

The power of data in the twenty-first century economy



INTERVIEW

José Luis Martínez

Spokesperson/Director of the Spanish Banking
Association (AEB)



COVID-19

Right from the start of the COVID-19 epidemic, we at GMV have been monitoring the situation closely, following the recommendations handed down by local, national and international health authorities. We have hence been phasing in a series of preventive measures to ensure the health of our employees and collaborators and their families.

We at GMV are well aware of our overriding responsibility to our employees but also our clients, a firm commitment we are determined never to fall down on. On the strength of our COVID-19 business continuity plan, brought in on 13 March, nearly all our activities in all our international offices and in all the countries we trade in are being performed remotely; as a result we are going to be able to continue most of our clients' projects and services with almost complete normality.

Nonetheless, compliance with these new, tighter constraints decreed by the Spanish government and the various measures brought in by other governments make it inevitable that, by force majeure, some of our projects might fall behind schedule, whenever their performance involves our personnel or clients traveling from one of our offices to another, or to our clients' premises, and the work involved is not classified as essential. We are confident that all our stakeholders will be understanding about any unpreventable delays provoked by this complex situation.

We are convinced that, with the collaboration and commitment of one and all, we will come through this serious crisis successfully. In the name of the whole of GMV group we pass on our best desires to all affected persons for a prompt recovery and also express our heartfelt gratitude and recognition for everyone at the moment fighting in the front line to protect us all.



Letter from the president

On 13 March GMV closed almost all its offices due to the COVID-19 pandemic. All our employees, with the sole exception of key personnel working in critical activities, are now teleworking from home, and even these critical activities have been pared down to protect the health of our team, of their families and of all people they come into contact with, thus contributing to check the exponential growth of the pandemic.

We are in a lucky position; in our case teleworking is functioning very well. Our employees are dedicating themselves and efficiently using the tools made available by GMV to continue developing the projects and providing the services contracted by our clients, actively communicating with them and with each other.

But we also depend on the smooth operations of our providers and clients. Some of them are also successfully executing many of their processes remotely from home. The European Space Agency has gone even further, establishing a business continuity plan to help ward off an economic collapse added onto the

current human health crisis. This plan lays down measures to ensure continuation of tendering and the contracting of new projects and to facilitate the execution and delivery of its projects already underway, streamlining procedures and authorizing the use of telematic resources for processes that are usually face-to-face, prolonging deadlines as need be and guaranteeing punctual payment of all milestones achieved.

We are aware that not all our clients enjoy the solvency of a large institutional organization, and the longer the necessary lifesaving restrictions last, the closer all of us will be driven to economic collapse. To avoid this we will do all within our powers to meet our commitments with our employees, providers and clients. We count on each one of them to do the same.

The next edition of our corporate magazine will be specifically dedicated to the coronavirus crisis and its impact on our company and on the sectors we work in.

Cordial greetings and please stay safe,

Mónica Martínez

Nº 73

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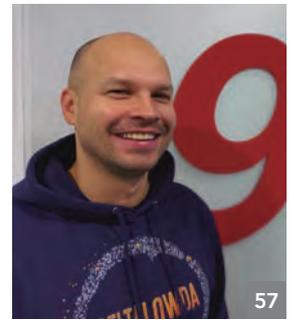
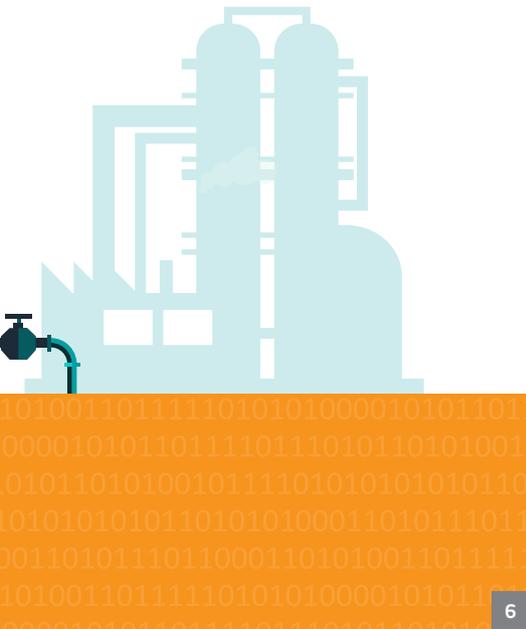
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The power of data in the twenty-first century economy

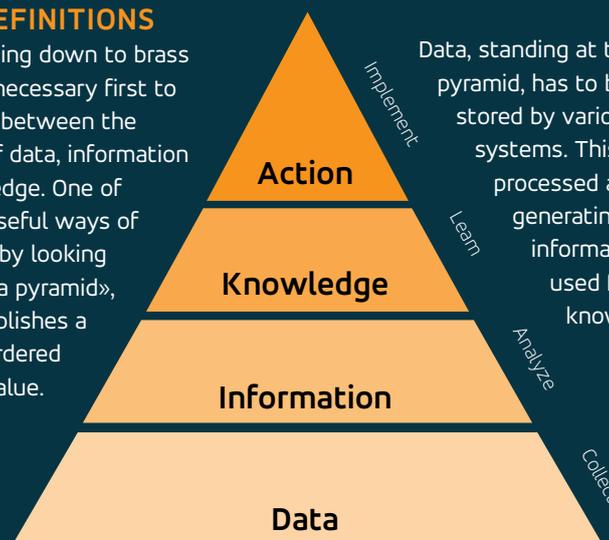
Data is the new oil. It's not clear who first coined this meme but it's become a mantra in recent years. What lies behind it? Why has data become such a driving force? Is this even true? Can data really give you a

competitive advantage? What are the benefits? What are the risks?

This article looks at these questions and gives an overview of the new economy that has now built up around data.

SOME DEFINITIONS

Before getting down to brass tacks, it is necessary first to distinguish between the concepts of data, information and knowledge. One of the most useful ways of doing so is by looking at the «data pyramid», which establishes a hierarchy ordered by added value.



Data, standing at the base of the pyramid, has to be collected and stored by various agents and systems. This raw data is then processed and analyzed, generating structured information to be used for generating knowledge.

Source: *Artificial Intelligence, Economics, and Industrial Organization* – Hal Varian

AT THE START

Without getting bogged down in the nuances that distinguish them, data and information have always underpinned the most basic economic processes. Prime examples might be the censuses run by different governments to gain a clear idea of their tax revenue; the historical review of operations run by banks to establish a loan's non-payment risk; the primitive actuarial calculations used to insure overseas missions.

But it is not solely in economic processes where data collation and processing has been a fundamental factor of development and progress. The selfsame effect can be described in practically any field: medicine, business organization, production, sociology, etc.

Why is there now talk of a new data economy, therefore? Why ring the changes between what has always been done in the past and what we are observing now?

THE CHANGE

In the last two decades we have witnessed three technological phenomena that have radically transformed our concept of data and information:

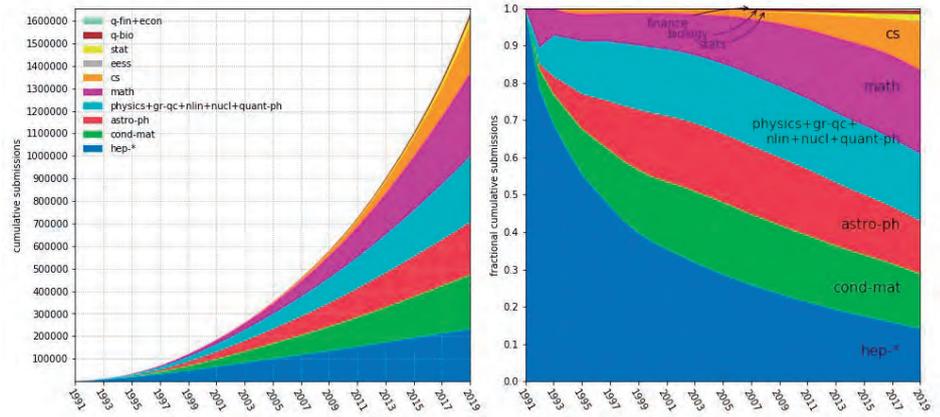
- Growing digitization spawns a huge increase in data. The digital transformation of large-scale economic and social processes has the side effect of much bigger trawl of available data.

Witness the millions of video hours now uploaded to platforms like YouTube or the countless number of photos shared in social networking sites like Facebook or Instagram.

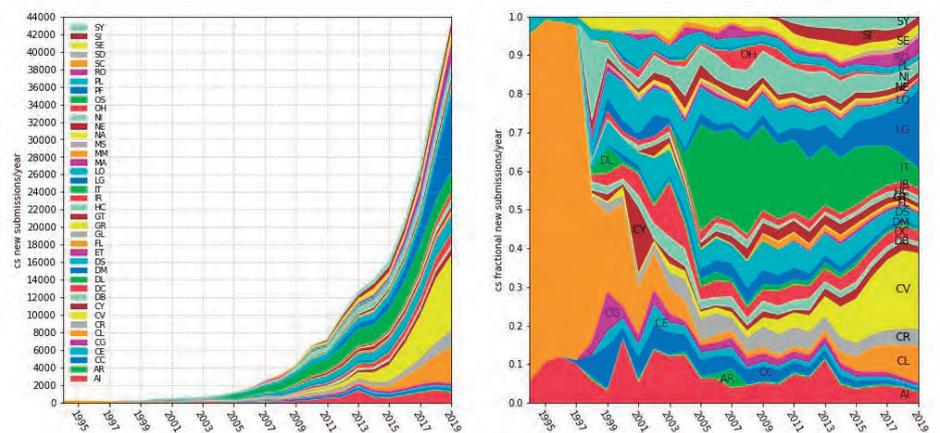
And this growth is now exponential with the millions of information-sharing connected devices under the internet of things.

- The drastic reduction in the cost of data collecting, processing and storing.

This cost reduction is not only quantitative. It is indeed now possible to buy more storage space



Published papers (Source: arxiv.org 2019)



Published papers Computer Science (Source: arxiv.org 2019). CL – Computation and Language. CV – Computer Vision. LG – Machine Learning

and more processing cycles with the same outlay. But there is also a qualitative side with the advent of cloud models (Infrastructure as a Service: IaaS) and pay-per use pricing schemes that allow fixed costs (initial outlay) to be transformed into variable costs (operating expenses).

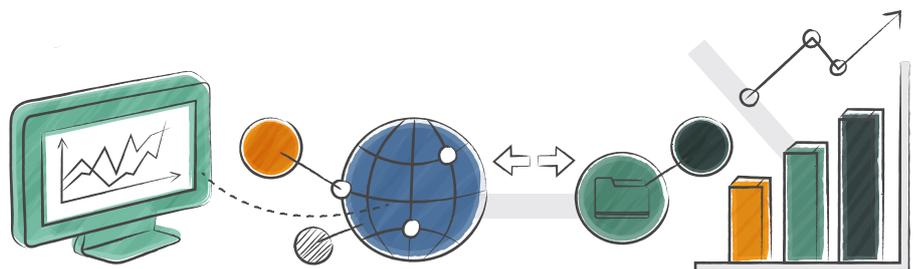
- Advances in analytical techniques (machine learning and artificial intelligence), which enable greater value to be extracted from data.

Although it is true that the math fundamentals and algorithms have

been around for some time, a huge increase in computation power and access has now facilitated their more efficient deployment.

This has translated into an exponential growth in research

These three technological phenomena have had a sweeping effect across the board. One of the most eloquent examples of this change is given by the list of publicly traded companies with the greatest market capitalization, comparing the 2019 list with the 2010 list.



2010

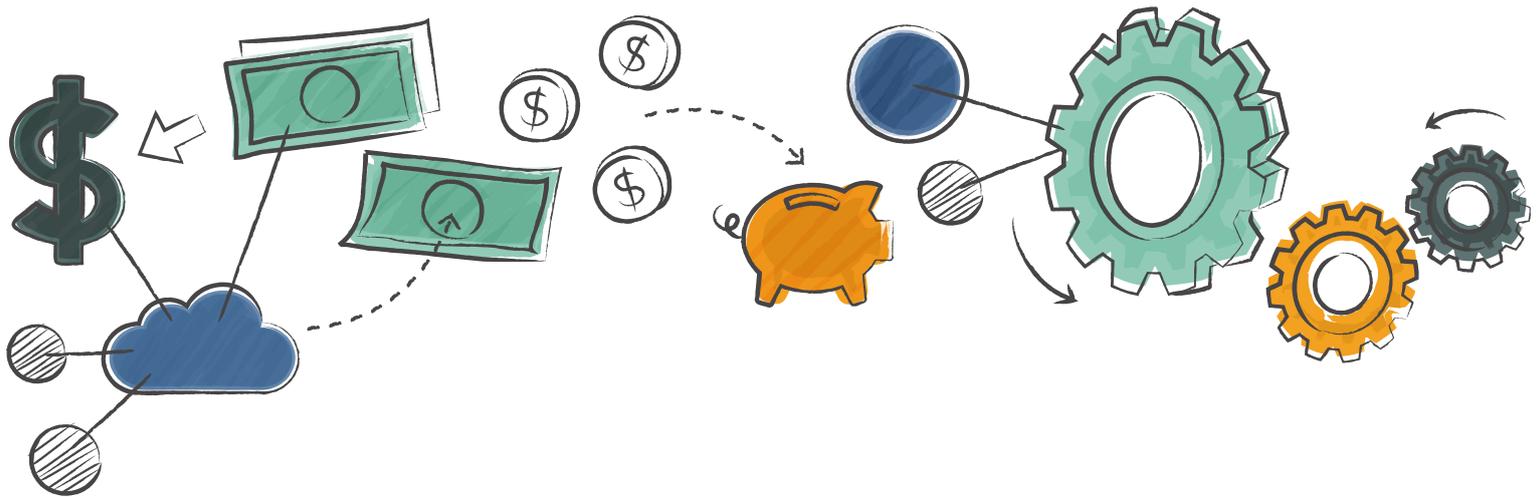
2019

2010				2019			
First quarter	Second quarter	Third quarter	Fourth quarter	First quarter	Second quarter	Third quarter	Fourth quarter
↓ PetroChina 329,259.7	↓ Exxon Mobil 291,789.1	↑ Exxon Mobil 314,622.5	↑ Exxon Mobil 368,711.5	↑ Microsoft 904,860	↑ Microsoft 1,028,000	↑ Microsoft 1,062,000	↑ Apple Inc. 1,305,000
↓ Exxon Mobil 316,230.8	↓ PetroChina 268,504.8	↑ PetroChina 270,889.9	↑ PetroChina 303,273.6	↑ Apple Inc. 835,670	↑ Amazon.com 928,540	↑ Apple Inc. 1,012,000	↑ Microsoft 1,203,000
↓ Microsoft 256,864.7	↑ Apple Inc. 228,876.8	↑ Apple Inc. 259,223.4	↑ Apple Inc. 295,886.3	↑ Amazon.com 874,710	↑ Apple Inc. 911,240	↓ Amazon.com 858,680	↑ Alphabet Inc. 922,130
↓ ICBC 246,419.8	↓ ICBC 211,258.7	↑ Petrobras 220,616.5	↑ BHP Billiton 243,540.3	↑ Alphabet Inc. 818,160	↓ Alphabet Inc. 751,170	↑ Alphabet Inc. 838,020	↑ Amazon.com 916,150
↑ Apple Inc. 213,096.7	↓ Microsoft 201,655.8	↑ ICBC 213,364.1	↑ Microsoft 238,784.5	↓ Berkshire Hathaway 493,750	↑ Facebook, Inc. 551,490	↓ Berkshire Hathaway 508,530	↑ Facebook, Inc. 585,320
↑ BHP Billiton 209,935.1	↑ China Mobile 201,471.2	↑ Microsoft 210,676.4	↑ ICBC 233,369.1	↑ Facebook, Inc. 475,730	↑ Berkshire Hathaway 521,100	↓ Facebook, Inc. 508,050	↑ Alibaba Group 569,010
↑ Wal-Mart 209,000.7	↓ Berkshire Hathaway 197,356.8	↑ China Mobile 205,339.6	↑ Petrobras 229,066.6	↑ Alibaba Group 472,940	↓ Alibaba Group 439,150	↓ Alibaba Group 435,400	↑ Berkshire Hathaway 553,530
↑ Berkshire Hathaway 200,620.5	↑ China Construction Bank 189,170.7	↑ Berkshire Hathaway 204,792.0	↑ China Construction Bank 202,998.4	↑ Tencent 2440,980	↓ Tencent 432,080	↓ Tencent 398,840	↑ Tencent 461,370
↑ General Electric 194,246.2	↓ Wal-Mart 178,322.7	↑ China Construction Bank 202,998.4	↑ Royal Dutch Shell 208,593.7	↑ Johnson & Johnson 372,230	↑ Visa 379,271	↑ Visa 385,370	↑ JPMorgan Chase 437,230
↑ China Mobile 192,998.6	↓ Procter & Gamble 172,736.5	↑ BHP Billiton 196,866.0	↑ BHP Billiton 196,866.0	↑ Visa 353,710	↓ Johnson & Johnson 370,300	↑ JPMorgan Chase 376,310	↑ Visa 416,790

Top 10 market capitalization 2010 (Source: Wikipedia)

Top 10 market capitalization 2019 (Source: Wikipedia)

Of the top ten, seven are now technology firms (none of them European). The common denominator of these firms is the creation of ecosystems, platforms and digital services. It is these same ecosystems, platforms and services that are providing access to a huge amount of information and data. Is this a competitive advantage? Is access to information and data a long-term growth factor?



