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SATELLITE SEOSAT ingenio

LATEST NEWS
SOLAR ORBITER
ON ITS WAY TO THE SUN

OPINION
GLORIA LASO
REMOTE TEACHING, A CHALLENGE FOR TEACHERS AND STUDENTS

THE DARK DUNES OF THE **MOREUX CRATER**

The Moreux crater on Mars demonstrates many intriguing geological processes and features. It sits at the northern extreme of the Terra Sabaea, a large area of the Red Planet that is splattered with impact craters and covered with glacial flows, dunes, rough ground and networks of intricate crests. Compared with other impact craters, both on Mars and on Earth, the Moreux crater seems a bit deformed and disorderly, the result of its erosion over the period of Martian history. Its edge, in the form of an egg, is broken, its dark walls are furrowed, wavy and mottled. In its centre is a prominent group of 'peaks' created as material from the floor of the crater rebounds and rises upwards following the initial impact.

Text: ESA. Photo: NASA, ESA.

A booming market: *pairing opportunities for small satellites and small launchers*

THE INTERNATIONAL SPACE SECTOR has changed substantially in the last 20 years. The current trend known as New Space emerged at the start of the century with the appearance of Space companies (mainly founded by millionaires) with the support of NASA and Venture Capital funds that enabled new commercial opportunities to open up. Among examples of this trend are SpaceX, Blue Origin, Virgin Galactic and Planetlab. What prevailed was a "traditional" development with some different approaches and the entry of private money in contrast to the usual organic growth in the sector. Among these new approaches has been the use of commercial technologies and a radical reduction in the length of programme revisions (SRR, PDR, CDR…) including many iterative trials.

The same happened in Europe, albeit some years later. Both the Space market and the market for private investment are smaller than in the United States, but the technical capability is the same or perhaps even better. This highlights the excellent quality of European companies and projects, both among the traditional industrial ones and new companies in the sector.

"IN MY VIEW, AND THAT OF THE COMPANY I REPRESENT, A NEW SPACE DIFFERENT FROM THAT OF "OLD SPACE" DOES NOT EXIST"

As a way of example, in the field of Space launchers one of the major differences in this trend has been the use of "less innovative" (or even obsolete) technologies, especially in the areas of propulsion, structures and avionics for large launchers. The use of traditional propellants such as kerosene and oxygen currently make up a large part of developments and activities on a global level, followed by methane and hydrogen. Undoubtedly, we have studied the competitiveness of launchers based on cost and not exclusively on performance and high reliability as was the traditional method. Such is the case with the Falcon 9, Antares and New Glenn. Today performance and reliability are assumed, while "cost effective" (which does not mean low-cost), is not.

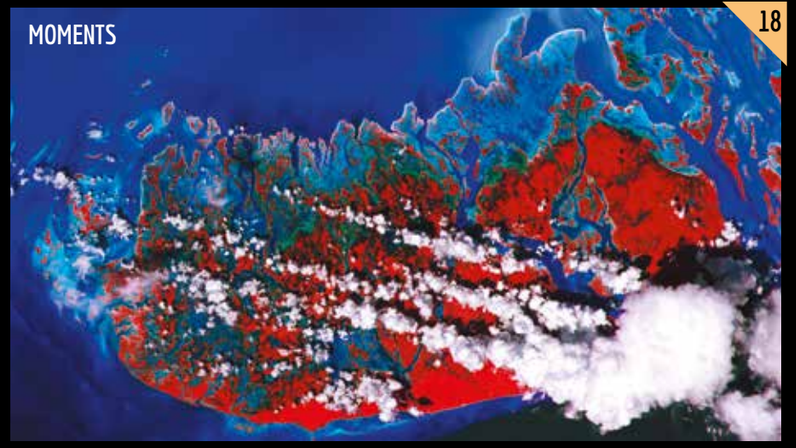
On the other hand, reduction in size (to what is known as small launchers or micro launchers) has enabled us to open up a new market, one for small satellites, and almost exponentially increased their development and the number of orbital launches. Examples of these launchers are Electron, LauncherOne and MIURA 5. It is true that micro launchers (like the US Pegasus) have been around for many years. However, the commercial focus has been different and, of course, the market is now much bigger than it was then. Pegasus was developed to accommodate institutional launches such as those for NASA and the DoD, and not so much with a commercial focus (perhaps because such a need did not exist). For example, according to SpaceX, Falcon 1 was not commercially viable on the grounds of competitiveness or performance but because there was no market for it at that time. It was ahead of its time. Today, by way of contrast, hundreds of small satellites (from 1kg up to nearly 300kg) are waiting to be launched into Space, be it a dedicated one or as part of a cluster with others. Today there is a market and there is demand, which is why there is a new business opportunity. This is the basis of "New Space", supposing that it is new. Equally, with this type of launchers, we assume both the performance and the reliability (as is logical) and also, as with large launchers, we seek out the commercial focus and therefore the optimization of costs (which, once again, does not signify in any way low-cost).

In my view, and that of the company I represent, a New Space different from that of "Old Space" does not exist. Although, the new commercial opportunities derived from a booming sector like small satellites and small launchers are without doubt an opportunity that all companies in the Space sector should be looking at.

EDITORIAL

Raúl Torres
CEO AND CO-FOUNDER OF PLD SPACE

SUMMARY



INFORMATION MEDIUM ON TEDAE'S SPACE COMPANIES:

Airbus DS, ALTER Technology, ARQUIMEA, Crisa (Airbus DS), DAS Photonics, Elecnor DEIMOS, GMV, GTD, Hisdesat, Hispasat, HV Sistemas, IberEspacio, Indra, PLD Space, SENER Aeroespacial, Tecnalia, Telespazio Ibérica, Tecnobit-Grupo Oesía and Thales Alenia Space España.

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SATELLITE SEOSAT ingenio

The National Earth Observation by Satellite Programme (PNOTS) was presented to the public on 6 July 2007 by the Ministries of Defence and Industry, Tourism and Trade. The objective of PNOTS was to launch into orbit and manage two Earth observation satellites that make up a dual double use system.

The first one, mainly dedicated to defence, was PAZ, an SAR radar satellite that went into orbit in February 2018 at an altitude of 514 kms. It became operational six months later.

The second part of PNOTS is the satellite Ingenio, also known as SEOSAT (an acronym for Spanish Earth Observation Satellite). It is a high resolution optical satellite for civil use that will be put into orbit at an altitude of 670 kms. It is scheduled to be launched in August 2020.

Gearing up the national Space industry through developing an observation system has been another of the main goals of PNOTS.

> **“It will be put into a heliosynchronous orbit at an altitude of 670 kms, making just over 14 laps around the Earth each day.”**

THE MISSION

SEOSAT/INGENIO is a satellite designed to provide panchromatic and multispectral high resolution images for various civil, institutional and government users, both national and international. It can offer services to European users within the framework of GMES (Global Monitoring for Environment and Security), today Copernicus, and GEOSS (Global Earth Observation System of Systems) . The main areas of observation will be Spanish territory, Europe, Latin America and North Africa and general areas defined by the users of Copernicus.

With an image capacity of 2.5 million km2 per day and a resolution of 2.5 m in panchromatic and 10 m in multispectral, it will be able to take up to 600 images a day. Thanks to its high resolution it will open up new possibilities for applications related to ground coverage and the recuperation of biophysical parameters thanks to its four spectral bands. These offer high quality radiometrics and the capacity to identify purer pixels thanks to their high resolution.

This will enable the satellite to provide information for applications in cartography. land management, coastal monitoring, management of water resources, agricultural monitoring, precision agriculture, environmental control and crisis management (security and emergencies) during catastrophes.

“It will be put into a heliosynchronous orbit at an altitude of 670 kms, making just over 14 laps around the Earth each day.”

THE PROGRAMME

THE INGENIO SATELLITE is the biggest ever Space project to be carried out by Spanish industry. As the client, the CDTI (Centre for Industrial Technological Development, delegated technical and industrial supervision to the European Space Agency (ESA) and its production to Spanish companies.

Construction of the satellite has suffered delays in waiting to incorporate the complex main payload which will be involved in taking images in the visible spectrum and near infrared. However, it is now completely finished.

The work on and assembly of all the units of the satellite have been carried out in the Madrid region.

At the end of 2018 the mechanical and electrical integration of the main payload was completed.

In January 2019 the function tests were carried out. These included a test programme to check the satellite's compatibility with the ground segment. This System Validation Test (SVT), consists of checking from Earth and the telecommands for the different modes of closing it down, to see that everything worked correctly.

This was followed up until the end of the year with different environmental tests to check if Ingenio could withstand the tough conditions of launching and functioning correctly when in orbit, where it will be exposed to cosmic radiation and extreme changes in temperature.

These are the mechanical, acoustic and thermal tests empty and the tests for electromagnetic compatibility..Further function trials have been carried out in 2020 and from February the satellite is now ready to be put into orbit.

When it gets the green light from Arianespace, the satellite will be transported to Kourou for its launching aboard a Vega rocket.

TEST FOR DEPLOYING SOLAR PANELS ©AIRBUS 2020.

FIG 1 FEATURES OF THE SATELLITE

CLIENT	CDTI (Centre for Industrial Technological Development) – ESA (European Space Agency)
PLATFORM	Astrobus AS250
MAIN PAYLOAD	High resolution cameras in panchromatic band and 4 multispectral Swath> 55 Km with two telescopes
TOTAL WEIGHT	750 kg
FUEL WEIGHT	80 kg
IMAGE TAKING CAPACITY	2.5 milllion Sq kms per day
ORBIT AND ALTITUDE	heliosynchronous orbit at 670 km
MISSION LIFE CYCLE	7 years (with the possibility of extending for a further three)
DOWNLOAD LINK	Band X at 280 Mbps – Storage memory 1024 Gbit
DATA MANAGEMENT	Capacity for compressing data images - factors 2 to 6
LAUNCH VEHICLE/ DATE	Vega / 2020

THE PLATFORM

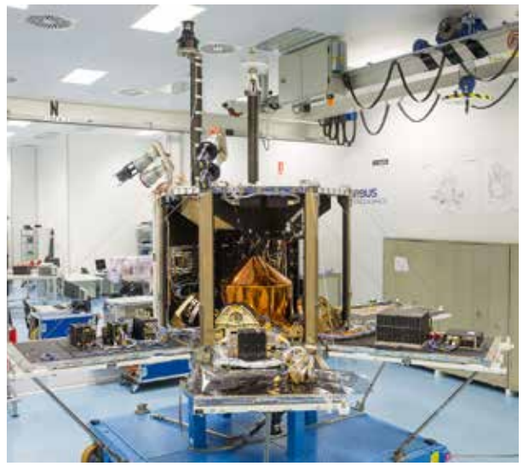
THE SATELLITE CONSISTS of a platform that accommodates a primary payload with an optical instrument and can house a complementary scientific payload (CSP).

