

MAGAZINE

Nº 48 | OCTOBER | 2021

PRO **ESPACIO**



Mars **THE ETERNAL  
DESTINATION**

INTERVIEW  
JOSÉ ANTONIO  
RODRÍGUEZ  
MANFREDI

CURRENTS EVENTS  
SPACE,  
vital for military  
operations

# If you are spacewalking If you are spacew, and you know it.



ESA astronaut Thomas Pesquet (left) and JAXA astronaut Aki Hoshide (right) performed another spacewalk on Sunday, September 12 to prepare the other section of the International Space Station to have its solar panel updated.

The new solar panels, called IROSA (ISS Roll-Out Solar Array), are being gradually installed over the existing panels to augment the energy system of the International Space Station.

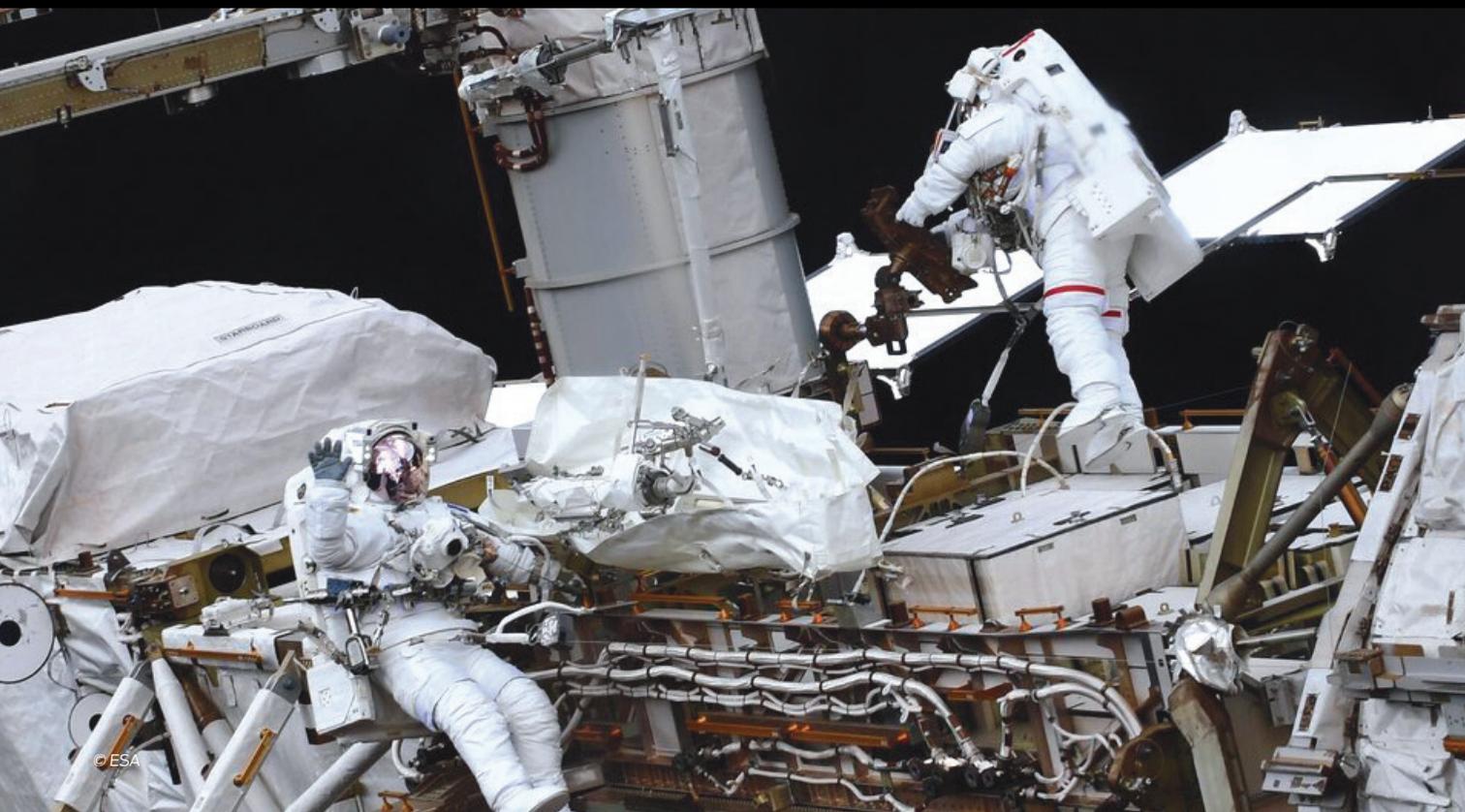
Thomas and NASA astronaut Shane Kimbrough prepared and installed two IROSA solar panels in three spacewalks during June.

