility. How do you see Galileo's future role and how to you think society is going to benefit from its development in these areas?

It was some years ago now that the European Commission coined the term infomobility, as one of the basic services any member of the public has a right to.

The transformation has by now occurred almost unbeknown to us. Very few people realize that the sectors generating c. 11.3% of Spain's GDP are directly GNSS dependent. Much of this dependency is bound up with the land and sea transport sector. The efficiency of logistic processes too depends on knowing freight whereabouts at all times and when it is due to reach the next point in the logistic chain so that the truck, train or ship doesn't have to waste time waiting around for it. Some studies moot that the cost of many basic farming or fishery products would increase by 20/25% but for GNSS.

We also want to know when the next bus will arrive or the nearest taxi or which route is the quickest at any one time.

But as well as all the above, Galileo also helps to save lives. Take the following two examples. Firstly, since 2018 it has been obligatory for all new cars sold in Europe to be fitted with the eCall system, an automatic 112-emergency-service calling system in the event of any accident. Built into eCall is a Galileo receiver to provide all the precise coordinates of the accident site. And I would underline the fact that the system is automatic, i.e., the 112 call is made even if the vehicle occupants are unconscious. It is estimated that the eCall system could save 2500 European lives a year.

Secondly, Galileo also has a search and rescue service, SAR. SAR works from emergency beacons normally used in the maritime or aeronautics sector. In the event of any imminent distress on the sea, for example, the ship's crew can trip the beacon, which then starts to send out electromagnetic signals. Galileo satellites are fitted with instrumentation to pick up these signals and pinpoint the transmission source. The emergency services can then be warned and guided to a high-sea search zone cut down to a radius of only a few kilometers.

Satnav systems, therefore, are already part and parcel of our daily lives and look set to become only more important in the coming years.

What particular opportunities do you think Galileo's keynote services like the Public Regulated Service (PRS) of the High Accuracy Service will generate for the land-, sea- and air-transport sector?

Galileo's authentication and high-accuracy services are likewise due to experience notable enhancements in the coming years, positions being pinpointed down to only a few centimeters instead of the previous one-meter leeway. These services will also be able to guarantee that it is a real, unmanipulated position. This will open the door to a host of new applications, especially the aforementioned autonomous-driving applications. And I'm not referring only to driverless cars here but vehicles of all types: autonomously-piloted, unmanned planes, ships and trains. These applications will engender huge changes in the transport and mobility world, making sure it is safer, more ecofriendly and efficient.

The PRS, for its part, is an encrypted service designed for government applications that need maximum protection from jamming and spoofing. This service can be used for the transport of certain freight such as radioactive or bacteriological material or in maritime rescue operations, which also depend on this Department.

Apart from satellite navigation, which other fields of activity or technology do you see as vital for the future of transport?

The new technologies and digitalization have brought in new business models that have then changed our ways of transporting both passengers and freight. But they also come good for the performance of some government activities.

I think that all enabling digital technologies, such as IoT, Big Data, Artificial Intelligence, Blockchain or 5G networks, are really going to come into their own in transport and infrastructure management.

The Spanish government is determined to put itself behind these developments. Digitalization and the new technologies, indeed are one of the keystones of MITMA's Safe, Sustainable and Connected Mobility Strategy 2030, recently approved by the Council of Ministers and included as an essential roadmap in the Recovery, Transformation and Resilience Plan.

Autonomous vehicles, higher logistics traceability, U-Space, commercial space transport are all looking set to undergo a revolution in coming years.

And Spain's business fabric must be ready for all this, with the support and impetus of government authorities at all levels.

GMV and Aurea Avionics present the Solo UAS system

GMV and Aurea Avionics chose the International Defense and Security Fair (*Feria Internacional de Defensa y Seguridad*: FEINDEF) as the stage to present its Solo UAS system, a portable, rapid-takeoff unmanned aircraft developed over several years of hard work to provide defense and security users with intelligence, surveillance and reconnaissance capabilities.

Solo UAS is a Micro Class I fixed-wing, high-performance, long-endurance system with hand-launch and parachute-landing facilities, meaning it can be launched and retrieved from any type of terrain without needing any additional infrastructure.

The system is made up by several components: the core is the flying-wing type aircraft, providing metadata such as target coordinates and wind speed. It also incorporates a joystick-type Remote Hand-held Control (RHC) allowing for automatic system operation and video display by the operators themselves, plus a Ground Data Terminal (GDT) as communication node with a 15-km line-of-sight (LOS) range and dual radiofrequency link. The system, wholly designed, produced and maintained in Spain, has no ITAR constraints.

The experience built up by GMV and Aurea Avionics in their two previous RPASs, Seeker and Passer, stood them in good stead for the Solo UAS program, the development of which has been given top priority over the previous year.

Drone Usage: a Legal Challenge

These days, data protection, logistical use and air safety are some of the challenges faced by users, legislators, and European authorities in the area of drone usage.

In this context, the Seminar Drones in the Area of National Defense: Legal Challenges was held November 15-18, organized by the Universidad Complutense de Madrid Law School, the Visiting Chair of Military Law in collaboration with the Ministry of Defense and the Spanish association of Air and Space Law.

Through a number of lectures, the event covered subjects such as the national aerospace security strategy, certification of unmanned aircraft in the military sphere, control and regulation of the UAS of the National Security Forces, the use of drones by the Spanish Air Force, responsibilities in the management of air space and the threat of illicit use of small drones.

The seminar was attended by Ricardo Sáenz, GMV's director of Defense and Security programs, who gave the presentation "Drones and Artificial Intelligence", outlining the applications of artificial intelligence in defense drones, the technological and regulatory challenges, and a usage case: the SAFETERM project that GMV is developing for the European Defense Agency that applies artificial intelligence onboard the drone to reduce risks in an emergency landing in which the link with the pilot on the ground has been lost.

BRIPAC evaluates the capabilities of the Passer UAS

The tests were part of the RAPAZ project to weigh up the various RPAS Class I options now available on the market

In October, Personnel from the Spanish Army's Paratrooper Brigade (BRIPAC) have evaluated the operability of the Class I Micro Passer UAS system from Aurea Avionics and GMV, a 1.9 kg unmanned aircraft designed to provide intelligence, surveillance and reconnaissance (ISR) capabilities to defense and security users.

The event took place in October at the Casas de Uceda Firing and Maneuvering Range (CMT) in the province of Guadalajara. In addition to the members of the BRIPAC, there were also staff from the General Directorate of Armament and Material (DGAM) and the companies Aurea Avionics and GMV, developers and owners of the system, in attendance.

The scheduled tests are part of the RAPAZ project, led by the Sub-Directorate General for Planning, Technology and Innovation (PLATIN), to assess the different options of Class I RPAS that exist in the Spanish market.

The specific objective of the session was to carry out extensive testing on the operability of the Passer UAS, performing specific activities to evaluate its detection, recognition and identification capabilities, sound and visual signature, operational ceiling, range, and advanced flight modes, including flight without GPS, loss of communications, and other emergency procedures.

The Passer UAS is a compact system designed especially for the Armed Forces, since its low weight, its vertical take-off, its 60-minute autonomy, one of the highest of its category, and its 6-kilometer communication range make it especially useful in missions where situational awareness is required in ranges of distances that other Micro rotary wing systems cannot reach.

Following in the wake of the Seeker UAS, the Passer UAS combines a product with 100% Spanish DNA, both in its design and its technological development, manufacturing, and maintenance, with a strong international projection thanks to its integration with command centers that meet NATO standards, allowing it to be both a part of the Spanish Armed Forces modernization project and to be fully integrated into the growing cooperation and collaboration of Defense industries at the European level.

GMV at World ATM Congress 2021

From 26 to 28 October the world's top ATM event, the World ATM Congress was held for another year in the Congress Hall of Madrid's IFEMA tradefair site.

GMV ran a stand displaying its navigation and surveillance developments and applications, featuring: ***APRESTA***, for automatic ADS-B performance analysis and detection of GPS interference from ADS-B data; ***Srx-10i***, dual-band GNSS interference detector; ***Emil***, ground ILS and VOR radio-aid inspection system; ***MagicGEMINI***, a GNSS-performance analysis tool; and ***MagicIFP***, a web application of ground- and flight-validation of PBN procedures based on satellite navigation.

Organized by the Civil Air Navigation Services Organization (CANSO) in collaboration with the Air Traffic Control Association (ATCA), this congress brings together developers, experts, providers and other public air-navigation stakeholders.

Galileo satellites operated with the new Ground Control System deployed by GMV

Its maintenance, upgrading and updating has been the company's responsibility since 2018

On December 5, two new satellites were launched successfully for the Galileo program from the European spaceport in French Guiana.

Following the launch, and from the initial stages of the deployment, the satellites were operated by the ground control segment infrastructure recently deployed by GMV, which the company has maintained, evolved and upgraded since 2018, when it was awarded this major contract by the European Space Agency (ESA).

This makes it a very relevant launch not only for GMV but also for the Spanish space industry. For over three years

of hard work, GMV, leading a large consortium made up of the most relevant European space companies, has managed this technical challenge and achieved unprecedented success despite the challenge posed by the COVID-19 pandemic that has affected nearly half of the project activity.

The new version of the GCS includes upgrades to increase the capabilities of the system, enhance the resolution of the virtualization and obsolescence, as well as operational enhancements. It represents a major step forward in achieving full operational capacity (FOC) for Galileo, increasing the management capability to 38 satellites.

The new GCS offers not only cutting-edge infrastructure and technology, but it also provides reliability and security, through the most advanced techniques. It is also able to support LEOP (Launch and Early Orbit Phase) campaigns for the Galileo satellite launches. Until now, these campaigns were always supported by external control centers (ESOC or CNES) in coordination with the GCS. But as has been proven in this recent launch, now the LEOP phases will be executed directly by the Galileo ground control segment with the new Galileo GCS V3.0.

Special thanks go to the European Space Agency (ESA) for their work, guidance and support as the authority responsible for the design of the Galileo system and as the technical managers of the GCS contract. And especially to the EUSPA, the contracting authority, ultimately responsible for providing the Galileo services.

None of this work would have been possible without the daily cooperation of the Galileo operators (Space Opal), who have closely reviewed the infrastructure enhancements and their operational validation.

Navigation 2021: towards a more navigable world

In November, Navigation 2021, took place as a hybrid event uniting two established conferences: the International Navigation Conference (INC) and the European Navigation Conference (ENC).

Both conferences brought together experts from research institutions, government agencies and investors whose primary goal is to work together for a more navigable world. The themes addressed included Position, Navigation and Timing (PNT) systems and technology, robust PNT, PNT applications, animal and human navigation, and navigation in society.

GMV, as a world leader in the satellite navigation market, had a prominent presence running a stand where it displayed the company's PNT systems and applications with a focus on SBAS, Precise Point Positioning algorithms, GNSS threat monitoring and integrated PNT solutions. GMV also presented on "Lessons Learned from SBAS Systems and Testbeds towards Next Generation SBAS Services".

The majority of session talks were online, and the in-person element such as keynotes, networking and exhibition took place in the EICC in Edinburgh.

GMV brings its satnav expertise to ESA's Moonlight initiative

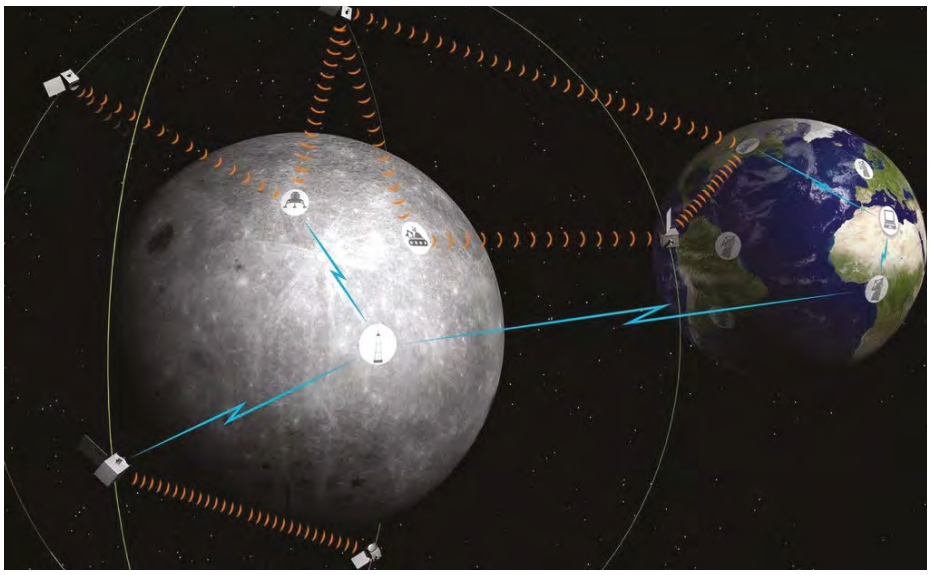
The Moon is our nearest neighbor in space. The Moon has the potential to be a source of new scientific advances, and it is the best place to test the technologies for human Deep Space exploration.

Space exploration is expected to grow steadily in the coming decades, with core focus on Moon exploration, transportation and orbital infrastructure. Dozens of very different commercial and institutional missions to the Moon have already been planned for this decade. Each of these ambitious plans requires reliable navigation and telecommunication capabilities.

A constellation of lunar satellites would enable missions to be designed more cost-effectively, to keep in constant contact with Earth and it could also allow lunar navigation in areas without direct to Earth visibility, even when on the far side of the Moon.

As part of Moonlight initiative, the European Space Agency (ESA) is planning the development of a European-led Lunar Communications and Navigation Service (LCNS), to enable the implementation of a delivery of communications and navigation services that will support the next wave of institutional and commercial Lunar Exploration Missions.

In this context, a consortium led by Surrey Satellite Technology Ltd (SSTL) has been selected for carrying a project to define the service provision and infrastructure, and to lay out the development path to provide sustainable commercial Lunar data-relay services for communication and navigation around the Moon. The LCNS Phase A/B1 Study will characterize the complete end to end LCNS system, including the Lunar Space Segment, the Moon Surface Segment, the Lunar User Segment and the Earth Ground Segment. GMV-NSL will be responsible of the end-to-end Lunar Navigation segment, helping to establish the fundamental technical grounds for the most critical aspects of a lunar radio navigation system, including the Earth Ground Navigation Management System, where GMV is leading and playing a key role in the European satellite navigation program Galileo.



GMV features in the preparation of the future EGNOS development phases

The European Space Agency has awarded GMV the initial study of EGNOS Next, the future generation of the European Geostationary / GNSS Navigation Overlay Service (EGNOS). Launched under the Horizon 2020 program, this project represents continuation of GMV's 20-year track record of working on the EGNOS project.

EGNOS is a satellite-based augmentation system (SBAS) that boosts the precision of Europe's satnav signals. It stems from a tripartite agreement between ESA, the European Commission and Eurocontrol. The next generation of EGNOS, EGNOS V3, currently in phase C/D, will offer enhanced Safety-of-Life (SoL) services to all civil aviation users both in single frequency GPS L1 and dual frequency GPS and Galileo L1/L5.

EGNOS Next, the upgrade of EGNOS V3, aims to pave the way for future program development phases, specifically addressing the growing interest in providing other user communities with precise, integrated and robust positioning systems to facilitate SoL operations in railway and maritime systems, unmanned aerial vehicles, etc.

The project awarded to GMV will look at system viability in terms of preliminary mission requirements, assessing expected performance, safety constraints, reliability and safety. This will involve not only the corresponding theoretical analyses but also development of a representative service demonstrator for carrying out simulations of new service concepts. The study will also help to define the EGNOS upgrade roadmap, presenting different implementation scenarios in view of the time needed to bring them into service, the cost, architecture complexity and performance features.

GMV has played a key role right from the start of the EGNOS program, participating actively in the phases of system design and definition. GMV's main contribution to the EGNOS system has been development of the EGNOS Central Processing Facility Processing Set (CPFPS), often dubbed the "heart" of the EGNOS System since it calculates all the corrections to be sent to users, including the integrity message. GMV has also played an active part in the development of test beds (System Test Bed), simulators (EGNOS End to End Simulator), analysis and monitoring tools and system qualification tools (such as ASQF- Application Specific Qualification Facility), plus a great number of auxiliary activities.

The European Space Forum 2021

GMV sponsored The European Space Forum, held online on 8 and 9 November.

Against the backdrop of the European Union's new space program, the event, featuring various speakers from different ambits of the space sector, represented an ideal chance to swap notes and advance towards the common goal of ensuring Europe's position as in important player in this thrilling new wave of space innovation.

Jorge Potti, GMV's space general manager, took part in session 1: "Delivering a Globally Competitive and Innovative European Space Sector". Miguel Ángel Molina, for his part, GMV's manager of ground-segment and operations commercial development strategy, took part in session 5i: "Space Traffic Management - Challenges and Opportunities for Europe".