Ingenio is based on the Astrobus AS250 platform which is of the same architecture used to build ESA's scientific satellite CHEOPS in Madrid, which was launbched at the end of 2019. Both are hexagonal in shape and are clad with solar panels.

The same architecture was also used for the Sentinel SP satellite that forms part of the European Union's Copernicus constellation. In short it is a platform designed for medium Earth observation missions.

Its principal features are:

- The primary payload, the image generator, is mounted on an upper panel of the satellite, with the star trackers integrated directly in the interface of the payload structure.
- The energy subsytem is based on solar panels covering an area of approximately 5.40 m2 and with a lithium battery of 1.5 Ah.
- The Attitude and Orbit Control System (AOCS) has a high performance gyroscopic architecture.
- The propulsion subsystem is based on a plug-in concept, housed in a single compact module with a mono hydrazine chemical propellant.



THE FINISHED PLATFORM WAITING TO INCORPORATE THE PAYLOAD. ©AIRBUS 2020.

INSPECTING THE OPTICAL INSTRUMENT UNDER STRICT CLEANING ROUTINES.

PAYLOAD

THE PRINCIPAL PART is a high resolution optical instrument which will be used to take images of earth on two channels: one is panchromatic (PAN) and the other multispectral, which consists of four bands (blue, green, red and near infrared.

The configuration is made up of two identical cameras aligned in a way that between them they can trace the 55 km necessary to fulfill the misión , working in a sweep mode known as pushbroom.

The main payload provides a native image with a pixel resolution on Earth of 2.5 m on the panchromatic channel and 10 m on the multispectral bands.

The images it takes are of very high quality and are also of very good radiometric quality.

The electronics of the main payload guarantee the correct operation of the cameras as well as supplying power, the gathering and transmission of data and thermal control.

Its weight is 130 kgs and the dimensions approximately 1.5 m x 1.5m x 1m.

The satellite will carry a Complementary Scientific Payload (CSP) funded and managed by the Ministry of Science and Innovation. The CSP will consist of two small instruments: UVAS (Ultra Violet Absorption Spectrometry) and SENSOSOL (solar sensor).

Once it enters service, the optical images from Ingenio will complement the radar ones that have been taken from Paz since it began operating. The two will provide Spain with a dual satellite system, consisting of one optical platform and the other radar. Their data can be combined to provide higher resolution and better information about the Earth's surface.

THE CONSORTIUM

Below we list the Spanish companies – members of TEDAE – that are participating in the SEOSAT/ Ingenio programme.

AIRBUS

Main contractor for the Ingenio programme and responsible for:

- Managing the programme and the consortium of companies.
- Acquisition of the flight equipment
- Design and manufacture of the satellite's platform and its cabling
- The alt campaigns for the three models of the satellite – structural, engineering and flight prototype
- Managing the development of the prototype image processor
- Integration and trials of the satellite
- The launch campaign
- The phases of LEOP (Launch and Early Orbit Phase) and IOC (In Orbit Commissioning)

THALES ALENIA SPACE

Responsible for the optical instrument electronics

- Responsible for the optical instrument electronics
- Development, integration and testing of the complete image chain, ensuring the features point by point, including the CCD image detectors, the proximity electronics and the video, feed and instrument control units.
- Inter-connecting cabling between the instrument's electronic units
- Integration and validation of the instrument's electronics, including verification of the radiometric features and the characterization of the sensors

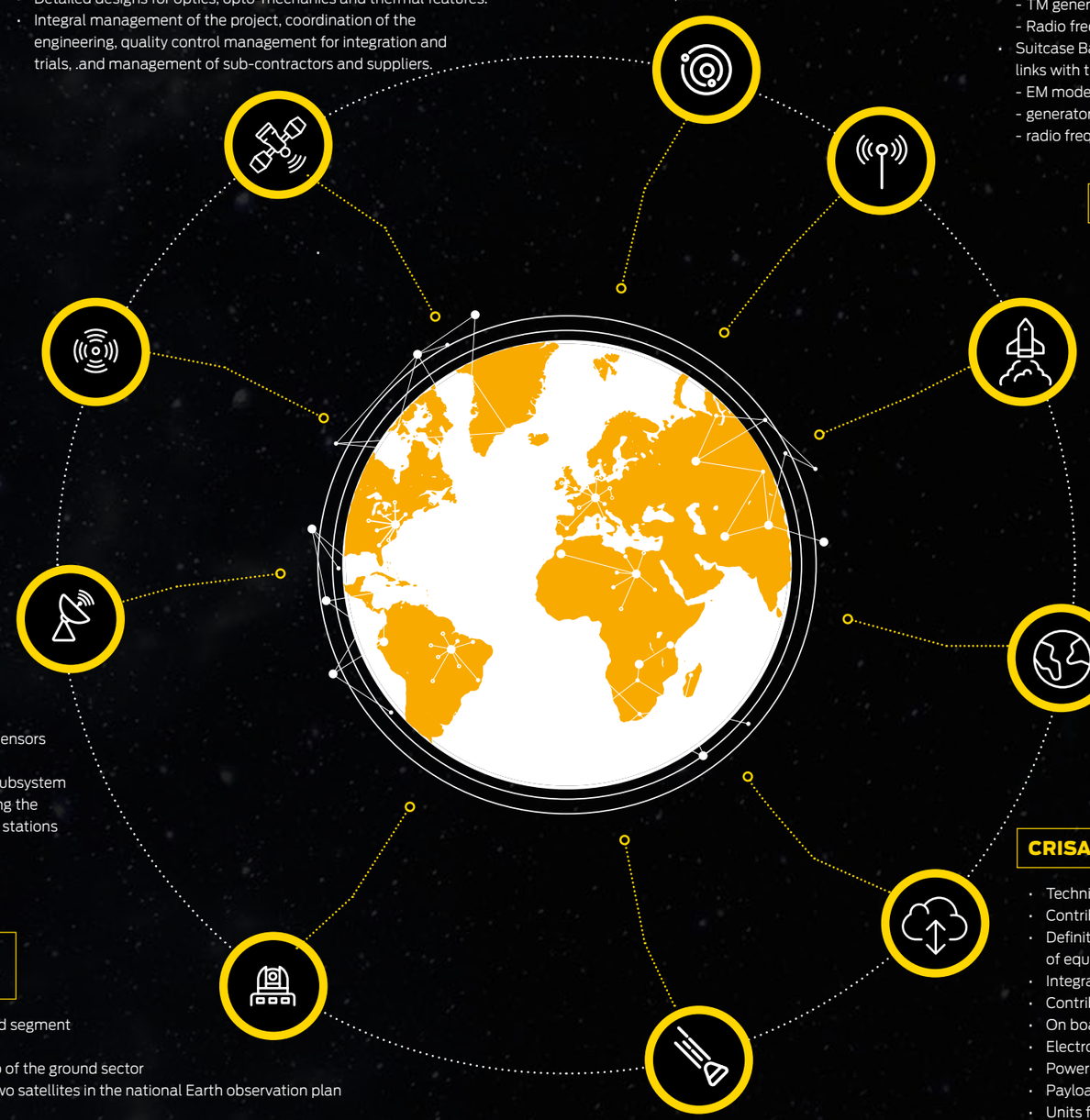
As the company responsible for the communications subsystems

- Development, integration and testing of the Band X data transmission subsystem
- The command subsystem, telemetry and tracking in Band S , establishing the command and control link between the satellite and the ground control stations

SENER Aeroespacial

Responsible for the main payload

- Construction, design of the architecture, production, integration, alignment and verification of the high resolution main payload camera and its high quality features.
- Detailed designs for optics, opto-mechanics and thermal features.
- Integral management of the project, coordination of the engineering, quality control management for integration and trials, .and management of sub-contractors and suppliers.



INDRA

Main contractor for the ground segment of Ingenio:

- Leading the development and integration of the ground segment
- Defining the requirements of the system
- Managing the development, implantation and start-up of the ground sector
- Integration, implantation, trials and start-ups for the two satellites in the national Earth observation plan (PNOT), Ingenio and Paz
- Setting up an integrated system for three centres:
  - The main centre located at the INTA complex at Torrejón de Ardóz in the Madrid region for planning and managing flight operations, as well as handling data received from the satellite
  - A back-up control centre at Maspalomas on the island of Gran Canaria to provide additional capacity to the main centre at Torrejón for receiving satellite data. It will also be able to carry out essential flight operations to guarantee control of the satellite in any situation.
  - Finally, a centre located in the Arctic for assessing what will be used for sending or receiving information from the satellite.
  - Its location in the far north helps in maintaining frequent contact with the satellite.

IBERESPACIO

- Supplying the thermal blankets and radiators for the instrument
- Supplying all the thermal blankets and radiators for the star sensors and the electrical thermal hardware for the platform.

HV SISTEMAS

- Suitcase Band S RF for carrying out compatibility trials with the Earth segment for science data link-ups with the satellite.
  - EM model of band S transponder
  - TC receiver
  - TM generator
  - Radio frequency chain with variable attenuation
- Suitcase Band X RF to carry out compatibility trials with the ground segment for scientific data links with the satellite.
  - EM model of Band X modulator
  - generator and codifier of scientific data (280Mbps)
  - radio frequency chain with variable attenuation and noise generator

GMV

- Technical viability study, estimating for the technologies involved, consolidation of user needs, mission analysis, start to finish simulations of the systems for the complete mission, and the definition of all the architecture for the ground segment.
- Design, development, integration, validation and delivery of a complete simulator for Enhanced Image Packaging (EIP) for the Space segment.
- Integral control system for flight operations (FOS) and responsibility for the development and integration of the complete flight operations segment for the control centre
- Simulator for preparing the operations, training the team and validating the mission control system.
- User services for the ground segment.

DEIMOS SPACE

- Definition and preliminary design for the complete ground segment (phase A/B1)
- In charge of critical components for the ground sector, including the image processing chain, archives and catalogue, as well as the tool for calibrating and validating products, quality control of the products, and the monitoring tool for operating the Payload Data Ground Segment (PDGS)
- In charge of designing and developing the operational processors 10p and 11p that process the telemetry data up to level 1c, providing high resolution multispectral optical images to meet demanding requirements in terms of processing time, making sure emergency images are supplied within 3 h of their acquisition.
- Support for the integration and validation (AIV) of the PDGS system.

CRISA

- Technical responsibility for the power subsystem and the data handling of the platform
- Contributing to the data handling system for the payload
- Definition of the electrical architecture and drawing up the specifications for the different pieces of equipment
- Integration and test engineering for the satellite
- Contribution to the AIV of the SET and for the Proto Flight Model (PFM) of the satellite
- On board computer (OBC) based on the Airbus SCOC3 processor, a high feature microprocessor.
- Electronic Remote Interface Unit (RIU)
- Power Conditioning and Distribution Unit (PCDU)
- Payload Data Handling Unit (PDHU)
- Units for ciphering and deciphering telecommands and measures for the platform and payload (DCU 5 & X)

GTD

- Onboard software for the modules: Reaction Wheels, AOCS; Mode Management Guidance, Solar Array Deployment, Bus Thermal Control, TM/TC, Instrument Video Unit and Complementary Scientific Payloads function
- Development of the tools for the deployment and integration/validation of the ground segment: Test Data Manager (TDM) and the Test Data Tool (TDT).The TDM manages the Test Data sets from a data base and the TDT generates and manages telemetry files

GROUND SEGMENT

THE GROUND SEGMENT of the Ingenio mission is deployed in the regions of Madrid and the Canary Islands, with an additional data download service in the Arctic.