The arrays were taken from their storage area on the outside of the Space Station and passed from once spacewalker to another toward the working area.

There, the rolled up arrays were secured, unfolded, connected and unfurled.

Aki and Thomas prepared truss P4 for the installation of IROSA. This is the same area where Thomas and Shane installed two IROSA, but closer to the main body of the Space Station, in an area called channel 4A. Here, only one new solar panel will be installed during a subsequent spacewalk.

While Sunday's extravehicular activity (EVA) has already been the fourth spacewalk during Thomas' Alpha mission, it was the first one in the company of Aki and the first time that a spacewalking pair did not feature a Russian or American astronaut.



# The Impact of Satellites on Impact of Satell

Since humankind started flying the first few space missions in the 60s, a myriad of projects have seen the light with the purpose of gaining a better knowledge about the space that surrounds us. Some of the most important ones were: the moon missions undertaken between 1969 and 1972; the Mir space station in 1986; the International Space Station in 1998, considered one of the greatest achievements of humankind; Voyager 1 and Voyager 2, launched in the late 70s in a mission toward the most distant planets of the solar system... But if there is one objective that has become almost an obsession throughout the years is the exploration of Mars, since it is considered to be the most habitable out of the planets within our reach. This makes it the best landscape to confirm the existence of life outside the Earth, in addition to being a massive source of data to find an answer to the enigma that is life.

The role of satellites in space missions has been essential in many scenarios: the arrival of rovers to Mars, the collection of mission data, and the transmission of data to NASA's Deep Space Network (DSN).

If we focus on the Mars missions, right now there are 8 artificial satellites orbiting the red planet: Mars Reconnaissance Orbiter, Mars Odyssey Orbiter, Mars Express, MAVEN, ExoMars Trace Gas Orbiter, Hope Mars, Mangalyaan (Mars Orbiter Mission) and Tianwen-1, and a number of upcoming new satellite launches in the next few years: Tera-hertz Explorer (TEREX) 2022-2024, Mangalyaan 2 (Mars Orbiter Mission 2) 2024, Martian Moons Exploration (MMX) 2025.

In Addition to all of this, NASA plans to send a telecommunications orbiter to Mars in the late 2020, and is studying the possibility if sending human crewed missions in the 2030. And along comes SpaceX, which has the ambitious project of performing some kind of mission to Mars during the 2020s. Its founder Elon Musk, wants to land his first, transport ship on Mars in 2022, followed by four vehicles during the 2024 launch window.

## And what role has Spain and its industry played in these missions?

We could say that it has had an important role in several of the missions that have been undertaken, participating in the construction of important

components both for satellites and for the vehicles sent to Mars. Some examples are:

**High Gain Antennas (HGAS)** installed on Curiosity and Perseverance developed by the consortium formed by Airbus Defense and Space and Sener.

**MEDA meteorological station** installed on Perseverance, which was developed by Spanish scientists of the Centro de Astrobiología de Madrid (CAB, CSIC INTA) and the Instituto Nacional de Técnica Aeroespacial (INTA) to measure the wind, dust, ultraviolet radiation and other weather indicators on Mars with its sensors.

**The REMS environmental station** (environment monitoring station) aboard Curiosity.

**The TWINS environmental station** (temperature and wind sensors for the InSight mission) on the InSight platform.

Thanks to them, Spain has reached the milestone of being the first country to have a weather station on another planet: REMS in 2012, TWINS in 2018 and MEDA in 2021.