A LITTLE ECONOMY

What economic characteristics do the data have against other change-enabling production factors?

In economics the characteristics and idiosyncrasies of the factors of production (capital, labor, energy, etc) help to explain how markets are structured. In the case of data, the three most useful characteristics for analysis purposes are:

- **Rivalry.** In economics, the concept of rivalry refers to a tussle between several agents for use of the same good. This is a continuum. In other words, consumption of the good by one agent does not necessarily imply its non-consumption by other agents. It depends on the good in question. Oil can be considered a high-rivalry good (oil consumed by one country cannot be consumed by another), whereas audiovisual production implies no rivalry at all. Neither does data, since the same data can be consumed by the same agents. The real, practical situation might well be different; agents who consider data to spell a competitive advantage will hardly be ready to share it willingly.
- **Exclusion.** In economics exclusion refers to the possibility of limiting access to a given economic good. Air,

for example is non-exclusive; access to it cannot be limited. Gold, to which access can indeed be limited, can therefore be classed as exclusive. Data comes midway; if access was totally limited the data would forfeit its economic value. Data access limitation would also involve an outlay in protection systems to fend off the various threats (information security, cybersecurity, business continuity, disaster recovery, etc.).

- **Externalities.** The concept of externality refers to the fact that consumption of a good by one agent imposes costs/benefits on other agents. The classic example is pollution, where an environment-impacting agent imposes costs on the other agents. Data presents positive externalities (network effects), and negative externalities (privacy).

All these features shed light on the data market, as a structure emerging from the supply-and-demand model.

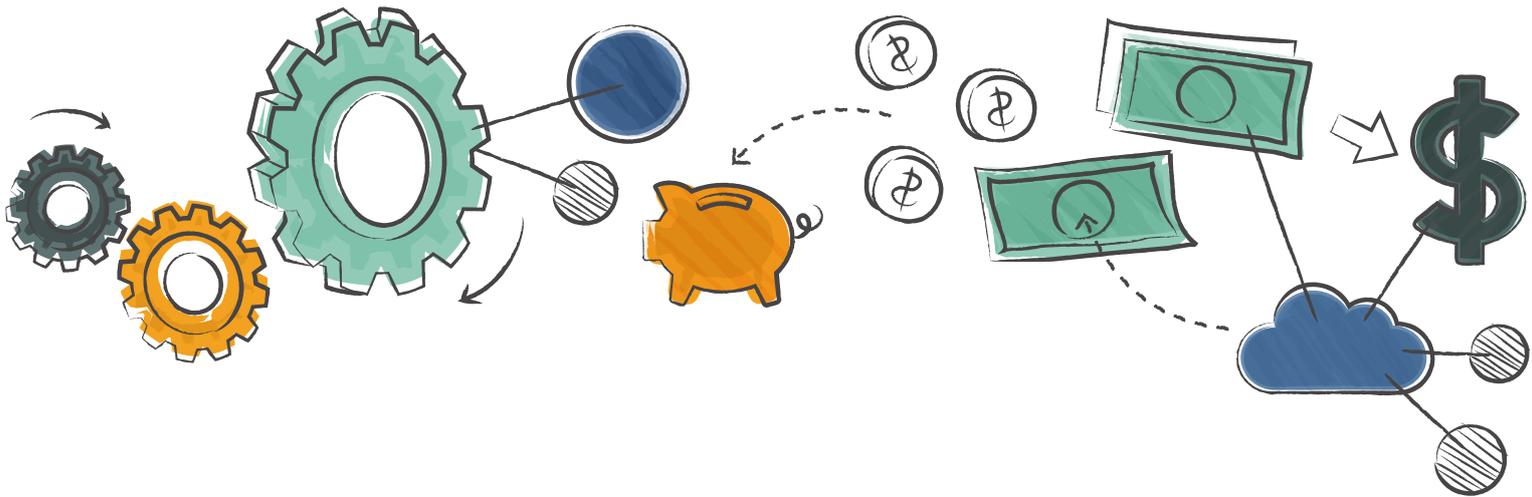
On the supply side the economic agent collecting and storing the data incurs a set of fixed and variable costs. A relevant aspect here is that when the data collected is the side product of another economic activity, the marginal collection costs are low, although the variable data-storage and -protection costs may be high.

The costs might increase when the data to be collected is personal in character, with a concomitant need to compensate the data subject, either directly or by “exchanging” his or her data for an ostensibly free service. This last scheme is habitual on digital platform models, where users pay with their data for service access (email, videos, social networking sites, etc).

The supply-side model presents economies of scale, the average cost of data collection and storage varying inversely with the amount of data collected. This is the case when the initial outlay is high but the marginal costs are low: this is the bedrock of platform-based business models with network-effect externalities (social media) in which the drawing power of a given platform for new participants varies directly with the number of agents already participating in it, whereby the marginal utility of the data-assigning agents increases, cutting platform costs. This phenomenon has been favored and kindled by the aforementioned technological innovations.

Closing the discussion on demand, all these phenomena have favored an exponential increase in the amount of available data and the collecting and storing agents.

From the demand side, increasing the value of the data involves taking into



account the role played by this data in the modern economy. Firstly, data has now become an input in the production of goods and services, playing a key role in the improvement of efficiency and innovation. Secondly, data has become an information transmission vehicle between economic agents, impinging on the efficiency of the various markets (reduction of information asymmetry effects) and on the strategic behavior of these agents.

BENEFITS

Although the data economy has not yet been ascertained to be a sustainable growth source, it's hard to argue that it has driven a thoroughgoing transformation in all economic sectors.

The possibility of obtaining higher visibility in the efficacy and efficiency of productive processes has translated into the identification of opportunities for competition-boosting innovation and improvement.

A greater knowledge of consumer needs means products and services can be custom designed to suit their needs. Conversely, greater consumer knowledge of the features of these products and services empowers consumers, improving their decision-making sovereignty.

Finally, opportunities for disruptive innovation crop up, with the advent of new business models, new services and new products.

From a microeconomic point of view, a *sine qua non* for firms to be able to obtain these benefits is access to the data itself, the processing technology and, crucially, skilled human resources capable of rolling out, running and maintaining the complex information systems and associated processes.

RISKS

From a risk perspective the data economy does not favor its sharing; quite the contrary. Since data is seen as a source of competitive advantage, the tendency is to corner the greatest amount possible, with a concomitant risk of high concentration and power in a small group of actors.

At the same time, the incentive is sufficiently important to impinge on such aspects as privacy. A certain self-regulation effect is likely here, firms being chary of a reputational fallout from any excesses, but this consideration is unlikely to be enough in itself.

Top-down market regulation would therefore seem to be inevitable, in order to guarantee its proper working from a macroeconomic point of view.

Finally, data value makes it an asset subject to accidental threats (loss/destruction) as well as intentional threats (unauthorized access/tampering). Here is where, once more, there is an urgent need for professionals skilled in information security, cybersecurity, business continuity/recovery from disasters.

This brief article has tried to give an overview of the data economy. It's only the start.

The future of applications deriving from big data, machine learning, artificial intelligence is unfathomable, impacting on all economic sectors in ways we are at the moment unable to imagine.

For companies the adoption of a data-centered strategy promises potential benefits but it also poses big technological risks. By far the least of these risks is the availability of skilled personnel to run them.



José Luís Martínez

Spokesperson/Director of the Spanish Banking Association (AEB)

José Luis Martínez Campuzano is the Spokesperson/Director responsible for Communications, Financial Education and Corporate Social Responsibility of the Spanish Banking Association (*Asociación Española de Banca: AEB*).

Until May 2016 he was Citi España's economic and market strategist, working on various cash-based business areas for 27 years and reporting directly to the president in Spain.

Before Citibank he was working at AFI and he has been a regular radio, television and press collaborator since 1995.

He is a tenure-holding professor of the Stockmarket Studies Institute (*Instituto de Estudios Bursátiles: IEB*); previously he was also a professor at the Industrial Organization School (*Escuela de Organización Industrial: EOI*). He has also collaborated in various Master degree courses at teaching institutes like CUNEF, ICADE and IESE.

He is a member of the ECB Observatory and collaborates with other economists in a monthly appraisal of ECB's decisions, the results being published in the economic review *Expansión*.

He graduated as economist from the Universidad Autónoma de Madrid, specializing in public finance, taking post-grad studies in applied economics.

With over 40 years behind it the Asociación Española de Banca (AEB) has enjoyed a grandstand view of the ongoing transformation in the financial sector. What part has AEB played in this transition?

Innovation in the provision of financial services is hardwired into Spanish banks and they have demonstrated their huge capacity of adapting to any changes in the scenario they operate in. These two hallmark features have always generated new benefits for clients, overseen by AEB. AEB is pledged to give the best service to its members, defending their interests within the framework of free competition and respect for the work of the authorities.

According to AEB figures, banks are now offering 73 % of their services online. What do you consider to be the pros and cons of the digitization of the financial sector?

The digital transformation in the

financial services sector goes hand in hand with the transformation of society itself. Clients are now asking from banks the same performance features they are demanding in other facets of their daily lives: flexibility, speed, transparency and security, 24 x 7. Digitization reinforces the already high level of financial inclusion in Spain. Spanish banks offer more digital financial services than their European counterparts, and at a lower price. We at AEB see no drawbacks to this process, only benefits for one and all.

The shift from a traditional bank to a digital bank involves a cultural change that affects not only the bank's staff but its customers too. How is the sector now working to bring this transition about?

It is the clients who are demanding new communication channels from the banks and marking out the digitization path. The banking sector is working to meet their needs while offering top-quality, affordable services for

It is the clients who are demanding new communication channels from the banks and marking out the digitization path

all its clients, whether they prefer face-to-face or online banking. In Spain three out of every four banking services are free; the same cannot be said of Europe. We also boast Europe's second highest density of banks per inhabitant.

One of the ongoing changes is the incorporation of new players like fintech and bigtech. How is the banking sector addressing this?

Banks are really the first fintechs, since this term refers to the application of technology in the provision of financial services. They are therefore collaborating positively with the newly created



technology firms of this type and even encouraging newcomers to the financial sector. To guarantee adequate customer protection, however, it is crucial to ensure that all

The data belongs to the clients. Working from this principle, it is still important for the use of this data to favor competition and innovation, always in the clients' benefit

financial service providers are subject to the same bank supervision and regulation; after all, the same activity involves the same risk. In the new digital era, with the incorporation of the major technology companies in the financial world, the authorities now have to look out for client protection, financial stability and medium- and long-term competition, in the interests of one and all.

Banks are one of the prime targets of cybercriminals. Some pundits claim that aggressions were up by over 20 % in 2019. Is AEB taking any measures to raise

awareness of this threat? Are there any particular measures you might like to mention?

Cybersecurity is top-priority for banks, which muster all means within their scope to guarantee the security of their clients' personal and financial data and head off future risks. But they do not rest on the laurels of past performance. Banks are continually checking their cyberattack-detection, -defense and -response capacity. As banks strengthen their protection barriers, cyberattackers are switching to the weaker link in the chain: the client. For this very reason AEB carries out periodical awareness-raising campaigns, sometimes in collaboration with law-enforcement agencies, to prevent cyberattacks. The latest campaign, held in February, centered on practical tips for downloading handheld apps.

What is your opinion of the recently implemented European Payment Service Directive (PSD2), designed to reinforce the security of electronic payment services, and the advent of new operators? Do you see this as a business opportunity for technology firms?

The European PSD2 review authority had two main aims in mind: encourage competition and minimize security risks. Paramount in the first endeavor was incorporation into the payment regulation procedure of new services that were emerging in the digital environment: payment initiation and the account information service. Insofar as these call for access to client accounts mainly held in banks, PSD2 lays down the levels of security to be met both for account access and for any electronic payment operation. Banks have been one of the most innovative and trailblazing players in the take-up of new technology. This trend is not going to change, so what PSD2 means for the financial market is a supply side in keeping with increasingly digital users. Crucial here is equal data-sharing opportunities for banks and the new operators.

Is Spain's financial sector a digitization benchmark? How does

Spain stand here in comparison to other countries?

Financial innovation has always been vital for economic development and prosperity. Spanish banks are spearheading Europe's digitization process; witness their leadership in instant transfers or the development of Spain's mobile payment solution called Bizum.

What sort of groundbreaking technology is the banking sector using in its digital transformation, and how?

All new technology has a huge potential for improving or even totally overhauling how things

have been done hitherto. At the moment, however, their degree of maturity is patchy. For example, banking biometrics has recorded a much higher takeup than blockchain technology, where some projects are still in analysis phase. The rollout of AI tools could have a very positive impact for numerous areas and services, such as risk-assessment models, the fight against fraud and, naturally, the development of new products. All this calls for technology such as the cloud or big data analysis tools.

Technology like big data could be vital in terms of turning client

data to the best possible account and offering these clients bespoke services. But how do we strike the right balance, ensuring these clients don't feel bombarded by their banks?

The data belongs to the clients. Working from this principle, it is still important for the use of this data to favor competition and innovation, always in the clients' benefit. The experience built up with PSD2 can serve precisely as the basis for showing how banks harness the opportunities offered by the new scenario, while at the same time ensuring clients receive the best possible services.





GMV takes part in the Future Combat Air System (FCAS)

GMV, together with SENER Aeroespacial and TECNOBIT-GRUPO OESIA, is leading in Spain the Remote Carrier Technology Pillar, which forms part of the Next Generation Weapon System (NGWS) project, included within the concept of the Future Combat Air System (FCAS)

In liaison with the Spanish MoD, GMV has reached an agreement with SENER Aeroespacial and TECNOBIT for joint leadership of Spain's participation in the Remote Carrier Technology Pillar.

The Remote Carrier Technology Pillar forms part of the Next Generation Weapon System (NGWS) project, included within the concept of the Future Combat Air System (FCAS).

The FCAS program aims to develop a "system of systems" connecting interoperable manned and unmanned air platforms. Driven by German and France, it is one of Europe's biggest defense projects. Spain has been participating as national partner since 2019. Spain's participation in FCAS,



through NGWS and other programs, is considered to be a sovereignty-enhancing state project that contributes towards the construction of Europe, ongoing technological development and the knitting together of an industrial fabric, while also generating a large number of highly skilled jobs.

The particular remit of the Remote Carrier Technology Pillar is to develop new technology and evaluate new concepts, in coordination with the new NGWS/FCAS combat manned aircraft, based on a set of unmanned vehicles, some of them with ISTAR observation capability.

The agreement reached between the three countries represents a great stride forward for Spanish industry's

participation in the NGWS/FCAS project and opens the doors for the development of disruptive technology, with the knock-on benefits for Spain's industrial technology base as a whole. Special mention here must be made of universities and technological research centers due to the dual character of many of the research initiatives coming under the umbrella of the Remote Carrier Technology Pillar.

GMV will be inputting its expertise built up from a long track record in international industrial cooperation projects. This rests on four main pillars: direct contracting with European agencies and NATO; the sale of JISR products; direct participation in R&D programs, and GMV's cooperative spirit, always keen to collaborate not only with the rest of industry but

also the main technological research centers.

This agreement cements GMV's position in this sector, giving it the chance to develop inhouse disruptive technology that boosts the company's already impressive reputation in this field.

The Secretary of State for Defense, Ángel Olivares, recently signed with his French and German counterparts, Joël Barre and Benedikt Zimmer respectively, a new implementation agreement for the full integration of Spain and its industry in development of the Joint Concept Study (JCS) of the Future Combat Air System (FCAS), giving further impetus to the participation of Spain and its industrial fabric in the program.

The value of EO for understanding our oceans

In late December 2019 Portugal's Centro de Congressos do Estoril hosted the "Linking Earth Observation Data and Sustainable Development across the Atlantic" workshop, organized by *Instituto Hidrográfico* and AIR CENTER under an ESA and FUTURE EARTH joint activity.