ESA entrusts GMV with the development of a key element of its next generation Ground Systems Infrastructure

The European Space Operations Centre (ESOC) started in 2020 the "ESA Ground Operation System - Multi-Mission Generation" (EGOS-MG) project, which is due to run until 2024.

The project embraces all activities aimed at fully exploiting the commonality among ESOC missions' ground segments, by reusing not only software across missions, but also the processes and tools used to make the software operational in each mission environment. Currently, ESOC data systems software infrastructure is used in all missions, but each mission (or set of missions) has its own engineering process, covering integration, validation, deployment and maintenance, and uses different tools and approaches to support the mission lifecycle. The focus of EGOS-MG is to provide a multi-mission infrastructure that missions can use "as a service", minimizing the effort needed to set-up and operate a new mission.

A key activity within the project is the definition and adoption of fully automated processes for the management and deployment of the multi-mission software and resources, through a "DevOps solution" that will provide a common platform for designing, developing, testing, deploying and operating the multi-mission software infrastructure for all missions.

In 2020 GMV started Phase B of this activity, aimed at designing the EGOS-MG DevOps solution and selecting the tools to be used, taking into account software industry best practices. For this project, GMV successfully brought together the expertise from GMV Aerospace in ESOC ground data systems infrastructure and engineering processes, and the expertise of GMV Secure E-solutions in industrial application of DevSecOps standards and best practices.

As a result, ESOC has recently entrusted GMV with the Phase C of the activity, covering the roll-out and operation of the designed solution, and the support for four key software development projects for adopting it during the next two years. This is a great challenge and a key enabler for the materialization of EGOS-MG objectives; once the solution is in operation, it will be possible to gradually adopt it for other GS systems, ultimately supporting the set-up of dedicated Ground Operation Services for a mission using multi-mission software, tools and processes.

IAC 2021

From 25 to 29 October the International Astronautical Federation (FAI) held in Dubai its 72nd International Astronautical Congress (IAC).

IAC has become the essential meeting point for all space players, including scientists, researchers, engineers, agencies, companies, students, young professionals, politicians, astronauts, the space media and members of the public who take an interest in space and space science.

Under the banner title "Inspire, Innovate & Discover for the Benefit of Humankind", IAC 2021 offered a wide-ranging program of papers and lectures taking in a great diversity of space disciplines.

GMV's presence at this event is a no brainer. As well as presenting several papers it also ran a stand in Spain's Pavilion (H6-34) to display its range of space products and services.

GMV undertakes the operational demonstration of EGOS-CC for Earth Observation missions

This is a crucial project for operational takeup of EGOS-CC and EGS-CC in general, representing as it does the first operational use of EGS-CC with an orbit mission

The European Ground System Common Core (EGS-CC) is a European initiative to develop a common software infrastructure to support the development of ground M&C systems for space missions, covering the needs of both pre-launch and operational phases. The adoption of EGS-CC at ESOC, addressed in the frame of ESOC's EGOS-CC project, will deprecate the SCOS-2000 infrastructure currently in use.

GMV has been an important contributor to both EGS-CC and EGOS-CC activities, with a very large participation in the EGS-CC Phase C/D project and a significant involvement in EGOS-CC for the development of EGS-CC extensions and the support for integration and validation of EGS-CC at ESOC.

The EGOS-CC project is now reaching its end, and new projects have been started focused on the operational usage of the EGOS-CC systems. Among them, the "EGOS-CC for Earth Observation" project recently awarded to GMV, will produce an EGOS-CC-based MCS system for SWARM and Sentinel-6 missions, which will be tested operationally with the SWARM constellation through shadow operations.

This project encompasses three main activities: the development of Earth Observation and mission-specific features which are not yet available in EGOS-CC or EGS-CC; the preparation of demo campaigns for SWARM and Sentinel-6, to be executed by the Flight Control Team against the simulators of each mission; and the preparation of a shadow campaign for SWARM, to be executed by the SWARM Flight Control Team against the real SWARM constellation.

This is a key project for the operational adoption of EGOS-CC and for EGS-CC in general, as it will represent the first operational usage of EGS-CC with a flying mission, where the capabilities of EGOS-CC can be compared with those of previous SCOS-2000-based infrastructure. Furthermore, the selection of SWARM and Sentinel-6 as pilot missions for this activity will demonstrate the multi-mission and multi-satellite capabilities of EGOS-CC, and will pave the way for future EO missions, with the most usual EO-specific features already implemented as part of the project.

Coordinated scheduling software for the EU SST sensors

Following a European open call for tenders, the technology multinational GMV, European industrial leader in Space Situational Awareness (SSA) and Space Surveillance and Tracking (SST), has been awarded a new contract by the Spanish *Centro para el Desarrollo Tecnológico Industrial* (CDTI) to develop a coordinated scheduling software for planning and tasking the activities of the overall network of multinational sensors in the EU SST system.

To foster the development of the SST capability in Europe, the EU established in 2014 (through decision No. 541/2014/EU of the European Parliament and of the Council of April 16, 2014) a Framework for Space Surveillance and Tracking Support. This Support Framework aims to develop an independent SSA/SST capability in Europe called EU SST. Since then, the incipient national SST capabilities in the countries within the EU SST consortium (Germany, France, Italy, and Spain since 2016, as well as Poland, Romania and Portugal since 2019) have been federated in a coordinated manner: EU SatCen acts as front desk for the SST services provided by the EU SST consortium.

This new project is part of the sensor planning and tasking activities within EU SST, under the responsibility of CDTI in Spain. Its main objective is to develop a single scheduling software to define a coordinated plan for the large network of SST sensors in the EU SST system. This includes radars, telescopes and SLR stations all over the world from all members of the EU SST consortium (as listed above). The new software, named COPLA, is a new development based on the GMV's ***Senplanner*** SST sensors scheduler, which is currently used in the Spanish SST Operations Centre (S3TOC) to task the activities of the Spanish sensors contributing to the EU SST system. It is to be delivered to CDTI by March 2022 and has already passed in 2021 the first testing campaign, with fully satisfactory results.

GMV leads EU SST contracts in five countries (Spain, France, Germany, Poland, and Romania) and has additional capabilities and contracts in the UK and Portugal in the SST domain in Europe, working also for ESA and providing solutions and services in the commercial market through its proprietary ***Focusoc*** Operations Centre. All in all, over 70 GMV engineers work at GMV on SSA/SST activities, making it the largest SSA/SST industry and team in Europe.

UK Space Conference

GMV was present at the UK Space Conference 2021, held from 27 to 29 September in online format, participating in the panel discussion "Robotics & Autonomy in Space".

Held every two years, the UK Space Conference is the unmissable forum for the UK space community, bringing together the space industry, space-based service users, entrepreneurs, academia and the government.

The packed program has been drawn up with the aim of offering companies important information. This is rounded out by sessions dealing with research, technology, space environments and biomedicine and the promotion of cutting-edge technologies and capabilities.

State-of-the-art software to catalogue space debris

GMV has been awarded a new contract by the German Space Agency at DLR for developing progressive and advanced SST data processing algorithms for the German Space Situational Awareness Centre (GSSAC).

To foster the development of an SST capability in Europe, the EU established in 2014 (through decision No. 541/2014/EU of the European Parliament and of the Council of April 16, 2014) a Framework for Space Surveillance and Tracking Support. The aim of this Support Framework is to develop an independent SSA/SST capability in Europe by EU SST. Since then, the incipient national SST capabilities in the countries within the EU SST consortium (Germany, France, UK, Italy, and Spain since 2016, as well as Poland, Romania and Portugal since 2019; the UK left the consortium in 2021 post Brexit) have been federated in a coordinated manner: EU SatCen acts as front desk for the SST services provided by the EU SST consortium.

This new project is part of the data processing activities within EU SST under the German Space Agency's responsibility. Its main objective is to develop, validate and integrate advanced orbit propagation, orbit determination, and data correlation algorithms aimed at achieving an overall improved catalog build-up and maintenance capability, based on GMV's experience and capabilities in the field. This cataloguing capability is one of the main responsibilities of DLR as part of the German contribution to the EU SST system.

Both German and Spanish branches of GMV will be involved in the activity, working with teams located in Munich, Darmstadt, and Madrid. GMV leads EU SST contracts in 5 countries (Spain, France, Germany, Poland, and Romania) and has additional capabilities and contracts in the UK and Portugal in the SST domain. All in all, over 70 GMV engineers work at GMV on SSA/SST activities, making it the largest SSA/SST industry and team in Europe.

State of the Art in Next-Generation Satellite Technology

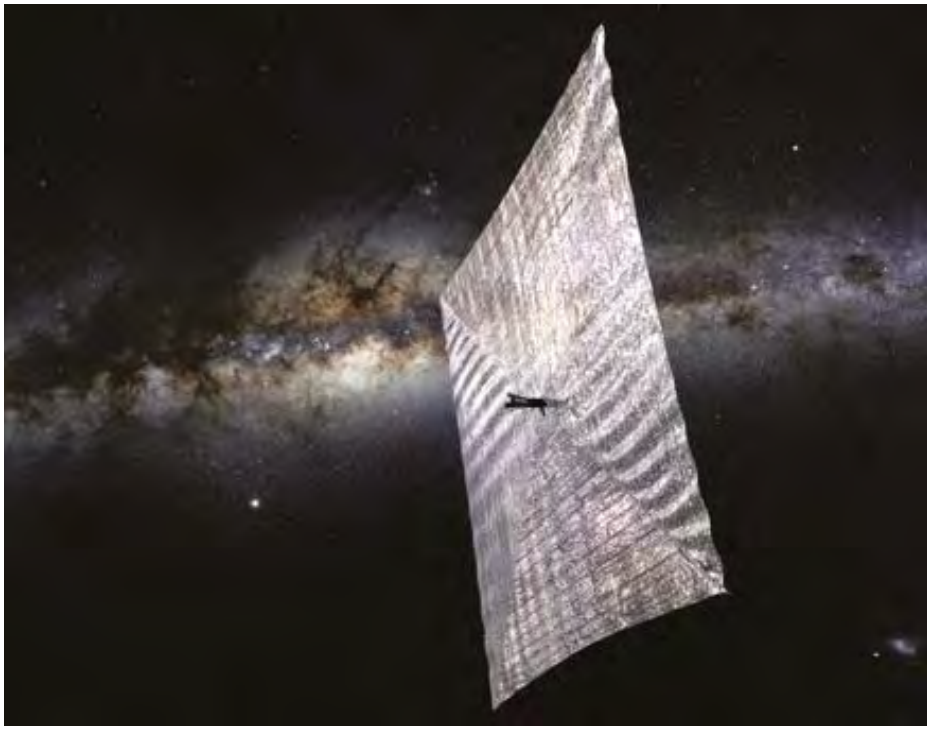
The Computer History Museum in Silicon Valley, California, has once again hosted the annual Satellite Innovation conference, one of the most important gatherings of satellite industry leaders. GMV was given a space in the exhibition area, where it displayed its vast portfolio of solutions in the area of the satellite control ground segment for the space sector.

This event is a showcase for presenting emerging technology on the satellite market, covering different areas such as innovation policies, cloud computing and artificial intelligence, cybersecurity, broadband initiatives such as 3GPP, optical communications, ground infrastructure for advanced space systems, launchers and new propulsion systems, connectivity solutions for LEO operators, large constellations, Earth observation, space robotics, and even space debris.

GMV is a worldwide leader in ground systems for telecommunication satellite control, serving over 35 global operators, such as Eutelsat, Inmarsat, Hispasat, and more. It is also the European leader in ground control and data processing systems in the area of Earth observation, for weather services and environmental and meteorological monitoring. GMV took advantage of this event to highlight its catalog of solutions for the smallsats market, as well as for satellite constellations and large satellite constellations.

GMV explores collision avoidance solutions on low thrust missions

The proposal drawn up by *Politecnico di Milano and Madrid's Universidad Carlos III* has been chosen by the European Space Agency (ESA) for the project "Assessment of Collision Avoidance Manoeuvre Planning for Low-Thrust Missions", shortened to ELECTROCAM.



The current trend towards low-thrust systems like electrical propulsion, driven by fuel- and cost-saving concerns, calls for a review of collision avoidance procedures. Low reactivity in these low thrust systems means that long constant thrust arcs are necessary to product maneuvers of a similar magnitude to those offered by chemical engines. This introduces new levels of uncertainty into the problem as well as constraints affecting the time available to an operator for deciding whether or not to initiate a collision-avoidance maneuver. The current screening, calculation and decision methods have therefore fallen behind the times.

The project starts by taking stock of low-thrust solutions and uncertainty propagation methods in view of their eventual application in collision monitoring procedures.

Project activities come into their own when identifying the typical profiles in which low-thrust solutions operate. These profiles include all the following: orbit assessment from low-orbit to the typical altitudes of mega-constellations, GNSS or geostationary constellations; orbit maintenance profiles both in absolute terms (how to monitor a reference orbit) and relative terms (e.g., the relative position of GNSS constellation satellites to ensure optimum coverage of the earth's surface).

ESAW 2021

Following on from the success of former workshops, the European Space Agency's Operations Centre (ESA / ESOC) in Darmstadt, Germany, held the eighth European Ground System Architecture Workshop (ESAW 2021) on 2 and 3 November.

ESAW provides an international forum for system experts to swap ideas constructively and catch up on future technological trends in data-system and mission-operation architecture, featuring control, preparation and mission planning; data analysis; archiving and distribution; automation; earth station control and supervision systems; space-earth communication services and support systems.

ESA has called for a series of presentations covering all aspects of mission operation data systems, focusing on collaboration and common solutions for conventional space missions but also taking in the new fields like space safety, integrated applications, constellations, CubeSats, HAPS, robotics, Mars- and Moon-exploration (including Gateway and astronauts-in-the-loop), New Space, Space-as-a-Service, etc. Special attention is also being paid to the application of groundbreaking solutions by using software technology under development, such as virtualization, cloud computing, containerization, DevSecOps, software defined networks, big data, artificial intelligence and machine learning, augmented reality/ virtual reality, cybersecurity, model based system engineering, digital twin, quantum computing.

The event included interventions by experts from European and international space agencies, institutional and commercial operators and key IT firms, GMV among them.

GMV helps to palliate climate change in the European Union

GMV inputs its earth-observation data-mining expertise to the RethinkAction project, coming under the European Commission's Green Deal program

October saw kickoff of RethinkAction, a 4-year research project under the European Commission's Green Deal Innovation and Research program, which aims to help make Europe the first climate-neutral continent.

The project, run by a consortium coordinated by CARTIF, proposes the development of an inter-sector planning and decision-making platform to drive climate action, focusing on direct action to palliate the effects of climate change and with a particular emphasis on land use.

GMV's RethinkAction role draws on its longstanding experience in mining earth observation data to develop a set of standardized processes and tools for collecting and integrating open data and tapping into available repositories as well as setting up an open and standardized database to be integrated in the project platform.

Global land-use resources are fundamental if not critical for meeting Sustainable Development Goals. Land use, after all, is a key factor in climate-change adaptation and is also crucial for many human livelihoods and life itself. Both soil coverage and land use are key indicators for gauging humans' impact on the planet. Soil degradation in general is also a prime factor in the loss of biodiversity. The Earth System, notably, has been recognized as one of the Planetary Boundaries at risk of being transgressed. Humankind is no longer sure of a safe operating space in which people might live and thrive as hitherto.

In this context the main aim of RethinkAction is to back EU Green Deal targets by inputting a practical and relevant plan with actions and solutions involving not only the sustainable use of earth's resources and recovery of biodiversity but also actions of social improvement conducive to a fair and even-handed post-COVID green recovery plan.

The platform developed under this project will allow users to weigh up land-use options to understand the climate-change impact over time, based on 6 representative case studies of the main regional differences.

The consortium is made up by 13 partners from 9 countries, inputting between them expertise in social sciences and humanities, climate change, earth observation and image analysis, plus knowledge of local and global models together with the contribution of ICTs.

Earth Observation, crucial for the transparency of green investments

Reforestation is an important ally in holding off and adapting to climate change. It is hence a key component of New Green Deal talks, pacts and policies worldwide. The European Union is no exception here, running its own European Green Deal and its flagship initiative, the EU Forestry Policy.

GMV is backing these international efforts with its EoForest service, a portfolio of EO-based services to support sustainable forestry.

