MAGAZINE
PRO ESPACIO
No. 42 | JULY | 2019

"COLLABORATION BETWEEN TRADITIONAL SPACE AND NEW SPACE IS GOING to be very strong

JORDI **PUIG-SUARI**

FEATURE
EUROPEAN SATELLITE NAVIGATION SYSTEM

LATEST NEWS
SUCCESS OF THE FIRST FEINDEF

MOVING OFF THE LANDING PLATFORM

The ExoMars rover has a brand new control centre in one of Europe's largest Mars yards. The Rover Operations Control Centre (ROCC) was inaugurated on 30 May 2019 in Turin, Italy, ahead of the rover's exploration adventure on the Red Planet in 2021.

The control centre will be the operational hub that orchestrates the roaming of the Europeanbuilt laboratory on wheels, named after Rosalind Franklin, upon arrival to the martian surface on Kazachok, the Russian surface platform.

The epicentre of the action for directing Mars surface operations on Earth is at the ALTEC premises in Turin, Italy. From here, engineers and scientists will work shoulder to shoulder at mission control, right next to a very special Mars yard.

Filled with 140 tonnes of soil, the Mars-like terrain has sandy areas and rocks of various sizes that will help rehearse possible mission scenarios.

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"NEW SPACE",
THE NEW FRONTIER FOR STATE OF THE ART TECHNOLOGY COMPANIES

Tecnobit-Grupo Oesía has been present in the Space sector since 2007 and has recorded various successes following on from the extensive experience it has gained from decades of working on flight electronics in the aeronautical sector.

We have the capabilities to develop equipment and solutions demanded by the sector, which has enabled us to consolidate the company in the Space market with developments that follow European Space Agency (ESA) regulations, as well as working on projects for benchmark companies.

Among its Space developments, Tecnobit-Grupo Oesía supplied all the electronics for the ELSA (ADS) antenna array. These consisted of Control and Process Units (ICU), management system and feed distribution units (PDU), etc. and diverse systems for micro-satellites.

In parallel with our activity in what is considered traditional or Classic Space (governed by the standards set by international agencies like ESA and NASA), we also have the strategic desire to promote developments in the sector known as New Space.

New Space focuses especially on systems that will operate in low orbits (LEO). In a way, it can be said that this scenario is among those that Tecnobit – Grupo Oesía covers in the field of aeronautics. And in the case of deep space, it is precisely why the company has much to offer through its experience in both cases.

New Space emerged from Universities and Research Centres, and is now one of the technological sectors and expanding markets that encourages major efforts in Research and Development. It also generates major investments (it is calculated that in 10 years it will be a market worth a trillion dollars).

One foreseeable development of New Space bursting on to the scene is that in lower orbits traditional satellites will give way to constellations of nano and micro satellites for which the capacities of the system are based on the group as a whole (model constellation). Replacing a single satellite with a network of smaller ones has a number of important advantages:

- in their size and design (eg the type of materials), the cost of production and launching is much less,

- their coverage can range from zonal, or restricted to a precise geographical area, to global (in any part of the planet) based on the number of components in the constellation.

- their endurance is less reliant on the resistance and durability of their components, more on the fact that the constellation can be maintained by assuming a level of repositioning that will cover the "decommissioning" of parts of them by launching new ones to substitute them.

This, together with the emergence of specific new launchers for this type of nano / micro satellites, will allow for systems that are theoretically everlasting in providing a service.

- the generation of waste in these types of small systems that operate in low orbit is without doubt miniscule, given that the units will end up disintegrating in the atmosphere.

NEW SPACE IS NOW ONE OF THE TECHNOLOGICAL SECTORS AND EXPANDING MARKETS THAT ENCOURAGES MAJOR EFFORTS IN RESEARCH AND DEVELOPMENT. IT ALSO GENERATES MAJOR INVESTMENTS

Among examples of the future use of this type of capability, based on a constellation of nano / micro satellites, will be:

- providing broadband communications, not only to areas of high density population but also the most remote ones.

- improving the tasks of earth observation through systems based on the "potential of the group" and its great endurance.

At present Tecnobit-Grupo Oesía is taking an active part in the development of major European New Space projects in the commercial field. We are dedicating energy and innovation to offering a technological contribution to creating advanced solutions based on a model constellation of nano / micro satellites that will transform the way that telecommunications work.

Luis Furnells

PRESIDENT
TECNOBIT-GRUPO OESÍA

SUMMARY

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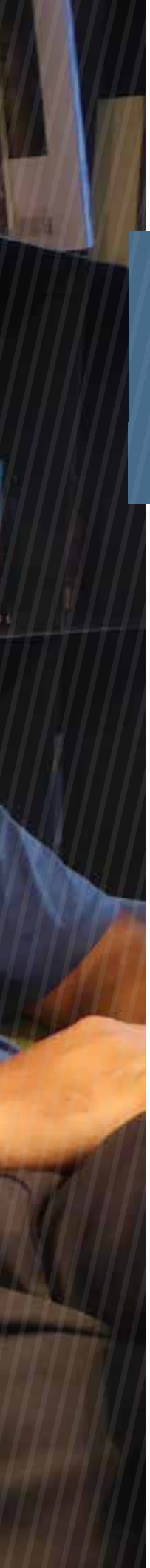
Quarterly edition - digital and printed.
Legal deposit ISSN 2254-9692
M-46591-2004
Printed by Expomark

Jordi Puig-Suari

"THE FASTEST PROCESSES THAT I KNOW OF HAVE BEEN SIX MONTHS, FROM CONTRACT TO FLIGHT, SOMETHING THAT WAS UNTHINKABLE BEFORE."



"Collaboration between traditional Space and New Space is going to be very strong"

Jordi Puig-Suari, aerospace engineer and professor at Cal Poly (California Polytechnic State University), has been a lover of aircraft ever since he was little and aspired to designing a screw that flies before he dies. He hasn't done that, but he has invented – along with Bob Twiggs- a concept satellite that is revolutionising the Space sector, the CubeSat, and the new idea that people now have of him, known as New Space.

HOW DID THE CUBESAT CONCEPT COME ABOUT?

CUBESAT IS BASED ON THE IDEA of "democratization of Space". I grew up in a country where at the time Space was inaccessible, and look what's happened there. I was speaking with a young guy from the Ivory Coast who is studying in South Africa and has built a satellite, something that before would have been impossible and know that I am in part responsible for this happening on a global scale. That someone in Vigo says: "Listen, at the University of Vigo we make satellites and before nobody would have thought it." For me the satisfaction is obvious. The concept goes back quite a few years. Bob and I wanted to teach students how to create something that is very small and simple and that can be used to launch satellites and do the engineering systems and be present in the whole process from design to launch. All this we noted down on a paper napkin that I think I still have a photocopy of, the one I sent to Bob to hang on to the idea. We first thought of making one up to a maximum of one kilo (a PicoSat is up to a kilo) and we said that if we are going to make a kilo that is a litre. Then out came the numbers and finally it was 10x10x10. What's more, we wanted to do it in international units, not in inches, so that students in the United States learn in centímetres.

HOW LONG DID YOU TAKE IN MAKING THE FIRST ONE?

The idea of the standard came out at the end of 1999. We had already spent six months thinking about the idea of the 10 cm and there were people getting started, but we still did not know how we were going to launch parts of the standard. The first 10 years were a test, changing ideas. So we've spent almost 20 years doing it and the first to be launched were in 2003. The fastest processes that I know of have been six months, from contract to flight, something that was unthinkable before.

With Cubesat the principal standard is 10x10x10 cm, plus the millímetres that separate them. Picosat is up to 1 kg and Nanosat up to 10 kg. Minisat is up to a thousand and microsat up to a hundred. With the small ones, nobody thought we could do anything. But there are many satellites of 20 or 30. That is much much smaller than one of 100 and nobody calls them micro – they are nanosats.

HOW DID YOU ARRIVE AT WHERE YOU ARE NOW?

Space was never on my options list because in the '80s in Spain the idea of Space was scant. I started studying in Barcelona and an opportunity arose for me in the United States, in Indiana. I finished my studies there and to validate my degree in Spain I had to do a master's, so I stayed a few more years, giving classes at the university, doing research. During my doctorate I was very interested in sytems engineering. I wanted to make things, not do analyses. People were starting to talk about nano-satellites, of making a chip and putting it in the satellite. And that interested me a lot. I went to the University of Arizona, where they were making one of the smallest of satellites. I came a cropper because the students kept on changing and we did not know when we were going to be able to launch what we were working on. In Cal Poly an aerospace school was starting up and they wanted to hire someone to set it up from scratch. The mentality at Cal Poly was "if you want to learn something, you have to do it", and I plunged into the project. Then I met up with Bob Twiggs, from the University of Stanford, and we began a project together. And that's where it all began.

HOW DID TWO PROFESSORS FROM DIFFERENT SCHOOLS GET TO COLLABORATE?

It's a very interesting story. Bob told me how he was making large satellites but he wanted to do a project where he could add on a small satellite that would be launched from the big one. And he asked me: "Are you up for making the small one?" I dared to do it because it was only batteries and it was going to be something very small - although it was a project that was cancelled. I had already set up a team of students who, without me realizing it, had started to come from other arms of engineering - manufacturacing, mechanical, electronics -, attracted by what the others were doing. One day I had to tell them that the project had been cancelled because of a cut in the budget, but the students didn't give up and continued with the idea. That is where the students began to design the pit-boat. Finally they presented it for a student competition and came second, which is not bad. What Bob and I did was to standardize it. We didn't have any more time or money, and we remained faithful to the idea from the very start. As a matter of fact people from the sector, including from NASA, have recognized that.

HOW WOULD YOU DEFINE NEW SPACE?

Everyone has his or her own definition but r**eally it's a philosophy**. It's not a technology, it's not a device, **it's a way of making Space different**. Assuming more risks, being more open to new technology that comes from other

industries, that don't come from Space. It has been a tool for change. We started out trying to make Space more agile, cheaper and to have a greater presence in the commercial sector, and the result was "New Space". The idea that people usually have is that it is Space companies financed by investment from Silicon Valley, a thing that is more modern and aggressive. Or, like Google and Apple, that world translated to Space. And that is a way of seeing it, but it overlooks the technological question in which there is also a change.

WHAT IS THE SPECÍFIC TECHNOLOGY OF NEW SPACE?

The technology of New Space is to go "robbing" the best of all the rest and taking advantage of Intel, Microsoft and Apple spending thousands of millions developing new systems that we normally do not use in Space, because they were not designed for Space. But they are super powerful and improving very quickly. It happens that many years back Space and the commercial sector were more or less in step. But when the commercial sector started to accelerate, Space did not invest sufficiently and we began to pick up ideas and technologíes from other fields.

DOES THAT MEAN THAT YOU USE TECHNOLOGY THAT COULD BE BOUGHT DIRECTLY FROM A SHOP?

That's the way it is, even more so because what people do is use specífic chips from other technologies, design a plate specifically for Space and then this plate is on sale. Go into the web and you can buy an onboard computer for CubeSat. They can even deliver it to you via Amazon.

HOW IS IT DIFFERENT FROM TRADITIONAL SPACE?

The fundamental one is the capacity to accept risks. Now we say "it may not work" but we try. In traditional Space you are making perfectly structured spacecraft, but they are very big, very expensive and not many are made. So you spend 10 years making a satellite that is half of your career and it has to work. Industry sees it as a problem. They have the mentality that "you cannot fly anything that has not flown." So we cannot fly anything that is new and we stall. The commercial sector of traditional Space was much more aggressive than governments.

ARE TRADITIONAL SPACE AND NEW SPACE COMPLEMENTARY?

When we started all this those who made CubeSats thought they could do everything with them. And those that made large satellites, on the other hand, thought that the small ones could do nothing. But neither of their assertions was correct. CubeSats or small satellites can do many things, but it is better to make it bigger because you can do more things, because we cannot do it all. So the big satellite makers have accepted that there are things that, yes, you can do, and others you cannot. That is when they started to talk about a need for a combination. There has been a change in mentality and **I believe that collaboration is going to be very strong**.

IT LOOKS TO BE ALL PROS, BUT WHAT ARE THE CONS?

Space garbage is something that could be a problem and we have to solve it and do things well. Another is the level of frequencies. If there starts to be a lot of satellites there can be interference and one has to think about how to handle it correctly. The same goes for security levels. Everybody can make them and people who before didn't have the capability to launch a satellite now do. Another thing that I don't see as a disadvantage but is a problem is that with many of the regulations and processes for obtaining frequencies the permits were designed when we were launching three or four satellites. The infrastructure, the number of people you have working on it and the requirements for documentation are designed for much longer periods. We have found that you can make a satellite faster than it takes to obtain the permits to launch it. As a matter of fact this matter is speeding up on a global scale. It was seen that things had to change, but governments are slow.

> "SPACE GARBAGE IS SOMETHING THAT COULD BE A PROBLEM AND WE HAVE TO SOLVE IT AND DO THINGS WELL"

WHAT SORT OF THINGS ARE CUBESATS USED FOR?