Sponsored by GMV, this event aimed to foster the use of Earth Observation (EO) information for ocean-related activities carried out by researchers and stakeholders in the Central and Southern Atlantic and in alignment with the European Space Agency (ESA)'s Atlantic Regional Initiative. The participants were also invited to join the Marine Technology Workshop 2019 (Marinetech19), held by the *Instituto Hidrográfico* biennially since 2015, where they were able to swap notes with other experienced users, including ESA and Copernicus experts.

The workshop presented a number of case studies, EO-based tools and services in a broad range of ocean-related topics. Prominently featured were ESA's initiatives in bringing consistent EO data to users, but also the new EO-data-based services that have proved to be a powerful tool for the democratization of information and sustainable development across the Atlantic.

As well as sponsoring the workshop, GMV offered the presentation "Earth Observation: the new frontier in climate resilience" while also moderating the session on "Earth Observation for Coastal Resilience" and presenting a Showcase of EO Tools and Services.



GMV to install control system for Space Norway's two Arctic-deployed satellites

GMV will develop and install the operations center of the satellites ASBM-1 and ASBM-2, built by Northrop Grumman and making up the core of the Arctic Satellite Broadband Mission (ASBM) satellite system

GMV has signed a contract with Northrop Grumman for development and supply of the Satellite Operations Center for Space Norway HEOSAT's ASBM-1 and ASBM-2 satellites.

Space Norway HEOSAT, a subsidiary of the government owned Space Norway, is a Norwegian company set up to run the Arctic Satellite Broadband Mission (ASBM).

ASBM-1 and ASBM-2, built by Northrop Grumman on the GeoStar3 platform, make up the core of ASBM, a satellite system designed to work in highly elliptical orbits (HEO) to ensure broadband connectivity at latitudes beyond the reach of geostationary satellites. Geostationary satellites are capable of providing coverage from the equator, whereas ASBM satellites will be using their unique orbit to provide coverage in the Arctic, from 65 degrees Northwards, providing broadband for civil and military users in the Arctic.

GMV will be developing and installing the control center for Northrop Grumman, including the real-time command and telemetry processing system based on **Hifly**[®], the flight dynamics system based on **FocusSuite**, plus the ground segment control and monitoring system, **Magnet**. The contract's scope also takes in the provision of other GMV flight control solutions, like **Flyplan**, for operation planning and automation, **FleetDashboard**, for global knowledge of the state of the system, together with **CentralLog**, which pools the events of all the various subsystems.

GMV will install the control software and equipment at the ground stations in Northern Norway.

Each one of the satellites, penciled in for a late-2022 launch, is fitted with payloads for Inmarsat, the Norwegian Ministry of Defense and the United States Airforce.

GMV deploys a precise Copernicus orbit determination service in the cloud



■ Copernicus's precise orbit determination (POD) service, designed and deployed by GMV, has been working successfully since 2014, giving support and providing precise orbit determination services with millimetric accuracy for the Sentinel-1, Sentinel-2 and Sentinel-3 missions.

This service has the capability of processing state-of-the-art satellite monitoring techniques (including GPS and laser) and providing orbits with various levels of precision and response times, ranging from near real-time solutions to offline

solutions of greater, millimetric precision; all this is essential for scientific processing of satellite data.

The hardware of this service, deployed and monitored by GMV from its Tres Cantos datacenter, comprised processing machines, FTPs as client interface, an archive and firewall for protecting the infrastructure from unauthorized access.

The service has been up and running since 2014. In early 2019, however, in view of the European Space Agency (ESA)'s interest in migrating all

operational processors, GMV proposed transferring all this hardware to the cloud. The project was finally awarded to GMV, which has carried it out in collaboration with the cloud service provider, GIGAS. Under this project GMV has been responsible for software of the POD and its operations, as well as deployment, configuration and maintenance of the cloud infrastructure and 7x24 monitoring.

During the project, which kicked off in April, necessary adaptations of POD software have been carried out, including the use of dockers, a widely used cloud technology for adding an additional abstraction and automation layer of application virtualization. Later on the whole infrastructure, working in parallel with operational execution in GMV's datacenter, will be deployed in GIGAS's cloud.

This project also highlights the cybersecurity aspects, the configuration of which was also GMV's responsibility.

At the end of January ESA declared the cloud system to be operational and congratulated the team on its performance.

GMV to supply the flight dynamics system of Inmarsat's I-6 F1 and I-6 F2 satellites

■ Inmarsat has awarded GMV a contract for development and supply of the flight dynamics system (FDS) of the satellites of the Inmarsat-6 (I-6) mission.

Inmarsat PLC, a telecommunications-satellite company based in London, provides worldwide mobile services by means of thirteen geostationary telecommunications satellites. I-6 F1 and I-6 F2, the two satellites of this mission, scheduled for launch in 2020 and 2021 respectively, aim to improve

Global Xpress services in L and Ka bands.

The satellites, developed by Airbus Defence and Space, are based on a variant of the Eurostar platform's E3000 Mk2, using electric propulsion and steerable thrusters both in the launch and early orbit phases and in nominal operations.

The I-6 satellites will be operated by Inmarsat; GMV will be providing the flight dynamics system based on its

inhouse **Focussuite**, the most marketed FDS worldwide.

The I-6 mission will endow Inmarsat with a whole new generation of 5G capabilities, providing worldwide mobile communications services.

In the context of the new technological challenges, Inmarsat has turned to GMV and its advanced flight dynamics system for improving and personalizing its satellite operations with the highest possible degree of reliability, safety and automation.

Solar Orbiter heads for the sun

■ On 10 February, right on schedule, the Solar Orbiter mission lifted off on an Atlas V 411 from Cape Canaveral, Florida, heading for the sun.

At its closest point Solar Orbiter, led by the European Space Agency (ESA) with strong NASA participation, will be only 42 million kilometers from the Sun's surface, giving us

unprecedented insights into how our parent star works.

In the frame of this mission, under a contract with ESA's European Space Operations Center (ESOC), GMV has taken on responsibility for the design and development of its control center. GMV will also be providing ESOC with mission-long orbital control support

(Flight Dynamics) in traditional areas like maneuver calculation, testing and orbit validation, plus command validation. Furthermore, GMV's Portugal subsidiary is responsible for the Central Checkout System (CCS) under Astrium UK, software that forms part of the satellite-testing ground support system.

Solar Orbiter, which will orbit the sun five times in a two-and-a-half year period, carries scientific instruments that will be taking both in-situ and remote-sensing measurements, giving us our first complete view not only of solar physics but also of the heliosphere. The European probe will also be imaging the sun's polar regions, as well as studying and trying to forecast the sun's behavior and effects back on earth.

Solar Orbiter takes its cue from a long tradition of European solar exploration missions, featuring Helios 1 and 2 satellites, Ulysses and SOHO, in collaboration with NASA, plus ESA's Proba-2 mission.



GMV attends the latest SATELLITE

The Walter Edward Washington Convention Center in Washington D.C. recently hosted today's most important satellite-technology event, SATELLITE 2020, bringing together representatives from the top telecommunications-satellite companies.

GMV now boasts a wealth of experience in ground-segment development and is currently the world's number-one supplier of control systems for communications space missions. As such it could hardly miss this event in a world where telecommunications is becoming increasingly interrelated and connected and underpins other important markets like the media, transport, finances and even the consumer industry.

GMV, with the support of the Spanish External Trade Institute (*Instituto*

Español de Comercio Exterior), once more exhibited its range of space-mission ground segment solutions, including **Hifly**[®] (satellite control), **Focussuite** (orbit control), **Closeap/Focusoc** (collision risk management and associated services), **Flexplan** (satellite-resource planning system), **Magnet** (monitoring- and receiver-station control), **Smartrings** (configuration management) and **Smarthz** (payload optimization); plus network-security (cybersecurity) and vulnerability-analysis services.

Despite the COVID-19 lockdown, which even forced the conference to close one day earlier than scheduled, the conference still served as the world's best showcase for in situ display of GMV's range of Space products, offering the possibility of holding real-time

demos for both actual and potential customers while also pinpointing new needs in the space industry. The event also still represents a unique yearly chance to do some networking and swap notes on sector breakthroughs.



Present and Future of the small satellites sector



From 25 to 27 February Malaga in Spain hosted the second Spanish Small Satellites International Forum (2020). The aim of the forum is to analyze the sector's technological developments and its international market, plus Spain's capabilities for playing an upfront role in the microsatellite industry.

As well as sponsoring the event GMV brought to bear its flight-segment and ground-segment expertise. Miguel Ángel Molina, GMV's commercial space manager, took part in the ground-segment discussion panel, stressing GMV's New Space capabilities and the growing number of satellites, constellations and associated services, as well as microlaunchers or ground stations that are now cropping up in the market. Also, Francisco Javier Atapuerca, head of the Mission Analysis and Studies section (EGS), then gave a presentation under the title "GMV's experience with CubeSat and Required Technologies".

Successful launch of the first satellite of EUTELSAT's all-electric Spacebus NEO platform

■ On 16 January EUTELSAT KONNECT, Eutelsat's latest satellite, was successfully launched atop an Ariane 5 rocket from the European Spaceport of Kourou in French Guiana. EUTELSAT KONNECT is the first satellite based on the all-electric Spacebus NEO platform built by Thales Alenia Space.

Eutelsat, one of GMV's flagship clients, runs GMV-developed systems for controlling its complete fleet of satellites, featuring the NEO multi-satellite and multi-platform satellite control system, based on its inhouse systems *Hifly*[®] and the orbital dynamics system *Focussuite*. Both systems will be responsible for running the ground operations of this new satellite.

Right now EUTELSAT KONNECT is in the progressive orbit-raising period from launcher orbit to service orbit in the geostationary earth orbit (GEO ring), where the satellite will synch in to the earth's rotation speed. This process will take between 6 and 8 months, since the satellite uses low-thrust all-electric propulsion; this propulsion system, however, is highly efficient, using five times less fuel than chemical propulsion.

These all-electric engines represent a paradigm shift in space missions. In the case of commercial telecommunications satellites, the drastic fuel reduction means the satellite's mass can be cut down, with a knock-on reduction in the launch price. The payload can be increased

too, and thereby the mission's capability. Furthermore, optimization of the long GEO orbit-raising and control trajectories poses a stiff challenge for the orbital control and mission analysis systems, for which GMV is already offering solutions within its *Focussuite* family.

EUTELSAT KONNECT will ensure total or partial coverage to a total of 40 countries in Africa and 15 in Europe. By next autumn this high-performance satellite, with a total capacity of 75 Gbps, will enable Eutelsat to provide 100 Mbps internet services for companies and individual users.



GSAW 2020

■ GMV took part in the twenty-fourth Ground System Architectures Workshop (GSAW 2020), held under the banner "Opportunities in Data Exploitation" in Los Angeles from February 2 to 5 March.

GSAW's working groups, panel discussions and tutorials provide a splendid forum

for the world's space-related ground system experts to collaborate with other users, developers, vendors, and researchers.

GMV ran a stand in the exhibition area to showcase its range of satellite-control products.

GMV renews its Columbus services for ESA and DLR

On the strength of its experience built up over the years, plus the liaison between its companies in Germany, France and Spain, GMV has won a three-year renewal of the services it is providing for ESA and DLR under the Columbus project

For some years now GMV has been participating in diverse activities within the European Space Agency (ESA)'s Columbus project.

The Columbus module is the European science laboratory, forming part of the International Space Station. This module is monitored and controlled from the Columbus Control Centre (Col-CC), located in Oberpfaffenhofen, Germany.

Col-CC is also responsible for providing the Columbus Ground Segment, which interconnects Col-CC with all the following: the European User Support Operations Centres (USOCs), Mission Control Center Houston (MCC-H, USA), Huntsville Operation Support Center (HOSC, USA), Mission Control Center Moscow (MCC-M, Russia) and EAC (European Astronaut Centre).

The main role of the ground segment is to route the different types of data

(TM/TC, payload-data, video, voice, etc) between the various stakeholders.

GMV's participation in this project is orchestrated through a contractual agreement between GMV and ESA/DLR. This translates into all the following: provision of flight controllers, which plan, monitor, control and manage the Columbus systems and ESA payloads activities; provision of ground controllers, which plan, monitor and configure the ground segment and ensure coordination between the different centers; provision of ground-system and subsystem engineers, specialists in their field, who are in charge of sub-system maintenance and checking for obsolescence; and, finally, support for the ESA Houston office, giving high visibility on future manned missions.

Fruit of the experience built up in these activities over these years, plus the close collaboration between its

subsidiaries of Germany, France and Spain, GMV has recently renewed for a three-year term all these ESA/DLR services.

Apart from the renewal of these activities, under this new agreement GMV has also managed to expand to Columbus the training & logistics contract supporting the training of astronauts and future flight controllers.

In the coming months a Ka-band antenna will be installed on the Columbus Module providing additional downlink/uplink capabilities via the European Data Relay System (EDRS) constellation. This will enhance Columbus' science-experiment supporting capabilities.

GMV is currently developing the COL-KA simulator, which will help flight controllers to carry out their work.



GMV working on planetary defense technology against asteroid impact

■ February saw the kickoff meeting of the Near-Earth Object Modelling and Payloads for Protection (NEO-MAPP), a European-Commission H2020 project.

GMV is participating in a consortium led by France's National Scientific Research Centre. NEO-MAPP's remit is to carry out advanced research in Near Earth Objects and new payload technologies for planetary defense.

In April 2029 the 370-m diameter asteroid Apophis will come closer to hitting Earth than the distance of geosynchronous satellites. Such small asteroids frequently threaten the planet, yet are the least observable from the ground. The success of any effort to

deflect a Near Earth Object depends on development of reconnaissance and impact missions, which in turn call for technological development, particularly asteroid-modelling capabilities, as well as the capability of performing close proximity operations and making relevant measurements.

The objective of NEO-MAPP is to further the technologies required for understanding the response of NEOs to kinetic impacts and the associated measurements by an observing spacecraft in close proximity. In this endeavor two reference missions will be addressed by the multi-disciplinary team composed of scientific research centers and main players in the

industry: a kinetic impactor validation mission, and a rendezvous mission.

Within this project GMV will be inputting its expertise built up during several decades in areas like orbit determination and image processing, plus general consultancy for mission design and rendezvous operations.

Experts from GMV and the scientific R&D center FCIências.ID in Portugal will join the University of Bologna in Italy and Airbus Germany, advancing ground- and vision-based orbit determination methods and tools and defining a reference mission in synergy with the European Space Agency's Hera.



GMV hosts NATO's SST research program panel meeting

■ On 25 and 26 February GMV head office hosted the Systems Concepts and Integration Panel (SCI) meeting, forming part of the working methodology of the Science and Technology Organization (STO) within NATO's science-technology program.

The meeting was held under the title "Collaborative Space Domain Awareness Data Collection and Fusion Experiment". SCI's particular mission is to enhance knowledge of advanced systems,

concepts, integration, engineering techniques and technologies across the spectrum of platforms and operating environments to assure cost-effective mission area capabilities. Since it first kicked off in 2018 it has striven to bring together efforts, skills and information in the space domain.

The first day kicked off with a display of GMV's defense and security capabilities in the aeronautics and space sectors, focusing on its inhouse Space Surveillance

and Tracking (SST) developments. The meeting continued with a stocktaking of this expert panel's progress and an analysis of the new goals in relation to SST procedures, metrics and tools.

The event was attended by representatives from NATO member countries, the Spanish Ministry of Defense and the Space Surveillance Operations Center (*Centro de Operaciones de Vigilancia Espacial: COVE*) and the worldwide space industry.

Third workshop of the H2020 MySustainableForest project



■ On 28 January Aveiro in Portugal hosted the third stakeholders workshop of remote data users for sustainable forestry, under the MySustainableForest project.

Financed by the European Union under the Horizon 2020 framework program (No 776045), MySustainableForest kicked off in November 2017 under a GMV-led consortium of 11 European organizations working to make the project operative by 2020.

MySustainableForest sets out to test the benefits of precise and thoroughgoing woodland management

by means of the systematic use of satellite data together with traditional readings recorded in situ. Furnishing woodland owners and forestry managers with new data will enhance and favor ongoing woodland production practices.

MySustainableForest will offer a platform of services and products such as the characterization of timber resources, characterization of wood in terms of hardness and density, estimate of the volume of stored carbon, biotic condition and the wood's vulnerability to plagues or severe weather events or other natural risks such as floods, fire or erosion.

Since 2017 the producers of the GMV consortium, föra, Madera+ and EFI, have delivered over 250 forestry products. The Aveiro workshop, through the project's platform, presented the flagship products on Baixo Bouga, Caniceira in the central region, Quintarrei in the northern region and Calha do Grou in Alentejo.

The workshop brought together R&D institutions; geospatial information companies; Portugal's forestry companies; woodland managers; species gene banks; pulp, biomass and laminated timber industries; insurers and public authorities.