And in late 2020, Airbus was selected by the European Space Agency (ESA) to tackle the design, development and construction of the ERO (Earth Return Orbiter) orbital vehicle and the SFR surface vehicle. Both of them within the scope of the MSR (Mars Sample Return) program that is being undertaken jointly with NASA. It is the first space vehicle expected to bring back Mars samples to Earth. Just a few months ago, both agencies have approved the preliminary design of the satellite, expected to launch in 2025.

As for the ground segment, Spain plays a fundamental role by hosting one of the three stations that make up NASA's Deep Space Network, located in Robledo de Chavelas. This complex is equipped with 6 antennas: one 26 meters in diameter, 4 34 meters in diameter and one 70 meters in diameter.

Proof of the opportunity that is opening up for companies of the space sector in the upcoming years is the approval by the European Space Agency (ESA) for an investment of 14.4 billion Euros in the next five years (2021-2026) – the highest budget in its history, out of which 1.953 billion will be allocated to the human and robotic exploration of the Moon and Mars.

"Spain has reached the milestone of being the first country to have a weather station on another planet: REMS in 2012, TWINS in 2018 and MEDA in 2021"

editorial



**RAÚL  
CASTROMIL**

DIRECTOR OF  
THE SATELLITES  
DEPARTMENT OF  
AICOX SOLUTIONS

3

EDITORIAL

**THE IMPACT OF SATELLITES ON MARS MISSIONS**

**Raúl Castromil**

Director of the Satellites department of AICOX soluciones

6

REPORT

**MARS, THE ETERNAL DESTINATION**

14

INTERVIEW

**JOSÉ ANTONIO RODRÍGUEZ MANFREDI**

20

INSTANTS

**BACK TO THE MOONS**

28

CURRENTS EVENTS

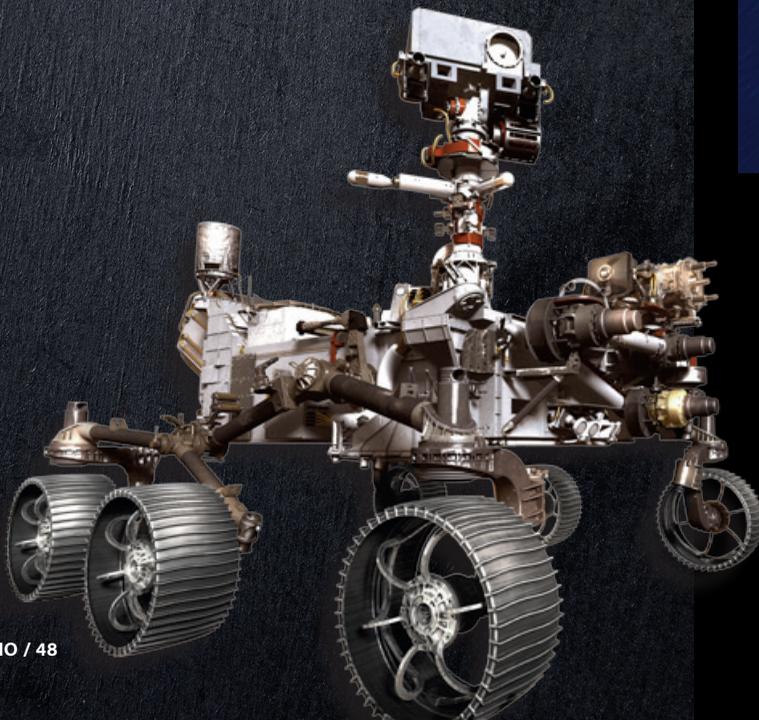
**MILITARES SPACE, VITAL FOR MILITARY OPERATIONS**

- *The Copernicus program of the European union offers daily reports on the activity and evolution of the La Palma volcano*
- *The second edition of FEINDEF 2021 is around the corner*
- *The Hubble telescope captures an amazing image: a Herbig-Haro object*
- *InternationalSpace University (ISU)*