One of the most recent activities under this heading kicked off in June of this year when ForestPlanet, Inc. contracted GMV to oversee reforestation of a damaged forest area in the Usambara Mountains, in north-eastern Tanzania. Using open-source satellite data from the Sentinel-2 constellation provided by European Copernicus Programme, and free Google Earth imagery, GMV was able to retell the story of the changes in the Kwezizi forest. This forest degraded progressively during 2019; yet, in the fall of 2020, thanks to ForestPlanet and its partners, the area was reforested with approximately 80,000 trees belonging to native species. GMV analyzed satellite data spanning mid-2018 to mid-2021 and was able to prove that the reforestation was a complete success.

Reforestation is crucial for all value-chain stakeholders. Earth observation provides the transparency needed by a business model based on reforestation, benefiting donors, investors and local communities. In today's Kwezizi a sapling woodland with patchwork cropland is now improving soil quality, checking soil erosion and runoff. This is all helping to enhance the climate-change and food-insecurity resilience of local communities. Better woodland also means more tourists and hence an additional source of income for local residents.

This successful collaboration between ForestPlant and GMV has led to a new, recently-initiated contract. The new reforestation scheme, coordinated by ForestPlanet in the Irente Planting site, will take place in December 2021 and GMV will monitor it from space.

Women in Space, the banner theme of 2021's WSW

Every year, under different watchwords and activities, over 90 countries join in Word Space Week (WSW), an international celebration of science and technology, and their contribution to the betterment of the human condition. The idea is to stoke up the new generation's interest in various facets of the space sector.

WSW 2021 revolved around Women in Space, bringing together a total of 3149 events by collaborating organizations. GMV has formed part of this annual movement, as a member of Women in Aerospace Europe (WIA-E), a not-for-profit that, since 2009, has been bringing to wider notice throughout Europe women's aerospace prowess and leadership while promoting the space sector in society as a whole.

On 5 October Madrid's CaixaForum culture center hosted, for the first time onsite, the event "Women in Space" geared towards pupils in the last years of baccalaureate and university courses to give them a better idea of the space sector from the professional's point of view.

Mariella Graziano, GMV's executive manager of robotics and flight systems development and strategy, took part in this chat as part of the panel made up by women space professionals. Other GMV employees helped to draw up and present three WSW 2021 reports or white papers, coordinated by WIA-E, dealing with different thematic blocs of the space sector and especially STEM careers and education, the space skillsets most in demand and the importance of increasing the number of women in executive posts.

The DART launch kick starts the HERA mission

GMVs GNC will guide this mission, penciled in for a 2024 launch, which aims to develop and demonstrate new planetary defense technology and to study the asteroid system after the DART impact

On 24 November NASA successfully launched the Double Asteroid Redirection Test (DART) probe, heading for the small asteroid Dimorphos, which it will deliberately crash into in autumn 2022 in an attempt to tweak its orbit.

DART forms part of the Asteroid Impact and Deflection Assessment (AIDA) mission, an international collaboration between the European Space Agency (ESA) and the North American Space Agency (NASA). Its main remit is to study how far the kinetic impactor technique (by means of DART) can deflect the orbit of a nearby binary asteroid system called Didymos. The after-collision effect will then be monitored and characterized by HERA. This system is made up by two asteroids: Didymain, with a diameter of 780 meters, is the larger; Dimorphos, 160 meters wide and the one NASA's mission is heading for, is the secondary asteroid orbiting the former.

Europe's HERA mission is due to reach the asteroids in 2024 with a twofold goal: firstly, to develop and demonstrate new planetary-defense technology and, secondly, to monitor the asteroid system after the DART impact, gleaning priceless insights for planning strategies against any real risk of asteroid impact against the earth.

HERA has a GMV-developed guidance, navigation and control (GNC) system for guiding a spacecraft to any asteroids that might pose a real impact threat or represent a particular scientific or commercial interest, and also setting up the orbit around it.

HERA's GNC successfully passed its preliminary design review (PDR) to check it meets requirements and to present the system's preliminary design, greenlighting the start of the detailed-design and implementation phase.

Asteroids tend to be small and low-mass, irregular in shape and lie in the little-known environment of outer space. All these factors make it difficult to safely control the spacecraft during the extremely demanding tasks of approach and then navigating around the asteroid. To meet this challenge GMV is developing a groundbreaking GNC system that meets this additional safety requirement and ensures mission success.

The GNC system developed by GMV for HERA autonomously runs the flight plan defined by the human controllers on earth, edging the autonomy level up to complete onboard calculation of the necessary maneuvers for flying at a given height or carrying out an escape maneuver in the event of any collision risk.

GMV is also in charge of designing and developing for this mission the GNC system of Juventas, one of the two CubeSats traveling onboard HERA; once released from the mother craft, Juventas will nuzzle up very close to Dimorphos so that its onboard radar can investigate the asteroid's internal structure before finally touching down.

First Space Legal Congress, The Need for Regulation of the Spanish Space Sector

On November 29th, the Space Committee of the Spanish Institute of Engineering and the Aerospace Legal Observatory, formed by the Spanish Association of Aeronautic and Space Law (AEDAE) and the Research Group GIESA BIOLAW of the Faculty of Law of the Complutense University of Madrid organized in Madrid the "First Space Legal Congress, Necessity of regulation of the Spanish space sector."

The event was attended by representatives of the aerospace industry, the Administration and a round table discussion with elected representatives of different political parties on two essential aspects for the space sector in our country. The first, the need for specific legislation to regulate space activities to provide certainty and legal security to investments and promote and encourage a driving force for R&D and technological development in Spain and to prevent us from falling behind in taking advantage of opportunities compared to the countries around us. The second is the advisability of creating a Spanish Space Agency, as a unifying body for the different fields in this area to facilitate the projects of our companies in the sector.

Jorge Potti, GMV's General Manager of Space and chairman of TEDAE's Space Committee, took part in the round table "Challenges and opportunities in the Spanish space sector. Advisability of a Spanish Space Agency?"

GMV wins Fault-Tolerant Control for Clustered Rocket Engines

November saw kickoff of the ESA project Fault-Tolerant Control for Clustered Rocket Engines (FTC-CRE). The goal of the activity is to design, implement and verify Guidance and Control techniques for reusable launch vehicles with a cluster of rocket engines.

The fulcrum of the Guidance and Control algorithms selection process will be their reconfiguration capabilities in the presence of failures within the cluster of engines. This means that the developed algorithms will be able to cope with failures in the rocket engines and the Thrust Vector Control system responsible for pointing the engines' nozzles, providing the launcher with attitude control.

The topic of Fault Tolerant Control for Cluster of Engine applied to launch vehicles has come back into the limelight in recent times due to the ongoing development of new reusable launchers such as SpaceX Falcon 9 and Starship. Thanks to these developments, and the competitive cost offered by re-usable launchers, Space agencies have been steering the design of new launchers in that direction. This activity is a great opportunity to be at the forefront of the development of this technology in Europe.

GMV is priming this activity, leading a team formed also by TASC Group and SABCA. GMV in inputting its experience in design, implementation and verification of GNC for launch vehicles, topped up with launcher-system expertise acquired within programs such as MIURA and VEGA-E.

Opinion

Robotic's new role, another step towards future automation and sustainability

The coronavirus pandemic has brought many of Spain's productive sectors face to face with sterling new challenges. The manufacturing industry has been one of the sectors hardest hit by mobility constraints, distance-working requirements and the running down of some components. Nonetheless, the coming years look bright, on the strength of technological innovation and spending under Spain's Resilience, Transformation and Recovery Plan (Plan de Recuperación, Transformación y Resiliencia: PRTR).

Here is where robotics, and, where applicable, collaborative robots, really come into their own, not only in terms of improving and streamlining productive processes but also increasing worker safety, due to the high contagion risk in closed environments. Cobots have greatly helped to democratize SME technology takeup, debunking the hackneyed idea that such technology is profitable only for multinational carmakers or the big firms. SMEs have opted for cobots for several reasons, the most important being:

- The acquisition and commissioning costs are much lower than with conventional industrial robots.
- Programming is much simpler and more intuitive.
- The plant footprint is greatly reduced since there is no longer a need to fence it off or install proximity sensors.
- Inertial sensors are capable of predicting a collision with any person and shutting down before causing harm.
- Greater flexibility in moving around the plant and fitting in with the different workloads.

Although the abovementioned factors are deal clinchers when purchasing equipment of this type, perhaps even of greater importance is the ease of integrating cobots with AI systems, enabling the robot's movements to be tweaked in line with dynamic situations as they crop up throughout the day in any production process. The latest developments in parallel computing technology, both onsite and cloud, taken together with the development of new algorithms and AI strategies, have also opened up new possibilities. We at GMV are now carrying out projects to integrate both technologies in sectors as diverse as the following: the chemical industry, for handling samples and waste; farming, for versatile fruit packing of different grades and sizes; or software development itself, for mobile app battery testing.

Finally, it should certainly be noted that the takeup of robotics favors

Ángel Lázaro
Industry Business Partner
GMV's Secure e-Solutions sector

"Cobots have greatly helped to democratize SME technology takeup, debunking the hackneyed idea that such technology is profitable only for multinational carmakers or the big firms"

SDG fulfilment, steering industry towards a new, development-driving but ecofriendly digital model. Once more, AI enables us to make better decisions; the rollout of 5G too will favor progress in healthcare, energy services, production, farming and environment protection. In sum, smart, interconnected machines will be crucial aids in the achievement of "SDG 3. Health and Wellbeing, SDG 9. Industry, innovation and infrastructure" and "SDG 12. Responsible Consumption and Production".

ARISE Project Successfully Completes 5 Field Tests

The ARISE project (Autonomous Robotic InSpEction), which combines an onboard FPGA-based computer, leading planning and autonomous navigation software for mobile robots and LIDAR, has completed 5 field tests. The tests were conducted at the Hollmans mine in Cornwall. Late this year and early next year, additional field tests will also be conducted.

These trials have tested the SLAM (Simultaneous Localization and Mapping) instrument known as SLAMBOX. Mapping precision is important, as the 3D data are used to evaluate safety following explosions, as well as being used to improve other mining processes.

GMV's system creates onboard maps in real time as the robot or a person carries the equipment. The GMV team has also conducted a series of data collections and tests to advance towards fully autonomous operations that will be demonstrated completely early next year.

The goal of ARISE is to develop a robotic platform capable of conducting autonomous inspections of geotechnical conditions during the down time following an explosion, when workers abandon the mine due to the subsequent smoke and seismic risks.

GMV leads this project and has developed the ARISE system for the robot and the instruments. It also uses GMV's autonomous navigation software, Brain, developed originally for space exploration in the extreme mining environment.

Mobile robots and AI will radically improve the world's way of working

Robots driven by artificial intelligence are changing the way we live and work. In the past, surprisingly, AI has not played a great role in the development of traditional mobile robotics. Now, however, as robot takeup is soaring, they are becoming increasingly capable of perceiving and interacting with their environment, opening up a whole new world of mobile robotics development.

The sky is now the limit for Autonomous Mobile Robots (AMRs). Their takeup in such initiatives and areas as Smart Cities, logistics, farming, transport, etc, is set to boost efficiency and enhance our quality of life. GMV, therefore, is now fast-tracking this transformation process with the development, simulation and rollout of AMRs. As well as AI, there are several technologies involved in their development, the six most important being: AI platforms, cloud/edge computing, 5G, cybersecurity, robotics, and precise positioning and navigation systems, where GMV is an international standard bearer.

GMV is now working not only on platform development but also on different use cases for testing and gauging the overarching aim of sustainability. In Smart Cities, for example, GMV is developing AMRs for last-mile deliveries; in controlled environments the company is now using inspection robots. Elsewhere, in road maintenance, GMV is using its technology to automate the deployment and collection of traffic cones, etc.

Miguel Hormigo, Industry Manager of GMV's Secure e-Solutions sector, recently taking part in the marquee energy-efficiency and sustainability event, the Smart Energy Congress, ran through some of GMV's current pipeline projects, such as autonomous last-mile transport in Smart Cities; pesticide-dosing farming drones; and robots capable of undertaking outdoor inspection tasks.

Soil Monitoring for Sustainable Development

GMV recently began the first phase of the ARSH (Autonomous Robotics Soil Health) project for monitoring soil quality, primarily in Northern Ireland. The project is being developed within the framework of activities of the UK's Agri-Food and Biosciences Institute (AFBI), with financing from the British government's Small Business Research Initiative (SBRI).

The purpose of the project is to collect data on soil health to seek out and implement more sustainable farming processes, with a positive impact on the environment through the reduction of the carbon footprint caused by the agri-food industry. The project covers the geographical area of Northern Ireland, where geological and climate processes have given the region a wide variety of soils.

GMV's role in ARSH is in integrating robotics and artificial intelligence techniques in the monitoring process, significantly reducing the costs that are currently involved in analyzing soil topography. The preliminary results of this study will be presented in March 2022.

The AFBI is a multidiscipline organization dedicated to research and development, primarily in three fields of action: natural and marine environment; plant, animal and human health and welfare; and sustainable livestock production.

GMV participates in the ESA-ESRIC Space Robotics Challenge

At the end of November GMV, in collaboration with INTA-CAB and UVA, took part in the ESA-ESRIC Space Robotics Challenge, organized yearly by the European Space Agency (ESA) and Luxembourg's European Space Resources Innovation Centre (ESRIC).

The thirteen teams from Europe and Canada were given 2 ½ hours to find and characterize rocks in a simplified, moonlike terrain.

The robot used in this challenge was the GMV-designed FOXIZIRC rover, equipped with navigation, localization, perception and manipulation technology. INTA-CAB and UVA came together to develop the rover's onboard inspection technology. They were able jointly to analyze the structure and makeup of the terrain and carry out future space-mission strategies.

In the mission's control center GMV's robotics teams were able to solve several problems and safely work the rover remotely.

The 5 shortlisted projects to move onto the final of this European challenge will be announced in January.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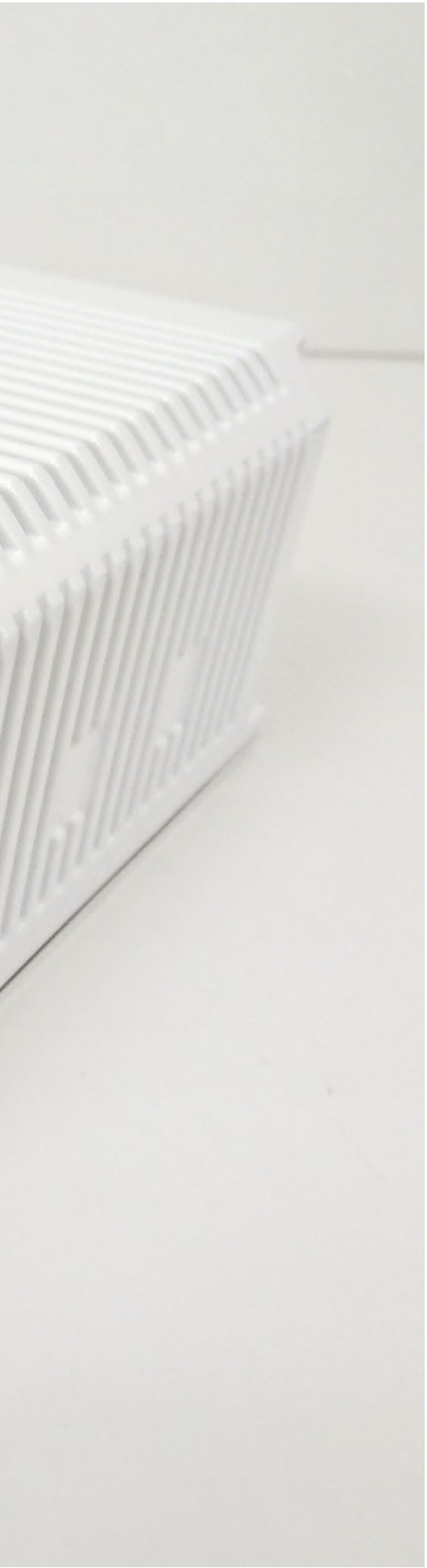


Kickoff of the VCR 8x8's navigation system production phase

GMV's ISNAV is an advanced navigation and timing solution for ground systems, which is able to track the armored vehicle's position with and without a GNSS signal

ISNAV has been developed by GMV within the VCR 8x8 Technology Program. It meets the program's stringent requirements and, fitted in several demo vehicles, it has successfully passed both the mission system integration tests and the functional tests. ISNAV is an advanced timing and navigation system for land systems, designed to include Galileo PRS capability, furnishing advanced Positioning, Navigation, and Timing (PNT) features; these enable it to work out the vehicle's position in scenarios of all types, even without Global Navigation Satellite System (GNSS) coverage. ISNAV has also been designed as a modular system that can be adapted to the particular vehicle sensor and receiver configuration in each case. GMV will produce the 240 ISNAV units in its Tres Cantos manufacturing workshop, inaugurated in 2019. The first units will be delivered in Q4 2023.