GMV committed to the small-satellite community

From 28 to 31 January Rome in Italy hosted the fifth IAA Conference on University Satellite Missions and CubeSat Workshop, jointly organized by the Group of Astrodynamics of the Use of Space Systems (GAUSS) and the International Academy of Astronautics (IAA).

Held under the banner title "Getting closer to Mars", the conference included technical sessions on launch

opportunities for universities, ground segment operations, space debris, new microsatellite-application perspectives and several CubeSat-mission presentations.

In the space system session GMV presented a paper summing up its CubeSat activities, running through the work carried out by the company's various offices in this cutting-edge sector.

The paper looked in detail at some of the company's CubeSat products, such as the GNSS Receiver for Space Applications, AIR hypervisor and Ground Segment products adapted for CubeSat applications, as well as GMV's operational technology developed for ESA-led space missions that are now up in space, like the OBSW for OPS-SAT, or missions in the pipeline like RACE, Juventas or the Portuguese microsatellite Infante.

EOLAW, EO derived information in support of Law Enforcement



■ ESA turns again to GMV to bring space-based applications and services down to Earth. This time GMV in Portugal is leading the EOLAW contract to bring EO-derived information to law enforcement.

The project's goal is to demonstrate the benefits of using EO-based information together with state-of-the-art Information and communications technology (ICT)

data analytics and non-EO data fusion through the implementation of selected services in a virtual platform in the law enforcement domain.

The rapidly changing market for EO based services (rapid increase of data sources from new types of EO missions as well as a variety of commercial EO missions and small satellites) together with the advances in ICT have led to a different reference framework for the development of applications exploiting EO data. This means it is now increasingly possible to embed EO analytics within the workflows and processes of target demand sectors, as a result of ICT developments addressing the underlying technical challenges for such fusion and integrated analytics.

Within this scenario GMV is working with a number of relevant stakeholders (EO service providers, in-sector providers and industrial customers, but also ESA, government agencies and NGOs) to provide operational solutions that embed EO-based analysis and reporting (and associated processing

chain) into these stakeholders' current procedures.

The project will address different areas such as environmental crimes (e.g. illegal logging and trafficking and illegal, unreported and unregulated fishing), crimes against humanity, counter proliferation and as well terrorism and organized crime.

The GMV-led consortium will implement selected services in a virtual platform and run extensive demonstrations, involving stakeholders in the law enforcement domain.

Ultimately, the project will demonstrate the impact and benefit from embedding EO-derived information and related analytics capabilities within operational processes of these stakeholders, involving from the beginning the whole supply chain including in-sector providers in order to increase awareness, acceptance and understanding of the potential benefits of using EO-derived information in the law enforcement domain.

GMV renews as a member of PAE's managing board

■ GMV has been voted once more onto the managing board of Spanish Aerospace Technology Platform (*Plataforma Tecnológica Aeroespacial Española*: PAE) after elections involving votes from 67 of the 75 associated entities. GMV received the support of 86 % of the assembly.

PAE serves as a Spanish aerospace R&D meeting point for its 85 associates, including industry, academia, SMEs and technological research organizations. It also brings together all national stakeholders within both the aeronautics and space sectors.

The election was held during PAE's general assembly, held on 12 December in the Ministry of Science and Innovation.



Big Data and remote sensing to understand migratory movements



■ In mid December Leuven in Belgium hosted the kickoff meeting of HumMingBird, a European Commission Horizon 2020 (H2020) project.

GMV, together with another 15 partners from various countries, is participating in this 48-month project led by KU Leuven (Katholieke Universiteit te Leuven).

HumMingBird aims to provide a better understanding of the changing nature of migration flows and the determining

factors, analyzing patterns, motivations and emerging trends to identify the future political decision-making consequences.

GMV's participation, through its UK subsidiary, centers on the use of satellite data in combination with Big Data technology to understand migratory flows associated with environmental disasters.

The analysis, centering on Africa, will reinforce GMV's position in the use of

new technologies applied to migration flows and humanitarian aid, as well as consolidating the company's Big Data analytical capability.

Moreover, the relation with other specialist partners in sociology, migratory movements, social-network data analysis, etc, will enrich GMV's capacity to understand the changing nature of migratory movements and hence improve our analytical capability.

GMV analyzes space opportunities in Portugal in the URSI Congress

The Portuguese Committee of the International Union of Radio Science (URSI) held its thirteenth congress on 17 December 2019 in Lisbon (Portugal), under the banner theme of "Space: Challenges and Opportunities".

This draft regulation sought to seize the momentum that currently exists at a national level with the creation of the Portuguese Space Agency and the Space Authority, to assess to what extent space can contribute to new technological ecosystems for mass communication and scientific research.

The opening session was led by Manuel Heitor, Minister of Science, Technology and Higher Education and João Cadete de Matos, Chairman of the ANACOM Board of Directors.

Teresa Ferreira, Space director of GMV in Portugal, was one of the invited speakers to discuss the Opportunities of Space in Portugal, focusing on the new technologies that are being developed and implemented in the space sector, namely in some key projects GMV is leading.



GMV working to include space-debris detection systems onboard the new generation of Galileo satellites

■ Under the framework of Space Situational Awareness (SSA) programs, GMV is proposing to include secondary instruments onboard the second generation of Galileo satellites to enhance the capabilities of a ground-based sensor network (mainly surveillance and tracking radars and optical telescopes) in order to support Space Surveillance and Tracking (SST) and Near-Earth Objects (NEO) segments. Space-based telescopes have several advantages over ground-based systems for space surveillance; the performance is better due to the absence of any atmospheric disturbance in the field of view or timing alignments.

One of today's major SSA activities is the European Space Agency (ESA) project SBSS-GNSS, led by GMV. Its remit is to analyze the in-orbit algorithms, sensors and avionics for monitoring space debris. SBSS-GNSS would be embarked as experimental payload on Galileo's space-debris surveillance satellites in medium earth orbits (MEO) and low earth orbits (LEO) as a secondary service for detecting and tracking space debris in the most populated space area. To do so it will be using miniaturization technology for the high-performance, space-robust imaging sensor and computing electronics.



Under this project GMV's Spanish and Romanian companies will be responsible for all SBSS-GNSS activities plus analysis of requirements and definition of the testing plan. It will additionally take on responsibility for definition and implementation of the camera-based detection algorithms as well as the final integration of this implementation on the SBSS-GNSS hardware and validation of the final product. GMV will also be responsible for avionics design and development,

comprising a system integrating an optical camera and an image processing card based on hardware acceleration by a space-qualified Field Programmable Gate Array (FPGA).

The SBSS-GNSS system will allow the Galileo constellation to offer MEO and LEO debris data as a secondary and complementary service with a low cost and impact on the primary mission.

GMV brings its maritime-services GNSS expertise

The International Association of Lighthouse Authorities (IALA) periodically brings together representatives of aids to navigation services from about 80 different countries for technical liaison, swapping notes and coordination of the worldwide improvement of navigation aids.

GMV, as an IALA member, has taken part in several technical conferences

and meetings to share the company's ongoing satellite-navigation expertise and examine how it might be brought to bear on maritime navigation safety and security.

From 27 January to 1 February IALA held an Edinburgh workshop on "The Future of Marine Radiobeacon DGPS/DGNSS". The event brought together GMV with another 49 stakeholders

from 22 different countries to discuss the range of options for countries considering maintaining, upgrading and improving or withdrawing navigation aids.

After the workshop's series of presentations and discussions work began on drawing up some guides, to be completed in the next round of IALA committee meetings.

GMV plays a key role in G2G's ground segment

GMV currently holds responsibility for maintenance and upgrading of Galileo's control segment, one of the main ground-segment components of first-generation Galileo (G1G); since 2018 it has also been heading one of the consortia working on Galileo's second-generation (G2G) ground segment

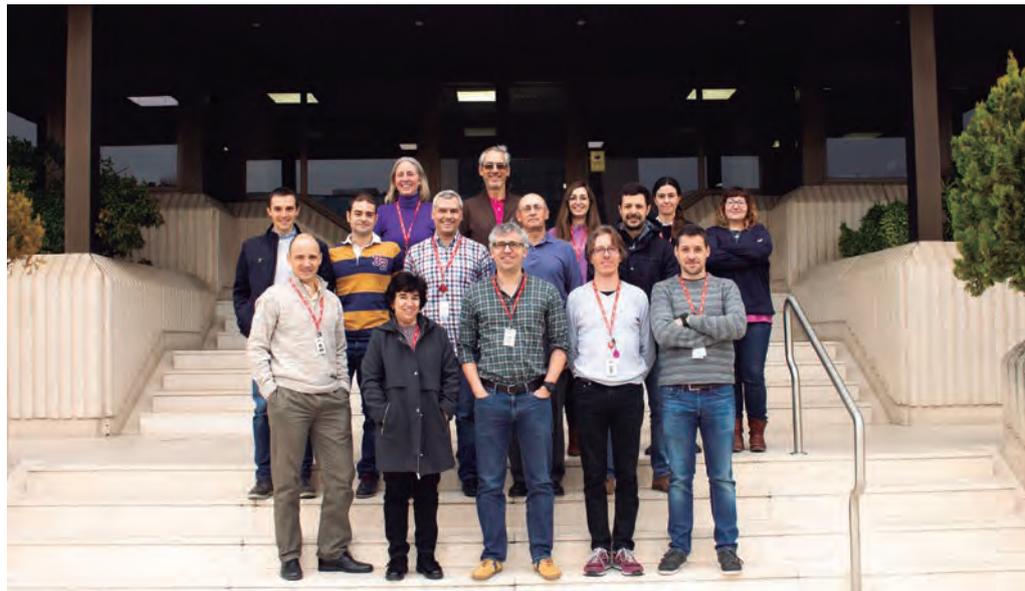
In the final week of December 2019 the European Space Research and Technology Centre (ESTEC) of the European Space Agency (ESA) hosted the Galileo 2nd Generation Ground Segment System Requirement Review (G-SRR), attended by a large GMV team.

The main objectives of Galileo 2nd Generation, shortened to G2G, are the introduction of new services, the improvement of existing services and the enhancement of system robustness and security, while also reducing operation and maintenance costs. The overarching idea is to consolidate Galileo's position as one of the future's main GNSSs.

G2G is divided into several phases. In the first, led by ESA, mission requirements were defined. This phase was followed by a preparation phase, leading on in turn to the implementation phase.

The preparation phase has itself been divided into several sub-phases, executed in parallel by several consortia of companies and broken down into space activities and ground activities. GMV has been leading one of the G2G Ground Segment consortia since 2018.

The main ground-segment activities during the preparation phase were fine tuning of mission definition and specification of the ground segment, as well as preliminary design. The last milestone of this phase consists of the ground segment requirement



review, formally brought to an end during the G-SRR Close-out meeting held in February 2020.

GMV is currently responsible for maintenance and upgrading of the Galileo Control Segment, one of the main ground-segment components of the Galileo 1st Generation Ground Segment (or G1G); it is also responsible for some core elements and activities of the Galileo Mission Segment, the other main component of the G1G Ground Segment. It is only natural, therefore, for GMV to be heavily involved in the development of the Ground Segment of Galileo 2nd Generation.

Taking on responsibility for the G2G Ground Segment represents a quantum leap from GMV's current G1G control and mission activities. G2G activities, after all, encompass the complete ground segment (i.e. G2G

combines both control and mission parts into a single ground segment). GMV's responsibility level will therefore leap from some elements of the G1G Control Segment to the entire G2G Ground Control Segment.

GMV is well aware of the large effort and outlay needed for a successful G2G Ground Segment Phase B2, which will be the last step before starting on the development and implementation of the operational G2G Ground Segment. It is therefore now working hard to assure a maximum participation in Galileo's ground segment implementation phase.

At the end of the G-SRR meeting, attended by a large GMV team, ESA officially thanked GMV for its sterling spadework for this phase as well as its positive and collaborative attitude in the review.

GMV's system-integration business goes from strength to strength

■ The European Defense Agency (EDA) has awarded GMV a framework contract for design and rollout of communication and information systems (CIS) for storing, processing and interchanging classified information (EUCI) up to EU SECRET level during the next eight years.

EDA's aim is to set up EUCI-CISs capable of handling classified information both at internal level, within EDA, and sharing it with government organizations and institutions of EU member states and

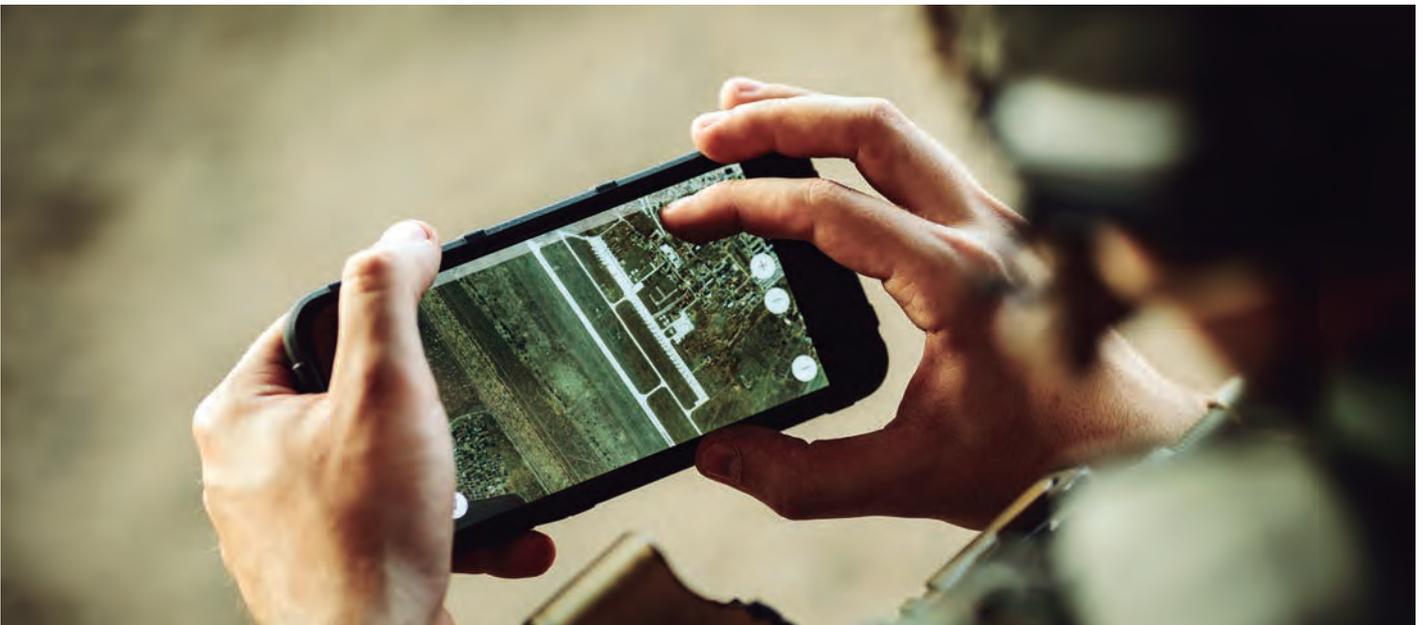
other stakeholders involved in projects requiring this information.

These systems will be designed and deployed in accordance with the EU's legal framework for handling and interchanging EUCI. In the end they will be cleared by the Security Accreditation Authority (SAA) of the General Secretariat of the Council (GSC).

Under this contract GMV, as system integrator, will be the single point of contact; it will also be the company responsible for establishing

and analyzing system- and user-requirements, assessing threats, vulnerabilities and risks, identifying the corresponding mitigation measures, drawing up the necessary documentation for the accreditation process and supporting its performance.

It will also be responsible for the design, implementation and deployment of said systems. After rollout GMV will then take on responsibility for providing maintenance and technical-support services and training up EDA personnel who will be running the systems.



GMV at the "2020 Industry Day"



On 9 January Portugal held its "Dia da Indústria com os Adidos Militares 2020" (2020 Industry Day with Military Attachés), organized by the Portuguese Platform of National Defense Industries (idD) in collaboration with Portugal's Chief of Staff of the Armed Forces.

The main aim of the event, held in the Alfeite Naval Base (Portugal, Lisbon), was to promote the creation of contact

networks between organizations of the industrial and technological defense base, the foreign military attachés accredited in Portugal and the national attachés accredited abroad.

José Neves, GMV's Defense and Security Manager in Portugal, represented the company at the event, which attracted 28 companies and 30 attachés from various countries.

Cloud intelligence as decision-making support and analysis

The European Defense Agency (EDA) has awarded GMV a study for developing a Modular Software Analysis platform (SWAN), which will be using technology like cloud storage and computing, artificial intelligence (AI) and other Big Data management tools

Since 2008 the European Defense Agency (EDA), in collaboration with its member states and contributions from the European Union Military Committee (EUMC) and the European Union Military Staff (EUMS), has been drawing up Capability Defence Plans (CDP) to give an overview of the capabilities needed to support decision making at EU level and in each country, with regard to development of the defense capability.