The main centre is located at the INTA complex at Torrejón de Ardóz (Madrid) and is equipped with all the necessary functions for planning and managing satellite flight operations and producing images. A back-up centre is located at Maspalomas on the island of Gran Canaria. This provides additional capacity for receiving data and managing flight operations when needed.

Ingenio is a mission that contributes to the European Copernicus programme, and its ground segment is already enabled to meet that role.

Scientific and research centres, institutions and different government departments will benefit from it.

■ FRANCISCO LECHÓN

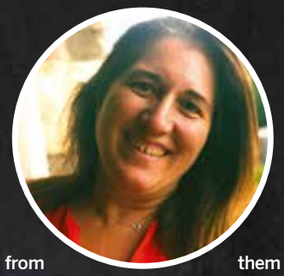
THE OPERATIONS CONTROL CENTRE AT TORREJÓN DE ARDOZ

THE SATELLITE FINISHED AND READY FOR INSERTING IN ITS CONTAINER

As in the IEE, nowhere
by Esteban

Remote teaching

a challenge for teachers and students



WHO HAS NOT RAISED their eyes to the heavens on a clear light and felt sheer admiration for what they see, while at the same time feeling so very tiny in the face of infinite Space? To many it is just a marvellous instant of impact – and that's that. Others take these sentiments and emotions and turn them into poems, paintings and questions. I have been one of the latter, and with these questions I have wanted to infect others – my students. I cannot find a bigger source of astonishment and questions than looking up at the immensity of objects that fill our sky. And if that transforms into a desire to seek answers to these questions, then we have sown the seeds of a scientific vocation in our youth.

> "As a great dreamer once said, "nothing is done without first imagining it". We didn't imagine anything like this and yet we have still been capable of doing it. And it is our vocation that has been the motor behind doing this.

It is precisely these difficult times of confinement and of change in many of our paradigms that are testing many of our beliefs. They have strengthened the idea that scientific research and the development of technology are pushing us towards the future and the ways in which we connect are fundamental for moving forward in scenarios that we could never have imagined.

Here we are, teachers from a great part of the world, turning the living room of our homes into a classroom, opening it up to our students and carrying them off to a world of discoveries and learning of their own. And it has been done from one day to the next, in record time, and with tools that we have been adapting as we move along. It would not have been possible to carry our support to the students without technology that has been developed for communicating at distance, or without the development that got the Space race going, of computers. Many advances that were made to support Space missions have been seeping into our lives without at times us realizing it. And that lust for knowledge that humans have has carried us forever a little bit further, making our life that much easier in these times.

Teachers all over the world have done our best to keep transmitting the desire to learn to our pupils and to accompany them in their personal and academic growth from home. We have had to accustom ourselves to a change for which we were barely prepared and had never had to do before. But our priority was to reach out to our students, and without the possibilities of communicating at distance, of working together over the internet, it would have been impossible. In a globalized world with so much technology the biggest difficulty is not one of having the tools to work at distance and online with our students but to know how to select the best ones for looking after them personally, because our students are just as diverse as their family circumstances are. It is also complex picking out from so many educational resources on the web, and in this area Space agencies like ESA have been supporting us by offering some very interesting educational resources during these days.

It has also been a difficult time for our adolescent students, as for them technology in their lives is focused on games and virtual relations and they were not as prepared as we thought to change their way of work. They may have taken thousands of photos and selfies but sending in a legible version of their maths exercises has been a challenge for many of them.

But the biggest difficulty for me as a teacher has been attending to all those students who are particularly affected by the digital divide. For them this situation is changing the status of equal opportunities that comes from an onsite and obligatory education. It is to them that we have to direct our biggest efforts.

As a great dreamer once said, "nothing is done without first imagining it". We didn't imagine anything like this and yet we have still been capable of doing it. And it is our vocation that has been the motor behind doing this.

Gloria Laso
ASTROPHYSICIST AND HIGH SCHOOL TEACHER

> a new industry focusing its efforts and investment in taking on new technologies and moving ahead with advances that are laying the foundations for the future of Space.

New proposals for PROPULSION IN SPACE

In the last few years we have witnessed some major changes in the Space sector as regards developments, ways of managing things and changes in perspective. If during the Space Race it was institutions that usually led the projects with government support, now it is the turn of private initiative to head up the new ways of heading into Space, taking care of other assumptions.

So we have a new industry focusing its efforts and investment in taking on new technologies and moving ahead with advances that are laying the foundations for the future of Space. This transformation is cementing progress in this field and it is worth paying attention to the different technologies that are fuelling innovation, reducing investment costs and that respect the environment.

They are quite diverse and fit into various fields, but we are going to look at some of those related to propulsion in Space.

Spanish company Added Value Solutions (AVS), based in Elgoibar (Guipúzkoa province), has a subsidiary in the United Kingdom that focuses on the segment of propulsion for small geostationary telecoms satellites and has put forward some new business perspectives in this field.

It has its own propulsion technology that is not based on traditional chemical fuels, relying on the decomposition of water and the subsequent treatment of the hydrogen that this produces. So this one offers the use of a 'green' propellant – water.

The company is also banking on another of its technologies, one that centres on resolving the heat generated by the movement of telecoms satellites in Space, one that offers great prospects for the future. It is developing electric propulsion products with an enormous range of power, thrust and specific impetus to meet the needs of the mission, taking in nanosatellites to large GEO (geospace) platforms.

OTHER SYSTEMS FOR SMALL SATELLITES

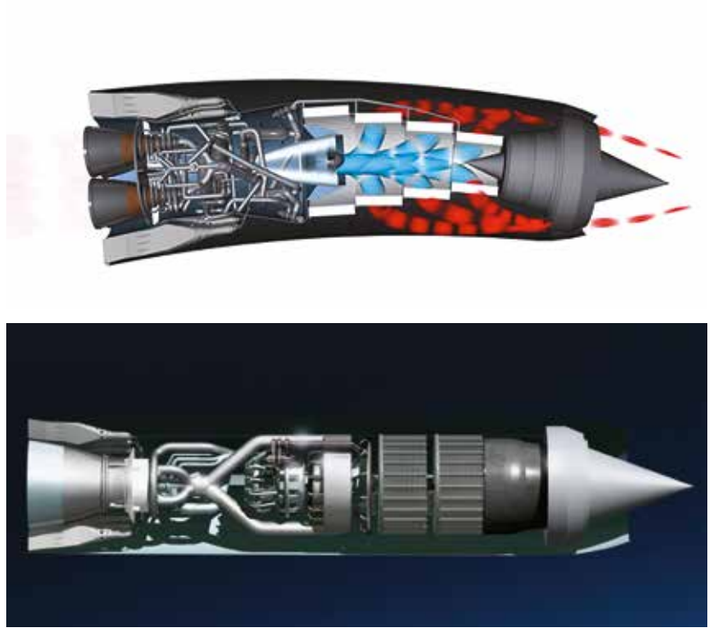
One interesting innovation is that of NanoAvionics, thanks to the design of a new generation of propulsion technology aimed at solving the deficiencies and needs of small satellites. They use ammonium dinitramide as a propellant (a mix of substances that are used to boost the Spacecraft into Space) and it is already on the market.

What has to be taken into account is that between 2012 and 2016 the average weight of satellites was reduced by almost 80%, and that since then the number of small satellites that have been put into orbit has increased by 300%.

To meet the need for cheaper and less dangerous propulsion systems, NanoAvionics is offering its EPSS (Enabling Chemical Propulsion System for the Growing Small Satellite Market) system, that uses a propellant, an ecological and non toxic product (ammonium dinitramide) that is 10 times cheaper than the alternatives and 30 % more efficient than its closest rivals.

In 2016 this same company started out on its EPSS 2 project with the aim of

FIG 1 SABRE ENGINE SCHEMATIC



developing and testing low cost and high performance propulsion systems, using a fuel that is respectful to the environment for powering satellites of up to 150 kg with a greater capacity for thrust and burn.

These propulsion systems enable the satellites to carry out complex tasks that are fundamental for offering high value services such as precision flight in satellite constellations; orbital manouevres; avoiding Space debris; the synchronization and positioning of communications equipment and payload instruments; the compensation for atmospheric resistance and the consequent prolongation of its useful life, as well as leaving orbit at the end of the mission. It also provides for services such as teledetection, scientific Space exploration, weather forecasts, communications, navigation and the Internet of Things (IoT).

EPSS consists of a propellant tank, a flow control system, and a mix of propellants. The tank has its own active thermal control system and uses a configuration of blowdown separating the pressurization agent and the propellant.

The reduction of costs in production comes from the company making optimum use of instruments and components optimized, above all from the catalytic system in the decomposition chamber. The system has already reached the maximum level of technological preparation (TRL 9) in an orbital demonstration and is now being integrated into the satellites of commercial clients. These customers now benefit from a longer useful life for their mission, more efficient orbital control and less time taken in deploying a constellation.

AIR LAUNCH SYSTEM

In the same context of solutions for small satellites, there is a necessity for technologies that can be adapted to specific requirements and that are economical for the launch of payloads. A project financed by European Union funds, ALTAIR, has developed a system that meets this demand.

Until now we depended on large satellite launchers that incorporated small ones as a secondary payload or integrated them into a group of small satellites. The need for a low cost specific solution led to the ALTAIR (Air Launch Space Transportation using an Automated aircraft and an Innovative Rocket) project, one that has demonstrated the viability of an air launched system adapted to the needs of the small satellite sector.

ALTAIR is based on a concept of aerial launching. It consists of an unmanned aircraft that takes off horizontally with a launcher attached. When it reaches a high enough altitude (12 kms), the rocket breaks away and burns up. Starting the flight at such a high altitude reduces the resistance on the launcher and increases the performance of the rocket. What is more, the independent transporter returns to Earth and can be reused, making it more economic in the long term.

MODULAR PROPULSION

With the support of European funds, ENPULSION conceived a technology that focuses on resolving the problems of propulsion. Known as an IFM Micro Thruster, it is a compact and modular propulsion system designed specifically for small satellites weighing between 1 kg and 500 kgs. It uses a technology called Field Emission Electric Propulsion (FEEP), which consists of a transmitter and an accelerator electrode using liquid metal as the propellant.