In general terms a CubeSat does the same as other satellites: observation of Earth, communications, scientific

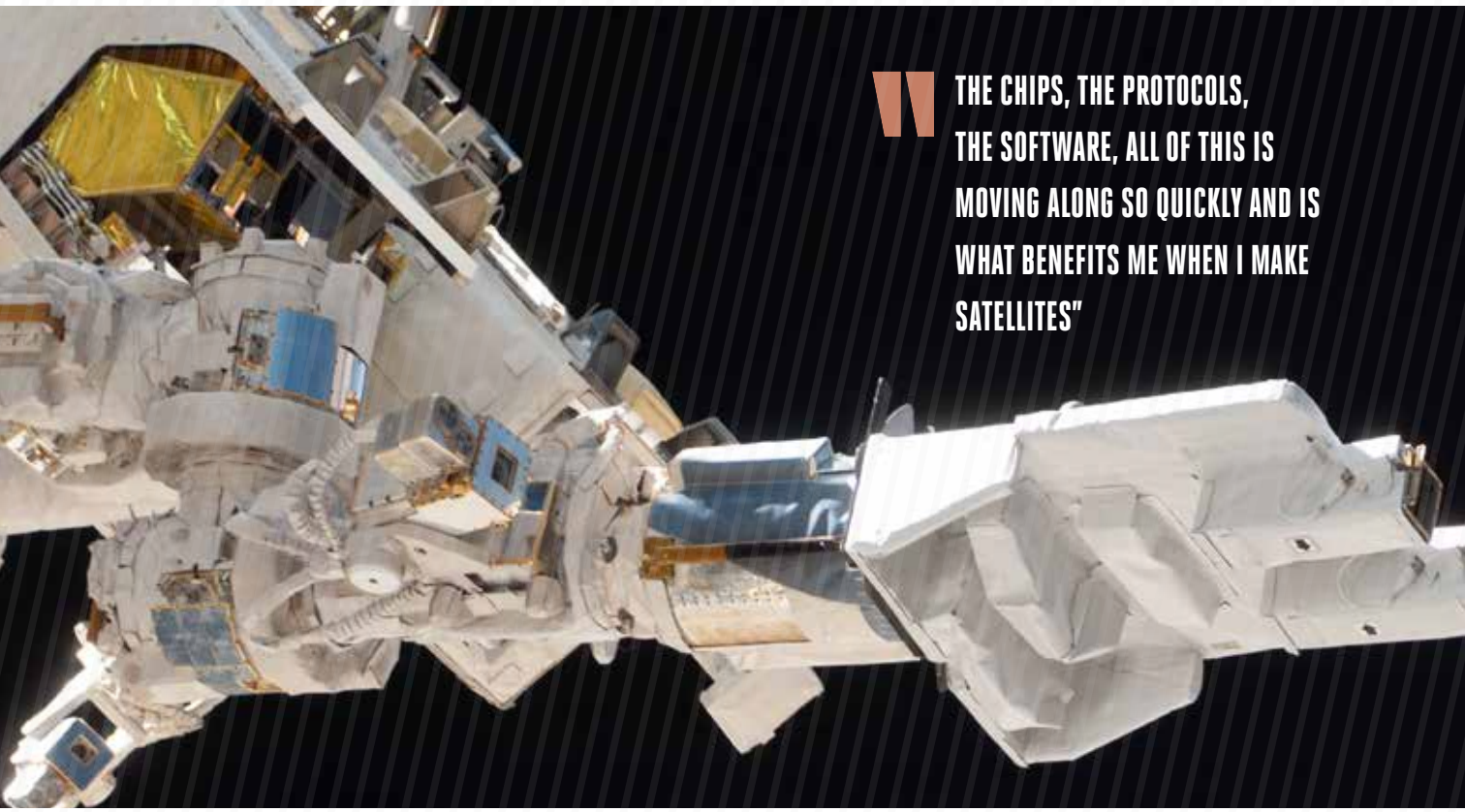
research, looking at the weather, going to Mars...the difference is that it doesn't do it in the same way. You have smaller capabilities than you have with larger satellites. They are made in less time with less reliability and with less precision. If you are making an Earth observation in the way they are done with large satellites, temporarily it is not fast. For example, Planet is developing satellites that take photos at a lower resolution but produce a photo every day of any part of the world. **It changes the potential of the application**. It takes photos even if nobody wants them and has a data base in which there is a photo of Earth every day. You can even travel back to the past. If there was a natural disaster in a spot where nobody was taking photos – because it is very remote, poor – everybody would be taking photos after the catastrophe. But Planet will have photos from beforehand to make it possible to compare the before and after scenes. And in the market place, if for example you are an insurance company and there's a flood and somebody tells you they had a house with a garage behind. You ask yourself if it was there before the flood, so you can call up the photo from the day before and check it out. The other important feature is that the cost is lower.

WHAT SORT OF SCALES ARE WE TALKING ABOUT?

It depends. To understand this the cost of a CubeSat is a percentage of "x", which is the value of a large satellite. As an example, the Marco A and Marco B satellites that went to Mars with NASA's Jet Propulsion Laboratory cost less than 50 million, dozens of millions of dollars to launch two small satellites to Mars that didn't do much. That's to say it's really between 7 and 10% of the costs of the missions to Mars that usually cost hundreds of millions. With a 3U (three unit) scientific CubeSat, that can do some really interesting things, the budgets work out at about a million dollars – that's for three years including its flight, data collecting and all the rest. So a satellite for a million dollars does not compute with what we did before. And that is for a scientific satellite, with all its scientific instruments.

HOW DO WE EXPLAIN THESE CHANGES TO THE AVERAGE PERSON?

There are various aspects to the problem, one of which is that is much more accessible. Many people talk of democratizing Space to a level at which more people can do it. Today we have many universities and we have the students that are starting out and want to build a satellite, something that was unthinkable before. Moreover, **satellites and Space applications**



"THE CHIPS, THE PROTOCOLS, THE SOFTWARE, ALL OF THIS IS MOVING ALONG SO QUICKLY AND IS WHAT BENEFITS ME WHEN I MAKE SATELLITES"

affect everybody and every day and that is something that people are not aware of. Studies show that almost 100% of industry and other sectors of the economy benefit from Space, from a GPS location to satellite photos. Practically everybody makes use of a satellite every day even if they don't know it. No longer is it just the multinational companies that can access the services of satellites, and that has changed.

WHAT SHOULD SPANISH UNIVERSITIES BE LEARNING FROM FOREIGN ONES?

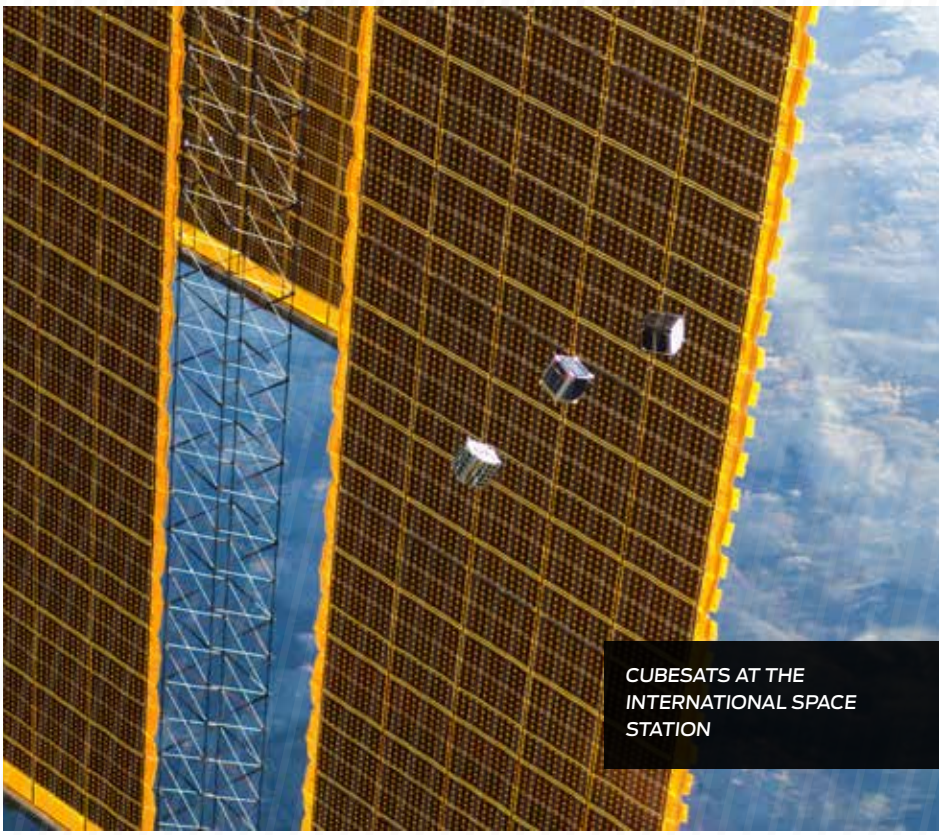
That is a very interesting question. Universities have always been developed on a level of departments, schools, telecoms, industrials, mechanics...And many of the problems and difficulties in the real world – and which is why we started CubeSat – are in the connections between the electronics, the software, the mechanics and the power system. So the idea was to create systems to link them all. On an educational level they are projects that are not solely about Space, so they help you learn to connect threads that normally are not connected. We need to explain better that traditional universities have to learn from some of these universities that are starting to do it and are proving very effective.

HOW MANY YEARS ADVANTAGE DOES THE USA HAVE IN NEW SPACE?

Not that many, because New Space is not very old. We have taken 20 years, but the first 10 passed in convincing people about what can be done. In reality we are talking about five or six years. Yes, they have an advantage, but it is a philosophical one rather than a technological one. Because there they understand, they invest, they take risks: students know how to set up a company. At the moment things are changing so rapidly and there are so many new ideas that nobody is very far behind.

WHAT IS THE RELATIONSHIP BETWEEN 5G TECHNOLOGY AND NEW SPACE?

What is important is that just a short time ago we started out on 4G and now we are on to 5G, and that is the technology that I am going to use. The chips, the protocols, the software, all of this is moving along so quickly and is what benefits me when I make satellites. It's not that I use it in exactly the same way but I move at the same speed as they do.



CUBESATS AT THE INTERNATIONAL SPACE STATION

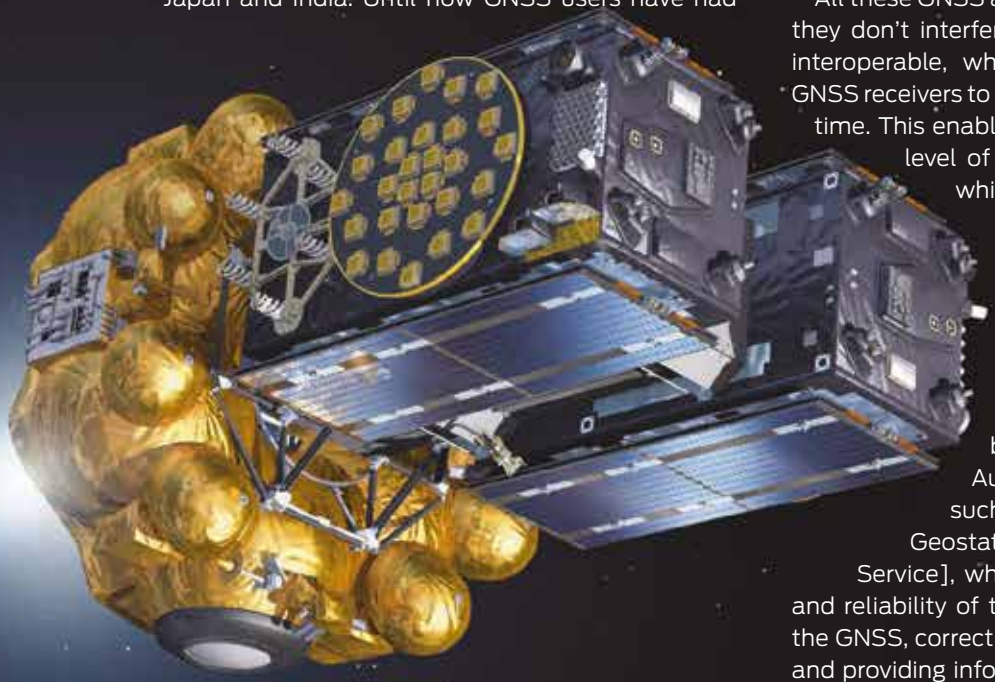
European satellite NAVIGATION SYSTEM

THE CENTRES IN SPAIN

GALILEO IS THE EUROPEAN UNION'S GLOBAL Navigation Satellite System (GNSS), providing precise information for location and for time, and has a significant positive impact for both European and global users. Its goal is to guarantee the EU's autonomy in the field of satellite navigation and at the same time to help promote Europe's industrial fabric in this rapidly expanding market and create a large number of high quality added value jobs.

> *"GALILEO COMPLEMENTS EXISTING OR UNDER CONSTRUCTION GNSS SYSTEMS: THE GPS FROM THE UNITED STATES, GLONASS FROM RUSSIA AND CHINA'S BEIDOU"*

Galileo complements existing or under construction GNSS systems: the GPS from the United States, GLONASS from Russia and China's BeiDou. There are also various regional systems [RNSS], the main ones being those developed for Japan and India. Until now GNSS users have had to rely on non civilian GPS and GLONASS signals. With Galileo they now have a new and reliable alternative that unlike other programmes is under exclusive civilian control.