The latest approved version of this plan, CDP 2018, includes Information Superiority as one of the top priorities to be considered and highlighted as essential at all operational levels. EU operations are dependent on

Communication and Information Systems (CIS) that support Command and Control (C2) and the delivery of ISR information. These Information Communication Services (ICS) need to support concepts like Federated Mission Networking (FMN) and can be organized through service-oriented architectures.

Along these lines EDA has awarded GMV a study for developing a dedicated Modular Software Analysis platform (SWAN), to research into the possibilities of supporting the analysis and assessment of military scenarios, focusing on those related to Hybrid Warfare, through an extensive analysis and processing of the different data involved. This platform

will be using technologies such as cloud computing and storage, artificial intelligence (AI) plus other Big Data management tools. These tools seek to respond to the needs of Defense Forces that operate in dynamic, mobility-requiring environments with high threat levels.

The SWAN platform will be able to collate, process and analyze data from heterogeneous information sources in order to provide Situational Awareness for Hybrid Warfare conflicts. It has to be able to provide a comprehensive Common Operational Picture in order to support planning, decision-making processes and coordination at EU and member state level.



GMV showcases its defense-project expertise at LIMEX 2020



From 28 to 30 January the Spanish Army's Higher Polytechnic School (Escuela Politécnica Superior del Ejército de Tierra) in Madrid hosted the latest LIMEX, a series of lectures, exhibitions and demos to look at the latest hi-tech border-protection developments.

GMV sponsored the event and also ran a stand to display its inhouse defense and security solutions.

Together with Aurea Avionics, GMV presented at the event its new UAS Passer, a multi-rotor drone designed to obtain critical Intelligence, Surveillance and Reconnaissance (ISR) information, as well as Seeker, which has participated in the RAPAZ program of the Spanish MoD's Directorate General of Armaments and Material (Dirección General de Armamento y Material: DGAM).

David Merino, Head of GMV's Maritime Surveillance Section gave a conference paper under the title "Successful Spanish-Portuguese collaboration in the Maritime Integrated Surveillance Awareness (MARISA) project". GMV, one of MARISA's partners, is playing a key role in this Horizon-2020, European-Commission-funded project.

TALOS successfully integrated into the ASCA program

■ GMV has developed TALOS, its inhouse, tried-and-tested command and control system, for the Direction General of Armaments and Material (Dirección General de Armamento y Material: DGAM). Under the TALOS-ASCA project GMV is now upgrading TALOS's functions, endowing it with the fire support command and control (FSC2) systems of other nations.

Interoperability between these systems is developed under the international interoperability program that goes under the name of Artillery System Cooperation Activities (ASCA), in which Spain is currently participating as a sponsoring member. Under the ASCA program GMV is providing support and technical assistance for Spain's national representative in the program.

To be eligible for ASCA membership a country must prove that its national command and control system and national operational rules (NIOP) are compatible with the ASCA-defined interface.

The command and control system certification process has to be performed by way of an interconnection of the applicant

country's system with the system of an ASCA member country. This member country sponsors the applicant country during this process. In the case of Spain the sponsoring country was the United States.

Experiments between TALOS and the US system, called the Advanced Field Artillery Tactical Data System (AFATDS), were held in October 2019 in GMV's site in the Madrid Technology Park (Parque Tecnológico de Madrid: PTM) of Tres Cantos (Madrid). These experiments proved the correct working of TALOS according to ASCA requirements.

After this first hurdle has been passed, ASCA then requires a second round of experiments with another member country to finish the process. This was carried out against the British system called the Fire Control Battlefield Information System Application (FC BISA) in the Royal School of Artillery in Larkhill (UK) during February.

TALOS also successfully passed this second experimentation phase. It has therefore now been cleared for operating jointly with the FSC2 systems of other ASCA nations in multinational operations.



GMV holds a demonstration of European soldier systems under the GOSSRA project

■ On 20 February GMV's Tres Cantos site in Madrid, Spain, hosted a meeting to present the Generic Open Soldier System Reference Architecture (GOSSRA) project.

GOSSRA is financed by the European Union through the European Preparatory Action on Defence Research (PADR) program. GOSSRA's remit, as its name suggests, is to develop a generic open soldier system reference architecture; this reference architecture will recommend specific approaches, guidelines, system structures and standards to be used in order to facilitate the development, integration and interoperability of systems based on this architecture, i.e., operating under the aegis of the EU or NATO.

GMV is working on this project in a consortium led by the German company Rheinmetall Electronics, together with the European firms TNO (Netherlands), Indra (Spain), Larimart SPA (Italy), Leonardo (Italy), SAAB (Sweden), iTTi (Poland) and Tekever-ASDS (Portugal).

GOSSRA focuses on the electronics of these systems, the voice- and data-communications, the sensors and effectors, the HIDs (human interface devices) and C4 systems (Command, Control, Communications, Computers, and Intelligence).

The meeting explained the capabilities developed under GOSSRA, which is now in its final (standardization) phase. Several technical demos highlighted the benefits to be obtained from the standardization of the various hardware and software components, such as the exchange of batteries, sensors or other devices among the systems of different countries. There was also a live exhibition involving the following soldier systems: dZ-ES 68 (Germany), SISCAP (Spain), VOSS SmartVest (Netherlands) and Soldato Sicuro (Italy), demonstrating the capability of interoperating and exchanging tactical information through

the standard interfaces recommended under GOSSRA.

The event was attended by, among others, Colonel Juan Luis González, Head of the Professional Army Support Section (Sección de apoyo al Ejército Profesional: SEAPRO); colonel Moisés Serrano, Head of Spain's

Soldier System Program together with GOSSRA office personnel and other army representatives; the Head of the Program of the Netherlands; representatives from the MoDs of Sweden, Italy, Poland plus representatives from the European Commission and the European Defence Agency (EDA).



GMV takes part in the 121st CISD meeting of the Spanish Quality Association (AEC)



■ The 121st meeting of the Committee of Defense Industries and Services (*Comité de Industrias y Servicios para la Defensa*: CISD) of the Spanish Quality Association (*Asociación Española para la Calidad*: AEC) was held on 20 February last, with the participation of the Industrial Inspections Area (*Área de Inspecciones Industriales*: AI) of the Spanish MoD's Directorate

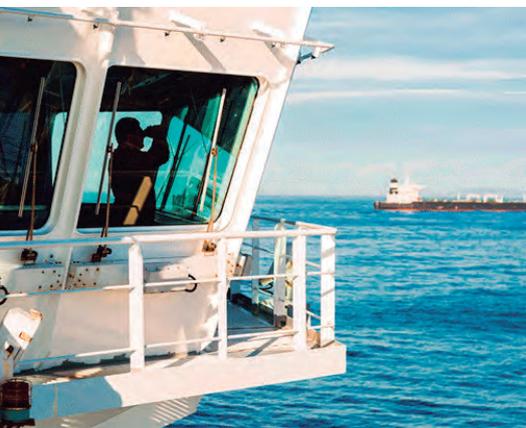
General of Armaments and Materials (*Dirección General de Armamento y Material*: DGAM) and the attendance of GMV.

Other keynote participants were Félix Pablo Torres, CISD president; C. C. Arturo Navarra, from the Subdireccióate General of Inspection, Regulation

and Industrial Strategy (*Subdirección General de Inspección, Regulación y Estrategia Industrial de Defensa*), members of CISD's governing board and representatives from Spain's defense industry.

The meeting venue was the Seville headquarters of General Dynamics European Land Systems (GDELS), site of the manufacture and assembly of the VCR 8x8 Dragon vehicles, for which GMV is supplying three of the onboard systems: the Shottting Detection System, the Navigation System and the Command and Control (C2) System for the vehicles, which serve as the communications interface with the new Dismounted Soldier System (*Sistema de Combatiente a Pie*: SISCAP) being developed by GMV in a joint venture with Indra.

GMV, a benchmark firm in setting up maritime surveillance networks



■ The Navy Logistic Support Headquarters (*Jefatura de Apoyo Logístico de la Armada*) has awarded GMV a contract for enlarging the interoperability improvement adaptor between the Common Information Sharing Environment (CISE) node and the systems of the Spanish navy's Maritime Surveillance Operations Center (*Centro de Operaciones de Vigilancia Marítima*: COVAM), of the Fishery Monitoring Center (*Centro de Seguimiento Pesquero*: CSP) and the Operational Coordination Center (*Centro*

de Coordinación Operativa: CECOP), to be installed in the navy's Cartagena sites in late 2020.

This project is an enlargement of the R&D services tendered under the EUCISE2020 program for creation of the EUCISE nodes for exchanging information between authorities of the various sectors.

EUCISE2020, which came to an end in the first half of 2019, was a European-Commission-brokered initiative to define specifications, develop and test a prototype CISE node and finance the national interface of a maritime safety/security and surveillance information sharing system in Europe.

In the framework of EUCISE2020 GMV installed a CISE node in navy sites in Cartagena for interconnecting with the information systems of various Spanish organizations such as the Deputy Directorate of Customs Surveillance (*Dirección Adjunta de Vigilancia Aduanera*: DAVA), the *Centro*

de Seguimiento Pesquero (CSP) and the *Centro de Operaciones de Vigilancia y Acción Marítima* (COVAM).

During 2019 GMV developed and deployed the SMACS adaptor (Spanish Maritime Affairs Cross Sectorial IT Interoperability Improvement), thus providing for interconnection between not only the three Spanish organizations but also between them and the rest of the CISE participants, favoring maritime information sharing and collaboration at national and international level.

Under the scope of this new project the navy is seeking the much more ambitious objective of working towards full connectivity. As well as the current capabilities this enlargement will provide for two-way information interchange with the maritime surveillance network MARSUR (involving military organizations from 20 countries) and connection with MAJIC JISR standards, areas in which GMV boasts a wealth of experience thanks to the family of CSD products developed for the Spanish MoD.

Opinion

Cybersecurity: the new challenge of C21st companies

It's hard to take in the importance of cybersecurity in the twenty first century without analyzing how it has affected and will continue to affect society's digital transformation during the coming years. Given the sheer speed of technological takeup, it is no idle claim to say that practically all organizations have now turned into technological or techno-dependent firms.

According to the World Economic Forum (WEF) cybercrime losses will add up to three trillion dollars a year by 2020, soaring year by year unless the dizzying rate of technology takeup is accompanied by a proper cybersecurity outlay and strategy from public and private organizations.

With this in mind there are four fundamental aspects to be taken into account: ensuring that all

collaborators' level of security at least matches the organization's own; establishing a design-up security program for subsequent phasing in of new solutions and state-of-the-art technology; the production of threat-preempting intelligence; and setting up sound, reactive and proactive cybersecurity services for detecting, preventing, containing and, in the worst-case scenario, recovering affected services.

To that end GMV runs an Early Incident-Response Center with the remit of developing and integrating the necessary components to meet current needs in operations, processes, human resources and technologies. Throughout our long experience we at GMV have built up the necessary capabilities to take on today's challenges, establishing an innovation and continuous-improvement program to give analysts the necessary tools and



Javier Osuna
Cybersecurity Services and Consultancy Director of
GMV's Secure e-Solutions sector

visibility to ensure responsiveness against the sophisticated threats we are now exposed to.

CCN hails GMV's cybersecurity role

■ Last December, under the banner theme of “Community and Trust, the bases of our cybersecurity”, Madrid hosted the 12th STIC CCN-CERT conference, organized by the Cybersecurity Department of the National Cryptology Center (Centro Criptológico Nacional: CCN). This conference has been always considered to be one of Spain's top cybersecurity events, both in terms of turnout and the quality of its papers.

The two-day event attracted a 3000-strong turnout to swap notes and listen to 130 renowned speakers talk about the latest trends in attacks, technological challenges, prevention in cybersecurity and law abidance.

For yet another year, GMV, keen to share and support CCN-CERT's success, has sponsored the event with the aim of creating between us all a secure and trustworthy digital society. Javier Candau, Head of the Cybersecurity Department of the Centro Criptológico Nacional, thanked GMV for its participation, awarding it a diploma that was picked up by Maole Cerezo, communication counselor of GMV's Secure e Solutions sector.



GMV at Penteo's “CISO Meeting”



On 4 and 5 February the IT consultancy firm Penteo put on in Zaragoza the “CISO Meeting” to take stock of current cybersecurity trends from the CISO's viewpoint.

The role of the Chief Information Security Officer (CISO) is more complex than ever today. During recent years security departments have had to confront an increasingly difficult threat scenario,

and CISO's are now playing a more upfront and important role within their organizations.

Mariano J. Benito, CISO of GMV's Secure e-Solutions sector, was one of the speakers, presenting the second edition of the “CISO's White Paper. The CISO's role within the organization” (*Libro Blanco del CISO. El rol del CISO en la organización*), an initiative launched by ISMS Forum with the institutional support of Spain's National Cybersecurity Institute (*Instituto Nacional de Ciberseguridad: INCIBE*). This report describes the CISO's role in twenty-first century organizations. Benito then took part in a panel discussion to compare the experience of various clients.

Opinion

Don't believe everything you see or hear. The threat of DeepFake

Just when it seemed we were getting used to evading fraudulent emails and disbelieving Fake News, the new technologies are throwing up new, more powerful and hard-to-dodge threats.

DeepFakeLab is open-code software that enables any video to be tampered with, switching one person's face for another's. Although this already poses quite a threat to the head-switched victims in each case, a much bigger problem lurks in the wings when the technology acquires such uncanny realism that it becomes difficult to distinguish a manipulated video from a genuine one.

It now seems possible to produce a perfectly credible video in which any public personage could be shown acting inappropriately or coming out with some outrageous comment. A few weeks ago a putative Mark Zuckerberg video in which he made questionable declarations turned out to be completely false. Another attention-grabbing video concerned the U.S. House Speaker Nancy Pelosi,

in which she was apparently shown to be drunk.

As well as the obvious threat of distorting public opinion, there is also the risk of a personal scam for committing some type of fraud. Recently news broke of a scam involving the mimicking of another person's voice during a conversation. This device had been used to fool a top executive into believing he was being called directly by the company's CEO, asking him to make an urgent and sizeable money transfer.

On the other side of the coin, the very same threat-producing technology might well be turned against the threat itself. There are now systems capable of detecting whether a photo, audio or video has been tampered with. The trouble is that, following the well-known arms-race principle, a better, less-detectable version is always likely to appear, upping the stakes again. Furthermore, detection in itself would not actually head off the harm done.

From the legal point of view there is also a need to up protection levels.



Crescencio Lucas Herrera
Managed Services Director
GMV's Secure e-Solutions sector

«There are tools for detecting whether or not a photo, audio or video has been tampered with. The trouble is that a new, harder-to-detect version will always crop up, with the damage already done by the time it is detected»

California has recently passed a law banning the creation of videos of this type for adults without the consent of the persons involved. It also forbids the circulation of manipulated content that might dent or harm the image of any politician. Such legislation is almost bound to be taken up soon by all countries. For the time being, however, it is still too difficult to prosecute the perpetrators effectively, so the law might to that extent be unenforceable. The day may come when it is possible only to visualize encrypted and signed content, ensuring perfect traceability, but this still seems to be quite a long way off at the moment.



The unstoppable takeup of cybersecurity in the food sector



■ On 4 February DIGIT-A, the digital collaboration platform of firms specializing in the digital transformation, put on a conference to look at the food-sector's digitization needs in order to ensure its ongoing competitiveness and innovativeness.

Héctor Besga, founding member of DIGIT-A, kicked off the event with an opening speech stressing the need for organizations to make greater digitization efforts. Next to speak was the special guest speaker, Javier Sirvent, technology evangelist, who argued that no economic sector can afford to ignore the importance

and impact of the digital transformation; all firms, he added, are now duty bound to change their business model or fall by the wayside, stressing the particular importance of client-centeredness in this whole endeavor.

GMV, a member firm of DIGIT-A, gave a paper as cybersecurity expert to raise the food sector's awareness of the importance of taking the right cybersecurity measures in such a critical sector.

Miguel Hormigo, Industry Manager of GMV's Secure e-Solutions sector,

highlighted cybersecurity as a business aspect; it needs to be tackled with a holistic approach, boosting production and driving digital innovation. In his own words "Cybersecurity is a continuous, proactive activity rather than a one-off task. To be effective, moreover, it must stem from a real transformation of people and processes on the basis of proper planning, preparation and prevention".

His speech also mentioned three cases of companies that have suffered a cyberattack and are now working with GMV to demonstrate the key points of technological action.

GMV sponsors h-c0n 2020

On 31 January and 1 February the hacking research community «Hackplayers», with GMV sponsorship, put on in Madrid the third h-C0N, a yearly hacking and cybersecurity conference.