The IFM Micro Thruster has no pressure vessels or chemical substances and can be launched from any type of rocket, even from the International Space Station. Both the thruster and the propellant fit into a module of 14 x 12x 10 cms that can be screwed directly on to any flat panel. It does not require a separate tank or fluid circuit, which saves on space. And its precision control is unbeatable, as is its attitude control.

HELICON PROPULSION

Researchers from the Carlos III University of Madrid (UC3M) and the SENER aerospace group have created a new electric propulsion Space technology called HPT (Helicon Plasma Thrusters) which is targeted at small satellites weighing less tan half a tonne and require less than 750 watts of electric power.

This is why it is an ideal alternative for the deployment of satellite constellations located in different orbital planes, at an altitude of some 1,200 kms, which are aimed at offering a global coverage of broadband Internet services

The consortium led by SENER Espacial started work on a project in January that will continue with the development of the HPT. Known as HIPATIA (Helicon Plasma Thruster for In-Space Applications), it comes under the European Union's framework programme for research and innovation 'Horizon 2020'. In addition to the UC3M, also collaborating on this new project are Airbus and the National Centre for Scientific Research in France and the company Advanced Space Technologies in Germany. Their mission is to support interplanetary voyages, programmes for the removal of Space junk and Space refuelling etc.

HYPERSONIC PROPULSION SYSTEM

The SABRE (Synergetic Air-Breathing Rocket Engine), created by British company Reaction Engines, uses ultra-light, high speed heat exchangers.

In this way the SABRE class engines will help aircraft to fly through the atmosphere at more than five times the speed of sound and enable the construction of Space launch vehicles that will radically improve accessibility and response capabilities when travelling in Space.

Its heat exchanger technology has the potential to revolutionize and transform what can be achieved with thermal management in a variety of industries from aerospace to vehicle making, industrial processes and the energy industry.

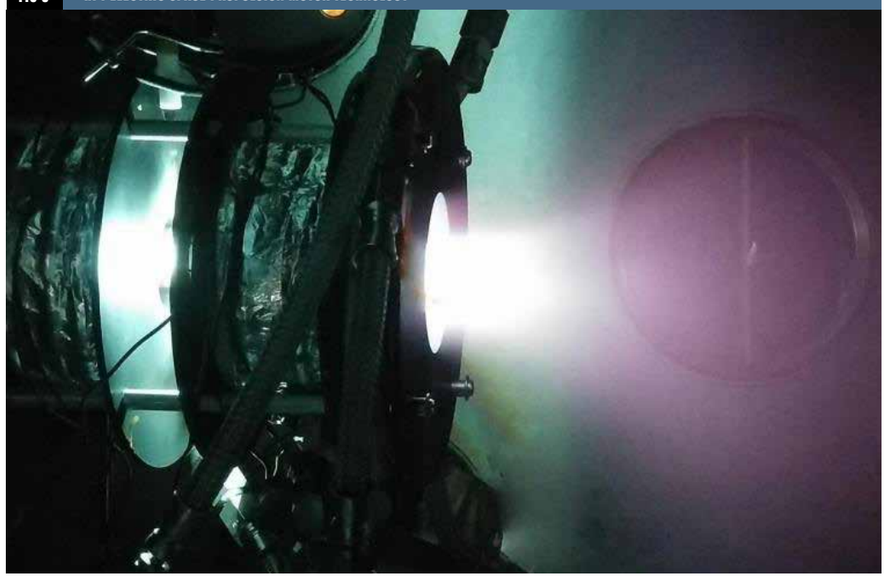
> **"What has to be taken into account is that between 2012 and 2016 the average weight of satellites was reduced by almost 80%, and that since then the number of small satellites that have been put into orbit has increased by 300%.**

Following this brief technological overview, we should point out that of course there are many innovative and different proposals that are fertilizing the way ahead and opening up new paths for Space development. The spaceships that will make interstellar voyages will require more efficient propulsion systems that provide higher speeds. That is the challenge that currently faces us. Fortunately, science, technology and creativity keep on cooperating..

■ ARACELI SERRANO

FIG 2 IFM NANO THRUSTER

FIG 3 HPT ELECTRIC SPACE PROPULSION MOTOR TECHNOLOGY



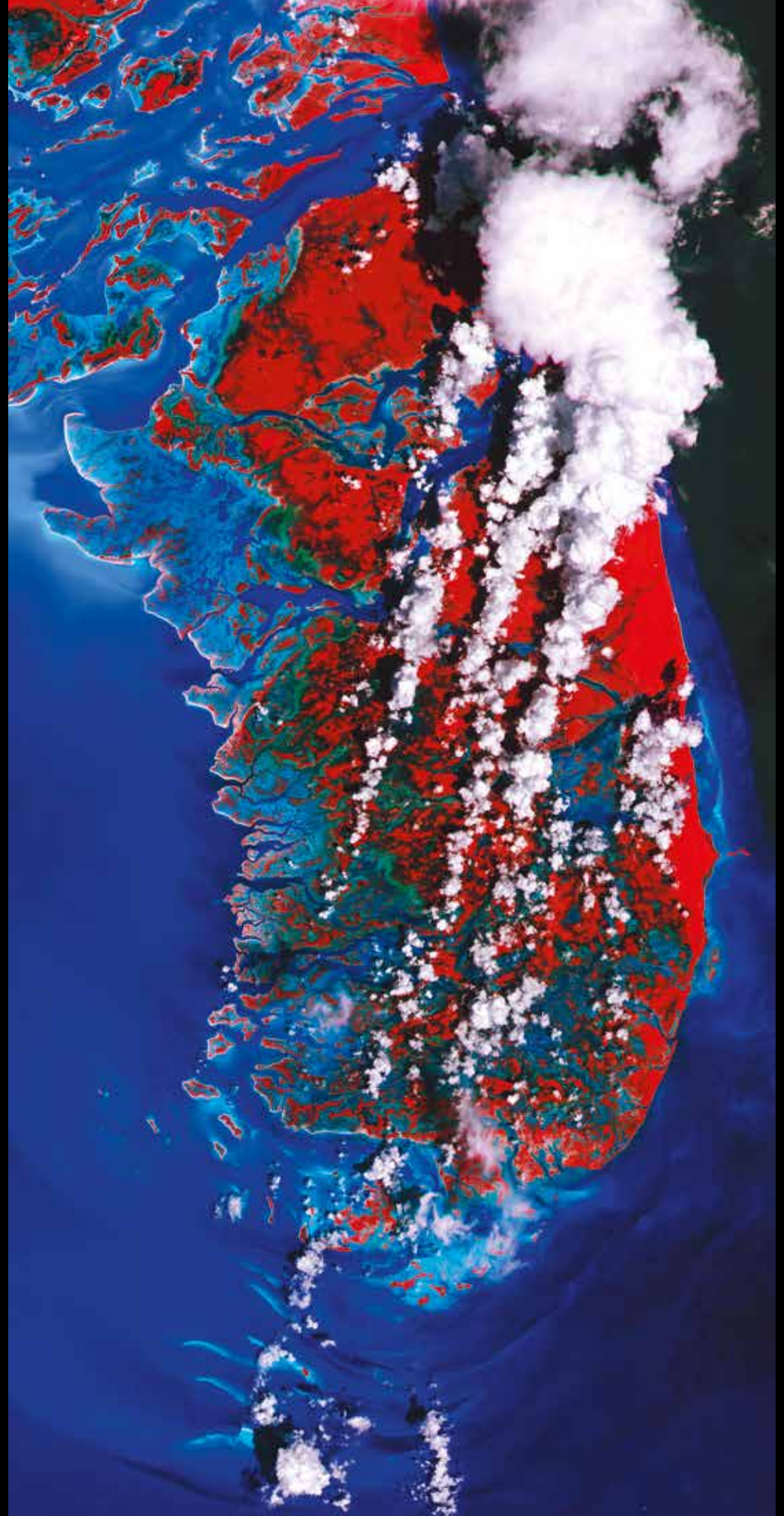


Image NASA

Working with the data

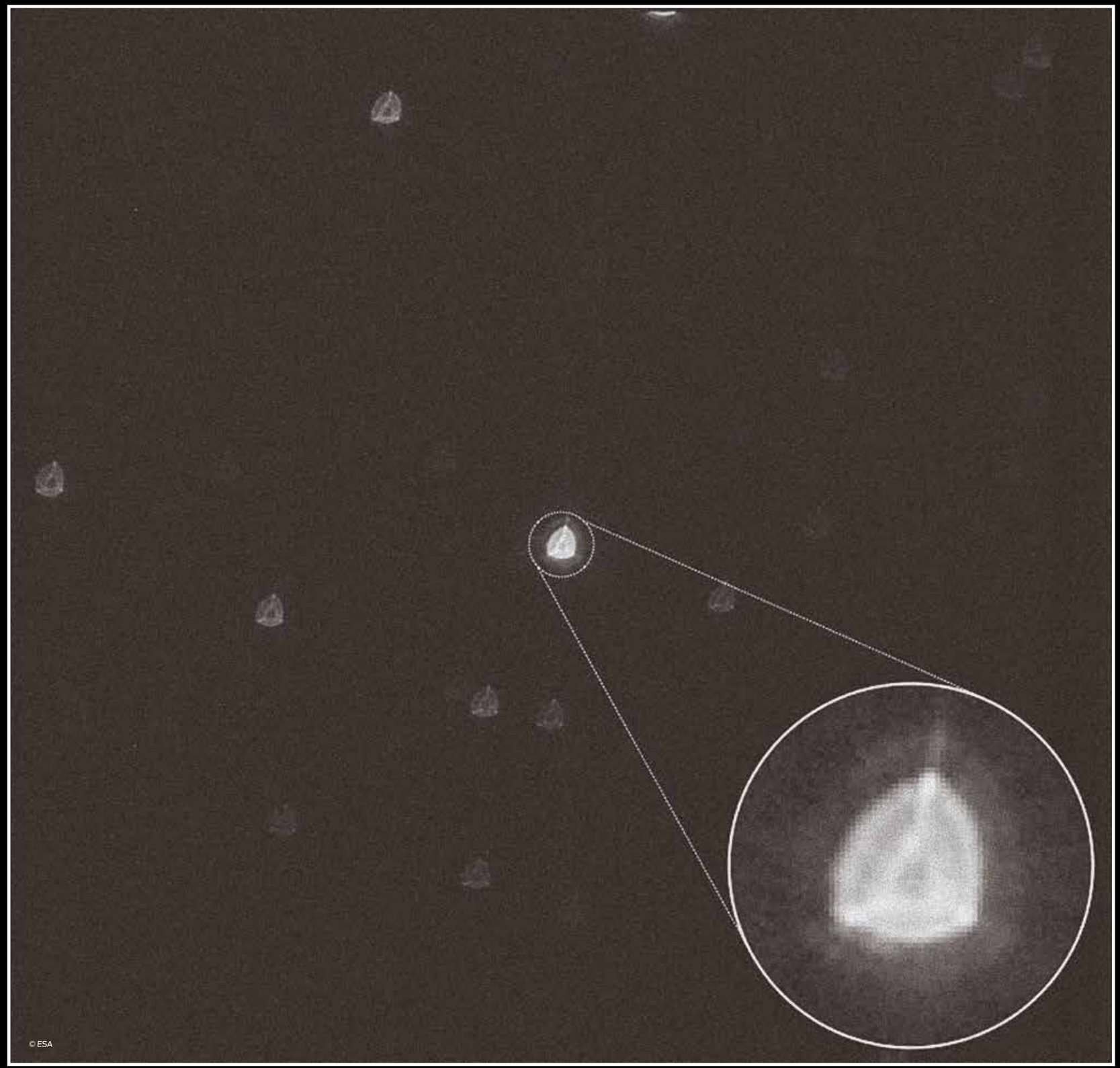
The instruments on board satellites and spacecrafts generate a wealth of data that needs to be processed and analysed on ground for them to be turned into useful information. Amongst other, we generate maps, metheological predictions, maritime traffic and geolocalisation data, telecommunications applications as well as scientific results that allow us widen our knowledge of the Universe. Advances made in the analysis, processing and interpretation of these data allow for their use in an increasing number of areas in our society, fostering thus the development of an economic activity with a relevant added-value.