38

OVERVIEW

**INFORMATION ABOUT TEDAE'S COMPANIES**



INSTANTS



INTERVIEW



CURRENT EVENTS



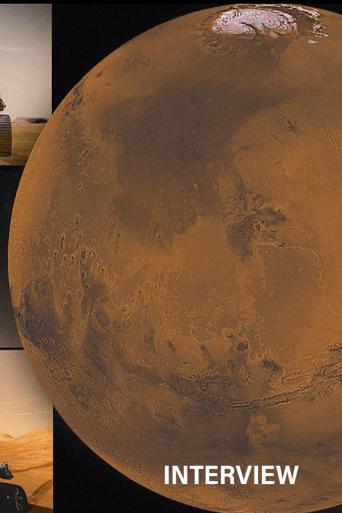
NEWS OUTLET OF TEDAE'S SPACE COMPANIES:

Aicox Soluciones, Airbus DS, ALTER Technology, ARQUIMEA, Crisa (Airbus DS), DAS Photonics, Elecnor DEIMOS, GMV, GTD, Hisdesat, Hispasat, HV Sistemas, IberEspacio, Indra, INSTER, INTEGRASYS, Inventia Kinetics, ORBITALCS, PLD Space, SATLANTIS, SENER Aeroespacial, Tecnalia, Telespazio Ibérica, TecnoBIT-Grupo Oesía y Thales Alenia Space España.

## OVERVIEW



## OVERVIEW



## INTERVIEW

## CURRENT EVENTS



## REPORT



## OVERVIEW



### EDITORIAL OFFICE:

Araceli Serrano, Antonio Tovar,  
Blanca Ahijado, Elena Lendínez,  
Francisco Lechón, Israel Segoviano,  
Iñaki Latasa, José Antonio García,  
Juan Romeo,  
Oihana Casas y Silvia Beltrán.

COORDINATOR: César Ramos

### EDITORIAL BOARD:

Ana Martín, Ana Nieto, Blanca de  
Frutos, Cristina López, David Manuel  
Fernández, Delfín Rodríguez, Elsa  
Alexandrina, Guillermo Ferreira,  
Ignacio Tourmé, Lorena Santos,  
Lucía Sencherms, Mar López,  
Marcia Arizaga, Marta Jimeno, Marta  
Massimiani, Mireia Colina, Oriol Casas,  
Pedro Rodrigo, Pilar García,  
Sara Lanchas, Sofía Alfaro y  
Victoria Velasco.