GMV's ISNAV provides the vehicle with navigation and timing capabilities to meet the stringent integrity precision requirements and ensure the VCR 8x8 satisfies all the Spanish army's needs for a long time ahead. The lifecycle is estimated to be about 40 years. Spain's army will thus be working with the most modern technology on its worldwide peace and security missions, in an armored vehicle with greatly enhanced communication and performance features.

As if any other proof were necessary, the signing of this contract for the VCR 8x8 production phase confirms GMV as one of Spain's go-to defense navigation firms, with proven expertise on land, earth and sea in platforms such as the RPAS ATLANTE, the SENDA system of the F-110 frigates and now the ISNAV for the 8x8 Dragon vehicle.

GMV joins the consortium looking to shape NATO's future control and surveillance

GMV now forms part of the Atlantic Strategic Partnership for Advanced All-domain Resilient Operations (ASPAARO), a consortium set up by Northrop Grumman Corporation and Airbus Defence and Space together with seven defense firms.

ASPAARO has submitted a bid for carrying out the risk reduction and feasibility studies (RRFS) for NATO's Support and Procurement Agency as part of the Alliance Future Surveillance and Control (AFSC) program.

The feasibility studies are a crucial AFSC milestone, aiming to support NATO countries' decision making for NATO's future surveillance, command and control capabilities, once the current Airborne Warning & Control System (AWACS) fleet has reached the end of its service life in 2035.

The ASPAARO consortium members boast between them a matchless set of skills and capabilities for meeting today's and tomorrow's threats, in order to satisfy NATO requirements across the board. The industry team will draw on its multi-domain concepts, advanced technology and integrated designs to pave the way for a totally interoperable architecture among NATO nations, while driving even more forcefully innovation based on investment and experience.

GMV's input here draws on its Joint Intelligence, Surveillance and Reconnaissance (JISR) experience, especially in Coalition Shared Database (CSD) systems and NATO standards, the company taking on responsibility for the part of the study dealing with communications and information broadcasting. GMV will also participate in the definition of the architecture, requirements, NAF visits and operational concept.

TALOS phases in new capabilities

As part of the ongoing upgrade of the TALOS Command and Control System, developed by GMV for the Directorate General of Armament and Material (*Dirección General de Armamento y Material*: DGAM), GMV is now enhancing its functions with the aim of developing the necessary software for working on up to five different tactical levels and phasing in the intrinsic functions of the Field Artillery Command Post (*Puesto de Mando de Artillería de Campaña*: PCART) at both Division and Army Corps (*Cuerpo de Ejército*: CE) level.

PCART takes part in targeting intelligence and timing activities while also running fire support. In the first case it sees to command and control of field artillery resources and target acquisition, with the capacity of performing tactical damage assessment and running the field artillery's corresponding firing plans. As for Fire Support Management (*Dirección de los Apoyos de Fuego*), the CE's PCART carries out command and control of the Field Artillery Groups (*Grupos de Artillería de Campaña*: GACA) while also performing the programming process, understood as a drawing up of firing plans.

Under development since 2010 for DGAM, TALOS is GMV's inhouse C4I system for the planning, management and execution of military operations at tactical level, allowing integration of various combat functions (command, firing, intelligence, logistics and communications).

This new upgrade, due to run up to late 2023, will allow system users to incorporate fire support functions linked in with the maneuver from army corps to company level, with functions adapted to major field artillery command posts, sharing out responsibilities and streamlining unit command functions.

GMV brings artificial intelligence to maritime surveillance

GMV features prominently in the H2020 PROMENADE project, which sets out to improve ship monitoring systems, allowing the operator to take the best decision at any one time

Mid-October saw the kickoff of the PROMENADE (imPROved Maritime awarENess by means of AI and BD mEthods) R&D project, co-funded by the European Union under the Horizon 2020 program.

The project's prime aim is to improve ship monitoring systems and develop AI systems for automatic detection of any anomalous behavior.

This is no bagatelle; about 12,000 ships will be circulating about Europe's waters on any one day, all of which need to broadcast their position to avoid collisions and facilitate maritime traffic management. Hence the importance of ensuring that this vast amount of information does not overwhelm the decision makers at any time.

The main challenges tackled by the project are threefold. Firstly, to incorporate additional information sources to improve the stock of available information, tapping into information from satellites, open sources, information from European networks like CISE, registered ship risks, balises and historical information. Secondly, to merge all this patchwork of information in such a way as to hive off all useless information and eliminate overlaps, thus improving the individual information of each sensor. Thirdly, the crucial task of detecting any anomalous behavior with enough notice to trigger an early warning in order to deal with the threat.

The development phase will be followed by a demonstration phase in real operational environments in three exercises: one held in the Alboran Sea, other in the Baltic and another in the Ionic Sea.

Under this project GMV is responsible for designing the solution, managing project innovation, setting up data-mining and -merging services and analysis of satellite images and technological leadership of the Spanish exercise, where it will be working with the Office of Justice and Borders and the Office of the Judicial Police of the Guardia Civil, deploying its inhouse Socrates solution.

This new project reinforces GMV's overall maritime surveillance business, working with the top firms and companies in this domain.

The OCEAN2020 project come to an end

In October the Final Review of the OCEAN 2020 was held in the European Defence Agency (EDA) offices in Belgium. Carried out under the European Union's Preparatory Action on Defense Research (PADR), OCEAN 2020 has been the Europe's biggest maritime-surveillance technology development program.

With attendance of EDA and EC representatives, the consortium presented a summary of the activities carried out along the project. A Final Conference was held the day after, targeting the presentation of main achievements, namely the two successful sea demonstrations, providing at the same time an outlook for the future of EU collaboration in the maritime domain.

Coordinated by Leonardo, the OCEAN 2020 was able to bring significant improvement of maritime Situation Awareness through the integration of UXS (Unmanned Systems) with ISTAR (Intelligence Surveillance Target Acquisition and Reconnaissance) capabilities.

GMV has had a twofold participation in the project, from its subsidiaries of Spain and Portugal. Its particular contribution focuses on C2 (Command and Control) and JISR (Joint Intelligence, Surveillance and Reconnaissance), in keeping with the company's international track record in these areas.

GMV also had a significant presence during the second sea demonstration that was held in Hano Bight, Sweden, last August. This demonstration in the Baltic Sea involved 17 European companies, research institutes and defence ministries. Working in a close cooperation with the Portuguese Navy – which provide the GAVIA Underwater Autonomous Vehicle, an unmanned underwater vehicle used to detect mines – GMV introduced a novel an Automatic Target Recognition (ATR) that brings efficiency to the recognition of mines process.

GMV present at the Technological Defense and Security Conference

In September the nineteenth Technological Defense and Security Conference was held. This year's conference, held in the National Technical Aerospace Institute (*Instituto Nacional de Técnica Aeroespacial*: INTA) in Madrid, pivoted around the digitalization of a hyper-connected, autonomous and intelligent world with special emphasis on the key emerging technologies such as artificial intelligence, Big Data, etc.

This two-day, biennial conference, organized by the Foundation called "Círculo de Tecnologías para la Defensa y la Seguridad" (Defense and Security Technology Circle) brought together experts from the armed forces and state security forces, universities, public research organizations (*Organismos Públicos de Investigación*: OPIs) and select companies to debate in lectures and panel discussions the current defense and security environment.

As a collaborating organization, GMV sponsored the conference and was represented in the organizing committee with speaking rights by Manuel Pérez Cortés, GMV's defense and security general manager.

It also took part as technical coordinator in the first session "Military Operations. Combat in the Cloud, Hyperconnectivity and Intelligence", where a paper was given by Ricardo Sáenz Amandi, GMV's defense and security programs manager.

New SISCAP development phase

After completion of three prototypes and an operational demo conducted before Legion personnel, the R&D project Integrated Dismounted Soldier System (*Sistema Integrado del Combatiente a Pie*: SISCAP), designed by GMV in a joint venture with Indra, has now entered a new phase.

SISCAP was set up in 2017 by the Directorate General of Armament and Material (*Dirección General de Armamento y Material*: DGAM) of the Spanish MoD to develop and integrate technology to equip future dismounted soldiers with the requisite combat operation resources. The program is broken down into 7 subsystems: Armaments and Munitions (*Armamento y Munición*); Fire Efficiency (*Eficacia de Fuego*: EFU); Communications and Information Subsystem (*Subsistema de Información y Comunicación*: SIC); Upkeep (*Sostenimiento*); Survival (*Supervivencia*); Power Source (*Fuente de Alimentación*: FAL); and Training (*Preparación*).

SISCAP centers on the research, design, development and validation of the communication and information subsystem functions to ensure soldier connectivity, such as the system's screenless computer, device control components, helmet-mounted display, platoon leader's graphic terminal, soldier's control unit push-button panel and built-in sensors (personal camera and wireless laser telemeter). A new EFU version will also be developed and vetted to boost capacities of detection, recognition and acquisition, together with the basic components.

The new phase, recently kicked off, aims to improve the most important aspects as flagged up in previous phases, featuring all the following: equipping and testing of a 7-unit platoon; new management, loading and energy-distribution solutions; boosted resilience; new visor HMI to improve system usability; introduction of augmented reality; and optimization of weapon optronics.

SISCAP's design is based on lessons learned in Spain's forerunner dismounted soldier program (COMFUT) running from 2007 to 2011, and on recommendations laid down in EDA's Generic Open Soldier System Reference Architecture (GOSSRA).

iMUGS demonstrates unmanned system deployment

In September Latvia hosted the second of the six demos programmed under the Integrated Modular Unmanned Ground System (iMUGS) project.

iMUGS came into being in 2020 with the aim of developing a modular, cybersecure and scalable architecture for hybrid manned and unmanned systems. Its remit is to standardize a Europe-wide system for terrestrial platforms; command, control and command equipment; sensors; payloads and algorithms. The operational challenges to be tackled include improvement of operability, enhanced situational awareness and speeding up of decision making.

iMUGS is being run by a consortium primed by Milrem Robotics, with the participation of another eleven hi-tech defense companies, including GMV.

GMV is 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 Joint Intelligence, Surveillance and Reconnaissance (JISR) interoperability. The overall aim is to develop the C2ISR tactical component for planning and carrying out unmanned systems operations autonomously under remote control, while also distributing the land vehicle's sensor data to ISR networks.

In this demo Latvia's armed forces used Milrem Robotics' THeMIS unmanned ground vehicles (UGV) in two different scenarios to show the advantages of the combined use of manned and unmanned vehicles. These scenarios showed that unmanned systems, duly enhanced with groundbreaking communication systems and diverse defense technology, can be used to cull and share tactical information, boost situational awareness, cut down the troops' physical burden and boost protection of the forces.

GMV features as an innovation powerhouse in FEINDEF

From 3 to 5 November GMV took part in the second International Defense and Security Tradefair (*Feria Internacional de Defensa y Seguridad*: FEINDEF), held in Madrid and organized by the Spanish Association of Space, Aeronautics and Defense Technology Companies (*Asociación Española de Empresas Tecnológicas de Defensa, Aeronáutica y Espacio*: TEDAE) and the Association of Government Contracting Firms (*Asociación de Empresas Contratistas con las Administraciones Públicas*: AESMIDE) with the collaboration of the Spanish MoD.

GMV's stand, featuring its groundbreaking defense and security systems, attracted visits from such notable institutional figures as the Army Chief of Staff, Amador Enseñat y Berea, the Navy Chief of Staff, Antonio Martorell Lacave and the Airforce Chief of Staff, Javier Salto Martínez-Avial, as well as the chiefs of logistic support of the army, navy and airforce (MALE, AJAL and MALOG) plus several international delegations from such countries as Poland and Turkey.

Under the Joint Intelligence, Surveillance and Reconnaissance (JISR) heading, GMV exhibited its CSD SIERRA suite and the system for storing and distributing products for the CSD Enduring Solution project, awarded by NATO's Communications and Information Agency (NCIA). Other command and control, surveillance and reconnaissance systems developed for the MoD and international agencies were also on show, such as the TALOS program, the FRONTEX EUROSUR´s network and the EUCCIS program for EEAS.

GMV also showcased its skills and expertise in the development of critical software and the development of systems and equipment, notably the SENDA navigation system to be integrated into the F-110 frigates, the navigation and timing system for armed forces vehicles, ISNAV, to be fitted on the VCR 8x8 DRAGON vehicle. Also displayed were the Dismounted Soldier System (*Sistema de Soldado Combatiente a Pie*: SISCAP), developed in a joint venture with Indra, and the unmanned aerial systems (UAS) Seeker, Solo and Passer, developed jointly with Aurea Avionics.

As a member of SATNUS SL, the consortium coordinating in Spain all activities of the Remote Carriers Technology Pillar of FCAS's Next General Weapons Systems (NGWS), GMV also featured on FCAS's stand. As part of the SMS initiative, which sets out to develop and promote solutions for missile systems and other high-performance guided munitions, FEINDEF was also the occasion for signing two collaboration agreements between SMS and the companies AVIBRAS and INSTALAZA.

Opinion

Tourism Cybersecurity, what if you're next?

Tourism, one of the stalwarts of Spain's economy, accounted for over 12% of the country's GDP in 2019; this plummeted to 5% in 2020, representing the worst crisis in its history. Always pretty technology-intensive, the sector has been forced to speed up its digitalization process to cope with the pandemic, in an attempt to give its customers greater comfort and safety in an atmosphere of complete trustworthiness.

This fast-tracked digitalization affords many important advances but it also has the downside of posing considerable risks, especially if speed is achieved at the cost of cutting cybersecurity corners. Spain's tourism sector, indeed, lies well below the average cybersecurity takeup in the business fabric as a whole; no wonder, therefore, that it is becoming one of the cyber-attackers' prime targets.

Major national and international companies and organizations have now come into the attackers' crosshairs, despite the most robust protection measures. And any attack, even if not wholly successful, will always do some commercial harm.

It is therefore crucial to be able to pinpoint existing threats, head off attacks or get the business back on track as quickly as possible afterwards.

The main risks faced by tourism companies are attacks directed at Apps, remote access, Wi-Fi systems, information theft and sensitive data. Malware attacks, especially in the form of phishing, are now commonplace, with the theft of clients' credit-card data, loyalty data and personal data. Ransomware, notably, was one of the main threats last year; Spanish companies' mean recovery cost came out as 500,000 euros in 2021 (Sophos State of Ransomware for 2021).

Any cyberattack, besides its economic impact, can also dent any organization's reputation, even leading to a dip in clientele. It should also be borne in mind here that any information leak can be punished under the GDPR, with harsh fines ranging from 4% of yearly turnover to 20 million euros.

The global outlook, therefore, is grim. The only antidote is a cybersecurity plan forming part of the company's overall strategy, capable of guaranteeing protection of its systems and infrastructure. This would involve such measures as pentesting, secure Wi-Fi, perimeter security, data protection, secure cloud access, design-up security DevSecOps or security checks flagging up any threats. Crucial too is the work of bringing this home to everyone involved, training up all employees in good cybersecurity practices, since employees themselves are often the weakest link.

Nor should we forget that in 2022 cyberattacks will continue to increase and threaten organizations of all types in all sectors. Are we up for this? What if you're next?

Joan Antoni Malonda
Tourism Business Development
GMV´s Secure e-Solutions sector

> "Tourism sector has been forced to speed up its digitalization process to cope with the pandemic, in an attempt to give its customers greater comfort and safety in an atmosphere of complete trustworthiness"

JuevexISACA: Current trends in Business Information Governance

The Madrid Chapter of the Information Systems Audit and Control Association (ISACA) held in September the conference #JuevexISACA on “Current trends in Business Information Governance”.

Mariano Benito, CISO of GMV’s Secure e-Solutions sector and a recognized ICT privacy and cybersecurity expert, was an invited guest to talk about “2021 Cybersecurity Governance Models”.

Cybersecurity for CEOs: how to forestall and fend off an attack

In October the organization CRE100DO put on the session “Cybersecurity for CEOs: how to forestall and fend off an attack”. Guest speakers included experts from Spain’s National Cybersecurity Institute (INCIBE in Spanish initials) and from the industry plus professionals from several firms like GMV. Javier Zubieta, marketing and communication manager of GMV’s Secure e-Solutions sector, shared his knowledge and gave his recommendations to ensure readiness against any cyber-attack.

Cybersecurity solution for control centers

GMV develops a solution specifically designed to protect space-mission control-center work stations to ensure confidentiality, integrity and availability

Control centers are the most sensitive element of a mission when in operations. They are the eyes, the ears, the brain and the muscles of every mission. Everything that happens in the operation of a mission happens in the control center. It is therefore paramount that the control center behaves reliably and is well protected against any scenario that can, depending on the mission, compromise its confidentiality, integrity and / or availability. Such threat scenarios can be motivated by intentional attacks –external or internal- or by accidents caused by well-intended actions from users (e.g. employees, contractors, etc.).