ABOUT THE IMAGE

Andros_Bahamas
Andros Island, the largest island of the Bahamas, is featured in this false-colour image captured by the Copernicus Sentinel-2 mission. This image was processed in a way that included the near-infrared channel, which highlights the island's vegetation in bright red.

Credits: Contains modified Copernicus Sentinel data (2019), processed by ESA, CC BY-SA 3.0 IGO

Text: M. López



ABOUT THE IMAGE

Cheops_ Image of HD 70843, the star chosen as the first target.

The star, located around 150 light years away, is visible at the centre of the image. A deliberate defocusing of the Cheops optics, spreads the light from each star over many pixels. This makes the measurements of the starlight more precise, and is responsible for the peculiar shape of the stars in the image.

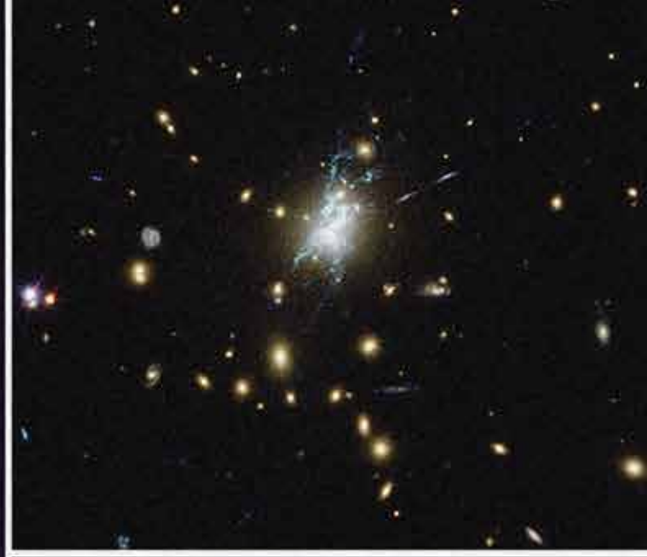
Credits: ESA/Airbus/CHEOPS Mission Consortium

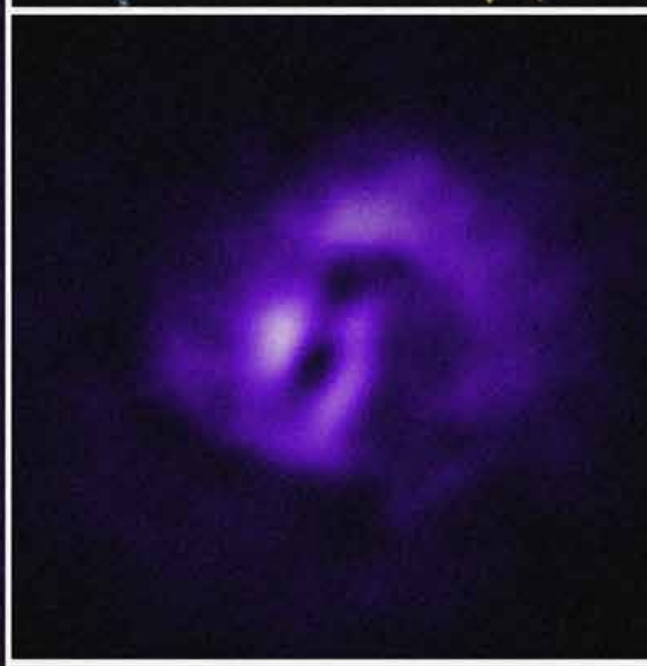
ABOUT THE IMAGE

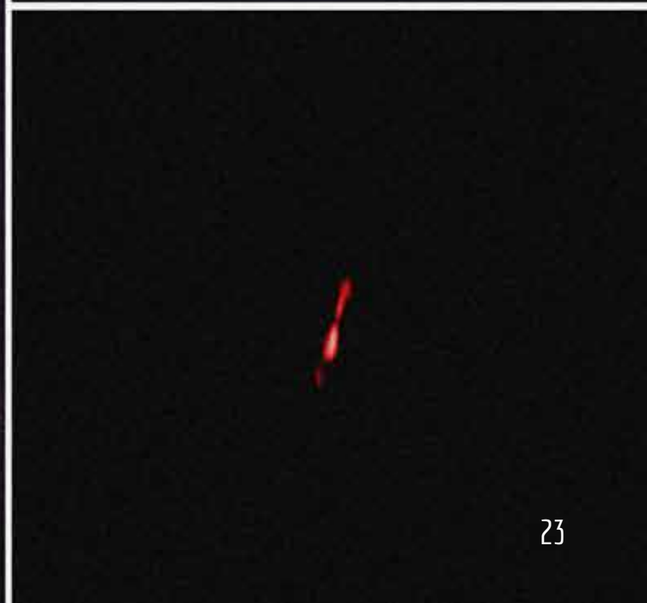
Phoenix Cluster Individual Wavelenghts

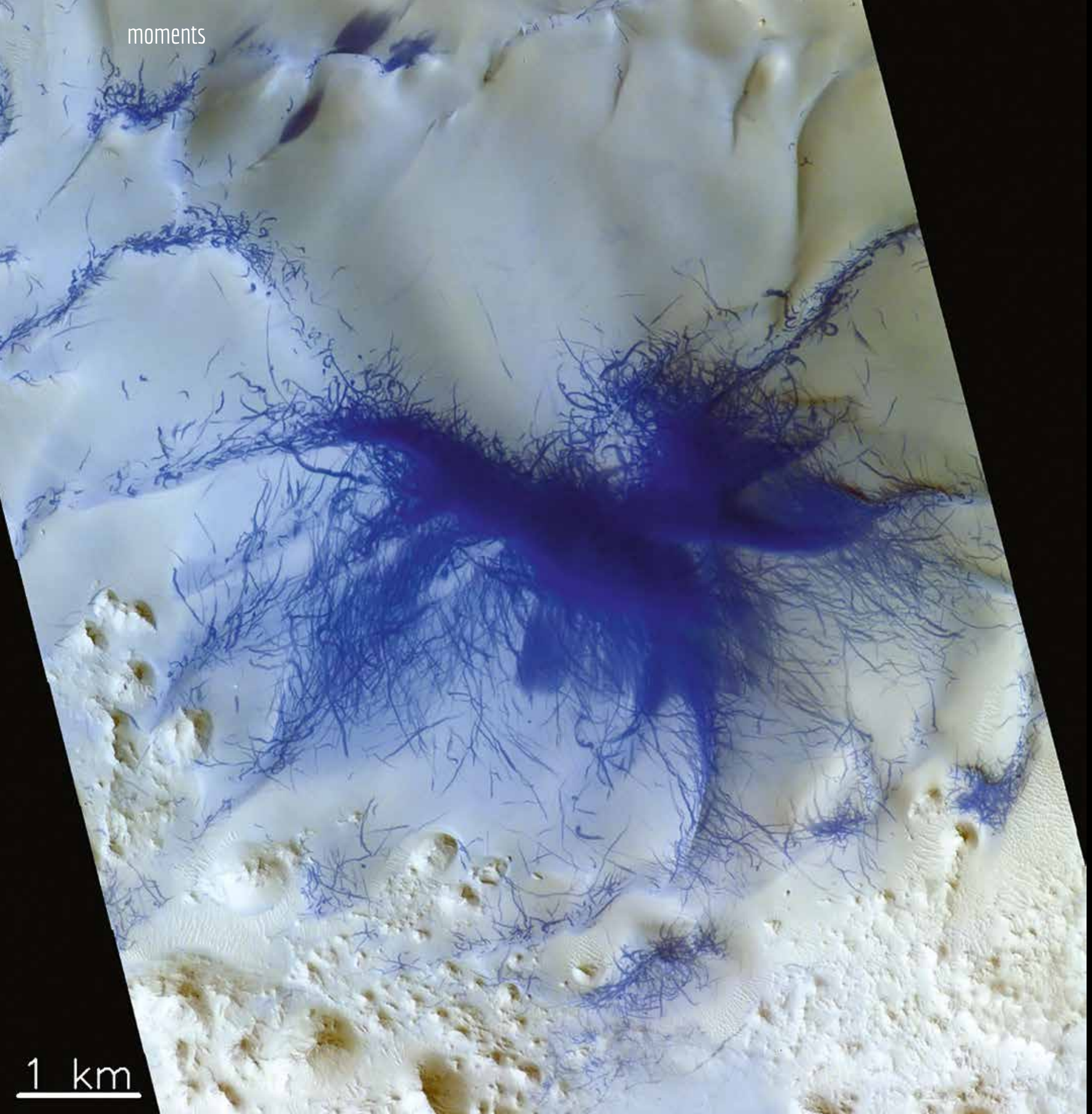
This image from the Phoenix galaxy cluster was made by combining data from Chandra (X-rays, hot gas in purple), Hubble (optical data, galaxies in yellow and star formation in light blue) and the VLA radio telescope (radio emissions in red).

Credits: NASA, ESA, y NRAO









ABOUT THE IMAGE

Dust_Devil Frenzy in Terra Sabaea, Mars

This mysterious pattern is thought to be the result of dust devil activity – essentially the convergence of hundreds or maybe even thousands of smaller martian tornadoes. Features that are bluer compared to the average colour of Mars are shown in bright blue hues, when in actual colour, would appear dark red.