All these GNSS are inter compatible. That's to say they don't interfere with each other and are also interoperable, which enables users of standard GNSS receivers to use different systems at the same time. This enables them to benefit from a higher level of service and features, no matter which coverage area they are in.

The features of a GNSS can be evaluated using four criteria: precision, integrity, continuity and availability.

These features can be improved by using regional Satellite-Based Augmentation Systems (SBAS) such as Europe's EGNOS [European Geostationary Navigation Overlay Service], which increases both the precision and reliability of the information originating from the GNSS, correcting measuring errors in the signal and providing information related to integrity (that is, a guarantee of correction) of the original signal.

Spain's Space industry is broadly represented in the European Union's GNSS in both the ground and flight segments.

Galileo satellite separating in the final launch phase of a Soyuz probe

CURRENT STATE OF THE EUROPEAN SATELLITE NAVIGATION SYSTEM [E-GNSS]

The E-GNSS are two programmes of the European Commission, that are managed by the GSA, the European Agency for Satellite Navigation Systems, based in Prague, and the ESA, the European Space Agency.

Galileo System

The start of the Galileo System dates back to 1999 when the European Commission presented the project as a major commitment by the EU. The first Galileo satellite – an experimental one – went into orbit in 2005 with the first operational one being launched in 2011. So far 26 satellites have been launched, 24 of which are operative and two are being tested.

The 30 satellites for the constellation will be complete by the end of 2021, while the process for defining the second generation is now under way.

The ground structure is complex and includes two control centres [GCC], in Germany (Oberpfaffenhofen) and in Italy (Fucino); a service centre for Galileo users (GSC) in Spain (Torrejón de Ardoz, Madrid); an in orbit test centre in Belgium (Redu-RSS); two security monitoring centres (GSMC), in France (St. Germain-en-Laye, Paris) and Spain (San Martín de la Vega, Madrid); a Reference Service Provider (GRSP) centre; a Time Service Provider (TSP) centre a Search and Rescue Service Provider centre [SAR/Galileo Data Service Provider – SGDSP] located in Toulouse (France); and the independent monitoring centre, Galileo Reference Centre (GRC), in Noordwijk (Netherlands).

Terrestrial components of the system include infrastructure deployed right around the planet. Currently there are:

- 16 **Galileo Sensor Stations** (GSS), that receive and send out in real time system measurements and signal data (SIS) to the Galileo Control Centres (GCC).
- 5 **Galileo Uplink Stations** (ULS), that distribute and send out mission data to the Galileo satellite constellation.
- 5 **Telemetry, Tracking & Control stations** (TT&C), that register and send out telemetry data generated by the satellites and distribute control commands to carry out maintenance operations in the constellation.

Once it is declared fully operative (FOC) the Galileo system will offer various high performance serices on a global scale:

- Open Service (OS)
- High Accuracy Service (HAS)
- Authentication Service (of the navigation message, OS-NMA, and the signal (SAS))
- Public Regulated Service (PRS)
- Search and Rescue Service (SAR)

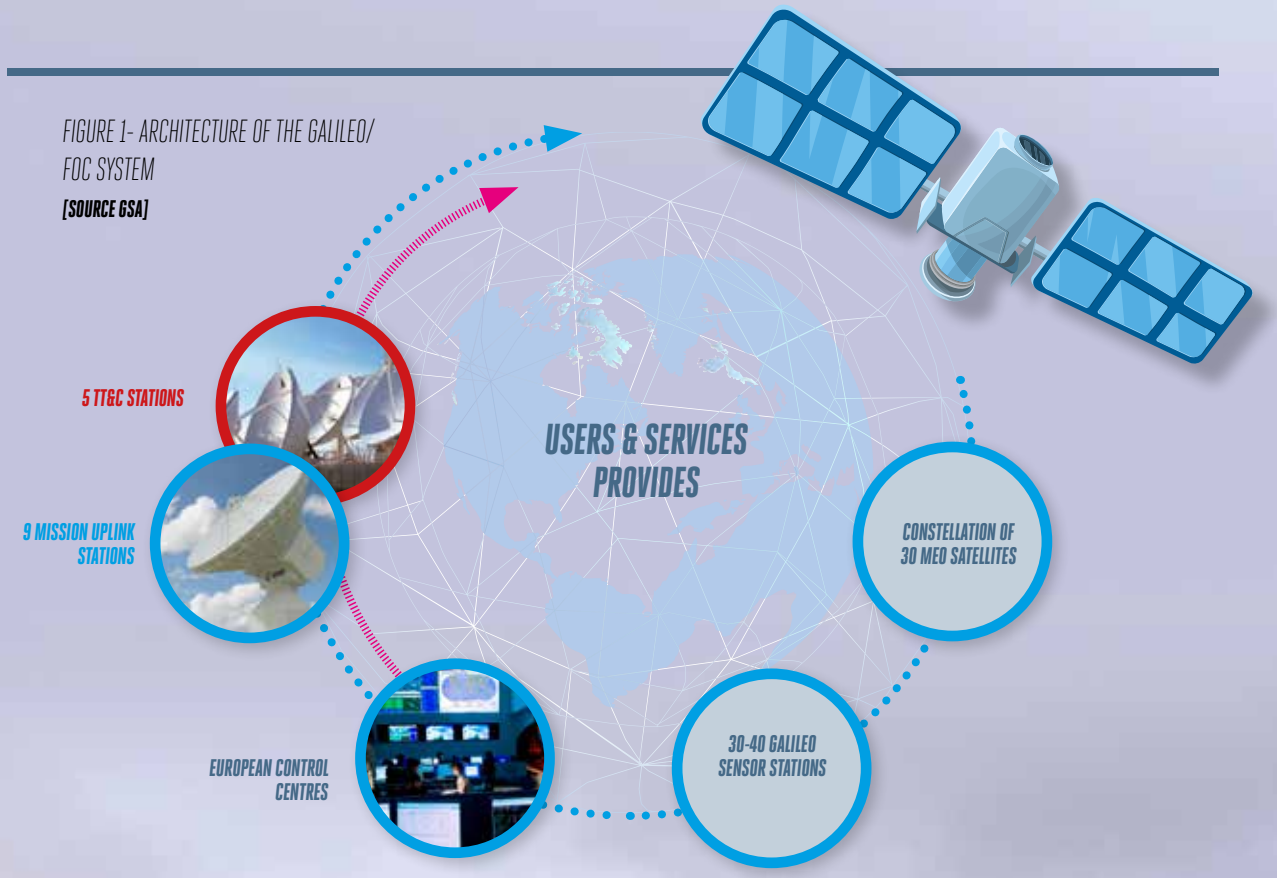


FIGURE 1- ARCHITECTURE OF THE GALILEO/ FOC SYSTEM

[SOURCE GSA]

There are also plans for providing services for distributing Emergency Warnings (EWS) and facilities for developing 'safety-of-life' (SoL) security applications.

The European GNSS Agency (GSA) announced the start of the Galileo System services for OS and SAR in December 2016. Since then the user service centre located in Spain –GSC- has been publishing quarterly reports on the performance statistics of both services. The results show that the system has surpassed the goals specified for both services. (Source: Galileo Public Report © European Union, 2018").

EGNOS System

The EGNOS (European Geostationary Navigation Overlay Service), as we mentioned earlier, is the European regional augmentation system based on satellites (SBAS). It is used for enhancing features of the constellations such as the GPS and in the future it will include that of Galileo. EGNOS was set up and deployed to provide SOL (Safety of Life) services for aviation, the maritime sector and for ground transport.

EGNOS uses the GNSS measurements taken by high precision geo reference stations – known as RIMS (Ranging and Integrity Monitoring Stations)-

"EGNOS MESSAGES ARE RETRANSMITTED TO USERS VIA TWO GEOSTATIONARY SATELLITES."

which are deployed all around Europe and north Africa. These measurements are then passed on to a calculation centre where they work out the correction differentials and the integrity messages. These are then transmitted throughout the coverage area using geostationary satellites, augmenting the original GNSS messages.

The EGNOS Programme

The EGNOS Programme was launched by the European Commission in 1994 and began operating in 2001 with the 2.1 version of the system. In 2009 the first EGNOS service was announced –the Open Service OS – and its operations were put in the hands of the company ESSP, still the supplier for the EGNOS service.

In 2011 the EGNOS Safety of Life (SoL) service was declared open after obtaining certification of the signal for its use in aviation. In 2014 the European Commission delegated the operating of EGNOS to the GSA.

From 2022 it is expected that the new version of the system, currently in development and known as EGNOS v3, will augment not only signals from the GPS system but also from Galileo.

The EGNOS programme is managed by two entities:

- The European Commission (EC): is the administrator of the EGNOS system, which is owned by the EU.
- The European Space Agency (ESA): led the development of the EGNOS system in the past and is now the body designated by the EC to design developments for the system.
- The European GNSS (GSA) Agency: is in charge of managing the EGNOS programme, its operations and exploitation, as well as the development and promotion of its services.
- European Satellite Services Provider (ESSP): The company is the current supplier of EGNOS services, ever since the GSA awarded it the service provision contract. The contract runs until the end of 2021.

Functioning of EGNOS and its services

EGNOS augments the civil signal GPS L1 (1575.42 MHz) (C/A), carrying out corrections in the following sources that affect the pseudo ranges of GPS: errors in the positions of satellites, in their clocks and errors introduced from the ionosphere.

EGNOS messages are retransmitted to users via two geostationary satellites. The information provided by EGNOS improves the accuracy and reliability of the GNSS positioning at the same time as supplying a true message (information about errors and the probability of them occurring).

EGNOS also transmits a precise time signal. EGNOS is designed to be interoperable with other Augmentation Systems based in satellites –SBAS-, such as WAAS from the US and India's GAGAN. The coverage area for EGNOS is all of Europe. At the moment, EGNOS provides three services:

1. Open Service (OS): Its main objective is to improve the precision of the GPS signal.
2. Safety of Life (SoL) Service: This service provides the highest standards of features for users of the security positioning services and has been designed to support operations for the guiding in

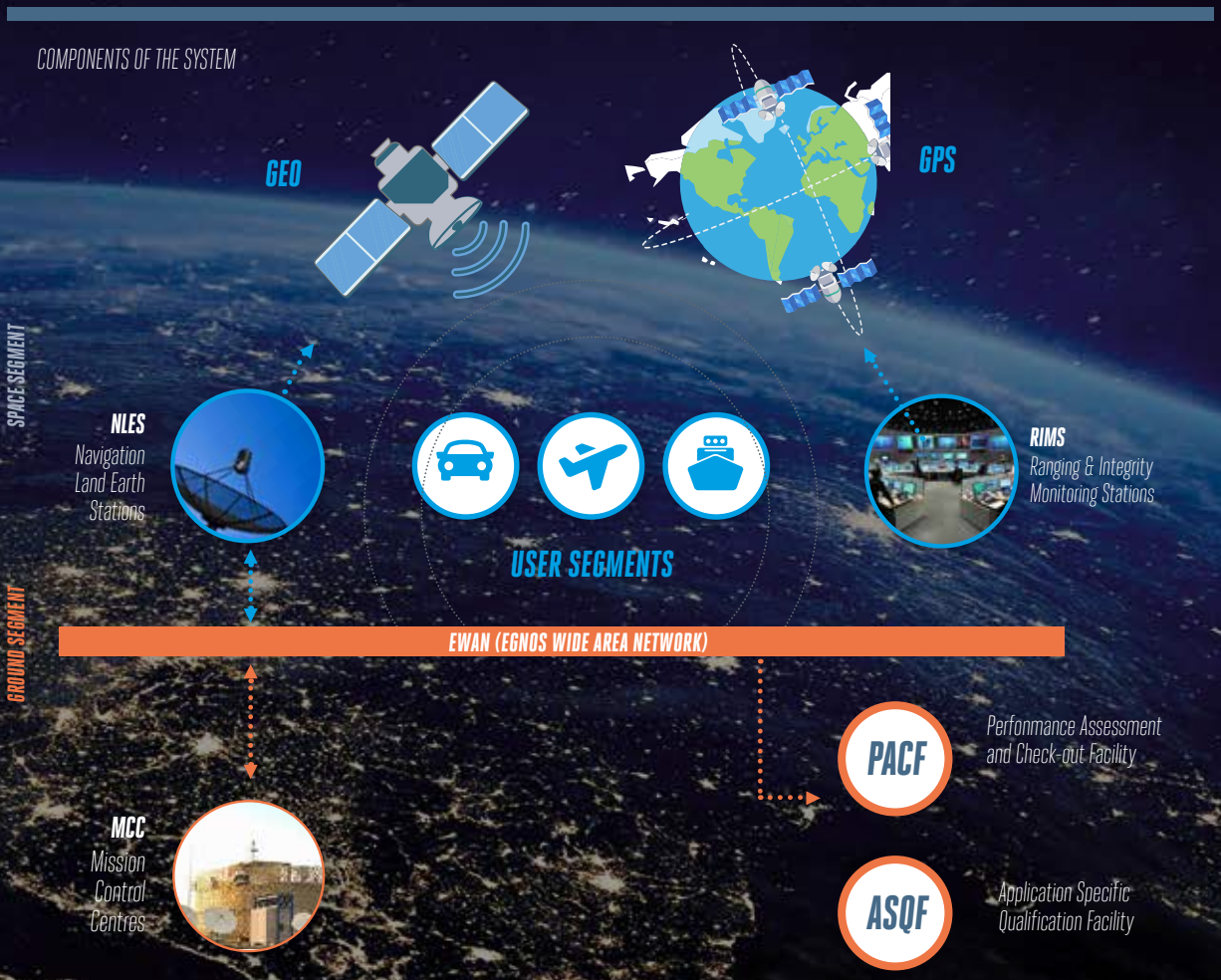
and landing of civilian aircraft up to LPV[Localiser Performance with Vertical guidance].