This third conference featured an interesting paper on Near-Field Communication (NFC) hacking. In his speech Óscar Alfonso, Security Auditor of GMV's Secure e-Solutions sector, ran through some of the best known variants and families of smart cards and proximity cards; he stressed their weaknesses, the most widely used attack vectors, the zero static block type and their idiosyncrasies.

He also showed videos of real cases and ran several demos of different attacks, deciphering and cloning cards of various types on the spot.



The face, a sign of identity: GMV technology for maxillofacial surgeons

Precision in maxillofacial surgery is crucial if specialists are to meet patients' expectation. To this end, GMV is taking part in the NAVIPHY research project, which aims to offer a simulation of the viscoelastic behavior of soft tissue, allowing clinicians to predict the patient's post-operation look

The face, just like a fingerprint, is a sign of identity. As the popular saying goes, it is the "reflection of the soul", the first feature to give information on a person. In the words of the psychiatry professor Enrique Rojas, the personality peeps out of the face; in the face resides a person's essence. Along the same lines, Rose Rosetree, author of *The New Power of Face Reading*, argues that the face "is a curriculum vitae". Way back in pre-Confucius China, face-reading was a profession. Elsewhere, in the same era, Pythagoras began in classical Greece the study of physiognomy; it is even claimed that he chose his disciples on the basis of their facial features.

Plastic surgery is now the order of the day even among youngsters. We all want to show "our best face" and many do not hesitate to ask plastic or maxillofacial surgeons for the necessary facial tweaks. There is quite another side to this story. Some people have to reconstruct their face for completely different reasons like serious injury or tumors. For this purpose they put themselves in the hands of maxillofacial surgeons, a specialty that, in the words of Doctor José Luis Cebrián, president elect of the Spanish Society of Oral and Maxillofacial Surgery of the Head and Neck (*Sociedad Española de Cirugía Oral y Maxilofacial de Cabeza y Cuello*), comprises "the diagnosis, surgery and treatment related to a wide range of mouth, teeth, face, head and



neck illnesses stemming from tumors, impacts, degeneration or ageing".

An operation of this type always subjects the patient to a heavy psychological load; he or she has to come to terms with the new face. As Doctor Cebrián explains, «digital technology gives us a 3D image, allowing us to predict fairly accurately the bone changes but not the behavior of the soft parts. We are therefore unable to predict and show to the patient a trustworthy image of his or her post-operation aesthetic and functional aspect». This is one of the challenges taken on by the NAVIPHY research project, with the participation of the Research Institute of La Paz University Hospital.

Carlos Illana, Head of Product of GMV's Secure e-Solution sector, is leading the project technology. He explains that

"reconstructive craniofacial surgery, facial bone surgery or aesthetic face- and neck-surgery are highly complex procedures: using shoulder-blade bone and back muscle to make the new mouth "tissue"; supplying blood flow for the reconstructed zone by connecting veins from other parts of the body; restoring functionality to part of the extirpated tongue or facilitating respiration by opening airways and doing all this with a satisfactory aesthetic result".

One of NAVIPHY's remits is to offer a simulation of the viscoelastic behavior of soft tissue, allowing us to predict the patient's post-operation look during virtual surgery planning and, later on, its functional behavior. NAVIPHY's results will be equally crucial in the treatment of cancer deformities by providing a pre-surgery delimitation of tumor structures.

HEXIN widens its research scope



■ GMV has recently been awarded a contract to phase a new function into the epidemiological and clinical data mining platform called HEXIN. The purpose of this new upgrade is to identify patients likely to suffer from osteomalacia and hypophosphatemia.

HEXIN is a big data platform developed with GMV technology that allows the Galician Health Service (SERGAS) to analyze all clinical information available on each patient in its information systems. It facilitates clinical decision-making, managerial

and support tasks in identifying epidemiological cases. Up and running since 2015, HEXIN also serves as a biomedical research tool, providing a search and information-analysis system for finding correlations between the data and drawing statistical conclusions, making it easier to identify cohorts and research case groups.

Osteomalacia is a metabolic bone disease characterized by an alteration of bone mineralization, frequently associated with alterations in metabolism of vitamin D or phosphate.

Hypophosphatemia, for its part, is an electrolyte disorder in which there is a low level of phosphate in the blood. Its various causes include malnutrition.

The new project will allow a SERGAS medical team to monitor and carry out comparative studies of clinical visits associated with both diseases. Potential patients will be identified by working with algorithms and rules acting on SERGAS's medical records. The resulting dataset can then be processed with statistical tools and AI algorithms to look for clinical evidence.

Guaranteeing a healthy lifestyle and promoting wellbeing at all ages



GMV has taken part in the 23rd National Healthcare IT Congress, Inforsalud 2020, organized by the Spanish Healthcare IT Society (*Sociedad Española de Informática de la Salud*) and held in Madrid from 3 to 5 March under the banner theme «Transforming our health system».

GMV ran a stand displaying its range of products and solutions designed and developed to meet today's healthcare challenges.

Fundación EHAS and GMV also presented the telemedicine project Río Napo, which responds to UN's Sustainable Development Goal (SDG) 3: "Ensuring healthy lives and promoting well-being for all at all ages". Driven by Fundación EHAS, this project brings specialist medicine within the reach of 21,000 people living in the farthest-flung parts of Peru's Amazon area, using GMV's inhouse telemedicine system, **Antari HomeCare**.

Antari optimizes the use of healthcare resources on frail patients

■ The healthcare concept of “frail” defines a state of special vulnerability of persons of advanced age with a greater risk of functional impairment and decline towards disability; they are also more likely to suffer mishaps and accidents (falls, frequent hospitalization, etc). Arising over the last two decades, it is now one of the innovative concepts within the field of healthcare and social sciences. Over 40 % of over-50s suffer from some functional limitation; about 40 % of the elderly could be identified as pre-frail; 15 % as frail or slightly disabled.

Recognizing and understanding frailty calls for a change of mindset, moving on from treatment-based strategies to other approaches based on early detection of and intervention on functional impairment. Healthcare systems have to cope with this new situation. Mindful of this, the European Union has set in motion research projects like FACET, which seeks to improve the quality of life of 13.05

million people. For this project GMV has developed a specific upgrade of its telemedicine platform **Antari HomeCare**.

The clinical trial (prospective, randomized and blind), led by the clinician Leocadio Rodríguez Mañas, head of the Geriatric Service of Hospital Universitario de Getafe, has studied over one year the trend of males with a mean age of 82 and women of 65. The resulting report has concluded that the remotely monitored trial subjects, using GMV’s platform, saw a slowdown in the development of frailty and also in the transitions (from non-frail to frail) as from the third month of observation. There was also an observed reduction in the use of healthcare resources due to the clinicians’ ongoing monitoring of the patients’ functional change of state, allowing them to draw up therapeutic plans to suit the trend of the main process and any side effects suffered by the patients under study. The study also found that continued use of GMV’s technology as deployed on the platform, motivates the persons under

study, gives them confidence and the wherewithal to look after their own state of health and wellbeing without needing to visit doctors or consult the healthcare professional in charge of monitoring them.

To carry out the trial, various types of monitoring sensors were fitted in the patients’ homes. Every day patients could check on their mobile application the exercises they needed to do, the results being sent on to the clinicians by the telemedicine platform.

In FACET GMV is working closely, under the umbrella of EIT Health, with Hospital Universitario de Getafe, with its Biomedical Research Foundation (*Fundación de Investigación Biomédica*) and Albacete Hospital. Other participants in the project include Abbott, as leader, Universidad Politécnica de Madrid, the National Health and Medical Research Institute (*Instituto Nacional de Salud e Investigación Médica: INSERM*), Aberystwyth University and PREMAP.





New functions phased into the fleet management system of Sydney's light rail system

Alstom, Australia's benchmark infrastructure provider, has once more contracted GMV for upgrading Sydney's light rail system

In 2016 ALSTOM, one of the world's top rolling stock manufacturers, awarded GMV a contract for the supply of an advanced fleet management system for the new line on the light rail network of Sydney (Australia), under construction at that time.

Now ALSTOM has once more contracted GMV to phase in a series of new control-center functions plus improvements in the interface of the tram-stop passenger-information panels, likewise supplied by GMV. The new functions will greatly improve the light-rail operation and boost service quality.

These new features include:

A new dashboard showing in real time the level of service performance in



terms of meeting contracted running times, offering key performance indicators (KPI) and figures on availability, traveling times, etc.

New regulation actions. In any fleet management system the regulation actions are crucial in terms of guaranteeing that the service can run to time even in the event of unforeseen setbacks during operation. These new regulation actions will be employed mainly to ensure maintenance of the programmed headway along the whole line, thus ensuring the best service quality for passengers. These actions will allow all the following:

- Guarantee that scheduled headway is maintained by means of a series of automatic control stops to keep

frequencies constant along the whole line.

- Carry out multiple effect regulations, whereby inclusion or withdrawal of trams on the light rail automatically affects the adjacent trams and thereby maintains the headway.
- Solve any serious late running by dividing a vehicle-service between two trams, enabling the second to absorb the late-running of the first.

New driver views allowing the operator to compare planned and actual driver shifts. This new feature is rounded out with a web view of shifts that drivers themselves can check on their waiting-room screens.

New Playback view: The PlayBack view, common on advanced fleet-management systems, comes in very useful for playing back the vehicles' actual routes. This particular system goes one step further, adding in not only positions but also all information to do with calls, messages, events, etc.

Last but not least, integration possibilities with other systems will be boosted by means of the international standard Service Interface for Real Time Information (SIRI), already in use within the project but now extended with the Situation Exchange (SX) service that publishes operating information.

GMV technology to run Manila's local train network in the Philippines



■ Philippines National Railways (PNR) has taken up GMV's inhouse railway fleet-management system (**SAE-r**[®]) for running the local trains covering Manila's metropolitan area.

The project, later to be extended to all the operator's services on the

Isle of Luzon, is of great strategic importance for PNR, ensuring as it does a substantial improvement in the control of this railway service with a monthly ridership of over 100,000 in the metropolitan area of Manila. The system, to be completely set up by October 2020, will provide PNR with an all-in railway-fleet operation, management and planning system.

GMV's inhouse railway fleet management system, **SAE-r**[®], will keep all users permanently informed of the position and state of the train fleet and any operation incidents that might crop up. It will control the whole railway operation in real time; this includes all the following: monitoring of train activity and driver behavior, performing all regulation activities to ensure on-time running, supplying passenger information (bus-stop and on-train panels), managing communications between trains and the control center and supervising the rest of the onboard

systems (radio equipment, ticketing equipment, the train's own equipment, etc). This complete real-time operation, control and management system is rounded out by an advanced tool for a thoroughgoing after-the-event analysis of fleet running, punctuality and any operational events.

Although this represents GMV's first ever railway project in South-East Asia, the company has already become a worldwide benchmark supplier of railway fleet-management systems. GMV's inhouse **SAE-r**[®] has now been taken up by national operators like RENFE (freight and passenger) and urban railway infrastructure operators like Servicios Ferroviarios de Mallorca or Tranvía de Zaragoza, plus rolling-stock companies like CAF. Further afield, GMV boasts clients like Alstom in France, Sydney Light Rail in Australia, the tramways of Warsaw, Gdansk and Torun in Poland, ONCF in Morocco and Kaohsiung Light Rail System in Taiwan.

New CEO of GMV SYNCROMATICS



■ GMV has appointed Rich Archuleta as CEO of its Los Angeles Intelligent Transport Systems (ITS) company, GMV SYNCROMATICS.

Rich Archuleta is a highly accomplished technology executive. His 26-year

HP career began in semiconductor research, and he soon gained a reputation as a strategic business leader. Archuleta's management roles at HP included product and operating responsibilities across multiple units of the \$4B business, which employs 2500 worldwide. In 2007 Rich was appointed CEO of Plastic Logic, a company he grew from 30 to 400 employees with a research office in Cambridge, a product development department in Silicon Valley, a display Factory in Dresden and operations near Moscow. Afterwards he worked as a consultant to diverse technological companies.

Archuleta boasts a strong grasp of technology solutions, an outstanding track record of strong customer

relationships and a sterling market reputation. He holds a BS and an MSc in Electrical Engineering from Stanford University and an Executive Development Program Diploma from the Kellogg Graduate School of Management. Rich Archuleta has also written book chapters, technical articles, and patents.

GMV SYNCROMATICS currently provides its Intelligent Transportation System solutions to over 130 operators and public-transport authorities in 25 different states across the USA. Its flagship clients include the City of Los Angeles Department of Transportation (LADOT), the Los Angeles Metropolitan Transportation Authority (LA METRO), and MV Transportation.

GMV sets itself up in pole position for Galicia's concession renewal

ALSA has turned to GMV's fleet-management and ticketing systems for the first Ferrol and Ribadeo concessions to be awarded in the first block put out to tender by Galicia's Regional Authority (Xunta)



ALSA has turned to GMV's fleet-management and ticketing systems for the first Ferrol and Ribadeo concessions to be awarded in the first block put out to tender by Galicia's Regional Authority (Xunta).

The Xunta de Galicia is now in the process of renewing its region-wide transport concessions. To do so, it has held two public tenders in which Galicia's operating companies will renew or obtain new 10-year concessions.

Under this umbrella ALSA has taken up GMV's advanced fleet-management

and fare-collection systems for the metropolitan transport of Ferrol and Ribadeo, where 34 and 14 buses, respectively, will be fitted out. These concessions come under the first block to be put out to tender by the Xunta de Galicia, scheduled to come into service in the first half of 2020. This project sets up GMV in pole position for continued growth in this region.

In technical terms GMV will be fitting ALSA's buses with a ticket-vending machine to work with the Xunta de Galicia's contactless farecards, incorporating too EMV payment technology and a QR code reader. This

console will also act as an onboard fleet-management system, based on a 4G router acting as communication module.

At control-center level the company will also be supplying its ticketing and fleet-management backoffice systems to pass on fleet-running information to the Xunta de Galicia's central systems.

This new ALSA project sets up GMV in pole position for winning transport concessions in Galicia and as a benchmark technology provider of this and other concession firms operating in the region.

New Fleet Management System for Transportes Urbanos de Castelo Branco

■ Following the introduction of GMV's products in the Portuguese bus market in Bragança, GMV has won another public contract, this time for the Municipality of Castelo Branco, to install and maintain a new fleet-management system for the whole fleet of buses of Transportes Urbanos de Castelo Branco (TUCAB). The project also includes the provision of M20 on-board units in 8 buses and PIP panels in four stops.

With this contract Castelo Branco expects to increase its control over the performance of its public-transport fleet, while at the same time improving estimated times of arrival for passengers waiting at the stops.

On this first upgrade agreement with the municipality 8 buses will be equipped with GMV's M20 onboard units while 4 stops will be equipped with GMV's PIP panels.

For GMV this new contract and client reference help to bring its fleet-management solutions to wider notice within the national Portuguese market.

Castelo Branco is the district capital of Beira Baixa, a mostly rural area in Portugal where its inhabitants rely heavily on private transport. The idea behind the take-up of GMV's solutions is clearly to improve the reliability

of public transport, making it more attractive to the local population, increasing its use-rate while at the same time reducing the number of private vehicles entering or circulating in the city.

2020 is a year of change in the public transport area. With growing concern about the environmental impact of road transport, the public sector is becoming increasingly aware of the need to improve the reliability and efficiency of the services provided, focusing their actions on making private transport less attractive than public or shared solutions.

Demand-Response Transport in Beira Baixa

■ In November 2019, GMV signed the fifth contract in Portugal to deploy a new Demand-Responsive Transport system, GMV's top-of-the-line flexible transport platform. After rollout GMV's solution will cater for the entire Beira Baixa region in Portugal, extending public transport coverage to 100 % of the region.

Beira Baixa is a low-density population area, very characteristic of inland Portuguese, making it a perfect region for the deployment of flexible transport. It comprises 6 municipalities with around 89,000 inhabitants living in an area of 4614 Km².

The goal of flexible transport is to reduce operation costs while increasing

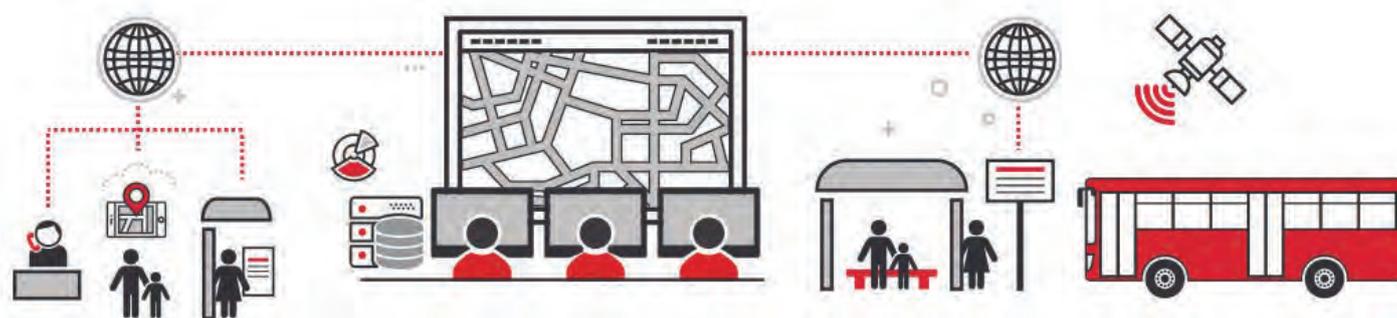
public transport coverage. The local population is provided with a booking service, enabling the operator to identify where the service is actually needed every day, laying on the necessary vehicles and routes to suit. This allows them to minimize bus usage, replacing them with light vehicles, such as taxis, in zones where the number of passengers doesn't justify the use of a bus.