Credits: ESA/Roscosmos/CaSSIS, CC BY-SA 3.0 IGO

THE HISTORY OF SPACE

THROUGH ITS PROTAGONISTS

***PROFESSIONAL CAREERS** like those of Carlos Sánchez Tarifa, José Manuel Sendagorta, Pedro Pintó, Luis Ruiz de Gopegui and Víctor Rodrigo have left a profound mark in the chronicles of Spain's activity in Space. Their talent, scientific curiosity and their technological input put Spain on the international map. And, what is more, they served as an inspiration for the many other professionals who followed in their footsteps.*

CARLOS SÁNCHEZ TARIFA

He is regarded as the pioneer of aerospace propulsion in Spain and those who worked with him highlight his innovative character, open intelligence and tenacious non-conformism in facing up to challenges. All this, along with his great sense of humour and vitality, made Carlos Sánchez Tarifa a point of reference for many classes of engineers and professionals in aeronautics and Space.

His prolific career began with the combustion research team set up by Gregorio Millán at INTA (The National Institute of Aerospace Technology). There he participated in a number of jet engine programmes, eventually leading the departments of Research and Advanced Studies and Energy and Propulsion. He was also involved in the building of INI- 11, the first jet engine to be constructed in Spain.

On the teaching side, he was a professor at the Military Academy of Aeronautics Engineers and later head of the department for Air and Space Jet Propulsion at ETSIA (the Higher College of Aeronautical Engineers), an area in which he was both a national and international point of reference. In 1960 he began a close and prolific relationship with SENER, taking on responsibility for questions linked to the aerodynamics of the rocket launch pad at Kiruna (Sweden) that the Spanish company built there for the ESA (then known as ESRO). Sánchez Tarifa went on to collaborate with SENER over a number of years on a variety of research projects on combustion in conditions of microgravity and as chief engineer on the engine programme for the Eurofighter.

LUIS RUIZ DE GOPEGUI

If someone on Earth had "heard" nearly all that could be detected from Space it has to have been the physicist, Stanford University educated electronics engineer and writer, Ruiz de Gopegui. After 13 years on the Higher Council of Scientific Investigation and a brief spell at INTA, he began working for NASA in Spain. According to his daughter, the writer Belén Gopegui, "one day he saw an advertisement in a newspaper: "Personnel needed for the Spacecraft tracking station at Robledo de Chavela." They needed to know English and electronics. My father knew both, applied and was selected."

That was how he came to be one of the first people to hear such famous phrases as "Houston, Tranquility base here, the eagle has landed" from Neil Armstrong, and "Houston, we have a problem" from the Apollo 13 mission. Ruiz de Gopegui was firstly director at the Fresnedillas base before going on to head up all of NASA's ground stations in Spain. He also collaborated in many of the US Space agency's programmes, including Apollo, Skylab, Apollo-Soyuz and the first flights of the Space shuttles.

What also should be remembered is his important role as a writer and disseminator, trying to spread his love for science and the cosmos and leaving us with a fascinating list of books such as Cibernética de lo humano, Seis niños en Marte, Ludwig el extraterrestre and Mensajeros cósmicos.

JOSÉ MANUEL SENDAGORTA

An aeronautical engineer, researcher and businessman, after passing through INTA he joined SENER, a company set up by his brother Enrique a few years earlier, opening it up to various new fields of activity and to the international market. A scientific visionary with a determined entrepreneurial spirit, "Manu" Sendagorta elevated his company into the select group of companies in the international field of Space industry, one that had previously been reserved for the major powers. He achieved it in 1966 by winning a competition run by ESRO (of which Spain had been a modest member since its foundation) to construct a rocket launch pad within the Arctic Circle (at Kiruna, Sweden), for studying the aurora borealis and variations in the magnetic field around the North Pole. Sendagorta embarked on an adventure that had been created by the man who had been his professor, Carlos Sánchez Tarifa, setting up a team of top level professionals who included Chechu Rivacoba, Iñaki Ibabe, José Luis Echeandía and Alberto Martín. The project and its construction were carried out in record time, facing up to all types of technical, material and climate difficulties and culminated with the successful launch of a SkyLark rocket in March 1967. From that moment on, he did not stop taking on innovative contributions in his professional career.

VÍCTOR RODRIGO

Ever since he left university in 1973, this aeronautical engineer has been very closely linked with Space. He started work at INTA as a systems engineer at the Spanish Air Force's missiles centre and later became director of Space programmes at the Institute. He was involved in the first ECS (European Communications Satellite) and MARECS (Maritime European Communications satellite) and on the lighting system for Spacelab. Another of the programmes he collaborated on was the satellite Olympus, the goal of which was to test and verify in orbit the new communications technology and services that would form the basis of the European satellites.

In 1983 he took the plunge into the private sector, signing up as director general of CRISA where he worked until his retirement in 2010. In those 27 years the company participated in hundreds of Space projects in exploration, telecommunications, Earth observation, the International Space Station and the Ariane launchers, for which the company supplied more than 800 flight kits. Since then Víctor Rodrigo has continued advising national and international companies and organizations on Space activities.

PEDRO PINTÓ

It is said of him that he has been teacher to many of those that now occupy major posts in Spain's Space industry and that he understands the role of the space industry in serving society – in developing solutions and infrastructures that bring progress and well being to citizens.

An aeronautics engineer who studied at the Universidad Politécnica de Madrid, Pedro Pintó Tardón joined INTA in 1965, where he was a director of the electronics division and participated in the design of the first Spanish satellite as head of I INTASAT, a project on which he was in charge of communications. In 1986, following a brief spell at CESELSA, one of the companies from which Indra was founded, he joined HISPASAT, leading in the definition and construction of the HISPASAT satellites 1A, 1 B, 1C, 1D and Amazonas 1.

One of the great milestones in his professional career was starting up the DESATCOM programme with the Spanish government to prepare our industry for incorporating new technology in communications satellites, to be competitive on quality, price and time frames. Pedro Pintó received the TEDAE 2019 Prize in the Space category.

BEGOÑA FRANCOY

ABOUT THE IMAGE: Fresnedillas (Madrid) 13-8-1966. Construction of the Apollo satellite dish, 26 meters in diameter, that will serve for communication with the first North American astronauts to reach the Moon, at the Fresnedillas facilities, which together with the Robledo and Cebreros station (under construction), form the Robledo Space Station, after the agreement reached between the Government and NASA. **EFE/yv**

to be continue...

HISPASAT PICKS THALES ALENIA SPACE TO BUILD THE AMAZONAS NEXUS

The managing directors of the two companies, Miguel Ángel Panduro and Jean Loic Galle, during the contract signing ceremony

Amazonas Nexus of HISPASAT

HISPASAT has awarded Thales Alenia Space the contract to build the Amazonas Nexus which will replace Amazonas 2 in orbit at 61º West and expand its capabilities.

This new high performance satellite will enable HISPASAT to reach new clients and markets, providing high capacity mobile services in the air and sea transport sectors among others. It will also service current clients of HISPASAT who use the Amazonas 2 satellite. Thales Alenia Space will be responsible for the design, production, tests and in orbit acceptance trials.

Greater flexibility

The principal new feature of the Amazonas Nexus will be a latest generation Digital Transparent Processor (DTP), an essential new piece of technology for increasing the geographical flexibility of the satellite if there are any changes in the original commercial scenarios. Thanks to DTP, the payload of Amazonas Nexus will be processed digitally, offering the possibility of assigning while it is in orbit the required capacities at any moment. This provides a great solidity in the current developing market for communications, both in terms of connectivity and data and in the transmission of content.

The new satellite will cover in particular the Americas, in the North Atlantic and Greenland corridor, and will deliver latest generation telecoms services in Ku band. The Amazonas Nexus paves the way for a new generation of satellites in the Hispasat fleet with an innovative architecture that also incorporates capacity in Ka band to optimize communications between the gateways and the satellite. This will enable it to considerably increase the onboard capacity available for commercial use, significantly improving the unit cost compared with traditional satellites.

Its advanced design, the HTS (High Throughput Satellite) capacity and the versatility of the Amazonas Nexus will make this satellite the most efficient in the HISPASAT fleet. Based on the Spacebus NEO platform of Thales Alenia Space, the Amazonas Nexus will have an all-electric propulsion, making it lighter and thus contributing to reducing launch costs. With an estimated operational life of 15 years, 20 kW of power and a launch weight of 4.5 tonnes, the Amazonas Nexus will be put into orbit in the second half of 2022.

New commitment with Spanish industry

Jean Loïc Galle stressed the importance of this agreement for the shareholders of Hispasat for its commitment to the Spanish aerospace industry. Galle, CEO and president of Thales Alenia Space at the time of the signing, promised to deliver the satellite on time to provide a speedy response to the growing demand for connectivity and to help HISPASAT continue to play a leading role in the Americas market.

■ Iñaki Latasa

SOLAR ORBITER
ON ITS WAY TO THE SUN

SPANISH INDUSTRY HAS PLAYED A SIGNIFICANT ROLE

THE SOLAR ORBITER MISSION, a joint initiative of the European (ESA) and American (NASA) space agencies to study the Sun, was launched on 9 February from Cape Canaveral (USA). The probe will be able to provide unique information for helping to understand how our star works and also to predict its behaviour.

For the moment, because of the COVID-19 health emergency, ESA has decided to turn off the scientific instruments of the mission, along with others such as TGO, Mars Express and Cluster, and place them in a safe configuration, so that the number of personnel could be reduced at the ESOC control centre in Germany.

When it starts operating again, Solar Orbiter will be the first satellite to offer close up views of the Sun's polar regions that are very difficult to see from Earth, taking pictures from latitudes above 25 degrees. It will fall into the rotation of the Sun around its axis for several days, enabling it to observe from a same point of view the development of a solar storm over a prolonged period. Also, it will provide information of the side of the Sun that is not visible from Earth.

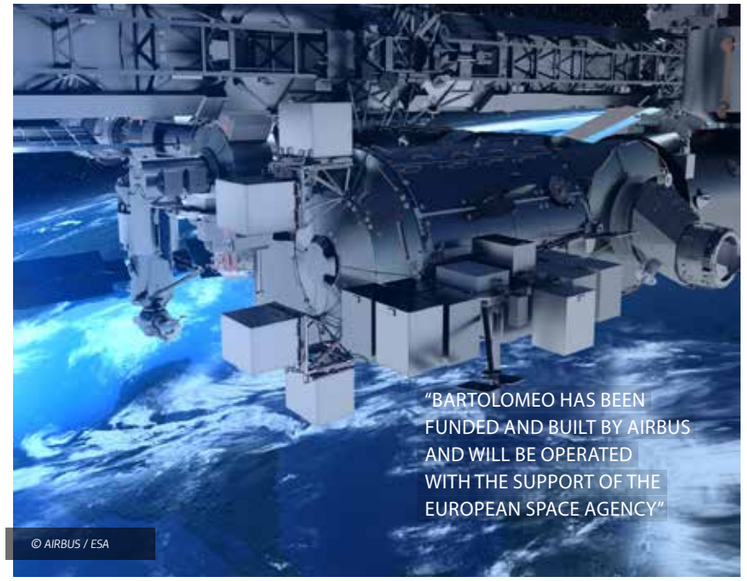
The objectives of the mission, in which Spanish industry has played a significant role, are to determine the properties, dynamics and interactions between the solar plasma, the magnetic fields and the particles in the heliosphere close to the Sun; to investigate the relationship between the Sun's surface, the solar corona and the inner heliosphere; to explore in all latitudes, the powers, dynamics and the detailed structure of the Sun's magnetic atmosphere: Sol; and to test the solar dynamo through observation of the high latitude fields of our star, its movements and its seismic waves.