3. EGNOS Data Access Service (EDAS): This service provides GNSS and EGNOS data via an internet communication service in real time, as well as details of FTPP data. It is the only point of access to the EGNOS data generated by the land based infrastructure. The service has been available since 26 July 2012.

Components of the System

- Space segment: is made up of three geostationary satellites that emit corrections and information integrity in the L1 frequency band: two are operational and one is testing.

- The land segment consists of a network of reference stations (Ranging Integrity Monitoring Stations, RIMS), two Mission Control Centres (MCCs), six NLES (Navigation Land Earth Stations) and the communications network EWAN [EGNOS Wide Area Network]. It should be highlighted that within each MCC is a Central Processing Facility (CPF) which is the calculating module for working out corrections and the residual errors that stem from them.



GALILEO SYSTEM INSTALLATIONS IN SPAIN

Services Centre GNSS - GSC

Spain has the Loyola de Palacio GNSS (GSC) Service Centre which is located at the INTA complex in Torrejón de Ardoz, in the Comunidad de Madrid region.

This centre is the sole interface for all users at a global level of the Open Service (OS). It supports the SAR- Search and Rescue segment – that has been operational since December 2016, and which in the future will manage operations for the High Accuracy (HAS) and authentication (OS-NMA) services.

Operations oriented in support of the user community

The operation and maintenance services of the GSC are completely integrated in the processes of the system operator (GSOp, Galileo Service Operator). The GSC is the integrated service interface for the user community and covers the administration of the web portal, the user help line service, technical support and evaluation of the service's performance. It also informs users of manouevres and availability of the satellites (NAGU).

"THE GOAL OF THE GSC TEAM IS TO IMPROVE THE POSITIONING OF GALILEO AS A KEY GNSS SYSTEM IN THE MARKET"

Developments for the Galileo system are scheduled to include the incorporation of High Accuracy (HAS) and Autentication (OS-NMA) services through a physical link at the centre.

Operations and service processes implemented at the GSC are continually being updated, based on the premise of maintaining customer satisfaction and increasing the quality of support services for the user.

The goal of the GSC team is to improve the positioning of Galileo as a key GNSS system in the market, promoting its services for incorporating new domains of user segments (e.g. railways, roads, maritime, aviation and synchronization) through the promotion and development of applications and services.

Within the scope of the GSOp contract, which was adjudicated to Spaceopal GmbH (JV Telespazio, DLR/Gfr), the Spanish companies and entities that provide services for the GSC are:Telespazio Ibérica, INECO, ISDEFE, INTA, GMV, INDRA and Deimos.

Figures 2 - 3: Entrance to the GSC and front view of the GSC - INTA.

The Galileo Security Centre - GSMC

The Security Monitoring Centre [GSMC] represents a critical piece of infrastructure within the Galileo system. Its objective is to oversee the security of the system in line with the bases of the programme and the satellite navigation services for users in the public sector. It has an important role in managing access to the Public Regulated Service [PRS], one of the five services provided by Galileo, which is used by customers in the security and defence sector (Police, Customs, Defence, Civil Protection, etc.).

Spain has received the backing of the EU to host this centre which was originally installed at Swanwick in the United Kingdom.. As a consequence of Brexit, it was decided to transfer the facility, to keep it within the EU.

The installations are located within the INTA complex of "La Marañosa" at San Martín de la Vega, near Madrid, and function as a support for the GSMC Centre which is situated near Paris.

The provisionary installations have now been handed over to the GSA – the European Agency for Satellite Navigation Systems. The event took place on 14 April, presided over by the Minister of Defence, Margarita Robles. She was accompanied among others by the UE's director of programmes for satellite navigation, Matthias Petschke; the executive director of the GSA, Carlo deDorides, and the deputy director of Land Systems at INTA, General Manfredo Monforte. Mr Petschke said he was convinced of the "high level of service" that the installations at INTA will offer (http://www.defensa.gob.es/gabinete/notasPrensa/2019/04/DGC-190411.html).

The infrastructure that the GSA has been allotted by INTA is provisional, with Spain committed to delivering a definitive GSMC installation, one that is currently under construction near the current complex.

This new centre represents an opportunity and strengthens Spain's presence in a European Satellite Navigation System (E-GNSS) that brings with it strategic advantages. These will improve the country's positioning in the programme and should translate to a bigger participation by Spanish industry in high value technological contracts and the consolidation of national know-how and technology, especially in the field of GNSS security services.

The GSMC has the following functions:

- Monitoring security: The GSMC monitors and takes action in areas related to security threats and alerts, and the operational state of the system's components.
- Management of PRS access at systems level: The GSMC guarantees that the confidential information related to the Public Regulated Service (PRS) is properly administered and protected and that the Operations Centre of Galileo is not put at risk. The GSMC serves as an interface with government entities (through platforms of computerized points of contact - POCP) for the requests of key cryptographics and with central components of Galileo for administering signals /messages connected with satellites.
- Implementation of 'joint action' instructions': In the case of a security threat to the European Union or a member state deriving from the operation or use of the system, or in the case of a threat to the functioning of the system itself, in particular resulting from an international crisis, the board, by unanimous decision, will decide on the necessary instructions for the GSA and the concessionaire of the system.
- Supplying the PRS service and Galileo with expertise and capability analysis in the field of security.

The Spanish companies and entities that provide services are: GMV, Indra, Deimos...

Figure 4 - GSMC: visit of the Minister of Defence accompanied by the Director General of the National Institute of Aerospace Technology, Lieutenant General José María Salom, and the Director of the GSMC located in France, Philippe Rosius. Source: Ministry of Defence.

ESP – EGNOS Services Provision Centre

The EGNOS Services Provision Centre is based at Torrejón de Ardoz (Madrid) in a building within the complex of the ENAIRE Air Traffic Control Centre that borders the Torrejón Air Base.

ESSP SAS, which manages the EGNOS services, is a limited company which has its headquarters in Toulouse, where the Operations, Engineering and Security units are based. Its Spanish subsidiary includes the Service, Provision and Promotion units. ESSP has seven shareholders that are suppliers of air navigation services.

The SBAS augmentation services use GNSS measurements registered by high precision benchmark stations that are deployed throughout the continent and in neighbouring regions. All the error measurements from the GNSS signals are transferred to a central computer bank where the differential corrections are carried out and integrity messages are generated. The data they generate is transmitted to the EGNOS coverage area using geostationary satellites that augment the original message from the GNSS system.

"SEVERAL COUNTRIES HAVE IMPLEMENTED THEIR OWN AUGMENTATION SYSTEMS [SBAS]. EUROPE HAS DEPLOYED EGNOS WHICH COVERS MOST OF THE EU AND SOME NEIGHBOURING REGIONS"

Several countries have implemented their own augmentation systems [SBAS]. Europe has deployed EGNOS which covers most of the EU and some neighbouring regions. Other countries that have already implemented or are developing their own augmentation systems are the United States, Japan, India, China, South Korea and Russia. SBAS is essential for applications where precision and integrity are critical. In particular, SBAS is indispensable in situations where human lives are at risk or where GNSS is being used to provide a form of legal or commercial guarantee.

Figure 5: ESSP – The ENAIRE Air Traffic Control Centre on the road to the Air Base at Torrejón de Ardoz, Madrid. [Source: Google]

For example, in the aviation sector, GPS does not meet the strict operational requirements of the International Civil Aviation Organization (ICAO) for use in important stages of a flight such as the final focus. However, with the addition of SBAS, the ICAO standards are met. Beyond the aviation sector, SBSS improves and broadens the reach of GNSS applications such as precision agriculture, the management of vehicle fleets on the road and geodesy, to name just a few.

ESSP carries out the following activities at the Torrejón service centre to support EGNOS users in its different domains:

- SD&A - [Service Development and Adoption]: Development and adoption of EGNOS services, promoting its benefits in different segments of the market (Aviation, Maritime, Railways, Agriculture, Cartography).
- UPM - [User performance monitoring]: Monitoring the performance, guaranteeing transparent information and alert services on the outputs of EGNOS for its users, including NOTAM hazard notices for the aviation sector.
- US - [User support]: To provide EGNOS users with technical asssessments via a 24/7 assistance service, a web site dedicated to helping the user and issuing notifications on the state of the service. Users are also kept up to date on improvements to and developments of the service.
- EDAS - [EGNOS DATA ACCESS SYSTEM]: Supplying registered users in real time via Internet with GNSS data that has not been processed and with messages from EGNOS.

BLACK HOLE

"To the camera no... I am not talking to camera" a specialist researcher in biodiversity tells me when we start to set up the equipment for the interview. He catches me by surprise and I let out a little laugh of disbelief. "Afterwards you put in some 10 second comments and headline them however you want," he continues. "I will tell you all you want, but not to camera".

CARLOS
RUSCALLEDA

SCIENCE CORRESPONDENT AT RTVE AND DIRECTOR OF THE PROGRAMME ASTRO24

This scene illustrates the distrust that many scientísts and technicians still have towards the media, especially TV. And it's not an unusual reaction. At times we give them more than enough reasons to clam up in unison.

If the radar on the Mars Express detects signs of liquid water under the surface of Mars we headline it: "Lake of liquid water on Mars" when in reality it's a salty mud. Then NASA suspends the first space walk led by women: "There are no clothes for them"; and if radio signals are detected at a billion and a half light years away: "Extraterrestrial radio signals." – (Put on some film clip says the boss, that always goes down well.) Sometimes it's an incendiary scientist who lights the fuse. "Oumuamua could be an alien spaceship" says a leading researcher at Harvard and everybody dives in.

Pieces of information like these that are treated lightly contribute to reopening the black hole of incomprehension between scientists and the media that it has cost so much to close (and then only part way). I knew a mathematician, head of communication at a leading scientific institution, who regarded journalists as little more than halfwits. He decided the best thing to do was to give them the news already edited and would not allow them access to the sources (the researchers), or if he did so reluctantly and well supervised.

The question is no better when seen from the other side. Doing scientific news has for many years been like chasing neutrinos in a quantum world. There was only one thing worse than interviewing a researcher; talking with a technician. Usually you come out more confused and perplexed than before you started your questions. Some colleagues go straight to the root of the problem. "Let's see, you tell me this" – and, yes, they told the interviewee what he had to say - "and in less than 12 seconds".

Fortunately Microsoft invented PowerPoint, scientists started to emerge from their laboratories, to present projects and give conferences, and they have ended up taking part in monologue competitions and creating their own Youtube channel. Parallel to this, the major institutions and companies set up press offices and the media began training journalists who specialize in science and technology, offering courses and chats for scientists to bring them closer to the reality of work in a newsroom. And so with time and a few fits and starts we have all been polishing the edges, ironing out differences and overcoming mix ups.

I think the essence of scientific communication is clarity in its explanation. If before giving the OK to your piece the editor asks you "So the lake is líquid water?", better that you bin it and start again. Scientists complain that we force them to renounce any complexity and to speak in metaphors for those that are not so gifted. I remember the problems Peter Higgs had in explaining his famous boson. I didn't even try to; neither do I believe it's my mission. I settle for saying how he won the Nobel Prize in 2012 and perhaps awakening the curiosity of a viewer, to keep him enquiring.

El Arenosillo is a modern missile experimental centre in Huelva province. Previously known as Cedea, it is accountable to the Sub-directorate for Experimentation and Certification at Spain's National Institute of Aerospace Technology (INTA).

In 1966, NASA and CONIE – the National Comission for Space Research – signed two agreements. One was called the Programme for Short Term Cooperation with NASA, to equip the site and cover the first launches. The other, the Programme for Long Term Cooperation with NASA, was for scientific experiments to be performed at the test field. With the short term programme both institutions recognized their mutual interests in carrying out a cooperative project to glean weather information from a high altitude above Spain and to test and evaluate equipment and techniques for using survey rockets to carry out meteorological observations.

El Arenosillo

It was from here that the future El Arenosillo, the one that we know today, was born. The Booster-Dart and Arcas type rockets would be the first to be launched to obtain overview data on winds, temperatures and pressures at altitudes of 30 to 60 kilometres. What was expected from all this was to gather data that would provide information on the dynamics of atmosphere circulation for use in studying meteorology and the atmospheres of planets.