After a thorough risk analysis, several measures need to be applied to mitigate the above threat impacts following a concept of defense in depth. Often, these measures are also dictated by internal or external regulations the operator or the control centers need to comply with.

The problem is that control centers have very specific characteristics which prevent the application of solutions which are commonplace in almost any other IT infrastructure. User authentication and authorization is a clear example. In control centers computers need to be always on, showing telemetry data, so that operators can immediately spot and react to any anomaly. 24/7 operations also require non interruptible monitoring and shift change as smooth as possible. Consequently, generic accounts for controllers or operators can be preferred to individual accounts and authentication mechanism limited to the minimum.

However, restricting access to the control center workstations and having traceability is an important deterrent and detection control for insider threats (unlikely but highly impacting) as well as effective mechanism for improving traceability of actions to users thus reducing bad-practices and improving training of operators.

We face therefore this duality, on one hand user authentication, authorization and traceability at workstations is an important, often mandatory security control to comply with regulations, but on the other hand there are no technological solutions to fit the specificities of control centers. This duality is often solved by having a strong physical access control to the control room, well-trained trustworthy operators, and accepting the remaining residual risk.

GMV proposes a specific solution aimed at protecting the wokstations of the control center, “biolock”. The solution allows:

- To maintain workstations always visible with telemetry data,
- meanwhile to lock any interaction with them until the user authenticates,
- to authenticate very quickly with a contactless badge,
- the workstation to remain unlocked while the user interacts with it,
- and to lock automatically again when idle.

The solution is controlled and monitored from a central server which permits the management of user privileges, workstations and logs.

ITH Innovation Summit: Innovation, Technology and Cybersecurity in the Tourism Sector

This year's ITH Innovation Summit (5 and 6 October) proved to be a fruitful meetup of tourism and technology experts.

Organized by Spain's Technological Hospitality Institute (*Instituto Tecnológico Hotelero*), the 2-day event looked at tourism's innovation and technology picture. Cybersecurity had its own panel: Dialogue and Doubts. Cybersecurity under the Spotlight (*Diálogo y dudas. Ciberseguridad a la palestra*) with the participation of Joan Antoni Malonda, Tourism Business Development of GMV's Secure e-Solutions sector.

Malonda ran though the digital risks hovering over the tourism sector. Tourism companies, after all, as custodians of a huge amount of sensitive client information, tend to be one of the favorite targets of cybercriminals. Malonda gave some recommendations to help ensure readiness against any attacks: "A vulnerability audit is crucial here, to find out where we stand, analyze company risks and gain an overview to correct these errors".

Other aspects brought out by Malonda's speech were the importance of working with a cybersecurity plan knitted into the company's overall strategy, as well as a personnel awareness-raising plan. He also stressed the importance of training to shut off one of the main attack vectors: the employees themselves.

Harbor Cybersecurity

The 6th Harbor Logistics Forum, centering this year on cybersecurity, invited GMV to take part as a top-ranking cybersecurity firm.

Organized by Alicante Harbor Authority (*Autoridad Portuaria de Alicante*: APA) and Distrito Digital these forums aim to help set up synergies between local firms and boost their innovation strategies.

The event, attended by representatives of Spain's harbor authorities, was inaugurated by Antonio Rodes, Director General of Valencia Region's Thematic Projects Society (*Sociedad Proyectos Temáticos*), while the closing address was given by Carlos Eleno, Director of Alicante Harbor Authority and Juan Ignacio Torregrosa, Director General for Advance of the Digital Society of the Regional Ministry for Innovation, Universities, Science and Digital Society of the Catalan Regional Authority (*Generalitat*). Luis Fernando Álvarez-Gascón, director general of GMV's Secure e-Solutions sector, on behalf of the company, gave a paper looking at the economic and reputational impact of a cyber-attack on harbor or logistic infrastructure. He also explained how to tackle security, manage critical and non-critical infrastructure risks as well as GMV's enabling technology and practices to help its clients protect themselves from cybercriminals.

León again hosts the International Information Security Encounter

Spain's National Cybersecurity Institute (*Instituto Nacional de Ciberseguridad*: INCIBE) has once more held the International Information Security Encounter, as an onsite event in the city of León.

ENISE aims to generate business opportunities, fast track internationalization of Spain's industry, stimulate networking, foment cybersecurity entrepreneurship and innovation and debate trends, solutions and challenges.

As sponsor of the event, GMV ran a stand displaying its inhouse solutions and services, taking in the whole cybersecurity lifecycle: identification, protection, detection, response and recovery.

Grupo Santillana's cybersecurity strategy

Under the banner theme "Digital Security: all change" the magazine SIC held in October the 21st World Privacy, Information-Security and Cybersecurity Congress (*Congreso Global de Cybersecurity, Seguridad de la Información: Securmática*), one of Spain's flagship cybersecurity get-togethers, where the top cybersecurity professionals talk about major projects, initiatives and approaches.

This year, GMV's GMV-CERT (Computer Emergency Response Team) boss, Oscar Riaño, accompanied Grupo Santillana's CISO, Rodrigo Nalda, to present the latter company's cybersecurity strategy.

Some years ago now Santillana launched a new, forward-looking education strategy, bringing in groundbreaking digital ideas in the 22 countries the group trades in. This thoroughgoing educational shakeup involved the adoption of new protection strategies, focusing on security as the core of the whole process, mindful too of the importance of working with services and tools that can come up with an answer to current challenges in a global and uniform fashion.

Santillana's global security strategy has always conceived working hand in hand with a leading managed security firm. Enter GMV, providing Santillana with services through its specialized GMV-CERT.

Under this arrangement GMV orchestrates the various security solutions, upping the value of specific services such as operation and administration of security technology, global vulnerability management through its inhouse ***Gestvul*** system, security hardening of equipment, advanced security monitoring, threat intelligence and security incident management.

Services are rendered globally, taking in all countries Santillana trades in and designing a hybrid, flexible and adapted security-event intake and correlation architecture, as a service to meet the company's present and future needs.

11th Cloud Security Alliance Summit

The Spanish Chapter of the Cloud Security Alliance, an initiative of ISMS Forum, held in September the 11th Spanish Cloud Security Alliance Summit.

This eleventh summit, held in Madrid, revolved around three main thrusts: firstly, the national and international regulatory framework, with Spain's new National Security Scheme (*Esquema Nacional de Seguridad*: ENS) and the NIS (Network and Information Systems) Directive coming under scrutiny; secondly, the European Alliance for Industrial Data and Cloud, focusing on cybersecurity's role in edge and cloud cybersecurity as generation infrastructure; and, thirdly, the strengthening of Europe's industry.

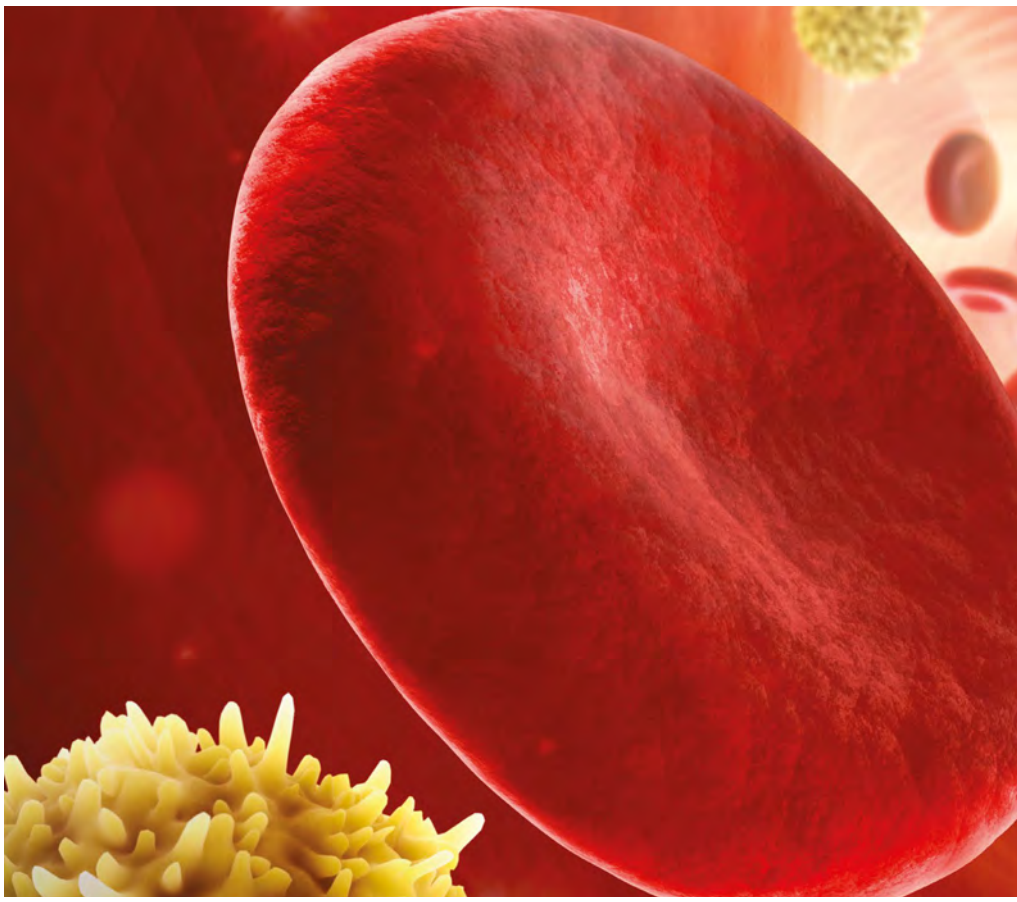
Mariano J. Benito, CISO of GMV's Secure e-Solutions sector and Coordinator of the Operational Technical Committee of the Spanish Chapter of the Cloud Security Alliance, was given top billing at the event, presenting the conclusions of the 9th Study of the State of Cloud Security.

1st Virtual Congress of the Spanish Radiation Oncology Society

As part of the 1st Virtual Congress of the Spanish Radiation Oncology Society (*Sociedad Española de Oncología Radioterápica*: SEOR), GMV organized a panel discussion to look at the benefits of intraoperative radiation therapy (IORT) for treating certain tumors, with the aid of GMV's inhouse IORT planner, ***Radiance***.

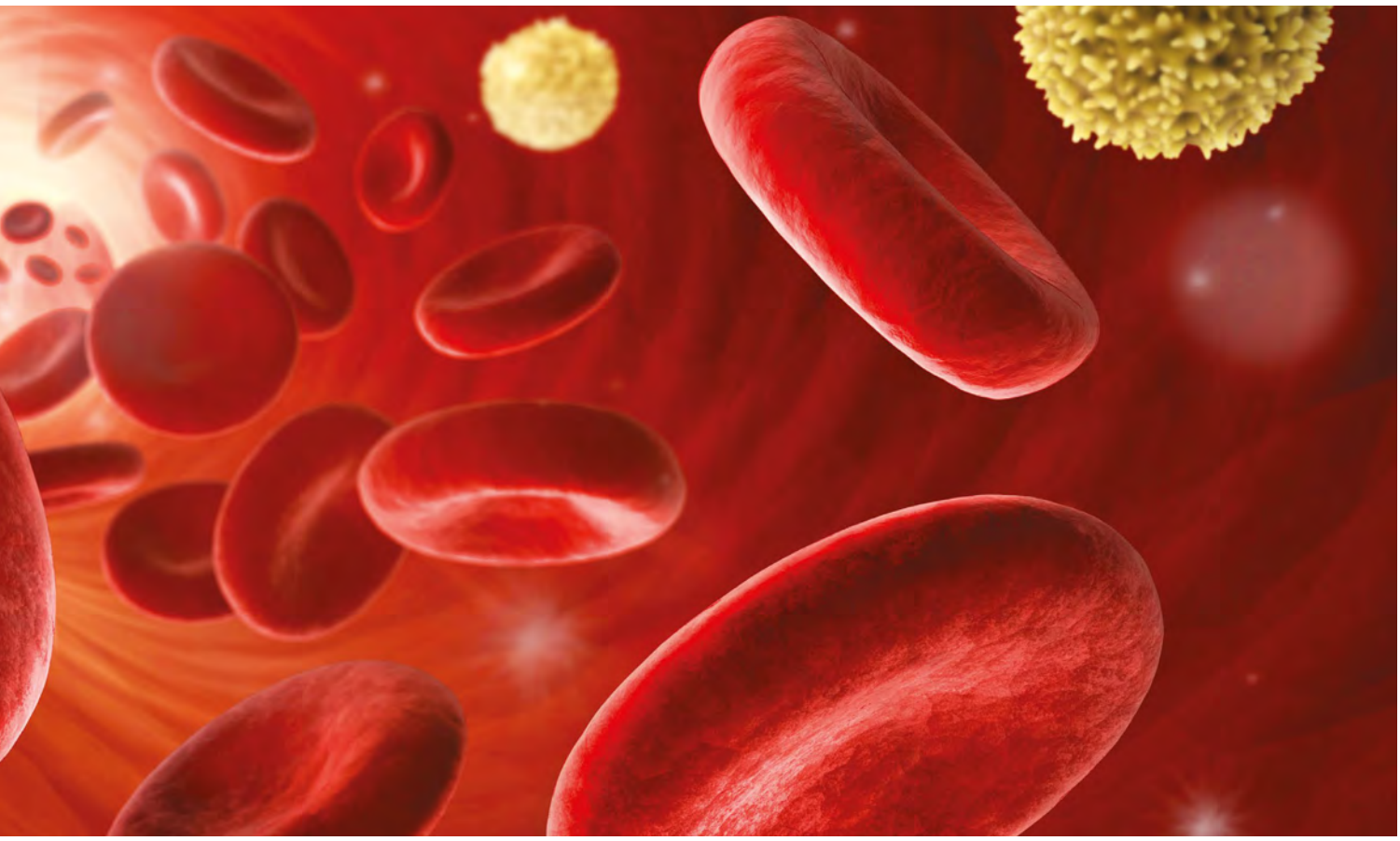
Doctor Pedro Lara (President of the Radiotherapy Oncology Group of the European Union Medical Specialists (UEMS); President of the National Radiotherapy Oncology Committee (*Comisión Nacional de Oncología Radioterápica*) of Spain's Health Ministry; radiology professor and lecturer at the Universidad Fernando Pessoa Canarias; Oncology Department Head of the Hospital *Universitario San Roque*; Director of the Canary Cancer Research Institute (*Instituto Canario de Investigación del Cáncer*) presented a paper giving concrete cases where IORT has greatly boosted healthcare results.

One of the most "important advantages" of GMV'S IORT planner, he explained "is calculation of the exact IORT dose to be administered, giving a 3D image and record of performance" during IORT treatment of cancer patients likely to benefit from this technique. Carlos Illana, product head of GMV's Secure e-Solutions sector, took care of the technical side of the presentation, running through the history of IORT and giving specific examples where it has proven its mettle. He also explained that GMV was now working on operating-theater medical imagining developments that are set to bring in "a substantial improvement in tumor operations".



Europe's first hematologic malignancy map applying big data and artificial intelligence

The HARMONY Alliance applies cutting-edge big data and artificial intelligence analysis technology developed by GMV, to draw up Europe's first hematological malignancy map



GMV has won the ongoing trust of the HARMONY Alliance, participating in its second project, HARMONY Plus, as leader of the work package guiding HARMONY data towards a databank form, with patient information from different sources to facilitate clinical studies, backing all this up with the design of control arms. The new services to be phased in by the company will also boost the platform's capability of mining the results of scientific research, in order to achieve more sustainable services.

As project technology partner, GMV aims to implement big data and AI technology in pursuit of HARMONY's overarching goal: to cut down development- and bringing-to-market times of new treatments and innovating medications for applying precision medicine and making headway towards personalized healthcare.

In the first years of work the HARMONY Alliance has managed to cull patient data from 12,000 cases of myelodysplastic syndromes, over 40% from the Spanish Myelodysplastic Syndrome Group (GESMD in Spanish initials). "A sufficiently large sample has now been obtained with cases throughout the whole of Europe, from which to draw the necessary clinical evidence", argues Jesús María Hernández, specialist of the Hematology Service of Hospital Universitario de Salamanca and coordinator of the HARMONY consortium.

Mining of this vast amount of data with digital tools gives new insights that boost the analytical capacity and research accuracy. In the words of Doctor Guillermo Sanz, scientific director of the Instituto de Investigación Sanitaria La Fe de Valencia, and coleader of the Alliance "the HARMONY big data platform set up by GMV enables Alliance researchers to draw up the first European map of hematological malignancies by harmonizing the shared data, safeguarding patient protection and privacy at all times". This will facilitate "healthcare decision-making conducive to more efficient and safer treatment".