■ Oihana Casas

© ESA/ATG medialab

THE BARTOLOMEO PLATFORM, IN ORBIT

THE BARTOLOMEO PLATFORM was launched on 6 March from Cape Canaveral, Florida (USA) and is now on its way to the International Space Station (ISS) where it will couple up with the exterior of the European module, Columbus.



© AIRBUS / ESA

Bartolomeo has been funded and built by Airbus and will be operated with the support of the European Space Agency. The platform can accommodate up to 12 different modules of payloads between 4 kgs and 450 kgs, to supply them with energy. It will also enable transmission of data to Earth, with a download capacity of optical data of up to three terabytes a day per module.

Bartolomeo is waiting to house payloads that will serve to advance observation of the Earth, environmental and climate research, robotics, science materials and astrophysics, as well as prototypes for new Space technology. The interfaces, their preparation prior to launch and the process of integration are to a large part standardized, with the goal of saving time and costs on future missions. ■ O. C.

CREATION OF NATIONAL AEROSPACE SECURITY COUNCIL

THE NATIONAL SECURITY COUNCIL has reached agreement on setting up a National Aerospace Security Council it was announced recently in the Official State Bulletin (BOE). This new body will be in charge of guaranteeing the country's airspace from ground to outer Space and will be chaired by the Supreme Chief of Defence Staff (JEMAD), currently Air Force General Miguel Ángel Villarroya.

The prime task of the new body will be to support the National Security Council in the areas of planning and policy coordination in matters relating to aerospace security. ■ O. C.


MASPALOMAS STATION © ESA

THE UPM INAUGURATES THE ESA HUMAN AND ROBOTIC EXPLORATION – SCIENCE DATA CENTER

THE UNIVERSIDAD POLITÉCNICA DE MADRID (UPM) university has inaugurated the HRE-SDC of the European Space Agency at the Montegancedo campus. It will serve as a reception centre for conditioning, disseminating and evaluating the scientific data generated from the scientific missions carried out by ESA's Human and Robotic Exploration (HRE) division.

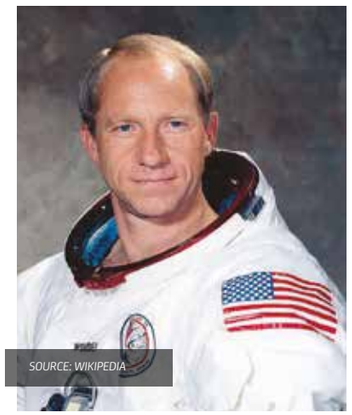
The HRE-SDC work team will be made up aerospace and IT engineers.

Its launch answers the European Space Agency's commitment to exploit and fully preserve the data generated by the various Space missions and from experiments on different platforms, an initiative known as the "Heritage Space Data programme"

With the creation of this new centre, the ESA will be turning this public Madrid university into a benchmark centre for the gathering and management of data from experiments carried out on European space missions. ■ O. C.


Artist's impression of the Orion spacecraft with the ESA service module. © ESA

NASA ASTRONAUT ALFRED MERRILL "AL" WORDEN HAS DIED


SOURCE: WIKIPEDIA

ALFRED MERRILL WORDEN, engineer, astronaut and pilot of the command module for Apollo 15 in 1971, died on 18 March, aged 88, following a heart attack. Worden was one of just 24 people who have travelled to the Moon.

A colonel in the US Air Force, Worden was a test pilot and instructor before joining NASA as an astronaut in 1966. He was a member of the backup crew for the flight of Apollo 9 and was reserve pilot for the command module on the Apollo 12 mission. He finally made it to the Moon as command module pilot for Apollo 15. During the return flight to Earth he carried out an Extravehicular Activity (EVA), a Space walk of 39 minutes, to retrieve from the service module the photo cassettes of the lunar surface. That was the first lunar exit and the first Deep Space EVA in history.

Later in his career Worden became an aerospace scientist at NASA's Ames Research Center in California. ■ O. C.

DEVELOPMENTS ON THE LUNAR GATEWAY PLATFORM

"THE INSTRUMENTS PICKED BY NASA WILL BE USED TO MONITOR SPACE CLIMATE AND SOLAR RADIATION"

NASA HAS SELECTED the first two scientific instruments to be carried aboard the Lunar Gateway platform, the future human base in lunar orbit that will be used to support operations in the Artemisa lunar programme while it demonstrates the technologies that will be needed to carry out a human mission to Mars.

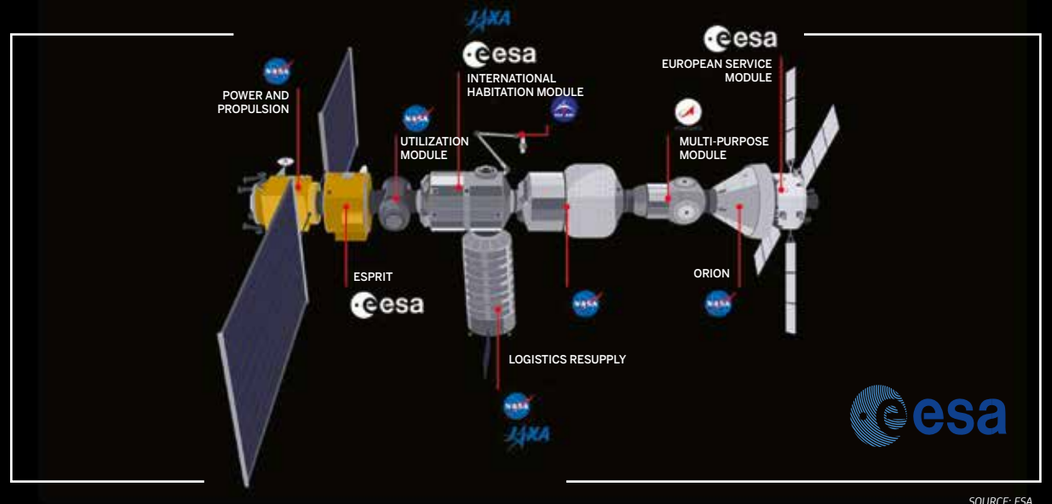
Lunar Gateway is a project being carried out by the Space agencies of the United States (NASA), Russia (Roscosmos), Canada (CSA), Japan (JAXA) and Europe (ESA).

The instruments picked by NASA will be used to monitor Space climate and solar radiation. The instrument package for studying radiation will be put together by the ESA and will help to keep the astronauts safe by managing the levels of exposure to radiation in Gateway's orbit.

Meanwhile the Space climate package, which will be assembled by NASA, will observe solar particles and winds in addition to the unpredictable bursts on the Sun's surface. Its goal is to improve the capabilities for forecasting events that originate on the Sun and that could affect astronauts on and around the Moon, as well as on future missions to Mars.

Unlike the International Space Station (ISS), there are no plans to keep Gateway permanently crewed. The lunar platform is seen as a staging point for manned missions to the Moon or to Mars, as well as being a test bed for the different technologies and procedures that will be needed for these manned journeys.

■ O. C.



SOURCE: ESA

ESA IS ORGANIZING A SERIES OF VIDEOCONFERENCES "ESA IN A POSTCOVID WORLD" WITH EXPERTS FROM DIVERSE FIELDS

THE EUROPEAN SPACE AGENCY has programmed a cycle of five web seminars in which invited guests from all fields will be taking part with the aim of debating and examining how Space can help to improve life on Earth both during and after the Covid-19 pandemic.

The main theme of the first web seminar, which was held on 4 May and called "Climate care: Remote Life, Better Life?", was the considerable reduction in environmental contamination due to the confinement of citizens all over Europe and the world, and how the pandemic could change the way we behave and live in the future. Taking part were Josef Aschbacher, director of Earth Observation Programmes at ESA; Jakob Blasel, an environmental activist who is a member of the "Fridays for Future" movement; economist and consultant Alfredo Roma; Paolo Vineis, professor of environmental epidemiology at Imperial College London, and the director general of the ESA, Jan Wörner. It was moderated by Donatella Ponziani, the head of Downstream Gateway at the ESA.

The next web seminar was held on 20 May on "Healthcare", followed on 3 June by "Post-millennials education and social life"; on 9 June by "Working efficiently, working remotely," and lastly, on 15 June, "COVID-19: reinvent your business model." All the conferences can be watched on the ESA web page. ■ GUILLERMO CAYADO

CAB AND THE IAC PARTICIPATE IN THE DISCOVERY OF A GIANT EXOPLANET

THE CENTRE FOR ASTROBIOLOGY (CAB, CSIC-INTA) and the Canaries' Institute of Astrophysics (IAC) were part of the international scientific team led by the University of Geneva that has discovered a giant exoplanet, WASP-76b, located some 390 light years away in the Pisces constellation. It was found thanks to a new instrument called ESPRESSO that was installed in the VLT (Very Large Telescope) at the European Southern Observatory (ESO) at Cerro Paranal in the Atacama Desert in Chile.

WASP-76b is an extremely hot giant exoplanet where daytime temperatures can reach more than 2,400°C, high enough to vaporize metals such as iron. These steams are dragged by the wind towards the nocturnal regions of the planet where, with the drop in the temperature (to around 1,500°C), they condense and fall in the form of rain.

On it researchers have identified for the first time chemical variations, a phenomenon caused by the exoplanet always showing the same face to its host star. This situation, known as "tidal locking" is the same as that experienced between the Moon and Earth: the time taken by the exoplanet to rotate around its axis coinciding with the time it takes in travelling through its orbit. In this way, WASP-76b maintains a daylight region and a nocturnal one, with large temperature differences between the two.

The exoplanet receives thousands of times more radiation from its star as the Earth does from the Sun. This causes the temperatures on its daytime face to be so high that molecules split up into atoms, and that metals like iron are found in the atmosphere in the form of steam.

■ O. C.

NASA NAMES ITS MARS 2020 ROVER PERSEVERANCE AFTER RUNNING A SCHOOLS COMPETITION

NASA HAS CHOSEN THE NAME OF 'PERSEVERANCE' for its next Space exploration vehicle, the rover that will be heading for Mars at the start of 2021. The name was suggested by Alexander Mather, a boy living in Burke in the state of Virginia, in a competition for primary school pupils held throughout the USA.

Estudiantes preparando la carga del cohete © ESA

The Perseverance rover is a robot that weighs just under 1,043 kilograms. It will search out signs of past macrobiotic life, define the climate and geology of Mars and pick up samples ahead of its return to Earth. Perseverance forms part of the Mars 2020 project, which in turn is part of an even broader programme that includes missions to the Moon as a preparatory move to human exploration of the Red Planet. ■ O. C.