FOTOS CEDIDAS POR MARIANO VÁZQUEZ VELASCO, AUTOR DEL LIBRO "DE EL ARENOSILLO AL CEDEA"

THE LAUNCH SITE OF EL ARENOSILLO WAS GIVEN THE GO-AHEAD TO BEGIN OPERATING ON 1 OCTOBER 1966, AND CARRIED OUT ITS FIRST LAUNCH UNDER THE ORDERS OF ÁLVARO AZCÁRRAGA ON 15 OCTOBER

At the end of 1964, studies began to choose a place for the launch site and the types of rocket to be used and the necessary equipment. These were entrusted to INTA and the recently created Department of Advanced Studies, headed by Segismundo Sanz Aránguez. They in turn tasked the job to the aeronautical engineers Álvaro Azcárraga and Pedro Sanz-Aránguez, who had completed their training in the United States and who relied on support from staff in other departments at INTA. It was decided that the ideal area would be in the south of Spain, based on the technical and operative conditions of the project. The final setting chosen was a forested area near the Pico del Loro hill, the Arenosillo gully, and the beach at Mazagón in the province of Huelva.

FIRST LAUNCHES

The launch site of El Arenosillo was given the go-ahead to begin operating on 1 October 1966, and carried out its first launch under the orders of Álvaro Azcárraga on 15 October, with great expectations and a satisfactory outcome. That first launch was made with a Skua rocket, the first in a family of survey rockets built by the British BAJ. Over time its four models would be launched from El Arenosillo. These rockets consisted of a main motor, the Bantam, and an accelerator system made up of a variable number of booster motors, the Chicks, depending on the version used and the activities it needed to carry out (at altitudes of between 70 and 110 kms) with payloads of up to 15 kgs. With these four models the direction of the rocket was governed by the draft of the fins, which could not be modified. The first launch went up to an altitude of more than 60 kms. Then they did two more with Judi- Dart rockets that reached 55 kms. The Judi-Dart was the first of the HASP (High Altitude Sounding Projectile) rockets launched from El Arenosillo as part of the first CONIE-NASA meteorological campaign. They could be used to ascertain wind direction and speed as well as the temperature of the atmosphere in the test zones. It was a one stage craft, made up of a solid fuel Judi engine and an inert stretched body, the Dart. This carried the payload, as well as a delayed pyrotechnic system for initiating a cargo ejection, one that would separate the cargo – depending on the type being carried – between 90 and 115 seconds after the moment of lift-off.

The first CONIE-NASA Cooperative Meteorological Programme envisaged the launch of five Skua and 12 Judi-Dart, with the aim of measuring the temperature and the speed and direction of the wind in the atmosphere at an altitude of between 20 and 70 kms (at that time meteorological interest reached up to 70 kms).

The second Skua launch was not as satisfactory as the first. Because of a mechanical fault in the launch ramp it lifted off on an unstable trajectory and crashed a few hundred metres

PREPARING THE SITE. LAYING OF CABLES AND FIRST CONSTRUCTION. PHOTO SUPPLIED BY ANTONIO GARCÍA LÓPEZ

from the ramp. As it did so it passed between the control centre and radars, posing a big danger to the site staff and visitors that day.

After what happened, activities at the launch site were immediately suspended while a commission was set up of weapons experts Victoriano López and Pedro Sánchez, technical engineer Luis Casado, and Mariano Vázquez Velasco who was seconded to the United Kingdom, to clarify the causes. The launch ramp was redesigned and two test firings were carried out at a British Army base in the Outer Hebrides islands off Scotland. Once these were successfully completed, launches restarted at El Arenosillo.

MAJOR HIGHLIGHTS

After the first international presentation of data from El Arenosillo, in Prague, hundreds of launches were carried out. One of the major highlights that now forms part of its history was the placing in orbit of the satellite Intasat, the first from INTA and also the first that Spain put into Space, as El Arenosillo became one of the receiving points for scientific data.

A SPECIAL DAY: FIRST OFFICIAL LAUNCH, ISDE OCTOBER 1966

14 OCTOBER 1966, THE FIRST SKUA ARRIVES ON SITE

14 OCTOBER 1966, ARRIVAL OF THE FIRST SKUA. FROM LEFT: VICENTE CONTRERAS, FRANCISCO RABADÁN, ADOLFO ABAD, ÁNGEL DELGADO, JOSÉ A. CORTÉS AND JOSÉ MARÍA DORADO

"THE INSTALLATION IS STILL ACTIVE TODAY AND HAS GAINED GREAT IMPORTANCE FROM OTHER PROGRAMMES RUN BY INTA AND THE MINISTRY OF DEFENCE, FUNDAMENTALLY STUDIES OF THE ATMOSPHERE AND TRIALS OF UNMANNED AIRCRAFT (RPA)"

UP TO DATE

In 1994 El Arenosillo stopped operating as a launch base for survey rockets, at a time when the site was already being redirected towards new paths to ensure its continuity. The installation is still active today and has gained great importance from other programmes run by INTA and the Ministry of Defence, fundamentally studies of the atmosphere and trials of unmanned aircraft (RPA). Under the new name of Centro de Ensayos (Test Centre) de El Arenosillo (formerly CEDEA), it comes under the authority of the Institute's Sub-directorate of Aeronautical Systems.

Its latest activity includes one of the agreements signed between INTA and PLD Space which will enable the launch of the sub-orbital rocket MIURA 1 from the Experimentation Centre at El Arenosillo during the third quarter of 2019. Its objective is to provide scientific and commercial access to Space from Spain.

One of the centre's most painful episodes happened in the summer of 2017 when a fire flared up in the area known as La Peñuela de Morguer, leaving nearly 8,500 hectares burnt and numerous cases of material and environmental damage in the area of the Doñana national park. It ended up affecting the installations at the Experimentation Centre at El Arenosillo, especially the perimeter of the site, its monitoring systems, and the electricty supply, as well as burning various vehícles. It's an episode from which El Arenosillo has now recuperated.

■ *Guillermo Cayado*

LAUNCH OF THE INTA 300B

DRONE (TARGET) AIRCRAFT

El Arenosillo: **A sentimental story**

By Álvaro Azcárraga

As this is one of the most notable happenings in the history of Spanish Space activity it is useful to look back at how it all started. The agreements in 1958 with the recently created NASA to establish tracking stations on Spanish soil were undoubtedly the first steps. But Spain wanted more and it joined up with another 10 European nations at the Meyrin conference in 1960 for what would become the European Space Research Organization and later the ESA.

At the same time the process began to set up a single point of command in the sector, one which led to the establishment of Spain's National Space Research Commission (CONIE). This included members from all sectors with an interest in Space. The posts of president and secretary general went to two generals from the Corps of Aeronautical Engineers: the president of INTA, Rafael Calvo, and the director general of the institute, Antonio Pérez Marín. To understand this it must be remembered that at the time anything that flew came under the jurisdiction of the Air Ministry, including the crop spraying aircraft of the Ministry of Agriculture. The Scientific-Technical Committee of CONIE took on the presentation of a first truly Spanish Space programme, one that contemplated setting up a launch site for survey rockets and the development of a rocket capable of reaching the mesosphere with a reasonably sized payload. Not unexpectedly, two young aeronautical engineers, not long back from the United States where they had obtained Masters degrees at prestigious universities, were picked to lead the project. The technical development of the rocket went to Pedro Sanz, from the departament of motive power, and of the site to the author of this article, from INTA's Department of Equipment and Armament. The director of the programme was the aeronautical engineer, Luis Pueyo, one of the members of the Spanish delegation at Meyrin, where the European Space effort began.

In the autumn of 1965, these two engineers were accompanied by an older one, Jorge Soriano, who gave an air of authority to his young companions. They made a journey along the coasts of peninsular Spain (the islands were discarded because of the logistical costs and the Mediterranean coast for the

VISIT TO NASA IN SEPTEMBER 1965: HAROLD E. TOLEFSON OF THE LANGLEY RESEARCH CENTER, ÁLVARO AZCÁRRAGA, JOSÉ MARÍA GOYA AND PEDRO SANZ ARANGUEZ

mass tourism already building up there.) They finally chose a place in a national forest area near the Pico del Loro hill, the El Arenosillo gully and the beach at Mazagón in the province of Huelva. The unforseen incidents and the subsequent negotiations with the local authorities would make for a much longer article than this one. Suffice to say that INTA ended up being the owner of various hectares of land among sand dunes 30 metres above what was then an extensive yet empty beach. Apart from the scorpions, wasps and occasional snakes, there wasn't even a road.

It was now that the real Space work began. Designing the site, putting up defences, munitions stores, launch ramps, control centres, weather tower, canteens, access. The buildings part was carried out with the support of the infrastructure section from the air ordnance depot at Seville. The most important part, the laboratory for calibrating and electronics for the payloads, was put up in three weeks by a team from the electronics section of the Equipment and Armament Department at INTA, led by José María Dorado. Years later he would become the project director for the first Spanish satellite.

"THE LAUNCH SITE AT EL ARENOSILLO WAS GIVEN THE ALL CLEAR FOR OPERATIONS ON 1 OCTOBER 1966 AND CARRIED OUT ITS FIRST LAUNCH UNDER MY DIRECTIONS ON 15 OCTOBER, WITH GREAT EXPECTATIONS AND A PLEASING OUTCOME"

At the same time they were negotiating to run various cooperative programmes for research in the upper atmosphere

25TH ANNIVERSARY OF EL ARENOSILLO, 1991: JUAN JOSÉ MARTÍN FRANCIA AND LUIS GUITART

with the Max Planck Institute in Lindau, Germany, and with the NASA establishment at Wallops Island, near Washington.

This dual approach meant they had to have two separate launch teams to send out to prepare in the countries that were supplying the rockets. One went to the United States, headed by Víctor Manuel Álvarez de León, and the other to the United Kingdom, led by me. The American team also looked after the radars, as they were a technology transfer from NASA (They came from the time of the Korean War, and the Spanish technicians got an outstanding performance out of them!) Meanwhile, the European team was occupied with the payloads, launch security, communications and meteorology.

The launch site at El Arenosillo was given the all clear for operations on 1 October 1966 and carried out its first launch under my directions on 15 October, with great expectations and a pleasing outcome. The doubling up of launch teams finished a few weeks later when Álvarez de León had to give up his post because of problems with his wife's health and I ended up responsible for both.

A command system was set up under the Director of the Department, Guillermo Pérez del Puerto, by the chief of the Flight Experimentation section, Luis Martínez Carrillo.

After that first launch, using a Skua rocket that reached an altitude of more than 60 kms, two more were carried out with

TECHNICAL PERSONNEL FROM THE NATIONAL INSTITUTE OF AEROSPACE TECHNOLOGY PREPARING FOR THE LAUNCH OF THE METEOROLOGICAL PROBE CARABELA IV FROM THE ARENOSILLO SITE, HUELVA. PHOTO: EFE

Judi-Dart rockets that reached 55 kms. The essential difference was that the Skua, bigger and more sophisticated, carried a payload that enabled it to measure winds and temperature, while the US one could only measure wind. This was because the radar followed the movement of illuminated shavings that were ejected at height while the Skua payload consisted of a cylinder with a temperature gauge. Once ejected it fell with a part metallic parachute, the movements of which were also tracked by radar.

Prior to any launch a test firing was made with JATO (jet assisted take off) rockets that went up several thousand metres. These enabled us to check on the calibration of the radar and the optical aids in the antenna, which permitted the radar to pick up the rocket in the initial launch phase. The same radar also served for monitoring the impact zone at sea when the rockets came down. This followed established security guidelines in accordance with international regulations (an article on security by this author was published in the magazine Revista de Aeronáutica y Astronáutica at the end of 1966 or beginning of 1967) and obligatory NOTAM notices were filed to limit the use of airspace in the launch zone.

"AFTER THAT FIRST LAUNCH, USING A SKUA ROCKET THAT REACHED AN ALTITUDE OF MORE THAN 60 KMS, TWO MORE WERE CARRIED OUT WITH JUDI-DART ROCKETS THAT REACHED 55 KMS."

One of the basics was to calculate the profile of the most probable winds at the moment of launch. As these were not guided rockets they tended to lean against the wind. There were some general limitations about what was the admissible variation between what was measured beforehand with meteorological balloons and what was probable at the time of launch. This gave rise to heated debates at the control centre. For the laymen on the technical side at the launch it must also have produced a certain restlessness at times to see the launch ramp pointing towards the city of Huelva when the wind was from the east - only for the trajectory to end up in the appropriate southern direction. Here the work of the site meteorologist, Luis Sánchez Muniosguren, was fundamental. He was also responsible for data processing and their timely interpretation in an era when computer science was in its nappies.

I'm telling all this to vouch for the immense job of work that was carried out to get the launch site operative, work that was possible thanks to the good health of all those involved and the enthusiasm generated in knowing that history was being made.

Every story has its moments of drama and the second launch of a Skua, in November 1966, is proof of that. Because of a mechanical fault in the complicated launch ramp, the rocket lifted off on an unstable trajectory. It crashed a few hundred metres from the ramp, but not before having passed between the control centre and the radars. It threatened serious danger for the site personnel and the distinguished guests that day, among them the chief of the Strait of Gibraltar air zone, Lieutenant General Ángel Salas Larrazábal. He later became a regent for the Kingdom of Spain on the death of Franco, as one of the triumvirate set up for the role.

SETTING UP THE SECOND PROTOTYPE OF THE INTA-300

It would certainly have made history if the launch fault had proved to be more than just a mere shock!