Inmaculada Pérez Garro, for her part, Digital Healthcare Director of GMV´s Secure e-Solutions sector, stresses the key role of digital technology in this project. "This has made it possible to guarantee abidance by all personal healthcare data protection legislation and to draw valuable insights from a huge amount of data that, without this technology, would have been unmanageable".

This hub pools the research efforts of over 150 hematological neoplasm experts, more than 80 public-private organizations of 18 European countries and extends their research to all hematological neoplasms, incorporating those left out of the initial research, such as myeloproliferative neoplasms (MPN). HARMONY forms part of the public-private program Big Data for Better Outcomes of the influential European organization Innovative Medicines Initiative (IMI), co-funded equally by the European Commission and the European Federation of Pharmaceutical Industries and Associations (EFPIA).

Antari lowers the pressure on health systems

■ 30% of patients have benefitted from remote healthcare procedures during the lockdown. This is the finding of the study "Lockdown internet use for telehealth medical consultations", drawn up by the *Instituto ProPatiens*, with the participation of GMV.

The document concludes that telemedicine has a lot going for it. Main advantages are improved monitoring of chronic patients to relieve the health system of some pressure in such stressful times as this current pandemic and the favoring of sustainability. The center-spread interview of Carlos Royo, health-strategy director of GMV's Secure e-Solutions sector and president of the Spanish Association of Electronics, Digital Contents and ICT Companies (*Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales*; AMETIC), brings out the importance of these aspects and explains the role of telemedicine platforms like ***Antari Professional*** in these endeavors.

The executive considers that the COVID-19 pandemic has tripped many alarms. Worldwide health systems have come under a terrible strain, some even collapsing completely. He therefore stresses "the need of tackling the health sector digital transformation, following the lead of other sectors like finance, and we have to do this now if we wish to guarantee the sustainability of Spain's national health system".

As Royo explains in the document, AMETIC's Digital Healthcare Committee has been defined as a healthcare *Macroproyecto tractor* (public-private collaboration project designed to promote industrial innovation and the digitization of public services) that has been jointly driven by FENIN, FARMAINDUTRIA, SEIS, CEVE, ASEBIO, AECHAIN FEFE, CEAPs, ASPE, AMAT, FUNDACIÓN ONCE, ARAHEALTH, ANEA and UNESPA. Telemedicine-favoring actions scheduled for the next five years have been put forward as a model to ensure system sustainability and help to bring in more personalized medical procedures. Many of these actions have already been enshrined in Spain's various digitalization schemes like the Economic Resilience, Transformation and Recovery Plan, *España Puede* and *Agenda Digital 2025*.

Soft tissue simulation for computational planning of orthognathic surgery

■ The September issue of the Journal of Personalized Medicine, an international journal publishing research articles and information on breakthroughs in personalized medicine, included the article "Soft tissue simulation for computational planning of orthognathic surgery". GMV specialists Carlos Illana, Patricia Alcañiz and Ángel Villalobos have put their heads together to draw up this research article together with opposite numbers from the Computation Sciences Department of Universidad Rey Juan Carlos; physicians and engineers from the Biomedical Research Foundation (*Fundación para la Investigación Biomédica*) of *Hospital Universitario La Paz* and *Hospital Universitario La Paz*.

The article explains that simulation technologies offer promising opportunities for computer planning of orthognathic surgery. It proposes addressing corrective mandibular surgery in a holistic manner, ignored hitherto, paying special attention to modeling the coupling of rigid-bone and soft-tissue components of the facial model, so that the resulting model is computationally simple yet accurate, offering patients better results.

Carlos Illana, product head of GMV's Secure e-Solutions sector, explains that "the results presented in this article are fruit of collaborative work between the Hospital La Paz, the Universidad Rey Juan Carlos and GMV". Application of more precise deformation-simulation algorithms with ultra-rapid implementations offers "surgeons a surgical-planning tool to simulate surgical results with uncanny realism at practically interactive rates".

AI and Real World Data for improving cancer treatment

The OPTIMA project seeks to improve prostate-, breast- and lung-cancer treatment applying cutting-edge GMV technology for data access, management and harmonization

GMV is bringing its technology to bear on the OPTIMA project, which, tapping into the latest technological breakthroughs, aims to provide cancer patients with an individualized treatment regime. A platform will be set up for distributed access to and mining of big data from a wide-ranging network of European hospitals. The company is responsible for providing data access, management and harmonization pursuant to the European standard OMOP, plus platform design and extraction of complex information by applying Natural Language Processing technology.

OPTIMA is being driven by the European Union and the pharmaceutical industry through the Innovative Medicines Initiative (IMI), working with a 21.3-million-euro budget and the participation of 36 leading companies in the fight against cancer.

The developed platform will apply artificial intelligence procedures to Real World Data in order to come up with an answer to the most pressing questions in breast-, prostate- and lung-cancer research, especially where current evidence is weak or left out of medical guides. One of the key aspects is the use of technology to access and train up artificial intelligence algorithms in distributed environments, safeguarding privacy and security obligations as laid down in Europe's General Data Protection Regulation (GDPR).

The platform by now has 200 million records of the three abovementioned types of cancer, making OPTIMA one of the world's best prepared and most ambitious research cancer projects. Javier Téllez, Innovation Manager of GMV's Secure e-Solutions sector, points out that "OPTIMA is spearheading healthcare innovation in Europe, and GMV will be applying all its expertise built up in other large-scale healthcare research projects like EHDEN, PIONEER or HARMONY". He goes on: "our specific goal is to push back the envelope and facilitate access to massive datasets in a secure and distributed way, turning artificial-intelligence and predictive-analysis tools to the best possible account. This has previously been impossible due to the meagre access to quality data". Another important feature of the OPTIMA platform is that "it will be possible to use it for other types of cancer and the evidence generated will facilitate implementation of efficient healthcare policies".

The OPTIMA consortium is being jointly led by Professor James N'Dow of the European Urology Association and Dr. Hagen Krüger, Medical Director Oncology, Pfizer Germany.

The NAPO project continues to bring healthcare to the far-flung populations of the Peruvian Amazon

The NAPO project (Social innovation with connectivity and healthcare: 3G cell telephony and child-maternity healthcare in Amazon communities), brokered by the Spanish foundation EHAS, kicked off back in 2016. GMV has been chipping in with its ***Antari*** telemedicine platform. NAPO aims to roll out telecommunications infrastructure in an especially isolated area like the Peruvian Amazon, seeking to harness the potential of ICTs to improve public health services, opening up new opportunities, empowering the local population and achieving more sustainable development.

To check out how the project is going in person, Spain's ambassador in Peru, Alejandro Alvargonzález, visited the far-flung Peruvian Amazon communities in Nuevo San Román and Negro Urco. His retinue included the president of Fundación EHAS, Ignacio Prieto, and representatives from the Spanish Agency of International Cooperation for the Development of Peru (*Agencia Española de Cooperación Internacional para el Desarrollo de Perú*), GMV being represented by Óscar Gaspar, Country Manager of GMV´s Secure e-Solutions sector in Colombia.

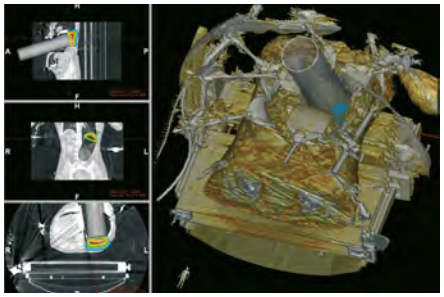
Gaspar also dropped into local schools and gave out teaching material.

GMV is collaborating in this splendid project by making its ***Antari*** telemedicine platform available and providing support to adapt it to the River Napo healthcare network.

GMV features among the main intraoperative radiotherapy players

The latest market research report "Intraoperative Radiation Therapy Market" published by MarketsandMarkets™ hails GMV as one of the top intraoperative radiation therapy (IORT) players on the strength of its inhouse development ***Radiance***.

According to this report IORT products and services are set to soar in coming years, the spending likely to increase by over 6% up to 2025 to reach a figure of 66 million dollars. GMV's inhouse IORT planner ***Radiance***, the first and still the only one of its type in the world, has now been taken up by hospitals from nearly a score of countries around the world.



National Hospital Congress

GMV took part in the 22nd National Hospital Congress (*Congreso Nacional de Hospitales*), held from 15 to 17 September by the Spanish Health Executives Society (*Sociedad Española de Directivos de la Salud*: SEDISA) and the National Nursing Executives Association (*Asociación Nacional de Directivos de Enfermería*: ANDE).

José Carlos Baquero, Artificial Intelligence and Big Data Manager of GMV's Secure e-Solutions sector, took part in the discussion panel on Artificial Intelligence in the Management of Healthcare Results, presenting ***uTile***, GMV's inhouse development allowing organizations to create spaces of federated data with a common model. This helps to draw up reports, stats analyses and perform machine-learning tasks with data, including healthcare data.

As the GMV executive explained, "Encryption means we no longer have to choose between data privacy and data sharing. These two concepts can now be combined". Federated networks, he goes on "wipe out bias and make it possible to exchange information securely, providing a more realistic view of clinical treatment results".

Gdańsk modernizes its Passenger Information System

The contract awarded to GMV includes delivery of new information panels and the launch of a new platform to manage them

Gdańsk has signed with GMV a contract for the expansion of the Passenger Information System (PIS). The contractor's task will be, among others, the delivery of 84 new PIS panels – 62 in entirely new locations and 22 as part of the replacement of the oldest devices –, as well as the launch of a new platform for managing the panels, integrated with the city's TRISTAR system.

The new contract of GMV with the Directorate for the Development of the City of Gdańsk (DRMG), together with the Public Transport Authority (ZTM) in Gdańsk, includes the delivery and installation of 84 LED Passenger Information System panels that will jointly operate with the new platform and application for managing the panels, integrated with the TRISTAR system. The newly developed platform will enable any expansion of the system of stop panels in the future.

The source of data on the estimated time of arrival of a vehicle at a stop, indicated on the above-mentioned panels, will be the SAE software, previously implemented by GMV in Gdańsk within the scope of the TRISTAR project. The contractor will also be responsible for delivering servers.

The PIS application should be developed at the beginning of the second quarter of 2022 (180 days from the date of concluding the contract), while the installation of the panels at the stops is planned for the end of the that The DRMG intends to allocate 8.711 million PLN for the modernisation of public transport. Proposals from three other parties were also taken into account in the tender for the implementation of the Gdańsk project.

The planned modernisation is part of a long-term and multi-stage investment of the Municipality of the City of Gdańsk, realised under the common name of the "Gdańsk Public Transport Project" (GPKM) and aimed at creating and maintaining a competitive collective transport system, which will be adapted to the needs of the inhabitants and people coming to Gdańsk.

New ITS for Granada

It will allow passengers to pay with contactless farecards, QR codes and EMV cards, either physical or host-card emulation in smartphones

GMV continues to be one of Grupo ALSA's go-to suppliers, winning a contract for renewing its 210-bus ticketing and fleet-management systems, previously supplied by GMV too. This transaction follows on from ALSA's takeover of the company Transportes Rober, S.A., which runs the urban transport of the city of Granada.

This new contract includes supply of onboard equipment with driver consoles and validators allowing passengers to pay their fare with contactless farecards, QR codes and EMV cards, either physical or host-card emulation in smartphones.

The driver's console, featuring voice and data communications with the control center, will run fleet-management functions by sending positioning information. It will also inform the driver of any delay or advance on scheduled running times and manage the current onboard information system (LED screens and PA).

Vehicles will also be fitted with an emergency button to trip alerts that simultaneously send the sound environment to the control center. Ridership counters will also be fitted on some buses.

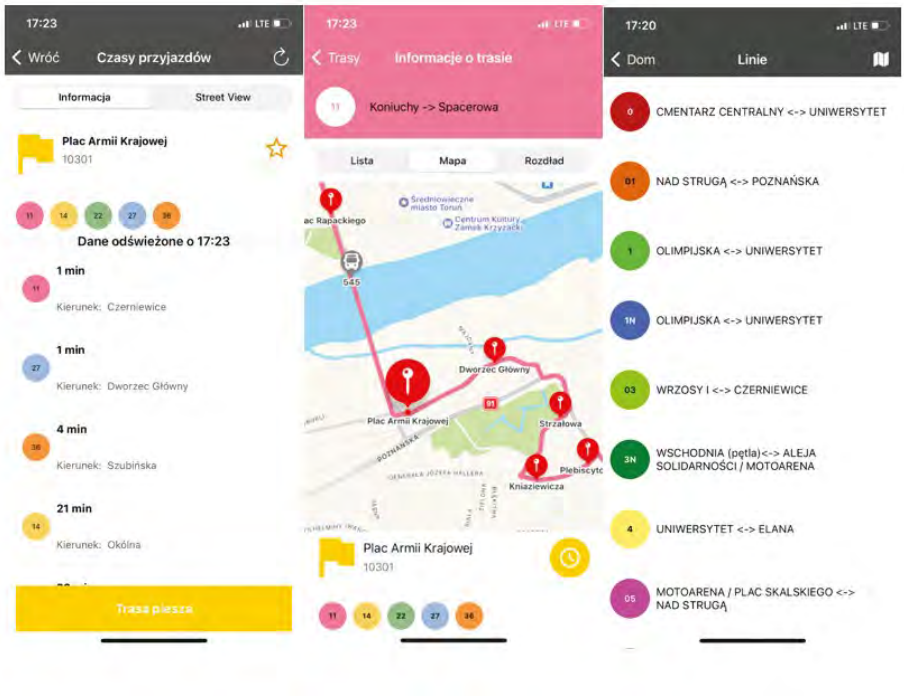
On the passenger side, a web is also to be supplied, giving information on lines, running times and passing times at each stop. Street panels will be overhauled and updated as well as the ticket vending machines and free-standing validators of the line running through the center of Granada city. These upgrades bring existing systems into line with the new one, including the use of new forms of payment with new farecards, QR codes and EMV. GMV will also be supplying 30 smartphone-type terminals for ticket inspection tasks.

The control center will be fitted with fleet-management applications to keep track of vehicle locations and flag up any late or early running, plus regulation tools for adjusting the service as necessary to improve its quality. The system will also have an open data interface with web services for publishing service information for any possible third-party integrations.

Ticketing applications will allow configuration, operation and the drawing up of reports plus integration with external tools for internet farecard recharging.

This new award cements GMV's position as Granada's go-to supplier of urban ITSs.

Toruń launches new public transport management infrastructure



The expansion of the fleet management and dynamic passenger information system in Toruń public transport has come to an end. GMV completed the works related to the development of a new ITS system for managing bus transport and related to the connection of the tramway system working in the city since 2014.Within the performance of the contract, GMV equipped 115 buses of the Toruń Municipal Transport Authority (MZK) with driver's consoles and onboard computers with GPS. The central software of the system also underwent thorough modernisation, being enriched with new modules such as the programme for visual planning of the bus and tram transport network topology and timetables. This solution allows optimisation of fleet utilisation, more efficient planning of rolling stock service schedules, as well as quicker generation of timetables for drivers, stops, and the website.

The inhabitants are informed about the planned time of arrival of a vehicle at a stop on an ongoing basis on the new 73 passenger information panels with a voice module, and a total of 140 panels are already connected to the system, including the oldest ones from 2014. On all the panels, from the level of the new central application, the dispatchers can post various types of messages about possible changes or transport difficulties.

A newly developed mobile application for the Android and iOS systems is a great convenience for travellers, presenting on a map the positions of public transport vehicles in real time as well as virtual panels with the planned time of their arrival at a stop. The application works even for locations that do not have a panel installed at a stop.

As part of the new software modules, Toruń's dispatchers received access to many analytical functionalities (e.g. a punctuality module), which enable them to continuously monitor the condition of transport in the city and to make adjustments on an ongoing basis in order to improve its operation.

The present and future of the rail industry

On November 30 and December 1, Ifema Madrid hosted Rail Live, the rail industry event that showcases the latest technologies and projects in the field of metropolitan, long-distance, and high-speed rail.

The topics of this edition were sustainability, the liberalization of the rail market, and the industry´s digitalization.

This year more than 130 exhibitors and speakers from network and infrastructure operators from around the world, private sponsoring companies, and industry associations participated. Technical visits to advanced railway technology sites were also organized for attendees.

As a leading company in the design, development, and deployment of intelligent transportation systems for the rail sector, GMV did not miss this event and had a stand to showcase its latest updates in the field of ticketing. Such as the new features developed for its ***SAE-R®*** product, a suite of applications that is already a leader in the field of AVLS systems for railroad operation.

The event was also attended by national and international companies in the sector.