GMV's solution will allow CIM Beira Baixa to save public money that can be spent on other key areas; it will also benefit the environment by cutting down the number of kilometers driven without passengers; last but not least it will extend

public transport to remote, scattered populations.

The increasing interest in Demand-Response Transport solutions stems from the original Medio Tejo deployment, GMV's first Demand-Response Transport project in Portugal. This has served as a benchmark for public authorities, demonstrating the real benefits of a lower-cost, more efficient and reliable transport arrangement for remote areas of scattered population that were previously hard to serve.

Full system deployment is expected to be completed along 2020, followed by a progressive extension of the solution to cover all municipalities of CIM Beira Baixa.



GMV to supply the fleet-management and fare-collection systems for Vectalia's first buses

■ Vectalia turns to GMV for supply of the fleet-management and fare-collection systems in its first concession award within the first block of concessions put out to tender by the Regional Authority of Galicia (Xunta de Galicia).

This new project sets up GMV in pole position for Galicia's ongoing renewal of transport concessions and as a benchmark technology provider of this and other concession firms operating in the region.

The Xunta de Galicia is now in the process of renewing its transport concessions

throughout the whole region. To do so, it has held two public tenders in which Galicia's operating companies will renew or obtain new 10-year concessions.

Under this umbrella Vectalia has taken up GMV's advanced fleet-management and fare-collection systems for its first 16 buses belonging to the concession awarded within the first block to be put out to tender by the Xunta de Galicia, scheduled to come into service in the first half of 2020.

In technical terms GMV will be fitting Vectalia's buses with a ticket vending machine to work with the Xunta de Galicia's contactless farecards, incorporating too EMV payment technology and a QR code reader, fitting it out for use as an onboard fleet-management system.

At control-center level the company will also be supplying its ticketing and fleet-management backoffice systems to pass on fleet-running information to the Xunta de Galicia's central systems.

Guaguas Municipales renews GMV's fleet management system



■ Under the fleet-management system renewal plan, the company Guaguas Municipales S.A. has just purchased 57 state-of-the-art onboard units while also migrating the control center to the latest version of the system. This company, with a fleet of over 250 buses and over 30 passenger information posts, runs the urban transport service of Las Palmas de Gran Canaria; it has now been placing its trust in GMV for over 20 years.

The current renewal plan kicked off in 2017 with the purchase of 21 information posts and 39 state-of-the-art onboard units.

The six-month project involves complete renewal of the operator's onboard equipment. The **TDMA** and **M10** units will now be replaced by the onboard unit **REC30**, compatible with the latest version of the fleet management system. Updates of

future versions will also be completed, including purchase of new equipment and de-installation of the current equipment and installation of the new. The control center will also be updated to the new version while new functions will be phased into a more modern and user-friendly web environment, with a greater information-management and -gathering capacity for data mining purposes.

GMV enhances accessibility at Valladolid's bus-stops



■ On January Valladolid's bus company (Autobuses Urbanos de Valladolid: AUVASA) announced the completion of the bus-stop information-panel renewal plan, a project carried out by GMV, developer

of the advanced fleet management system in which these new panels have been included.

This project has involved complete replacement of forty bus-stop-shelter

panels by bigger ones, bringing in LED technology and 4G communications while improving the space available at the bus-stops. Elsewhere, the LCD panels have been replaced by LEDs, improving visibility and energy consumption parameters.

The control equipment has been upgraded to next-generation 4G communications and the panel supports have been improved, both at bus-stop shelters and in the free-standing masts or bus-stop poles.

The most important new feature in this renewal scheme is an audio announcement system allowing visually impaired people to listen to the display-panel text information by means of a specially designed radio-frequency Ciberpass system to reproduce this information audibly.

GMV wins follow-on Poland's FMS and PIS maintenance agreements

■ GMV has been trading in Poland since 2009, successfully implementing ITS systems for public transport in many Polish cities. Most of the systems launched in the first years of the company's operation are already past the warranty period, but, thanks to the constant cooperation of users with GMV, these systems are now being maintained and further developed. The end of the calendar year is the period when GMV systematically renews maintenance agreements with its customers.

Bydgoszcz is a city where GMV's systems of Public Transport Fleet Management and Dynamic Passenger Information have been operating since 2012. These systems are constantly being extended with new elements, such as displays at the stops, and periodically covered by maintenance agreements. Under the agreements concluded at the beginning of 2020, GMV is providing the Municipal Roads and Public Transport Authority with the services related to the upkeep

and maintenance of the server infrastructure together with the central software of the FMS, 125 LCD displays at the stops and GPS onboard units in 325 public transport buses and trams.

In Toruń – along with the ongoing implementation of the new Fleet Management and Passenger Information System for the fleet of 150 municipal buses after winning the tender in 2019 – GMV is carrying out post-warranty upkeep and maintenance of the tram system launched in 2014. In 2020, the service is being provided on the basis of another maintenance agreement concluded at the end of 2019, covering comprehensive servicing of all elements of the Central Fleet Management and Dynamic Passenger Information System, including: FMS central software, onboard units in 51 trams and 67 LED displays at the stops.

So far, the largest and most complex system implemented in Poland by

GMV is the Central Public Transport Management System in Szczecin and the warranty period expired in 2018.

At the end of 2019 GMV concluded the second post-warranty system servicing agreement. Under this agreement, in 2020 GMV is maintaining the Fleet Management and Passenger Information System within the scope of central software, onboard units in 437 vehicles and 93 LED displays at the stops.

The agreement also covers the complete electronic ticketing system with the central software, 36 stationary ticket vending machines supporting cash and cashless NFC and EMV payments, 317 mobile ticket vending machines supporting cash and cashless NFC and EMV payments as well as 1,679 onboard NFC validators. In addition, other subsystems, such as the onboard CCTV video surveillance system with 1,165 cameras or the automatic passenger counting system, are also covered by GMV's maintenance.

GMV helps to boost safety in freight- and passenger-transport

GMV forms part of a consortium studying the incorporation of the digital tachograph into smartphones; this will allow integration of the many services offered by cooperative intelligent transportation systems (C-ITS) plus other benefits

The Directorate-General for Mobility and Transport (DG-MOVE) has recently awarded a contract for a "feasibility study and cost analysis of developing a certified application to be used as a Tachograph" to a consortium of 5 companies led by VVA, with a significant GMV contribution.

The Smart Tachograph devised by the EC to replace the previous Digital Tachograph aims to improve safety in the transportation sector by monitoring the behavior of commercial drivers. Since June 2019, every commercial vehicle with a mass exceeding 3.5 tons used for goods transportation or more than 9 people (driver included) must be fitted with a Smart Tachograph. The Tachograph records information about driving time, rest periods and breaks, and loading/unloading operations in order to ensure compliance with road-safety rules.

In spite of the risks entailed by lengthy and uninterrupted trips, there are many motivations (mostly economic) that lead drivers to circumvent the regulation governing driving and rest times.

The current Smart Tachograph technical specifications are defined in Council Regulation (EU) No. 799/2016, whereas the legal framework for its deployment is laid down in Council Regulation (EU) No. 165/2014.

The three main new features of this updated tachograph version are, firstly,

a GNSS satnav device; secondly, a Dedicated Short Range Communication (DSRC) module for data communication to the control authorities; and, thirdly, an interface with intelligent transportation systems (ITS), which can send data to third parties from a suitable handheld like a smartphone.

The two latter innovations provide the Tachograph with communication capabilities to provide added-value services (such as fleet management), or integrate a more visual interface.

Modern smartphone platforms provide a versatile base for the implementation of a digital tachograph. Not only do they provide a high processing power and sensors (GNSS receiver, accelerometers, gyroscope), but also communication capabilities (including mobile communications, WiFi and Bluetooth) and a large range of user information presentation possibilities.

A smartphone-based tachograph would enable the integration of multiple C-ITS services and other added-value services in the platform; this makes it ideal for providing the functionality described by the EU in Mobility package I. GMV will contribute to the definition of the

features that the new platform should provide as well as possible technical approaches to implementing them.

However, one of the key aspects of the current generation of tachographs is the security and robustness of the system, which can boast EAL4+ certification of hardware and essential software.

The new smartphone-based approach should provide at least similar security, even if it is not provided through the combination of EAL4+ HW & SW but through different means, such as integrity checks and other anti-tampering measures. GMV-SGI will perform a security analysis and determine how the different technical approaches could provide a security level that at least matches, if not exceeds, the security provided by the current solution.

Finally, the rest of the consortium will perform a legal and economic analysis to ensure that the proposed solutions can be brought to market and ascertain whether or not it would be a viable alternative to ensure compliance with the road regulation and enhance the safety and well-being of European transport workers and citizens.



GMV supplies on-board units in test vehicles for Lisbon emergency services

■ Emergency services often have a tough time driving around busy and congested cities. All too often the emergency call response time drags out far too long for this reason. The consequences are obvious; a delay in responding to a health emergency will increase fatality rates. A delay in responding to a road accident will increase congestion, and the two are regularly combined. Many other emergency situations can occur at any time and are left without response for long periods, mostly due to heavy traffic generally occurring in big cities.

To tackle this problem, the municipality of Lisbon, a consortium member of the CROADS Portugal project, took the initiative of implementing a pilot use case

where priority vehicles can automatically open green corridors in congested streets.

The basic idea for the pilot is threefold: the vehicles are equipped with ETSI G5-enabled OBUs integrated with the vehicle's emergency system. Several roadside RSUs are installed to capture the emergency messages coming from the passing vehicles. On the infrastructure side, the RSUs are integrated with the traffic lights system in order to create the necessary green wave in time to decongest the road ahead of the emergency vehicle, thus allowing it to drive through without stopping.

GMV's role in this pilot is supplier of the pilot vehicles' onboard units, plus

software integration with the in-vehicle emergency system. The pilot takes in 5 vehicles and one road. The OBUs are already fitted and the system ready for the necessary data collection to be used for the pilot evaluation.

This pilot is expected to slash the emergency response time. Its success may eventually lead to the upgrading of the pilot into a full-scale emergency green corridor solution, encompassing all the remaining emergency vehicles circulating in Lisbon and multiple congested city arteries, while at the same time opening the window for its implementation in other public-transport scenarios.



Carsharing: a win-win proposition

Currently, over half of the world's population (54 %) lives in towns and cities, and the number is expected to rise up to 70 % before 2050¹. A significant part of this population can perform all their daily routine inside the very same city where they live, either because they live close to their workplace or because they are able to work remotely.

Although it is unclear whether it is due to a higher environmental concern, a change of values among *millennials*, or due to economic reasons, statistics show that the number of cars owned per capita goes down as the population moves to big cities².

The fact of owning a car is in itself a large expense. On top of the purchase price, you have to account for taxes, maintenance, parking space, insurance... estimates say that 60 % percent of the vehicle cost is not directly related to travel or fuel, but fixed costs². And cars are stopped most of the time, over 80 %, which is not particularly efficient. However, public transport is not a real substitute to private ownership, since they are constrained by lines, stops and schedules, which restrict its usages for some cases.

Therefore, car sharing is a very appealing proposal, since it allows for door to door mobility like the private vehicle, but it reduces the associated costs. Car sharing systems democratize access to point-to-point

transport, allowing users with a tighter budget to have access to door to door transport when necessary.

It also provides flexible access to different types of vehicle for different types of use cases. Once purchased, a car has fixed features, whereas car sharing system allows to pick the most suitable vehicle for the task at the moment, whether it is short urban transit, large capacity transport, all terrain driving or longer trips with passengers.

Thanks to mobile communications, keyless car access and satellite navigation it is possible to track and manage a large fleet in real time and even to interact with the vehicle remotely, so that all users of a car sharing system can know where the vehicles are located, each individual vehicle features and status, book them in advance, and access the vehicle without the need for physically exchanging keys, fobs or tokens.

Also, since shared vehicles' usage is more efficient and intensive in time, it is possible to spend a relatively larger budget per vehicle in order to pick the safest, most reliable and most fuel-efficient vehicles (and thus, more environmentally friendly). This is doubly true for those cases where an electric vehicle can be used (for example in urban car sharing fleets) as it can be refueled with renewable energy and it does not have emissions during its operation.

The deployment of a car sharing system does increase the technical complexity



Pablo Rivas Salmon
Project Manager in the automotive division
GMV's Intelligent Transportation Systems sector

«Carsharing is a very attractive alternative, offering similar mobility to a private car at a much lower cost»

associated to the provision of mobility, as you have to deploy and operate the system, and also poses organizational challenges, since workers have to adapt their workflow or travel habits to the new system features. Nonetheless, despite these challenges, available technologies allow solving these problems, providing a positive and user-friendly experience and providing a large and measurable benefit, both economic and social, and even environmental, over the traditional single-user vehicle fleets, and presenting a viable alternative to vehicle ownership for most use cases for a large segment of the population.

¹ United Nations. World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352). (2014).

² KPMG me, my car, my life 2014 report <https://assets.kpmg/content/dam/kpmg/pdf/2014/11/Me-my-car-my-life.pdf>

Innovation in times of transformation: New bearings for our firms

The executives and experts Luis Fernando Álvarez-Gascón and Bernardo Hernández González are taking stock of the situation of innovation in times of digital transformation and its key role in the growth and advance of any country's economy and its whole business fabric



Innovation boosts productivity; as such it is a kingpin in the advance and growth of any country's economy and companies. Spain, worryingly, is lagging behind the world innovation leaders; this is a big concern as there will inevitably be a knock-on effect on its citizen's welfare levels. In the latest "Global Innovation Index 2019" of the World Intellectual Property Organization (WIPO) Spain's innovation capacity ranks 29th in a total of 129 countries around the world.

On 14 January the Association for Managerial Progress (Asociación para el Progreso de la Dirección; APD) held a dialogue to take stock of Spain's innovation situation and bring home to Spain's business fabric the crucial role of innovation in achieving competitive advantages and moving Spain up the ranking. The dialogue was held between two top names in the innovation world: Luis Fernando Álvarez-Gascón and Bernardo Hernández. Álvarez-Gascon is General Manager of GMV's Secure e-Solutions sector, 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) and President of the Innovating Firms Forum (*Foro de Empresas Innovadoras*: FEI). The businessman Bernardo Hernández is currently CEO of Verse Technologies, co-founder of idealista.com and President of Tuenti.

During the two executives' "Inspiring Dialogue" Álvarez-Gascón argued that it is crucial to link innovation to results, claiming that "innovation is knowledge at work".

GMV's executive added that the digital transformation concerns not only the private but also the public sector. Governments are duty bound to come up with the right regulatory framework for innovation and also pursue innovation-favoring and-funding policies. They must also play an active part in knitting this transformation together at country level. Hernández took up his cue: "We're asking that politicians at least don't poke a spanner in the works of innovation".

Hernández stressed the fact that some of Spanish companies' innovation performance is good but they are still in the minority. "There is a need

for a change of mindset", he argued, "setting sights not only on a good performance but on a higher sphere of true excellence".

GMV holds it as self-evident that innovation should be one of the company's main driving forces; innovation has been hard-wired into the company from its very start and it plows back a large share of its profits into R&D. GMV's own innovation commitment has made it a benchmark of growth and stability after 35 years of development and adaptation. Álvarez-Gascón explained it in these words: "Talent is key: the capacity to learn, evolve, collaborate and pursue a long-term capital commitment by plowing back profits".

It is crucial to link innovation to results, claiming that innovation is knowledge at work. Luis Fernando Álvarez-Gascón

The advantages of a SIEM system

The current state of cybersecurity means that analysts are now duty bound to keep an eye on everything that happens in their systems: the smallest clue might be a sign that the corporate network is under attack by an APT, infected by a ransomware campaign or exploited by an insider to extract sensitive information.

SIEM (*Security Information Events Manager*) solutions are the best option for dealing with this amount of information, but their rollout can be a daunting prospect. In this context, on 18 February José Pedro Mayo, GMV's Head of Solution Design and Architecture, gave a paper in "Elastic{ON} Tour Madrid", talking about GMV's experience with these solutions to show the key points to look for in any SIEM and how Elastic Stack (ELK) might cater for them.