Launch activities were suspended sine die while a commission made up of weapons experts Victoriano López and Pedro Sánchez, technical engineer Luis Casado, and this author, seconded to the United Kingdom to clarify the causes of the fault, redesigned the launch ramp. Two test firings were carried out at a British Army base in the Outer Hebrides islands off Scotland. Once satisfied with the results, launches were renewed at El Arenosillo. There were also faults with the American Judi but with the ejection of the payload rather than the carrier.

The year 1966 passed and most of 1967, while new programmes were negotiated with two partners initially and a much more ambitious one was concluded with the French Space entity CNES. This led to the installation of cinetheodolites on the coast at Sanlúcar de Barrameda, on land ceded by Lieutenant General Infante de Orleans, that permitted the right angle filming of the trajectory of the Nike-Cajun rockets that could reach an altitude of more than 150 kms. NASA also transferred a second radar to the launch site, given the performance obtained from the first (for two consecutive years they were the most precise of all the equivalent NASA radars) the site became a member of EXAMETNET, the US network for launch sites used to study the atmosphere and launches began of French Centaur rockets. Above all, for us, were the preparations for the long awaited launch of the INTA 255. This led Luis Martínez Cerrillo, Luis Sánchez Muniosguren and me to spend the month of January 1968 in the frozen lands of Point Barrow, Alaska, to refine our operational capabilities with the Nike-Cajun. And later, to the first international presentation of data from El Arenosillo in Prague, just a few months before the Soviet invasion. That for us really seemed like an adventure – not those that happened at the launch site! By the way, that Prague presentation helped us gain the respect of the then all powerful vice president of the Soviet Academy of Sciences, Dr Allia Massievitch and signalled the start of a possible Hispano-Soviet cooperation in the field of atmosphere research. That it didn't happen – in my opinion – was because of US pressure.

From then on hundreds of launches were performed, dozens of working papers published, and Spain had the honour of being the international reference point for the mesosphere data (CIRA 1970), which is a not bad result for a job that cost 28 million pesetas (some 12 million euros today) and became a recognized benchmark on the international scientific scene.

I have to express my admiration and respect for the site personnel, for their dedication and their performance, not always in the best of working conditions.

"THE YEAR 1966 PASSED AND MOST OF 1967, WHILE NEW PROGRAMMES WERE NEGOTIATED WITH TWO PARTNERS INITIALLY AND A MUCH MORE AMBITIOUS ONE WAS CONCLUDED WITH THE FRENCH SPACE ENTITY CNES"

My gratitude goes to all the authorities at INTA and CONIE for their respect for the work of the two young engineers, without interfering more than when it was strictly essential. Most of the time that was to defend us from the jealousies of other parts of the establishment of that era.

new space
MADE IN SPAIN

SETTING UP IN THE FIELD of Geospace Intelligence, **Aistech Space** has emerged with the mission of "democratizing" access to knowledge of Space and offering added value in the managing of assets, Earth Observation and the tracking and monitoring of aircraft. It will do this via a constellation of 25 nano satellites that will be operational in 2020 with global coverage and will offer information with an average update time of 10 minutes.

AISTECH SPACE INTEGRATES ITS OWN SATELLITES AND AIMS TO BE 100 TIMES CHEAPER THAN TRADITIONAL SATELLITES BY MAKING USE OF THE CUBESAT STANDARD

It was founded under the umbrella of the company incubator scheme that the European Space Agency (ESA) inaugurated in 2014 at the campus of the Universidad Politécnica de Cataluña.

Aistech Space integrates its own satellites and aims to be 100 times cheaper than traditional satellites by making use of the Cubesat standard. Sectors such as fishing, agriculture and agro-forestry figure among its potential clients in supporting precision agriculture and forecasts for its development, the control of waste spills in open seas and the control of fires. They will also be able to locate the position of ships and planes, enabling the tracking of fleets and the optimization of navigation routes.

Aistech Space works with leading investigation centres involved in the R+D of Space technologies with the aim of keeping very close to its clients and offering them highly accurate, frequent and quality data adapted to their needs. In this way it will contribute to improvements in decision making and competitiveness, efficiency and security levels.

Into this context of Innovation and Development slots the creation in 2016 of the Mixed Research Unit called: "The factory of the future applied to the development of a constellation of satellites for observation, communications, and maritime and air control," presented by the Galician Centre for Aerospace Innovation (CINAE) and Aistech Space itself.

Fruit of their work together is a common platform design for all of the satellites in a constellation, with high quaily standards and deployable in multiple planet orbits. To do this techniques of Industry 4.0 are applied which allow for the creation of an automated assembly line (factory of the future).

Within the Mixed Unit (located at the Centre for Aerospace Innovation at the Porto do Molle industry park at Nigrán, Pontevedra), Aistech Space focuses on the tasks of cargo integration while CINAE acts as its tecnological partner for missions and platform. This Mixed Unit is financially supported by the regional government agency, Axencia Galega de Innovación.

"FAITHFUL TO ITS MOTIVATION FOR RESEARCH, IT DEVELOPS COMPLETE SPACE SYSTEMS (FROM START TO FINISH) THAT ARE ADAPTED TO THE NEEDS OF SOCIETY"

CINEA set out on its path in the Space group at the University of Vigo with the project Xatcobeo (2007). It continued with Humsat and other projects, cooperating with the National Institute of Aerospace Technology (INTA), the Brazilian Space Agency (AEB) and other universities and companies from around the world with the support of the European Space Agency (ESA) and the United Nations Office for Outer Space Affairs (UNOOSA). Faithful to its motivation for research, it develops complete space systems (from start to finish) that are adapted to the needs of society and incorporate services in fields such as geolocalization and communications.

This philosophy of work and cooperation fits precisely with the ECSS (European Cooperation for Space Standardization) standards, with the goal of getting reliable results that mantain levels of excellence.

CINAE develops complete small satellite platforms (hardware and software), ground stations for small satellites and remote ones for passive telemetry, on board computers for small satellites, software for ground station networks and communications sub systems for small satellites. It also carries out consultancy work for small satellite projects, viabilty studies for missions and offers cargo gauges for satellite servers, among many other solutions.

■ Araceli Serrano

SUCCESS OF THE FIRST **FEINDEF**

The first International Fair for Defence and Security, held in Madrid at the end of May, amply surpassed the expected number of visitors with more than 10,000 professionals attending. During the three day event, the 150 exhibitors were able to present their most innovative new products to 48 official delegations from 32 countries. There were also some 30 conferences and round tables with prominent speakers proving a big attraction.

Members of the Administration were out in force, among them the main promoters of FEINDEF at the Ministry of Defence, Secretary of State for Defence Ángel Olivares and the Director General of Armaments and Materiel, Admiral Santiago González Gómez. Also attending were the Minister of Defence, Margarita Robles, and Pedro Duque, Minister of Science, Innovation and Universities who visited the different stands along with representatives of other ministries and institutions.

For Jaime de Rábago, president of TEDAE – which organized the fair with AESMIDE -"the result could not have been more positive for our industry and our companies. FEINDEF was born strong, and from the magníficent reception it had we are in no doubt that it will make a space for itself among the major international defence and security events. FEINDEF also achieved another of its priorities, in strengthening relations between industry and our Armed Forces and State Security Forces, for which we feel especially proud. All this confirms that Spain had to have its own fair to present internationally our industrial capabilities and technological leadership."

Work has already started on FEINDEF 2021, to consolidate it as an international benchmark event.

■ Guillermo Cayado

HISDESAT DESIGNATES AIRBUS AND THALES ALENIA SPACE TO BUILD SPAINSAT NG SATELLITES

The Spanish operator of government satellites, Hisdesat, has picked a main consortium of four companies - Airbus and Thales Alenia Space in both Spain and France – to build two SPAINSAT NG communications satellites to replace those currently in orbit, Spainsat and Xtar-EUR. Airbus will act as lead partner in the consortium.

The SPAINSAT NG I and II will be located in two different orbital positions and will operate in the X, military Ka and UHF bands.

The first of the New Generation satellites will be launched in 2023, guaranteeing the continuity of secure comunications services for the Spanish Ministry of Defence and other government agencies that use the existing fleet.

SPAINSAT NG system will offer cover of an extensive area of the world running from the United States and South America to the Middle East, including África and Europe and reaching as far as Singapore in Asia. Both satellites will enable Spain to:

- Ensure its command and control systems in operations beyond the line of sight in two thirds of the Earth.
- Guarantee its communications capacities in operational theatres lacking communications infrastructure.
- Improve moving satellite communications, with greater capacity, more secure and guaranteed communications.
- Expand the potential of working in network during the operations.

Spanish industry will provide the communications payloads for both satellites, including the integration of the Communications Module in Spain, which signifies a big step in itself. Airbus in Spain will be responsible for the payload in X band while Thales Alenia Space in Spain will be in charge of the UHF and Ka military bands. Other Spanish Space companies will also be involved, leading to the creation of qualified jobs and an important technological return for the country.

The UHF band communications represent a new capacity that is not available in the current SpainSAT fleet. Both satellites will offer repetition in areas of interest for the Spanish Armed Forces. They will incorporate advanced protection against jamming and spoofing and will be reinforced and protected against nuclear phenomena at high altitudes.

The satellites will be based on the Eurostar Neo platform, the new product for geostationary telecommunications satellites from Airbus. It is a notable development of the Eurostar series, very reliable and successful, that incorporates a wide range of new features. Among these are a totally flexible payload in band X that uses active antennas which can be reconfigured in orbit, an on board digital processor that will interconnect the payloads in band X and Ka military to allow a crossover of bands, and a high speed service link that will permit rapid reconfigurations. As a result it will have greater capacity and more flexibility, making it possible to electronically reorientate the beams to meet the coverage needs.

Hisdesat is the owner and operator of this new generation of communications satellites. The main client is the Spanish Ministry of Defence which will maintain a public-private partnership agreement with Hisdesat. The new satellites will offer capacities to other Spanish government bodies, allies and friendly countries with bilateral accords, to the EU's programme for government communications, "Govsatcom", and, it it is hoped, will also contribute in the future to NATO CP130, the alliance's capabilities package for communications satellites. SPAINSAT NG will also continue to offer services to the current and future client base of XTAR LLc.

The development of SPAINSAT NG will have the support of the Ministry of Industry, Tourism and Trade as well as the Centre for the Development of Industrial Technology (CDTI), within the framework of a public-private agreement between the European Space Agency (ESA) and the operator, Hisdesat.

The SPAINSAT NG satellites will have an operative life of 15 years and will remain in service until 2037.

■ Araceli Serrano

PREPARING FOR THE LAUNCH OF UPMSAT-2

UPMSat-2 is a university microsatellite project led by the "Ignacio Da Riva" Institute at the Polytechnic University of Madrid (IDR/UPM) in collaboration with UPM's STRAST (Real-Time Systems and Architecture of Telematic Services) group. It is seen as a logical continuation of the previous UPM-Sat 1 which was cleared for flight with the Ariane-4 in 1995 and put into orbit in July of that year. The objective of the project is to design, construct and qualify, then launch and operate a low cost platform based on it, one that incorporates new tecnologies and adapts to the needs of current launchers. It needs to be useable as a demonstration vehicle in orbit and for scientific and educational applications, exhibiting UPM's capacities in the field of Space technology.

With this in view, UPMSat-2 has been defined as a microsatellite that belongs to the 50 kgs category, geometrically packaged as a parallelepiped of 0.5 m x 0.5 m at its base and 0.6 m high. In general the platform features an area of approximately 0.40 m × 0.40 m × 0.25 m for payloads of up to 15 kg and 15 W power for a polar orbit at an altitude of about 500 km. The scheduled launch date is the first week of September on board a VEGA launcher from the European Spaceport in French Guiana. Its estimated life cycle is two years.

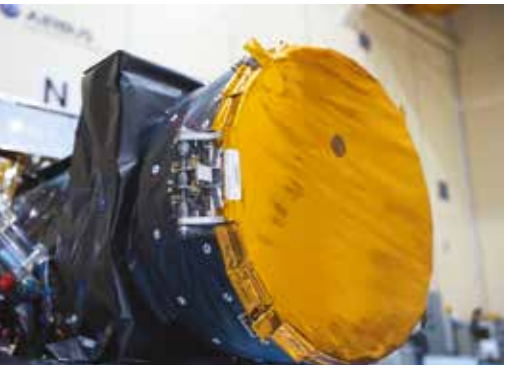
The UPMSat-2 will carry out the following experiments: Micro Thermal Switch (the behaviour of a miniaturized switch from Iberespacio); tests of a high sensitivity experimental magnetometer (Bartington); grading of avionics in flight (TECNOBIT, STRAST, IDR); monitoring onboard radiation and studying the development of the South Atlantic Anomaly (TECNOBIT; STRAST); development of a new low cost solar sensor (IDR); in flight study of the behaviour of a reaction wheel (SSBV), and various tests on thermal controls and new positioning control systems.

More than 80 people have collaborated on the development of the satellite including professors, students and technical, auxiliary and services staff from the schools of E.T.S.I. Aeronautics and Space and Computers and Telecommunications at UPM, especially students from the University Masters in Space Systems (MUSE) coordinated by IDR. Also involved in the development have been companies and institutions such as AIRBUS (the former CASA Espacio and CRISA), INTA, Saft, TECNOBIT and Iberespacio.