GMV Planner streamlines Fuenlabrada's public transport

GMV has won the contract for setting up and maintaining the future service-assignment IT tool of Fuenlabrada's Municipal Transport Company (*Empresa Municipal de Transportes*: EMT).

EMT Fuenlabrada's service planning system, using tools like Access and Excel, had been little automated until now. The previous, largely manual system was very time consuming, in view of the sheer number of employees, the free- and rest-time constraints laid down in the collective bargaining agreement and the particular circumstances of some partially-retired and part-time employees.

Such circumstances cannot always be catered for by standard Excel and Access formats, calling instead for bespoke calculation algorithms. The upshot is that, for all the effort put in, the results were often found wanting.

Under this new contract GMV will be supplying its inhouse ***GMV Planner*** suite that, crucially, can plan the complete lifecycle of the public transport operations, from designing the routes or scheduling up to assignment of drivers, management of holidays and integration with other corporate systems like payrolls or maintenance.

GMV Planner is not only a planning tool; it also includes mathematical algorithms that can be of great use in optimizing resource use (staff and vehicles), doing so in a centralized and efficient way with information synchronized through the various modules.

Its interface is highly intuitive, featuring a host of graphic editing tools for visual analysis and comparing proposed solutions.

GMV Planner allows EMT Fuenlabrada's expert planners to square the circle of cutting costs while improving services. Moreover, the technicians who previously had to churn out these tasks manually will now be freed for other activities.

GMV presents a new portfolio at TRANSEXPO '21

The XV International Fair of Public Transport (TRANSEXPO) has ended in Kielce. During the three-day event, GMV presented several new products in its offer. The latest solutions in the field of fleet management and passenger information are based on modern IT technologies and allow you to monitor the quality of public transport in a flexible and convenient way.

During this year's TRANSEXPO fair, GMV showed three new products in its Polish offer. The first solution is a modern RMDT high performance industrial computer in the form of a tablet. It combines the function of an interface for the driver, the SIP on-board computer and a video recorder that enables real-time video recording and streaming to the control room. The tablet is equipped with temperature and humidity sensors, which allow it to work even in difficult weather conditions. The RMDT device, in combination with the DTD-100 device, creates an on-board ticket desk, allowing the sale of tickets by the driver with the EMV payment option.

Eco-Driving and ITS Suite software were among the brand new solutions that visitors to the GMV's stand could see. The first is software for on-board and central computers that permits you to monitor the quality of the driver's work in real time. ITS Suite, on the other hand, is dedicated to managing public transport fleets. The stand also featured a modern EMV on-board validator.

GMV to maintain TMB's onboard video-surveillance system

Last October GMV was awarded a two-year maintenance contract of the onboard surveillance system on the metro fleet of Barcelona Metropolitan Transport (*Transports Metropolitans de Barcelona*: TMB); the contract is open for another two-year prolongation.

The equipment to be maintained has been fitted on 149 trains from 8 different series running on lines L1, L2, L3, L4, L5 and L11 of Barcelona Metro, comprising video recorders, communication antennae, video coders, Ethernet switches, IP monitors and digital cameras. The initial system was installed in parallel with the video-surveillance systems existing at that time, reusing up to 2038 analog cameras.

System maintenance includes a remote technical attention service to deal with any incidents, with 24x7 support for any critical incidents.

Also included is corrective maintenance with equipment being repaired on GMV's site, plus replacement of any faulty components detected in the first in-situ maintenance level carried out nominally by TMB technicians but also by GMV technicians on demand.

Lastly, obsolescence management services are also included plus preventive maintenance of the control center or definition of onboard equipment tasks. Neither is evolutive maintenance overlooked; this is based on a 320 hours-a-year labor pool encompassing engineering, documentation and firmware development tasks to complete the whole set of all-in maintenance included in this contract.

GMV helps Castelo Branco to enlarge its information system

After GMV's successful rollout of the new 8-bus fleet management system in Castelo Branco, with information panels giving real time bus-stop information, Castel Branco has now decided to extend the system.

As first step in this extension scheme Castelo Branco held a public tender for increasing the number of bus-stop information panels, a tender won by GMV. This project includes installation of 14 new bus-stop panels, bringing the total number of passenger information panels up to 18. Two 86-inch information panels will additionally be fitted in Castelo Brancos main bus station.

The bus-stop panels show on their 15-inch TFT screen ETAs and other service information and publicity. They also include audio announcements based on previously recorded messages; the information is also read out for visually impaired passengers.

This project's main remit is to increase public-transport service information for would-be passengers, making the whole bus journey a more pleasant experience. This aim falls into line with current government initiatives to favor public transport over private cars.

Along these same lines, in the same region of Beira Baixa, to which Castelo Branco belongs, GMV has already set up its demand-response transport system. In 2022 Castelo Branco plans to forge ahead with its ongoing ITS schemes.

GMV and HORIBA MIRA collaborate in a traffic platooning scheme

GMV NSL and HORIBA MIRA are collaborating in a groundbreaking, cutting-edge project to streamline traffic flows by means of a highway traffic-platooning scheme.

The technology is based on cooperation between all platoon vehicles to share their respective positions on the road. Cooperative positioning involves integration of information from several different sensors such as satnavs (GNSS), inertial sensors, vehicle odometer and relative ranging sensors. This sensor data is shared between vehicles by way of low latency wireless communications. Finally, the position calculated from these positioning algorithms is double-checked by an integrity algorithm to make sure it gives a "trustworthy" reading of the vehicle platoon's positions.

Integration of all this self-driving technology will provide a series of benefits for both drivers and the public at large. Passengers will be able to enjoy more fluid driving conditions on the strength of optimized breaking and acceleration profiles. This will in turn improve vehicle efficiency and cut down emissions. The improved performance on existing highways also means fewer new roads will have to be built, even at a time when road traffic looks set to increase steadily into the future. A cooperative positioning solution also trims hardware costs, while integrity algorithms ensure road safety and robustness. They can also be used securely and reliably to optimize speed and headway.

The project is funded under the ESA Navigation Innovation and Support Program (NAVISP) and it will serve as the roadmap for ESA's future developments and boost the takeup of GNSS and communication technologies by the automotive sector.

The opinion expressed in this article does not in any way reflect the official opinion of the European Space Agency

Opinion

On the importance of vehicle- and automotive-cybersecurity

A few days ago the standard ISO/SAE 21434 "Road Vehicles – Cybersecurity Engineering" was published, officially recognizing the importance of standardizing design-up engineering cybersecurity in the development of automotive products and post-marketing monitoring and maintenance.

This standard sees the light of day several years after the creation back in 2015 of the Society of Automotive Engineer (SAE)'s Vehicle Cybersecurity Systems Engineering Committee, set up to deal with the various threats and vulnerabilities hovering over vehicles. This was followed by publication of a guide to serve as roadmap for adapting and incorporating cybersecurity into vehicle systems.

The new standard takes its cue from SAE guidelines for tackling the automotive cybersecurity problem and brings cybersecurity into the engineering of electric systems and road-vehicle electronics. It has therefore tried to address the problems faced by both carmakers and their supply chain in keeping up with the rapid development of technology and stealing a march on the new cyberattack methods, which are developing alongside this technology at the same breathtaking speed.

Companies like GMV, with years-long experience in the automotive world and an expert knowledge of its systems, processes and procedures, pass masters too in cybersecurity, are well aware that this is no passing fad to be adhered to in a merely perfunctory, law-abiding way to fob off customer demand.

Just as this sector has adopted safety as an overriding concern, as an inseparable part of the vehicle- and component-making processes, security too now needs to permeate all facets of connected and autonomous vehicle makers.

GMV has always been a staunch upholder of design-up cybersecurity, and the official publication of this standard represents a perfect chance to get this message across. Cybersecurity should not be conceived as an unnecessary cost increase in the production of connected and autonomous vehicles and the components making them up. Quite on the contrary, it is an essential investment and is ignored at the peril not only of vehicle makers but also the eventual drivers of those vehicles.

Any cybersecurity incident can make a long-lasting dent in a brand's reputation as well as hitting its pocket hard. Any attack or fault stemming from a failure to take cybersecurity into account in the engineering and manufacturing phases might also have a disastrous knock-on

"The sophistication of vehicles brings with it an increase in risks and vulnerabilities that need to be identified in order to reduce them"

effect on the occupants, potentially with dire consequences.

For some time now we have been reading and hearing that the future automobile – as part of a sophisticated, overarching mobility system – needs to do much more than just get us from A to B. This product ushers us into a series of services that aim to boost road-safety, free up traffic flows, encourage ecofriendly driving and improve the driving experience by providing onboard entertainment that was previously unobtainable. All this calls for a sophisticated technology input – including connectivity – and increasingly complex software, with a size now adding up to 100 million code lines and bound to increase even more into the future.

Vehicles thus become a very powerful and versatile tool. The downside of this increased sophistication, however, is an increase in risks and vulnerabilities, which now need to be identified and wiped out or at least reduced to acceptable levels in our automotive systems. Zero risk is not possible; neither is it possible to head off every attack or vehicle intrusion. But these secure development practices raise the security barriers and conversely lower the risk levels we have to live with.

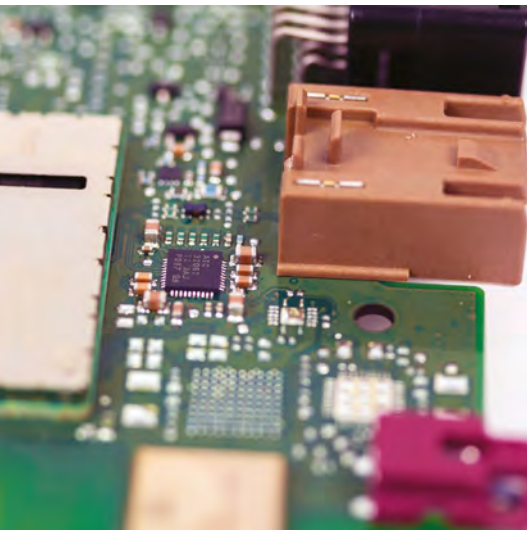
Neither should we forget that adopting design-up cybersecurity practices in vehicle development processes can also be a cost saver, as the development, maintenance and component costs are all brought under closer control. This makes it tremendously attractive to all automotive stakeholders across the board.

Last but not least, automotive cybersecurity is now booming. It is estimated that the world automotive cybersecurity market will be worth 9.7 billion by 2030, with a huge grown potential of over 7% a year.

Spain can play a key role in this market, brimming with major organizations in need of top-class employees. GMV, too, is playing a standout part and is also proud to input its expert knowledge to make sure vehicles can continue to get us about, entertain us and help us to run our businesses and enjoy our leisure, always with safety to the fore.

Sara Gutiérrez Lanza
Manager of the Automotive Business Unit of GMV´s Intelligence Transport Systems sector

GMV collaborates with FICOSA ADAS to secure the future of Advanced Driver Assistance Systems solutions against cyberattacks



GMV continues its collaboration with FICOSA, a top Tier-I global provider devoted to the research, development, manufacturing and marketing of advanced technology vision solutions including safety, connectivity and efficiency systems for the automotive and mobility sectors.

The aim of this collaboration is to work on the cybersecurity risk analysis and the definition and implementation of adequate security controls against cyberattacks for camera monitoring systems (CMS) ECUs, and compact surround view cameras.

The contribution of GMV entails support to FICOSA ADAS in the framework of ISO/SAE 21434, officially published this year. The objective of ISO/SAE 21434 is to manage the threats to the cybersecurity of the electrical and electronic systems of road vehicles, focusing on the requirements, process and goals in business disciplines including product development, production, operations and maintenance.

This agreement denotes the importance for suppliers Tier-I and OEMs to be prepared in cybersecurity matters in the face of the different regulations that must be complied with in Europe and other regions, such as the UNECE R-155 regulation for automotive cybersecurity management systems and UNECE R-156 for software update management systems, which are based on the ISO/SAE 21434 standards for Cybersecurity Engineering and ISO 24089 for Engineering for software updates in road vehicles, respectively.

For several years, GMV has been working to make automotive cybersecurity a reality, incorporating it throughout the product life cycle, including hardware, software, ECUs and remote vehicle supply platforms to encourage the principle of “security by design”.

The services that GMV offers in this field include support to achieve compliance not only with the principles of ISO/SAE 21434, but also with the scope of the regulations under UNECE WP.29, and making better use of secure development best practices in the automotive industry.

GMV has been collaborating with the FICOSA for over 15 years, developing embedded software for Telematics Control Unit (TCUs).

GMV with sustainable mobility

During October and November, the course on sustainable mobility, focusing on the implementation of the so-called Low Emission Zone (ZBE) in the metropolitan area of Barcelona, is being given. This free training was aimed at urban mobility professionals from public administrations. It's being held in a hybrid format, combining all the sessions given at the UPC's facilities in Barcelona, with talks by experts broadcast live.

GMV has been taking part in the program, tackling the technological solutions for ZBE deployment. Specifically, it's focusing on its systems based on smartphones and GNSS technology applied to the field of mobility and transportation, in which the company has more than 20 years of professional experience.

December 2023 is the date reflected in the Climate Change and Energy Transition Law (approved by the Spanish government) for Spanish cities with more than 50,000 inhabitants to design and implement their sustainable mobility plans, highlighting the regulation of low-emission zones.

Low-emission zones are a sustainable and efficient mobility solution, capable of minimizing greenhouse gas emissions and thus protecting people's health. The objective of this course is to respond to the short and medium-term challenges in sustainable mobility management, to act in line with the climate action targets proposed in the 2030 Agenda.

This course was organized by the Barcelona Metropolitan Area (AMB), the Polytechnic University of Catalonia (UPC), and the Carnet mobility innovation center. It also has the support of the EIT (Institute of Innovation and Technology) Urban Mobility, an organization co-financed with funds from the European Union.

5G permits instant, secure and single-app access to a cloud-hosted "virtual smartphone"

GMV's inhouse ***ubic*** solution provides users with cloud hosting of all their smartphone functions, with simple, safe and instant access

Orange and GMV are collaborating in a project that offers a groundbreaking and complete solution for configuring and accessing virtual handhelds, harnessing the advantages of the new 5G technology.

GMVs inhouse development ***ubic*** provides users with all their main smartphone functions in the cloud, doing so simply, securely and instantly, thanks to the speed, quality and low latency of Orange's 5G network.

Access to this "virtual smartphone" means it is now unnecessary for users to have apps installed in their actual handheld; all the basic tools are now cloud hosted. Access to these functions is provided through a single app, ***ubic***, which, thanks to the use of efficient streaming and virtualization technology in a secure mobility environment, gives access to a complete cloud-hosted smartphone.

The user friendliness of ***ubic*** opens up a whole range of possibilities. It can easily be adapted, for example, for elderly users who often find it harder to work handhelds. ***ubic*** provides a simplified version of their smartphone in an intuitive interface, using a smaller set of buttons and a limited number of functions, giving priority to the ones these users really need.

ubic can also be used as a parent-control device in any time in any place. This groundbreaking solution makes it possible for users to make timely changes as necessary or remove any sensitive information from the virtual handheld, easily and quickly controlling children's handheld use and striking the right balance between parental control, data security and children's safety.

ubic, in all cases, is designed to provide total cybersecurity and a virtual smartphone that meets specific and stringent user demands, such as very complex games or apps.

This initiative falls under Spain's National 5G Plan, for carrying out pilot 5G schemes, run by the public corporation Red.es, driven by the Ministry of Economic Affairs and the Digital Transformation and co-funded by the European Regional Development Fund (ERDF).

The aim of this plan, given continuity in the national 5G Technology Promotion Strategy, is to spur definition and implementation of many use cases of this technology by setting up a scheme of technology partners, who will join forces to speed up the process of bringing in what has come to be called the "digital economy" in the near future.

Transparency from the perspective of open data

Government transparency at local, regional and national level favors citizens' sense of belonging and involvement in the creation of everything that affects us all; it could also be vital in reviving our sagging economy. One of the key features is offering quality data open to all and conducive too to freely-flowing communication among all of us.

In the workshop Transparency from the perspective of open data GMV has presented the work carried out in this vein for *Ciudades Abiertas* (Open Cities), a collaborative project belonging to the 2nd Smart City Call led by the city councils of A Coruña, Madrid, Santiago de Compostela and Zaragoza, managed by Red.es.

Under this project GMV has drawn up a guide to help organizations design their transparency portal from the perspective of open data. This guide puts forward a portal-structuring recommendation, as well as the contents to be included and the services to be offered. Special stress is laid on the publication of a public information web catalogue that helps citizens find the information they want.

Based on the public information web catalogue, a transparency-indicator assessment methodology has been defined, allowing organizations to gauge how transparent they are and encourage them to improve continually. This methodology is based on open data as a way of boosting organizations' transparency.