BEPICOLOMBO FLIES OVER THE EARTH IN THE MIDDLE OF THE CORONAVIRUS CRISIS

BepiColombo, launched in Octubre 2018, is due to reach Mercury at the end of 2025. On this long journey it will be carrying out nine gravity assist manoeuvres. The first took place on 10 April when the spaceship neared Earth, at a distance of just 12,700 km, which is less than half the altitude of Europe's Galileo navigation satellites.

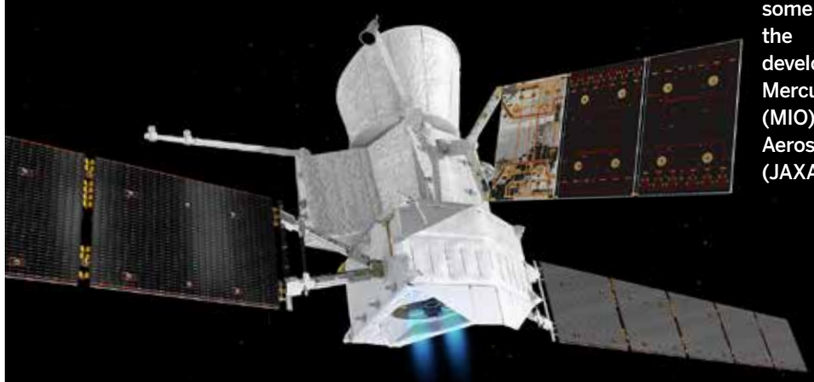
It did so with a ground crew at mínimum levels at the ESA's European Space Operations Centre (ESOC) at Darmstadt, Germany, because of the restrictions imposed for COVID-19.

"Distancing from the Earth is a phase in which we need daily contact with the spaceship," said Elsa Montagnon, director of operations for the BepiColombo at ESA, a few days before the manoeuvre. "That is something we cannot postpone".

"It will be the last time we see BepiColombo from Earth," declared Joe Zender, deputy project scientist for the BepiColombo project. "After this it will be heading deeper into the inner solar system."

The mission scientists planned the overflight as a means to test some of the 11 instruments on board the Mercury Planetary Orbiter developed by the ESA, and the Mercury Magnetospheric Orbiter (MIO) developed by the Japan Aerospace Exploration Agency (JAXA).

■ O. C.



CRISA WILL DEVELOP THE ELECTRONICS FOR THE MARS SAMPLE RETURN ORBITER ELECTRICAL PROPULSION

The electrical propulsion is one of the challenges of the MSR-ERO mission. The system is based on the RIT2X (+30kW) grid engines. Crisa will contribute with the power unit (PPU), one of the main elements in the propulsion system. PPU-RIT2X is capable of providing with two voltage working points in order to guarantee optimal thrust and specific impulse, both of these key factors for mission success.

PLD SPACE SUCCESSFULLY ACHIEVED A FULL ROCKET ENGINE TEST FOR MIURA 1 MISSION

The test allowed the company to validate the nominal performance of the TEPREL-B liquid engine during the full mission duration burn of two minutes, the necessary time to boost MIURA 1 launch vehicle into space. "Achieving this important milestone implies a turning point in the commercial space race, especially for Microlauncher development, and take us a step closer for launching MIURA 1 into space. With this result, PLD Space has a rocket engine capable of reaching space soon", Raúl Torres, CEO and co-founder of PLD Space.

CONTRACT WITH EUROPEAN MARITIME SAFETY AGENCY

exactEarth and Hisdesat will provide satellite-AIS data services with exactView RT for a four-year period generating revenues between $5.0-$7.0 million (Canadian).

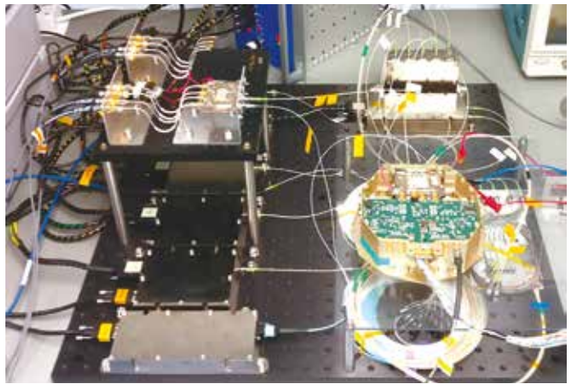
exactView RT consists of 58 operational satellite payloads and seven orbital spares that annually track a population of more than 600,000 unique vessels worldwide and generate real-time Average Global Revisit rates. A unique inter-satellite relay link guarantees download and delivery to EMSA of the AIS positions with an Average Latency of less than one minute after the message has been sent by the vessel.

HISPASAT WILL COLLABORATE WITH PLD SPACE IN THE COMPATIBILITY ANALYSIS OF SMALL SATELLITES ON BOARD THE MIURA 5 ROCKET

The two Spanish companies have signed an agreement to work together to define the terms and conditions that allow PLD Space to be certified as a launch service provider. HISPASAT will contribute to define the technical conditions (mass, volume, mechanical stresses, electromagnetic environment ...) that satellites must meet for their integration and launch on board the MIURA 5 rocket, contributing the experience acquired with large launchers.

SMOS OPS PHOTONIC SYSTEM INTEGRATION AND TEST COMPLETED

The TVR meeting of ESA Project "Optical harness for future L-band radiometer" was held at DAS Photonics' premises last 28/11/2019. The photonics equipment developed by DAS Photonics (local oscillator, clock and data distribution system) was successfully tested after integration with the receiver hardware developed by SENER Aerospace. The developed technology enables a potential advancement in the miniaturisation degree of future generation SMOS sensors for Earth Observation.



OHB-I AWARDS TO ELECNOR-DEIMOS A GROUND SEGMENT CONTRACT OF AN EARTH OBSERVATION MISSION

OHB-I, mission prime, has selected Deimos Space for the ground segment provision for a very-high resolution optical Earth Observation mission. Deimos' ground segment solution is based on its gs4EO software suite, developed as a modular system, including components operationally validated in ESA projects as well as in Deimos-2 satellite ground segment.

ARQUIMEA WILL PARTICIPATE IN EFESOS PROJECT

Developing three complex high-performance circuits, called IPs, that will be used as electronic components and for the design of ASICs (Application-Specific Integrated Circuit) for space and high reliability applications.

EFESOS (Evaluation of 22nm Fully-dEpleted Silicon-On-insulator technology for Space) is part of the Horizon 2020 Programme and is funded by the European Commission. Its objective is the development and validation of a cutting-edge microelectronics technology platform for radiation-hardened integrated circuits.

EUTELSAT KONNECT IN ORBIT WITH THE FIRST HILINK ON-BOARD

Eutelsat KONNECT satellite, which provides high-speed Internet access in Africa and Europe, was placed in-orbit on January 2020. It carries on-board the first HILINK, a high-rate, flexible, command and monitoring computer developed by Thales Alenia Space in Spain. This new platform, fully reconfigurable by software, enables operators to efficiently manage their digital telecommunication satellite payloads throughout the mission lifetime.

TELESPAZIO IBÉRICA: CORINE LAND COVER + BACKBONE, NEW PRODUCT FOR COPERNICUS

Telespazio Ibérica will participate in the generation of CLC + Backbone, a new high-resolution spatial vector product for the delineation of coverage with greater emphasis on geometric details than thematic than its predecessor CLC. The contract recently awarded by the EEA will last 2 years and will serve as the first stone for the generation of a new Copernicus service in the Land domain: CLC+.

AIRBUS SUCCESSFULLY COMPLETES IN ORBIT DELIVERY OF CHEOPS

As prime contractor, Airbus has performed all verifications to guarantee the correct operation of the satellite, ground segment and the scientific package. ESA recognised the great job done by the Airbus teams and confirmed hand-over of the mission operations from Airbus to INTA and the mission consortium.

The satellite in-orbit delivery is the culmination of the Airbus participation in the programme. CHEOPS the first ESA mission built in Spain.

GMV TO PROVIDE THE CONTROL SYSTEM FOR THE TWO SPACE NORWAY SATELLITES TO BE DEPLOYED IN THE ARCTIC

GMV will be developing and installing the operations center for the satellites ASBM 1 and ASBM 2 satellites, built by Northrop Grumman and making up the core of the Arctic Satellite Broadband Mission (ASBM) satellite system. The project scope includes supply of the real time telemetry and command processing system, the flight dynamics system plus the ground station control and monitoring system.

GTD AT THE FOREFRONT OF THE DEVELOPMENT OF NEW TECHNOLOGIES FOR SPACE PORTS

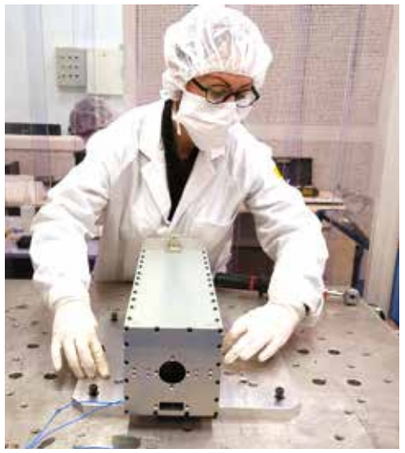
GTD leads the project within the framework of the H2020 that provides a valid solution to any space port, current or emerging, using 4.0 technologies. The goal is to provide a New Space solution for a multi-lander port allowing for flexible, flexible and agile launch campaigns.

The project, key to the development of these space ports, involves leading European companies and the main emerging European ports such as Kouoru, Sweeden, Andoya, Azores and Grottaglie.

VALIDATION OF SMALL SATELLITES AND CUBESATS

Heavy investments in small satellite constellations require a mastery of platform and payload reliability and a risk management strategy. This means that a risk management capability must be developed, as opposed to risk avoidance in the traditional space sector.

Component selection, testing, customised solutions for miniaturisation and the full capabilities of our laboratories are our added value.



TECNALIA PARTICIPATES IN THE MINISATELLITES CONGRESS HELD IN MÁLAGA (SSSIF)

TECNALIA has participated as exhibitor in the Minisatellites Congress held last February in Málaga. A new paradigm that opens the space to new companies and institutions through a reduction of costs and leadtimes. In cooperation with the RTOs belonging to the STAR3 Alliance, capabilities as complete evaluation, integration and low cost additive manufacturing technologies for this specific segment of the space market have been presented.

SENER AEROESPACIAL IS A SUPPLIER FOR FIVE KEY SYSTEMS IN SOLAR ORBITER

The mission to the Sun represents the largest contract in the history of SENER Aeroespacial, which has worked in parallel on five different contracts: the antennae subsystem, the feed-through filter subsystem, the boom instrument, and the EPD and So-Phi scientific instruments. In all of them, the intense radiation and high temperatures to which the equipment will be exposed have posed a number of technical and technological challenges in the satellite's development.

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No. 45 | MAY | 2020

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