■ Ángel Sanz

Finishing tests on the satellite UPMSat-2. Coming out of the IDR thermal vacuum chamber.

CHEOPS: READY TO FLY



CHEOPS (CHaracterising ExOplanet Satellite), the satellite built at the Airbus Spain plant, has been declared ready to fly for a date between 15 October and 14 November 2019, once the series of final tests on the craft are complete. "The mission will enable us to get a first characterization of the composition and nature of planets beyond our solar system" said Günther Hasinger, director of Science at ESA. The European Space Agency is very pleased to be able to launch CHEOPS this year. The project is the first ESA mission to be adjudicated to Spain in an open competition and forms part of the Cosmic Vision 2015-2025 programme.

Cheops is the first ESA satellite dedicated to exoplanets whose mission will be to observe brilliant stars which have planetary systems orbiting around them. The goal is to gather more data about these stars and to detect the decrease in light when a planet passes in front of them. Results of the project will enable scientists to learn about and measure the size of the planet with great precision, as well as determining exactly its radius and find out what it is made of.

■ G .C

THE FIRST SPACE WALK ONLY FOR WOMEN WILL HAVE TO WAIT

NASA astronauts Anne McClain and Christina Koch were due to make history by becoming the stars of the first space walk made exclusively by women. It was sheduled for 29 March from the International Space Station (ISS), but in the end it did not happen. The reason? The lack of an adapted suit for one of the two women, NASA said in a statement. Because of this McClain had to pass on her walking place to her companion astronaut Nick Hague, which is why the first space walk made up entirely of women will have to wait.

After the previous space walk on Friday, 22 March, in which McClain and Hague took part, McClain discovered she needed a medium size central piece of the suit that covers the body, the part where the vital support system and control module connect. The problem was that Christina Koch needed a piece of the same size. The final decision –according to the NASA statement– was that only one suit could be prepared for Friday, 29 March and that Koch should wear it, while McClain was replaced by Hague.

Stephanie Schierholz, spokesperson for NASA's crew carrying flight programme, said on Twitter that there were two medium size suits on the space station. However, at that moment only one medium size and one large size had been assembled and there was not enough time for the two medium size suits to be ready for 29 March. NASA has yet to tell whether the same two astronauts will make a future space walk together.

■ G .C.

DISCOVER ESA UNITED SPACE IN EUROPE

Discover ESA is the latest information leaflet launched by the European Space Agency – an illustrated guide that explains in detail and in an instructive way all of the agency's activities. It starts off telling what the agency is: how it was founded in 1975, has 22 state members, including Spain, and has been working on the promotion of European scientific and industrial interests in Space for more than 40 years. It goes on to talk about the function of satellites, how they offer a unique perspective of our planet and help promote communication thanks to their technology. This section looks in depth into Galileo, the global and independent navigation system for Europe that has been built by the ESA in collaboration with the European Commission. In the same way, ESA collaborates in the protection and monitoring of Space, warning of the dangers from space rubbish and asteroids.

Exploration is one of the agency's major activities as it enables ESA to experiment, discover and innovate around Space and to help in answering the big questions about the Universe. State of the art technology, such as Space probes, the development of launchers and Space vehicles for the future, are also covered in the contents of the guide which is available in six languages and also includes a Space poster. Both can be downloaded from the agency's web page.

■ G .C.

SPANISH SATELLITE SEOSAT-INGENIO
INTO ORBIT WITH VEGA

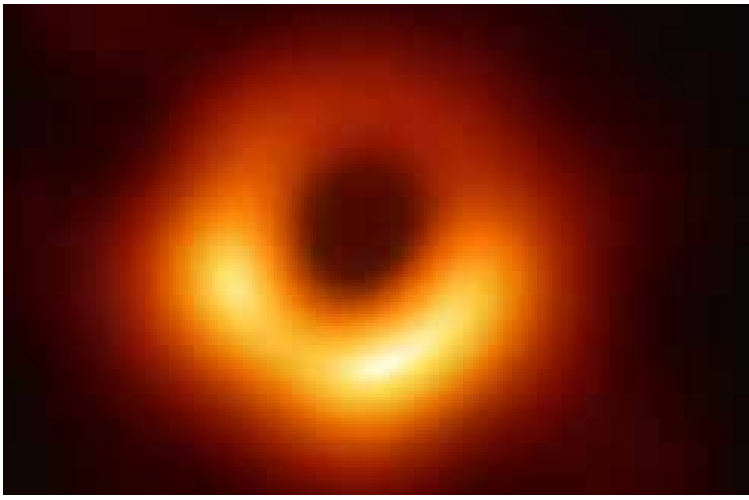
A Vega rocket will be used to put into orbit the Earth observation satellite SEOSAT-Ingenio, following the agreement signed between ESA and French company Arianespace on 17 May in Madrid. The ESA and Spain's Centre for the Development of Industrial Technology (CDTI) have also reached agreement for the Agency to manage the launching which will take place in 2020 at the European Spaceport in French Guiana. The CDTI is financing this mission as part of an international collaboration with the ESA within the context of the European Earth Observation Architecture. The data provided by SEOSAT-Ingenio will be accessible to institutional, government and civil users in Spain as well as European personnel involved in the EU's Copernicus programme and GEOSS, the Global Earth Observation System of Systems being built by the Group on Earth Observations (GEO). The aim of the Spanish satellite is to provide multispectral high resolution images of the Earth that can be used for applications such as the supervision of ground use, water management and risk management.

■ G.C.

TENTH ANNIVERSARY
OF THE PILOT PLANT MELISSA

MELiSSA, the acronym for Micro Ecological Life Support System Alternative, is a pilot plant installed at the University of Barcelona which this year celebrates its 10th anniversary. The project was set up with the aim of studying the most suitable technologies for recycling the waste from space missions. It is split into different modules that are each occupied with one aspect of the conversion of unwanted molecules into others that are necessary for human survival. The objective for ESA and its partners is to create a system that transforms carbon dioxide, urine and organic material into clean air, water and foods, in a continuous and practically undefined way.

The system to achieve this is inspired, for example, by the same natural process that trees and plants develop to convert the carbon dioxide that we exhale in breathing into the oxygen that we need to live. They are also researching chemical processes, mechanical filters and bio-reactors full of bacteria and microalgae to develop systems capable of providing food, drinking water and clean air in Space. According to Christophe Lasseur, head of the MELiSSA project at ESA, each year they are getting a little closer to their objective.



BLACK HOLE
PHOTO

An historic picture of the black hole located in the centre of the Messier 87 galaxy, captured by the Event Horizon Telescope (EHT) following an international study involving Spanish participation.

■ G.C.

LAST IMAGE FROM THE ROVER OPPORTUNITY ON MARS

In June 2018 the rover Opportunity took its last pictures before a dust storm put an end to its nearly 15 year adventure on Mars. The image, published by NASA on its web page, is a 360 degree panoramic shot put together from 354 photographs taken of the Valley of Perseverance where the rover was at the time of the storm. The snapshot, provided by the panoramic camera (Pancam) with its three filters, was taken between 13 May and 10 June.

The panoramic view reflects the Valley of Perseverance on the Red Planet. One can also see the edge of the Endurance crater, some of the components of the all terrain vehicle such as the antenna and some of the solar panels. After eight months' effort and a final attempt to reestablish contact with the rover, NASA declared Opportunity's mission to be finished on 13 February 2019.

■ G.C.

SMOS, MARS EXPRESS AND JUICE: A MISSION IN COMMON

La Through its Earth Observation programme and its satellites sent to other planets in the solar system, the European Space Agency (ESA) has various missions dedicated to the study of water, the aim of which is to demonstrate just how important it is for life.

SMOS is the one targeted with studying the cycle of water on Earth. The main objective of this mission is to produce global maps showing the salinity of the oceans and the humidity of the floor. But "since it has been in orbit for 10 years it has sent other different ones, like weather predictions, warning about the risk of fires through analyses of the aridity of the land or the tracking of hurricanes," says Jorge Fauste, Operations Chief for the satellite's MIRAS instrument.

Mars Express is the mission aimed at reconstructing the aquatic past of Mars, and in doing so offering answers as to why it ended up as a desert planet. According to the head of scientific operations for Mars Express at ESA, Alejandro Cardesín, the results of their research so far affirm that they know how much ice there is and of what type. "The actual atmospheric pressure is insufficient to maintain liquid water on the surface, which is why the scientists have sought for it in the subsoil," he says. Research will try to work out what happened for the water to be lost. "They are carrying out climate models to understand what the current atmosphere is like and how it developed from the past," he adds. This mission will also help contribute to studying climate change on Earth.

Lastly, the JUICE mission, designed and assembled by AIRBUS for ESA, which is targeted for a launch in 2022 and will be aimed at investigating water phenomena on Jupiter. "It was very interesting to discover in the '70s on Earth, at the bottom of oceans, hydrothermal springs where life can develop without sunlight," says Nicolás Altobelli, head of development of scientific operations for the Juice mission at ESA. "The JUICE mission will study on Jupiter how the combination of the presence of liquid water, basic chemical elements and energy can encourage or provide possibilities for the existence of life as we know it on Earth, " explained Altobelli at a press conference. Scientific operations and the contribution of results from the investigation will depend basically on Spanish colaboration from the AIRBUS factory in Madrid.

■ G.C.

THE BARBIE VERSION OF ASTRONAUT **SAMANTHA CRISTOFORETTI**

Barbie, the most famous doll in the world, has just celebrated her 60th birthday. And to mark the event ESA and Barbie have got together to create two unique dolls that look like astronaut Samantha Cristoforetti.

The dolls, one wearing a stylized reproduction of the Extravehicular Mobility Unit – the NASA spacesuit – and the other the blue flight suit of ESA with its corresponding patches, were presented by Mattel Italia at a special event to mark the International Day of the Girl Child, 11 October 2018.

In March this year the dolls were exhibited at the gala for International Women's Day organized by the association Professional Women International in Brusells and at ELLE magazine's Power Girl event in París.

Although they are not yet for sale, the dolls were created to highlight careers in which women are under represented and to make people aware of this through events and marketing campaigns, in a way that girls can see the opportunities that are open to them.

Since her creation in 1959, Barbie has become an international icon. Today she is still awakening the imagination and influencing conversations all over the world. From milestones for woman to famous collaborations, Barbie represents a reflection of our times, a snapshot of popular culture.

Created to show that girls have their own choices to make, Mattel believes that Barbie has always empowered the unlimited potential of each girl. One of the ways to help them keep believing in themselves is to demonstrate to them models of conduct, women of different origins and environments that break down barriers.

Mattel continues to integrate cultural variety in its dolls' lines with friends of Barbie and characters from different ethnic groups. There are now more than 100 types of dolls with different skin tones, facial features and hair and eye colours.

The communications collaboration unit at ESA organized the use of the two unique figures of Samantha Cristoforetti by Barbie Mattel Italia to promote its long term initiative, the "Dream Gap Project". The project derived from recent research which showed that because of cultural stereotypes and representations in the media as girls grow up they begin to think they are not adequate for certain types of activity.

As the head of diversity at ESA, Ersilia Vaudo, explains: "One of the objectives of the agency is to serve as an inspiration to all of Europe's citizens. The ESA is proud to be part of this initiative, fighting stereotypes and encouraging girls and youngsters to pursue their dreams, whatever they may be."

For her part, ESA astronaut Samantha Cristoforetti said: "I am pleased that the Barbie dolls of today not only reflect the bodies of real women but also their wide range of professional achievements. I hope this helps boys and girls to imagine a future in which they don't see themselves limited by artificial barriers and which have no place in our times."

■ Carl Walker / ESA

ALTER TECHNOLOGY participates in HOLDON

LIDAR optimized for monitoring the effects and causes of global warming

The main objective of the HOLDON project is to develop a new detection chain for improving the performance of Lidars on large platforms and reducing their payload for integrating in future micro and mini-satellites.

ALTER TECHNOLOGY has been put in charge of making a LIDAR echo emulator capable of simulating signals for a range of missions of interest in the UV to NIR spectral range.

ARQUIMEA successfully finishes the SEPHY project

The Space Ethernet Physical Layer Transceiver (SEPHY) project, developed as part of the H2020 programme, has produced an electronic component that is unique in the market and critical for the use of the Ethernet communications protocol in Space. ARQUIMEA has successfully led this segment, gaining praise from the European Commission for its good work and results. The project reinforces ARQUIMEA's position as a supplier of electronic components for Space applications.

First Flying Hardware from GTD scheduled to launch

GTD GmbH developed and delivered a core part of the Photobioreactor Experiment for the International Space Station. GTD developed the Electronic Box that monitors all sensors (temperature, pressure, gas concentration, optical density) and controls all actuators (valves, pumps, fans) to assure a correct experiment operation.

The experiment was launched on 30th April on the SpaceX CRS-17 mission to the ISS. The Photobioreactor is attached to the Life Support Rack (LSR).