A transparency dashboard has also been defined to communicate methodology-assessment results to citizens, allowing them to assess their level of transparency and ongoing improvement.

Innovation as the driving force of competitiveness

The consulting firm Ayming's 3rd Annual International Innovation Barometer was presented in the event "Innovation in a crisis". As well as discussing the role of innovation in their own organizations during and after the COVID-19 pandemic, the participating executives also took the chance to debate the barometer's showings.

These business representatives included Luis Fernando Álvarez-Gascón, General Manager of GMV's Secure e-Solutions sector and vice president of the Spanish Association of Electronics, Digital Contents and ICT Companies (*Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales*; AMETIC), taking part in the chat "Innovation as the driving force of competitiveness".

Álvarez-Gascón recalled how, last summer, after a period of uncertainty, "we were able to take stock of the situation and seek to rebuild, taking our cue from the well-thought-out response by national and European authorities, mooting ambitious long-term plans and strategies". He went on: "the time has therefore now come to congratulate ourselves and recognize the government's merits and high standing within the plan sent up to Europe". He also brought out the importance of associative collaboration for the design of these plans, explicitly mentioning the important projects with public-private collaboration and a big ripple effect throughout the economy; these featured prominently in the documents sent up to Brussels.

The executive also gave his optimistic take on things: "we are now living through a stage of great opportunities, with hot debates raging about geostrategy, technological sovereignty or strategic autonomy". These debates are likely to shuffle the pack completely and "we have to make sure we are in the game and are dealt the best hand possible".

CTA approves 6 new R&D projects worth €5.1 million

The executive committee of the Andalusian Technology Corporation (*Corporación Tecnológica de Andalucía*: CTA) has approved the financing of 6 new R&D projects that will mobilize private investment worth over 5.1 million euros.

These new projects involve such innovative ideas as an artificial-vision broccoli-harvesting robot; new olive-oil filtration processes by non-invasive techniques; AI-based fault prevention in solar farms; and improved photovoltaic energy storage systems. In the words of Miguel Hormigo, Industry Manager of GMV's Secure e-Solutions sector "These CTA-brokered initiatives are crucial in the ongoing process of digitalizing industry and carrying out innovative sustainable mobility projects. Since its very beginnings CTA has been a stalwart of R&D projects in favor of a greener, more technological and socialized country".

The newly approved projects, subcontracting 6 different research groups from the universities of Granada, Malaga, Seville, Pablo de Olavide and the Higher Scientific Research Council (CSIC in Spanish initials), will receive over 2 million euros in CTA incentives and will help to transfer knowledge to new solutions that will then come to market.

They will be carried out in the provinces of Granada, Jaen, Malaga and Seville, taking in the sectors or aerospace, productive processes, biotechnology, farming, energy, the environment and ICTs.

Newly approved projects:

- Assessment of chronic toxicity in three-monthly trisperidone ISM®.
- Research and development of new optimized, non-invasive olive-oil filtration techniques.
- Intensified dehydrogenation of long chain paraffins (C10-C13).
- Artificial-vision broccoli-harvesting robot.
- Creation and validation of an advanced algorithm based on AI modeling techniques for prediction and prevention of faults in large solar farms.
- Dimensioning and optimum operation of photovoltaic energy storage systems.

Modernizing Government Procedures

Patricia Tejado, Digital Public Services Manager of GMV's Secure e-Solutions sector, took part in the event "IDG Virtual Summit: Modernizing Government Procedures" giving a presentation on government authorities' use of open data and its economic and social impact.

Tejado shared billing with government executives like Carlos Maza, ICT Deputy Director General of the Industry Ministry, and Zaida Sampedro, Deputy Director General of Regional-Ministry Services and Digital Government of Madrid Region's Digital Government Agency. They both talked about the experiences in their respective organizations.

Patricia Tejado stressed the importance of giving priority to the opening up of data that "we know will be in heaviest demand and promises most potential. This depends in turn on a sound analysis of the needs of the future users of this data". She likewise argued in favor of "governance policies for data management and analysis, safeguarding data privacy". Here is where GMV's inhouse development ***uTile*** comes into its own.

She also talked about GMV's experience in trailblazing, iconic projects like the open data platform Datos.gob.es or the open city project.

New technology for a green and digital revolution

A crucial decade is now underway in terms of achieving national and European competitiveness and sustainability goals, using technology and digitalization as our main allies in this endeavor.

In this context the energy and utilities sector is busily seeking a more sustainable and coherent model. enerTIC recently hosted an encounter with technological leaders and major organizations of the energy and utilities sector in order to help identify and promote new technological solutions that aim to improve energy efficiency and decarbonize the economy, and to bring these solutions to wider notice.

Almudena Nieto de Castro, GMV's energy and utilities business development manager, took part in one of the panel discussions with representatives from UFD Grupo Naturgy, Enagás, Repsol, Acciona Energía, Minsait and Schneider Electric Spain to discuss the initiatives now working towards sustainability, efficiency and digitalization. Among other matters Almudena spoke about robot-based smart automation and total sensorization of assets as trump cards in the optimization of energy-distribution and -generation processes, enabling firms to become more competitive and more aware of the benefits to themselves and their environment.

Javier Hidalgo, for his part, Solutions Architect of GMV´s Secure e-Solutions sector gave a paper in the set of lectures dealing with industrial IoT and cybersecure appreciation of data. He argued that IoT was the sine qua non of the digital transformation process, providing firms and clients with quicker, simpler and more transparent information about productive processes, their efficiency and performance, never losing sight of the importance of design-up cybersecurity as the key to ongoing success.

In sum, the digital transformation is of paramount importance in this endeavor of reducing CO2 emissions, pursuing sustainability and combatting climate change, as set out not only in Horizon 2030 or the UN's SDGs, but also in the EU's Next Generation recovery funds and the Spanish government's own Recovery, Transformation and Resilience Plan.

Future technology, innovation y adaptation to change of the food-farming sector

In October the Spanish Association of Electronics, Digital Contents and ICT Companies (*Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales*; AMETIC) brought together in Fruit Attraction (the International Fruit and Vegetable Fair) several experts in a panel discussion under the title "Digitalization and Sustainability in Fruit and Vegetables", to talk about and seek the best strategies for driving innovation, research, technology development and digitalization as keystones of future growth in the farming sector.

Participants in the panel discussion included Miguel Hormigo, Industry Manager of GMV's Secure e-Solutions Sector, who gave his take on the best value-adding digital solutions in the whole farming food chain; he also talked about how we might achieve the manifold goals of boosting yields while farming well, more quickly and sustainably. Hormigo argues that "new process-automating technology needs to be harnessed to enhance quality and yield, using virtual forecasting tools".

Growing population levels are increasing the food demand and environmental impact. This is favoring the development of agriculture 4.0 to optimize the whole food-farming process. Precision farming blends digitalization and automation to boost yields and profitability while keeping the environmental impact as low as possible.

Agriculture 4.0 is here to stay, tapping into an increasing amount of information from sensors, weather stations or satellites to improve crop-farming decision-making. Machinery automation, for its part, partially or totally autonomous, works quickly and dependably, helping farmers to concentrate their workers where they are really needed, without running any safety risks and cutting down the consumption of fuel and energy.

GMV wins a sustainability excellence award from AHK

GMV has won the prize in the category of "Industry, innovation and responsible production" on the strength of its ongoing commitment to technological innovation and progress, bringing out the importance of sustainability projects

GMV was recognized at the 10th edition of the Excellence Awards by the German Chamber of Commerce in Spain (AHK), at an event held on October 27 at the Cómo Space in Madrid, with the participation of GMV President Mónica Martínez, who accepted the award.

The Minister of the Embassy of the Federal Republic of Germany in Spain, Christoph Wolfrum, and AHK Chairman Javier González presented the awards at a ceremony attended by nearly a hundred people representing Spanish and German businesses and institutions.

GMV was given the award in the "Responsible Industry, Innovation and Production" category, for its commitment to technological innovation and progress, highlighting the sustainability-related projects MySustainableForest, which has a portfolio of products and services related to responsible forest management, and FirEUrisk, for the evaluation and reduction of risk of forest fires in Europe and adaptation to future fire regimens. As well as the projects Bewats, Plastic-Less Society and Atin-Blueco, focused on monitoring plastic waste in the oceans to reduce their environmental impact.

The AHK organizes this initiative each year to recognize the work of businesses that make a notable contribution to strengthening Spanish-German ties in a variety of areas related to innovation, employment, corporate social responsibility, and professional training. This year's edition was divided into three award categories and focused on the green and circular economy, sustainability and energy efficiency, in line with the chamber's main theme for 2021: "Business and Sustainability. The path to a green, efficient, and circular economy".

The Excellence Award is endowed annually with €5,000, which is given to the social cause of the winner's choice. On this occasion, GMV and the rest of the award winners agreed to give the monetary amount to the charitable organization Mary's Meals, which feeds over two million children each day in countries in Africa with a low level of school attendance, to collaborate with their education.

Camaraderie and sport

At the end of 2021 GMV once more tested its mettle in Madrid's Race of Companies. This year's race, the twentieth in the series, attracted over 5700 runners, 60 of them from GMV, joining in this yearly run through the central thoroughfares of Madrid to foster sportsmanship, camaraderie and team spirit.

One month earlier, meanwhile, the starting gun was fired in Valladolid's own version of the Company Run. Four teams made up by GMV's colleagues from the Boecillo office ran the 6-kilometer course of this fifth run through Valladolid's historical and picturesque heart.

Our congratulations to all GMV's runners, who have proven themselves to be a proper team both inside and outside the company.

GMV partners in the URJC mentoring program

In late November, students of the cybersecurity engineering degree course of Universidad Rey Juan Carlos visited GMV's facilities as part of the mentoring program organized by the academic institution together with benchmark technology companies.

GMV's team accompanied the students on a tour of the different sections of the cybersecurity and infrastructure division, including data centers, digital identity, systems architecture and design, cloud, SecDevOps, information and data security, cybersecurity defense and security for international agencies.

GMV keeps in direct and constant contact with students throughout the academic year as part of this university program, with technical orientation sessions, practical workshops and lectures to guide them in their professional future. To round off this orientation program, GMV takes on students of this degree, depending on their aptitudes, to carry out an internship period on real company projects.

Thanks to this program, students, teachers and participating companies have created a forum for sharing ideas and needs and improving employability in the sector. GMV has been actively partnering since its first call in the 2018/2019 academic year to share its experience as a national benchmark in the development of advanced cybersecurity solutions and services in IP networks, mobility applications and ICT applications.

Madrid promotes the latest technological advancements

From November 1-14, the Region of Madrid organized the "XXI Madrid Science and Innovation Week" through the Fundación para el Conocimiento madri+d (Foundation for Knowledge madri+d). This edition was held under the theme "Science for the great challenges of humanity".

In order to show the scientific and technological advances that are being carried out throughout the territory the initiative, offered more than 1,300 free activities in 40 municipalities in the region where the goals to achieve the European Green Pact were promoted, with the dual aim of reducing social inequality and combating climate change.

These activities aimed to involve citizens in science, technology and innovation, to encourage scientific vocations among young people and to promote a culture of science and innovation in society.

GMV once again collaborated in these activities, participating as a speaker in the informative talk "Space debris: Why should it concern us? What can we do about it?" organized by the Universidad Carlos III in Madrid.

In addition, coinciding with this science and innovation initiative, GMV opened its doors to high school students from the IES Santa Eugenia school in Madrid to bring them closer to the professional operations of tech-sector companies and awaken in them a scientific-tech interest.

"Women and Engineering", learning through experience

On October 6, the headquarters of the Ministry of Science and Innovation hosted the graduation ceremony of the "Women and Engineering" mentoring program, in which Minister Diana Morant participated.

This program promoted by the Royal Academy of Engineering and AMETIC aims to motivate and encourage vocations in STEAM studies (science, technology, engineering, arts and math) for students with the best academic record and selected according to their interests and skills, in their final master's degree courses from different universities such as the Polytechnic University of Madrid, Complutense University of Madrid, Carlos III University, San Pablo CEU University and the Polytechnic University of Cartagena, among others.

GMV, together with other companies of the ICT sector, took part in this fifth edition of the program, which ran from March to June. During these four months, a GMV employee guided a UPM master's degree student in telecommunications engineering through various sessions as she made the transition from academic to professional life.

Through the shared knowledge and professional experiences, the student learned more about the area of ICT cybersecurity. The good results of this program also led to a scholarship for the student to join GMV's team, specifically GMV's cybersecurity services and the consultancy division of Secure e-Solutions.

Flexibility and mutual trust, the keys to GMV's new working models

Any unforeseen event, disconcerting at first, might have unexpected boons in the end. COVID-19 serves as a fine example of these hidden advantages. The lockdown forced firms to bring in swingeing changes in their working methods, organizing themselves in a totally different and unimagined way. Everybody got down to work and, thanks to this collective effort, results were achieved that were inconceivable beforehand. During this period team communication showed itself to be the keystone shoring up the whole edifice, the quality of work becoming an even greater commitment for one and all.

The upsides of teleworking are the reductions in commuting, in costs and the environmental impact, with a concomitant increase in the concentration

capacity. The downsides, however, are a lower sense of belonging and community, the loss of the informal day-to-day learning process among members of different teams.

We at GMV have been loath to speak of "the return to work" because it suggests a return to the past. We have focused instead on a study of which working models are needed in our firm to suit the particular type of activity we each carry out. We have always worked rather from the premise that flexibility is a sine qua non of retaining our hallmark values: always meeting deadlines and expectations, individual capacity, responsibility and trust.

In this pursuit three types of working models have been set up, as explained members of GMV´s staff below.

Carolina Morales – Hybrid model

My name is Carolina and I've been working in GMV's Commercial Satellite Control Centers (CSCC) division for five years now. After a period of 100% teleworking, I pondered the range of options offered by GMV and plumped for a hybrid model, working 2/3 days a week in the office and the rest at home.

Work in a development team often calls for rapid interaction with other team members or even a group of them. Indeed, this happens every day really. Teleworking obviously makes this more difficult.

On the other hand, home working has many advantages too: you waste less time commuting or stuck in traffic and can therefore make the most of your private time. Furthermore, I live outside the city of Madrid and can therefore combine my teleworking with quick visits to my family at vital times.

I discussed all these variables with the development team I belong to and we all decided between us that the hybrid model best suited our needs.

With this working method all team members meet up in the office two or three days a week, giving us the chance to rub ideas together in situ, without giving up our independence in organizing our other responsibilities and our personal lives.

Antonio Cabrera – Onsite model

Just over 3 years ago I joined the SKMF maintenance and upgrading team. The Satellite Key Management Facility protects communications between the ground segment and the control center and Galileo's satellite constellation. Given the very nature of the SKMF, its whole design, implementation and associated technical documentation is classified material that can be accessed only from a restricted access zone.
The pandemic therefore represented for us in the project an "exceptional" situation, though we continued to work in the way we always had before.

Any GMV worker asked about the advantages of onsite working would probably come up with very similar answers: the creation of links between people; the solving of complex problems calling for a high level of interaction and the strengthening of information channels of communication, to cite only a few.

My experience over these two bizarre years has only brought out even clearer all the abovementioned advantages. I've seen, for example, the importance of teamwork in achieving our goals. I've also seen how far team spirit and camaraderie, underpinning all our group endeavors, are only strengthened by daily contact.

One of the aspects I most appreciate about GMV is the timetabling flexibility we all enjoy and the beneficial effects on our family life. This flexibility has really come into its own in the present predicament. At the same time, however, I really don't think we can renounce everything that onsite working offers. I therefore chime in wholeheartedly with the idea of establishing a hybrid model by default, switching back and forth from office to remote mode as need be.

Miroslav Stoychev – Remote Model

For the moment I've opted into the 100% teleworking mode. It's a personal decision I was weighing up even before the pandemic started. And now this option has become a fixture at GMV, I've gone for it.

It gives you a real buzz as an employee to know that GMV trusts you to continue working responsibly from home even when the crisis has passed. Few other firms in our sector have dared to do so and that says much for the organization and the whole team.

GMV has been capable of restructuring the internal setup to enable all of us to choose the working model that best suits us. In my case 100% teleworking has allowed me to continue enjoying my work with GMV's talented staff while also making the most of my private life, my family, friends and all those who support me every day. This wouldn't be possible with traditional working arrangements.

But it is the whole range of working arrangements offered by GMV that proves most advantageous, allowing us all to enjoy a rich and fruitful working arrangement with the firm. To my mind the flexible working hours are one of GMV's strong points. Speaking from my own experience I can safely say it is one of the few working schemes that really is flexible. Each worker, always with the possibility of one-off exceptions, is able to organize his or her working day to suit his or her personal needs at each moment. It's one of the group's trump cards, increasing the whole staff's quality of life, and I love it.

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