The ELK Stack is a set of high-potential, open-code tools that are combined to create a log management system that provides for monitoring, consolidating and analysis of logs generated in many different servers. The use of Elastic as a SIEM solution enables GMV to cover all the following security event management phases: recording logs of the assets of interest; standardizing unstructured information, allowing its indexing; enrichment with additional data (geolocation, DNS solving, etc.); correlating and detecting anomalies (pooling, categorizing and filtering events); reporting and triggering alerts of various types.

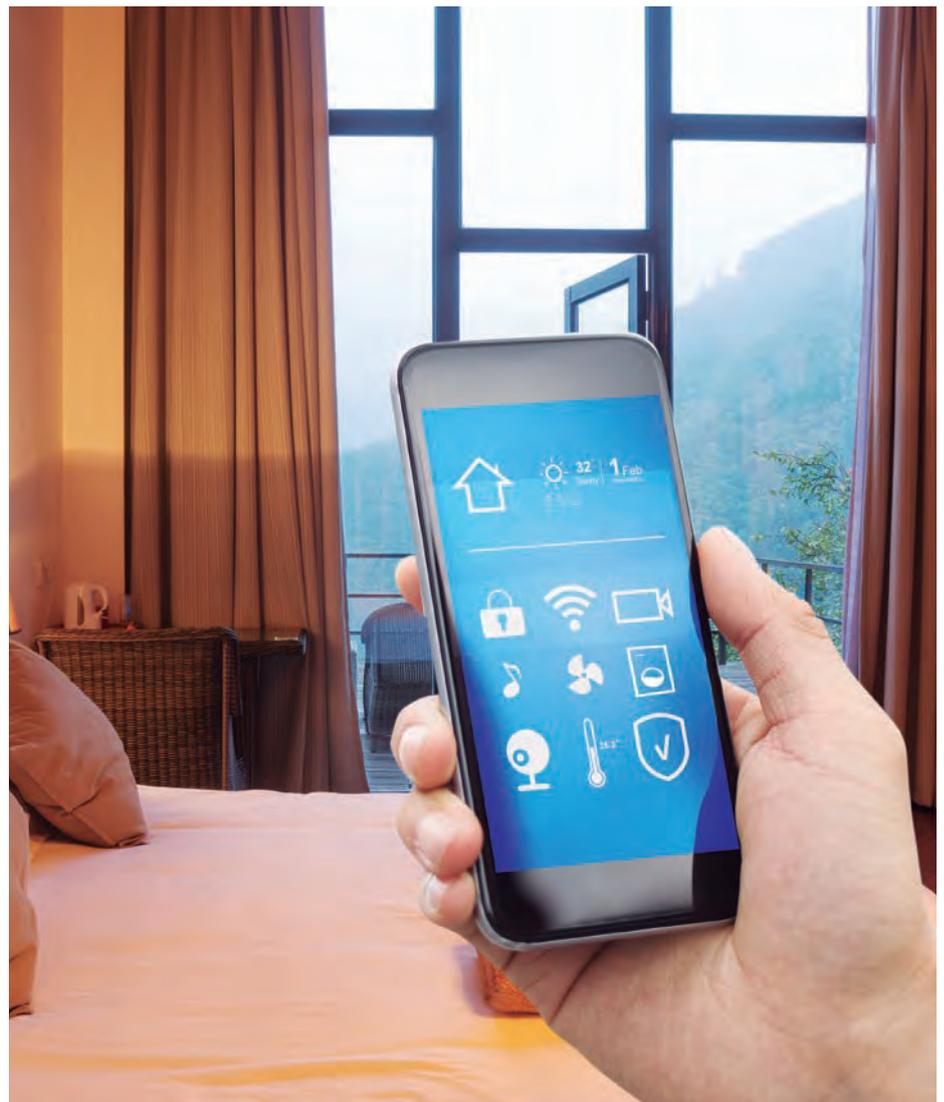
GMV passes on its technological expertise to ITH

■ The Technological Hospitality Institute (*Instituto Tecnológico Hotelero*: ITH) and GMV have signed a collaboration agreement making GMV a trusted technology partner of ITH associates. By sharing its knowledge and experience GMV aims to help tourism stakeholders digitize their business with cybersecurity as the cornerstone.

Tourism is the country's biggest money maker, contributing 14 % of the national GDP and employing nearly three million people. Sector companies are well aware that digital

transformation, as a key part of their business strategy, is essential if they want to keep up these figures. The tourism business is now determined to achieve excellence in the user experience of a 100 % digital client.

GMV believes that hyperconnectivity, artificial intelligence and Big Data are enabling technologies that bring many advantages to the table, improving client knowledge and personalizing the supply side, taking in cybersecurity aspects as important as data protection, secure and reliable cloud access, perimeter security and anti-hacking.



GMV gives its view of 2020's technology trends

■ The new technology trends are reshaping the way business is done, largely determining its success or otherwise nowadays. In this context, in mid-December, Ángel Gavín, GMV Business Partner, took part in the expert meeting organized by IT Digital Media Group, to analyze the big trends for 2020 and how they could be applied to our businesses and the challenges they pose.

Ángel Gavín believes that the main disruptive technologies, set to make companies more productive, include artificial intelligence and Everything-as-a-Service business models. He also considers it crucial to raise companies' cybersecurity awareness and train up employees to prepare them for any threat and rapid recovery from any incident.

The rollout of artificial intelligence and automation is now an across-the-board matter for any business organization, to boost its efficiency in client services, storage and its way of working. Robotic Process Automation (RPA) or chatbots, for example, free professionals from



tedious or repetitive tasks and boost operational efficiency, giving a quick and personalized response to the particular needs of each client. Although the takeup of artificial intelligence and Machine Learning will be conducive to such trends as hyperautomation or autonomous objects, it will equally pose great cybersecurity challenges. In 2020, therefore, companies will be duty bound to focus on protection of the AI-driven systems and tap into their full potential to improve security and head off any cyberattacks.

The growth of the Internet of Things (IoT) and connected devices will also be key for business. Data management, after all, has to be taken into account to ascertain the origin of the data, its quality and location. Today's consumers are becoming increasingly aware of privacy and data protection; this means that transparency and traceability now come across as fundamental elements to be taken into account by companies, as well as the legal and ethical aspects of the data, to ensure this data is unbiased and legitimate.

The challenges of IT/OT integration in industry

On 3 March GMV took part in the IBM-brokered event on the challenges of IT/OT integration in industry. Miguel Hormigo, Industry manager and Ángel C. Lázaro, Business Partner of GMV's Secure e-Solutions sector, hosted a presentation on GMV's work in the PRODUCTIO project.

In their intervention the two GMV experts demonstrated how to use **VirtualPAC**, a groundbreaking solution for updating machinery, remote control of plant systems (from PLC to ERP) and boosting system availability in the event of any faults, all managed from cloud infrastructure.



Visit from the minister of the Embassy of the Federal Republic of Germany

GMV is visited by Christoph Wolfrum, Minister and Director of Economic Affairs of the Federal Republic of Germany in Spain, and Steffen Koch, Economic Affairs Counselor of the German Embassy in Spain

On 28 February GMV's Tres Cantos site received a visit from Christoph Wolfrum, Minister and Director of Economic Affairs of the Federal Republic of Germany in Spain, and Steffen Koch, Economic Affairs Counselor of the German Embassy in Spain.

After welcoming words from Mónica Martínez Walter, GMV's President, the visit proceeded along the following lines.

First of all GMV presented some of its space activities, such as the development of ground control systems for commercial telecommunications satellite operators, an area where the company is world number one.

The two visitors were then given an account of GMV's activities in the automotive sector, with a presentation of the precise and all-in satnav solution (GNSS) being developed by GMV for the new

generation of autonomous vehicles of the German carmaker BMW Group.

The first part of the visit ended with a presentation of GMV's defense and security activities, where GMV is going from strength to strength around the world. This activity rests on three pillars: direct contracting with European agencies; the sale of JISR products (Joint Intelligence Surveillance and Reconnaissance) and participation in Europe's Horizon 2020 R&D programs.

The second part of the visit revolved around a presentation of the most recent robotics breakthroughs for future Mars exploration missions, designed for autonomous navigation field tests; guidance, navigation and control (GNC) tests and rover systems in general. The guided tour ended with a presentation of **Platform-art®**, GMV's inhouse advanced robotics testbed for space operations and systems, custom designed for ground testing of space-debris capture missions, planetary surface exploration, lunar descents and formation flying missions, among others.

Both Christoph Wolfrum and Steffen Koch showed a keen interest throughout in GMV's impressive track record and its cutting-edge technological capability in the various markets it tackles, as well as its internationalization and unflinching commitment to quality and competitiveness.



Pawet Kicman

«The experience built up in the Madrid offices had a profound effect on my career and everything I do today»

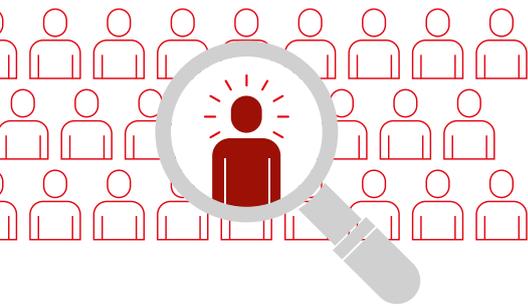
My space origin story starts in my childhood days. I remember watching Sci-Fi shows on TV with my dad and imagining how great would it be to fly in space. So I dreamed about becoming a fighter pilot and an astronaut. When I grew older I realized this wasn't a realistic career path for me, but instead I had a knack for engineering and programming, so I tried my luck there. I enrolled in Aerospace Engineering at Warsaw University of Technology and right away joined the Students' Space Association. In those university years I managed to have plenty of fun, but also got hands-on experience in projects and learning how ESA operates. After getting my bachelor's degree I wanted to gain international experience and study abroad. A good friend of mine recommended me to look at Cranfield University and their Astronautics and Space Engineering degree. I applied there, but was not accepted. Instead, I enrolled in my second-choice syllabus- an MSc in Autonomous Vehicle Dynamics and Control. This was probably the most positive and impactful failure in my entire life. When I got to Cranfield I discovered very quickly a passion for sensor fusion. I was fascinated by the fact that with mathematics and modeling you can create a quality map of the world, even using poor sensors. A year in Cranfield passed very quickly but I still wanted to know more and learn more. So I got myself into a PhD program at my Alma Mater in Warsaw, and started research on sensor fusion and vision-based navigation techniques. Four years later, I figured that academia was not for me. It was too far away from real life. I wanted to see my ideas and my code being



deployed in the real world, ideally-in space. So I applied to GMV in Warsaw. I had heard about the company in the past and kept an eye on it as a future possibility. Luckily for me the right projects were won at the right time; everything clicked and I got myself a new job.

As a GNC (guidance, navigation and control) engineer I joined GMV's Warsaw office in November 2014, starting my work on a fascinating study for landing on Phobos, one of Mars' moons. From there, a few things happened very quickly. Within two weeks my boss offered me a yearly Marie-Curie scholarship in the company headquarters in Madrid. The conditions were amazing, and thanks to my previous research experience I met all

the formal requirements. After quick discussions with my wife we accepted the offer and by the beginning of New Year I was in Madrid. Looking back, I have to say that the first weeks were not easy. In between the time we made the decision to move to Madrid and the time we got there, we learned my wife was pregnant and we were expecting a second child. So upon getting to Madrid I was on a mission to find us a comfortable place to live and on a speed-track to get us registered with the Spanish government and healthcare system. I barely spoke any Spanish so you can imagine there was a lot of stress, difficulties and misunderstandings. On the flip-side, I discovered that you can effectively communicate with a limited number of words, given some creativity and a



NAME AND SURNAME: Pawel Kicman

POST: GNC Engineer / SPS unit / Aerospace
GMV

DATE OF BIRTH:
october 3th, 1986

ACADEMIC QUALIFICATION: BSc.
in Aerospace Engineering, MSc. in
Autonomous Vehicle Dynamics and Control

START DATE:
November 2014

OFFICE: Warsaw (Poland)

HOBBIES: Ice hockey, cycling, sci-fi and
fantasy books and TV shows, tinkering,
craftsman's paper and beautiful writing
materials.

DEFINES HIMSELF AS: I would like to think
of myself as a curious, inquisitive and open-
minded person. Sometimes geeky and ironic,
always questioning the status quo, not
caring too much about my own position or
formal authority. I'm uncomfortable in large
crowds, but perfectly happy cutting the
distance and making deep and meaningful
connections one-on-one. A family person,
but I also need some time to recharge my
batteries in solitude: gardening, tinkering in
the workshop or going through a book

kind and open, listening persona. And
there were also countless people that
stepped in to help. For the support
I received in this time from so many
of my GMV colleagues I have eternal
gratitude in my heart. So many times
you lifted me up in the moments when
I felt completely helpless and saved
the day for me and my family. Thank
you!

Fortunately, this frantic start has
passed; we got comfortable and
settled in. In the end, we spent a
magnificent year in Spain. We made
plenty of good friends and fantastic
memories from visiting different parts
of the country and learning about
its culture and history. Finally, I also
picked up a little bit of the language,
just enough to get by. At the same
time I was getting to know people at
the company, familiarizing myself with
the space industry work style. But
the main goal of my visit to Madrid
was to learn about the intricacies of
space missions to small Solar System
bodies from the best specialists in
GMV and in the world, thanks to the
Marie-Curie fellowship. This experience
had a profound impact on my career
and the things that I get to do right
now. Establishing all those personal
relationships was tremendously
valuable and is still paying dividends
today. It is so much easier to cooperate
remotely with someone that you have
met in person, shared a lunch with or
just had some laughs in the corridor.

After getting back to Warsaw, together
with my team we completed my first
project with great success, getting
some recognition and consolidating
the name of our Polish GNC team.

This success has given us the chance
to take part in a studies related to
AIM, later re-branded as Hera, as a
fully funded ESA mission to a binary
asteroid that is going to fly within the
next few years. In this mission GMV, as
a group, has secured the prestigious
role of GNC subsystem leader. Over
the last four years we have managed
to create an outstanding team spread
across four different countries (Spain,
Poland, Portugal and Romania). A
team that is responsive, innovative,
communicative, regardless of the
distances, and can hold its own against
the tough requirements of deep space
missions. Unfortunately for me, at
the time of writing, my home country,
Poland, has not put up money for the
mission, which in practice means my
future involvement in it is uncertain.
Nevertheless, I am proud of what
this team has achieved, and more
importantly the way it has been done.

Currently, my work is beginning
to consist of more and more
management-related responsibilities.
This transition is quite a journey and
I still have a lot to learn. Although, I
see myself more as an ENGINEERING
manager, rather than an engineering
MANAGER (if you can tell the
difference), the people on my teams
are the most precious asset to me.
In principle I try to act as a serving
leader whose role is to take care of
the people, remove obstacles that
might be standing in their way, help
them grow and become more efficient.
During my time at the university I
had the privilege of participating in
a special series of lectures on Lean
Management in engineering, which
was extremely influential and eye-
opening. This innovative work was
related to applying Lean principles
from the world of factories to the
knowledge work of the R&D world.
There were plenty of examples
comparing the approach of SpaceX
to more traditional companies like
Boeing and Lockheed Martin, showing
how to avoid waste and build up
momentum and speed in the projects.
Whenever I can, I try to apply those
principles in my work and spread the
culture of efficient and responsive
R&D.

To wind up, here's a quick personal
reflection. As a teenager I stumbled
upon some exotic pop-punk band that
made music of a questionable quality.
But the lyrics struck me and stayed
with me as a kind of motto: "We need
more than a revolution, something
deeper than the false solution, to
replace what's going wrong". In my
professional career, when faced with
difficulty I always found myself
having three choices: be miserable,
run away, or be proactive and try to
make some impact. I am guilty of
taking to each one of those roads. But
truth be told, the last one leads to
the most happiness and satisfaction,
both for myself and the people around
me. I wish this was something more
of us could do, thereby making the
people around us better and the
company and the whole world a
better place.



uSpot, automated visual inspection

uSpot is GMV's solution that allows you to inspect an installation with greater precision.

Case of use in the industrial field:

It analyzes the products in the production line to establish a quality control, and thus make a precise and fast identification of the defective components crucial for the manufacturing operations to work properly and the final products to be free of imperfections.

Applications:

- Measurement (shape geometry and tolerances)
- Visual inspection (identification of defects, leaks, foreign objects, etc.)
- Enumeration
- Location / orientation

Benefits:

- Measuring without contact
- Quality control through continuous inspection
- Improve productivity (automation)
- Reduce production costs
- Standalone devices and rapid cloud deployment
- Improving safety

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