Photobioreactor integrated at LSR

Elecnor-Deimos extends its TTC services for satellite operators

As well as hosting the ground segment of the Deimos-2 satellite, The Elecnor Deimos complex at Puertollano also provides image reception services for third parties. To do this, it uses systems that are available at the centre or equipment provided by the client. Since the end of 2018, companies such as Norway's KSAT and LeafSpace, an Italian New Space operator working on Earth observation, have expanded the Space communications services they have contracted with Elecnor Deimos.

Crisa on 2020 Rover: one step closer to Mars

MEDA during acceptance tests at NASA-JPL in Pasdena (California)

From December 2018 till April 2019 we have completed H/W and S/W deliveries for MEDA instrument along with Nasa-JPL acceptance reviews. For this development, managed by (INTA-CSIC) Astrobiology Centre CAB, Crisa has performed systems engineering, mission product assurance, systems integration and tests as well as development of the control computer H/W and S/W and electrical design and/or manufacturing of wind and infrared sensors.

The city council of Madrid receives its updated cartography

The Consortium made up by EDEF (leader), COTESA and Telespazio Ibérica has finished the execution of the project "Actualización de la cartografía urbana de Madrid a escalas 1:1.000, 1:5.000 y 1.20.000", with which the City Council of Madrid renews the cartography of the entire municipality of the capital.

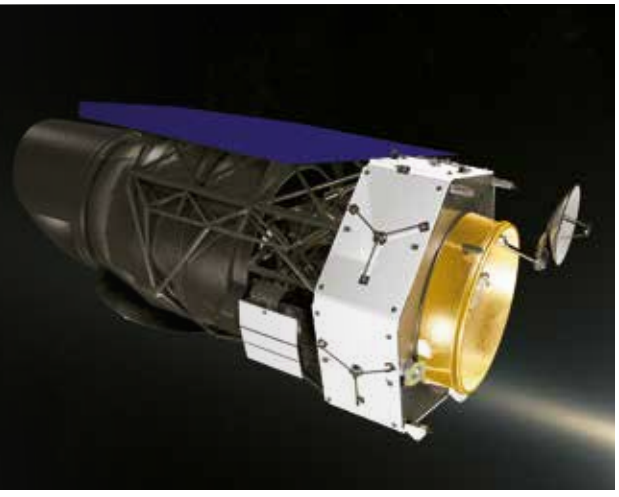
This cartography includes for the first time, the representation of nearly 200km of tunnels with centimetric precision; great contribution for maintenance and emergency management teams.

Indra radar is the first to detect fragments from the satellite destroyed by India

The Space monitoring radar S3TSR, designed and developed by Indra and installed at the Morón de la Frontera air base in the province of Seville, was the first in Europe to detect fragments from the Indian satellite that the country decided to destroy with a ballistic missile. Few other radars in the world were capable of doing it.

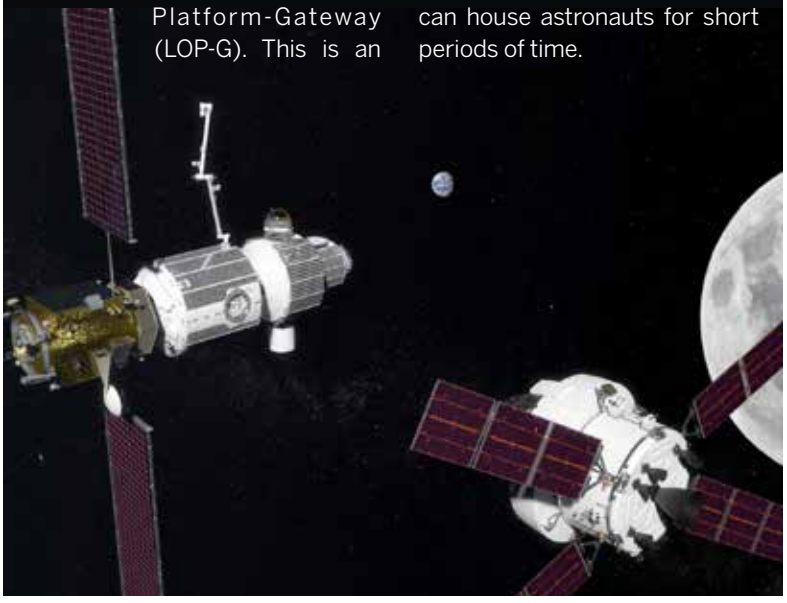
Thales Alenia Space contributes to NASA's PACE and WFIRST missions

The National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) has awarded Thales Alenia Space in Spain a contract concerning the delivery of key communication equipment, the S-band transponders, for the PACE and WFIRST missions. PACE is a strategic continuity mission responding to the challenge of climate and environmental change, while WFIRST is an astronomical observatory designed to settle essential questions in the areas of dark energy research, exoplanets detection and infrared astrophysics.



The SENER Group secures five contracts to develop the LOP-Gateway lunar mission

The engineering and technology group SENER has been awarded five contracts for the definition phase (A/B1) of a future space station in lunar orbit, Lunar Orbital Platform-Gateway (LOP-G). This is an international project in which NASA, Roscosmos, CSA, JAXA and ESA space agencies are taking part, in order to design and plan a station in orbit around the Moon called Cislunar that can house astronauts for short periods of time.



HISPAMAR starts operating from its new teleport and control centre

HISPAMAR, the Brazilian subsidiary of HISPASAT, has opened its new teleport and satellite control centre at Serviente (Río de Janeiro). The growth of the company's fleet made it necessary to provide more space to house the antennas and control equipment. The centre is sued to operate the Amazonas satellites which offer a broad range of telecoms services that include the transmission of audiovisual content, corporate networks, cellular backhaul and high output connectivity.

Hisdesat and COIT tighten their links

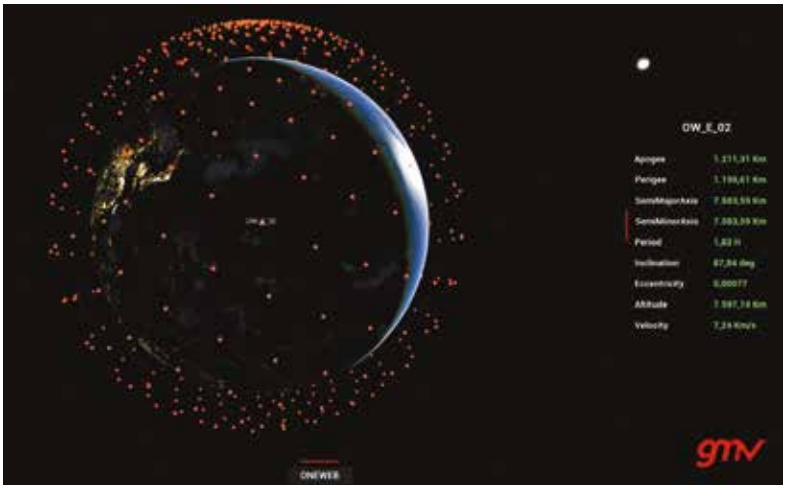
Both gave an account of their activities in a series of seminars about technical and regulatory aspects and the digital business scene in the Space sector.

Hisdesat will continue supporting the Telecoms Engineering Awards for Best Masters' Work and Best Doctoral Thesis in Government Satellite Services. It will also collaborate in developing the profession of telecoms engineer, helping support the administration and other stakeholders in the sector.

SSPA based on GaN to be used in the next generation of Ka band 5G satellites

FLEXGAN, a European project led by TTI-Norte, will involve the designing, developing and testing in a representative Space environment (TRL5) of a Solid State Power Amplifier (SSPA) using Gallium Nitride (GaN) for Ka band. The goal is providing a low cost, high power and capacity RF for 5G satellite applications. Taking part in the project are Airbus Defence & Space, the University of Rome Tor Vergata, OMMIC and TECNALIA.

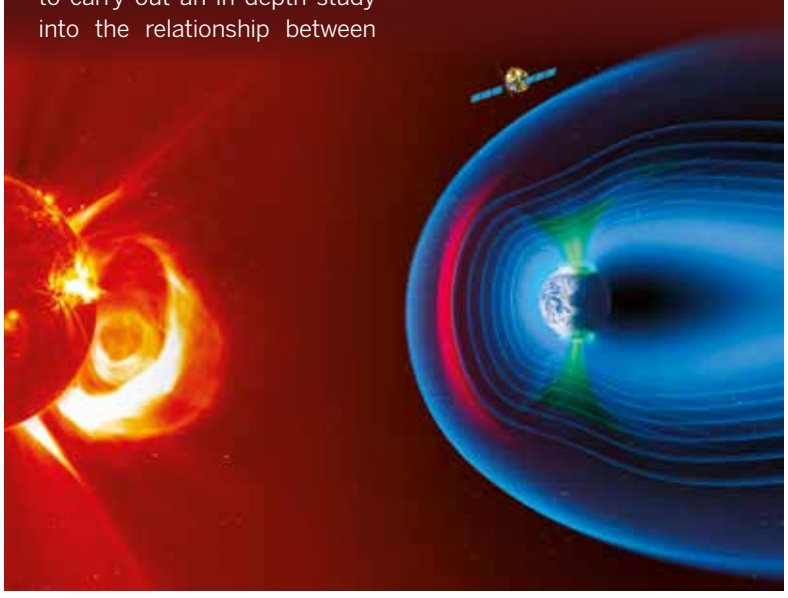
GMV controls the first satellites of OneWeb's constellation



On 27 February the first six satellites of OneWeb's constellation were successfully launched. Initially comprising 648 low earth orbit satellites (LEO), the final constellation may be extended to over 900. OneWeb's constellation, for which GMV holds the constellation's command and control center (C2) development contract, is the highest capacity satellite-based broadband internet system ever developed.

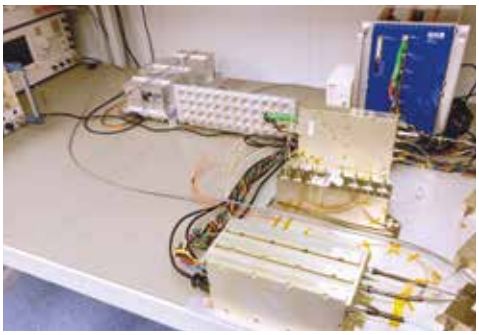
Airbus Spain wins the SMILE contract for studying Space climate

Airbus Spain has been selected as the main contractor for the payload module, the European contribution to SMILE, the first joint Space mission between the ESA and China. The goal is to carry out an in depth study into the relationship between the Sun and Earth, to learn about the interaction between particles of solar wind and the magnetosphere, the magnetic shield that protects and enables the existence of life on Earth.



H2020 OPTIMA Project final phase

Project OPTIMA "Towards Demonstration of Photonic Payload For Telecom Satellites" is entering the final demonstration phase. The photonic frequency generation and mixing units, optical switching matrix and opto-electronic receiver modules have been fully characterised and integrated at DAS facilities and are going to be tested by AIRBUS D&S AIT Department in Portsmouth (UK) during May-June 2019. OPTIMA is demonstrating to TRL6 a fully photonic frequency conversion chain including a switching matrix for High Throughput Satellites. More information available:
@ https://www.photonic-payload-optima.eu



Space successfully performs a drop test of a first stage demonstrator of the MIURA 5 orbital rocket5

At the beginning of the second quarter of 2019, PLD Space successfully completed a drop test with a full-scale demonstrator of the first stage of the MIURA 5 orbital rocket. This trial was a part of the FLPP-LPSR program, supported by ESA. This milestone is an important step in the development of a reusable orbital launcher which will offer space access services for small satellites.

ORGANIZE

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MAGAZINE PRO ESPACIO

NO. 43 | SEPTEMBER | 2019

NEXT ISSUE

With barely 60 years of history, the Spanish Space industry has managed to create an opening for itself in such a highly competitive market as aerospace, one that today is among the most influential in transforming society.

Despite the big successes achieved in recent years, such as GMV recently being chosen by the European Commission to control the ground system of the Galileo navigation system, the truth is that it's a sector that is still little talked about. With the aim of learning about its enormous potential, the achievements it has already made and the projects being worked on – and to tell people of the great opportunity that the Spanish industry represents in the areas of innovation and technological development – the first ever Congreso de Espacio (Space Congress) will be held in Madrid on 9 - 10 October.

Promoted by TEDAE, the Spanish Association of Defence, Security, Aeronautics and Space companies, the conference will bring together leading professionals in the sector to share details of the pioneering initiatives of Spanish companies and to analyze the big challenges we have to take on to overcome all the barriers. Congreso del Espacio 2019 will count on the participation of renowned professionals from industry, universities, public bodies and other institutions who will raise the profile of the Space sector.

MADRID
9 - 10
OCTOBER
2019

SOON WE WILL BE GIVING YOU MORE INFORMATION ABOUT THIS UNIQUE GATHERING IN WHICH TOGETHER WE WILL LEARN ABOUT OUR CAPABILITIES TO GO

"BEYOND THE LIMITS"

No. 42 | JULY | 2019

ESPACIO PRO MAGAZINE

"COLLABORATION BETWEEN TRADITIONAL SPACE AND NEW SPACE IS GOING to be very strong

JORDI **PUIG-SUARI**

LATEST NEWS

SUCCESS OF THE FIRST FEINDEF

FEATURE

EUROPEAN SATELLITE

NAVIGATION SYSTEM