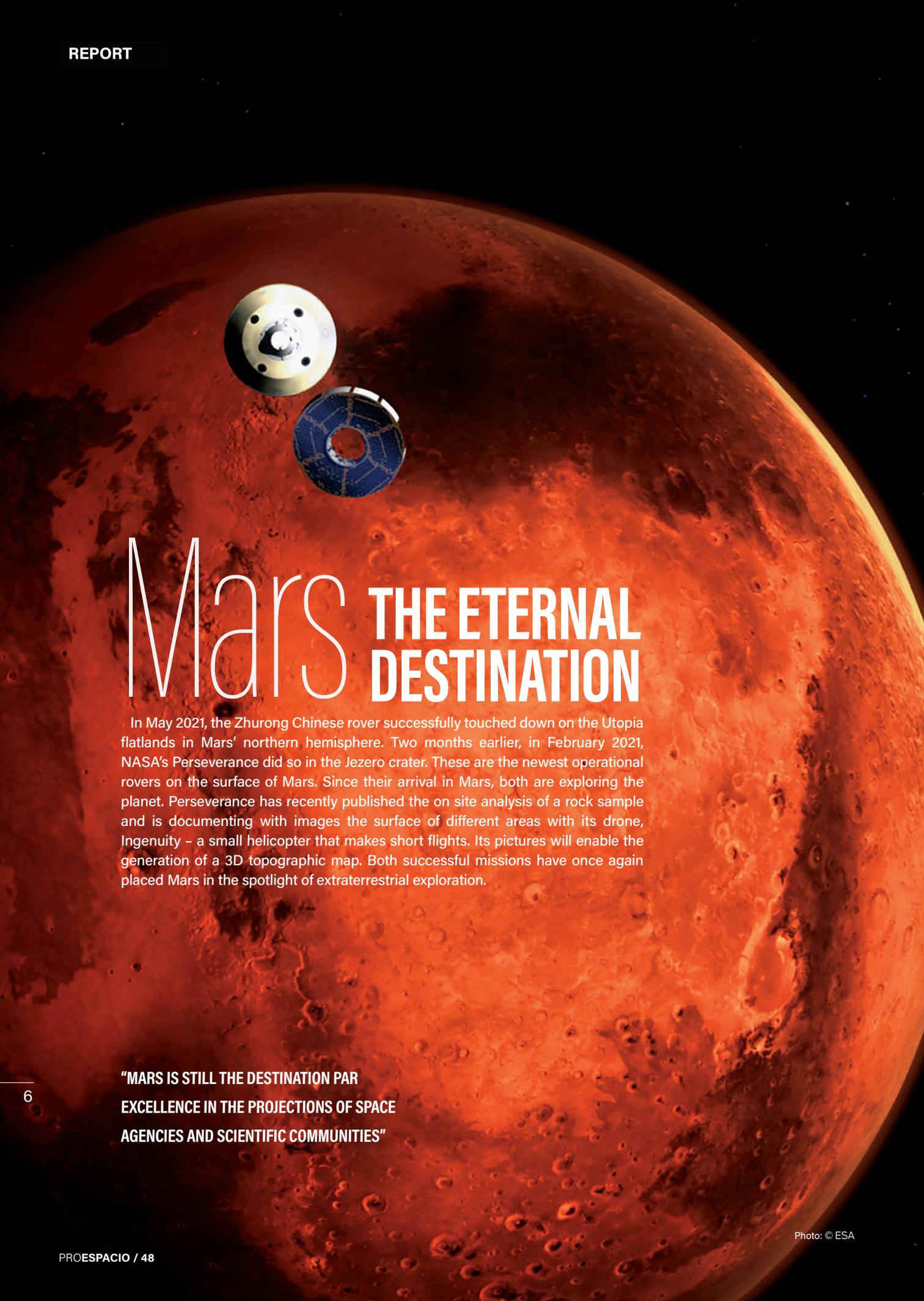
### LAYOUT:

Ismael Sánchez  
de la Blanca (ART DIRECTOR).

Alba Martín y Verónica García  
(GRAPHIC PRODUCTION).

www.expomark.es  
Digital and Printed Quarterly Edition.  
Legal Deposit  
ISSN 2254-9692  
M-46591-2004  
Printed by Expomark





# Mars THE ETERNAL DESTINATION

In May 2021, the Zhurong Chinese rover successfully touched down on the Utopia flatlands in Mars' northern hemisphere. Two months earlier, in February 2021, NASA's Perseverance did so in the Jezero crater. These are the newest operational rovers on the surface of Mars. Since their arrival in Mars, both are exploring the planet. Perseverance has recently published the on site analysis of a rock sample and is documenting with images the surface of different areas with its drone, Ingenuity - a small helicopter that makes short flights. Its pictures will enable the generation of a 3D topographic map. Both successful missions have once again placed Mars in the spotlight of extraterrestrial exploration.

**"MARS IS STILL THE DESTINATION PAR  
EXCELLENCE IN THE PROJECTIONS OF SPACE  
AGENCIES AND SCIENTIFIC COMMUNITIES"**

# ¿Why Mars?

**SINCE THE BEGINNINGS** of space exploration, Mars has been a dreamed destination in everyone's imagination as a habitable alternative: whether as the origin of other life forms or as a prospective second home for humankind. With its 144 million km<sup>2</sup> barely 28% the surface of Earth Mars offers firm ground where to build human colonies, but also has significant seismic activity, as shown by the InSight lander. While its atmosphere is one hundredths of Earth's, it is unbreathable (over 95% is carbon dioxide) and it is shaken by strong winds that generate dust

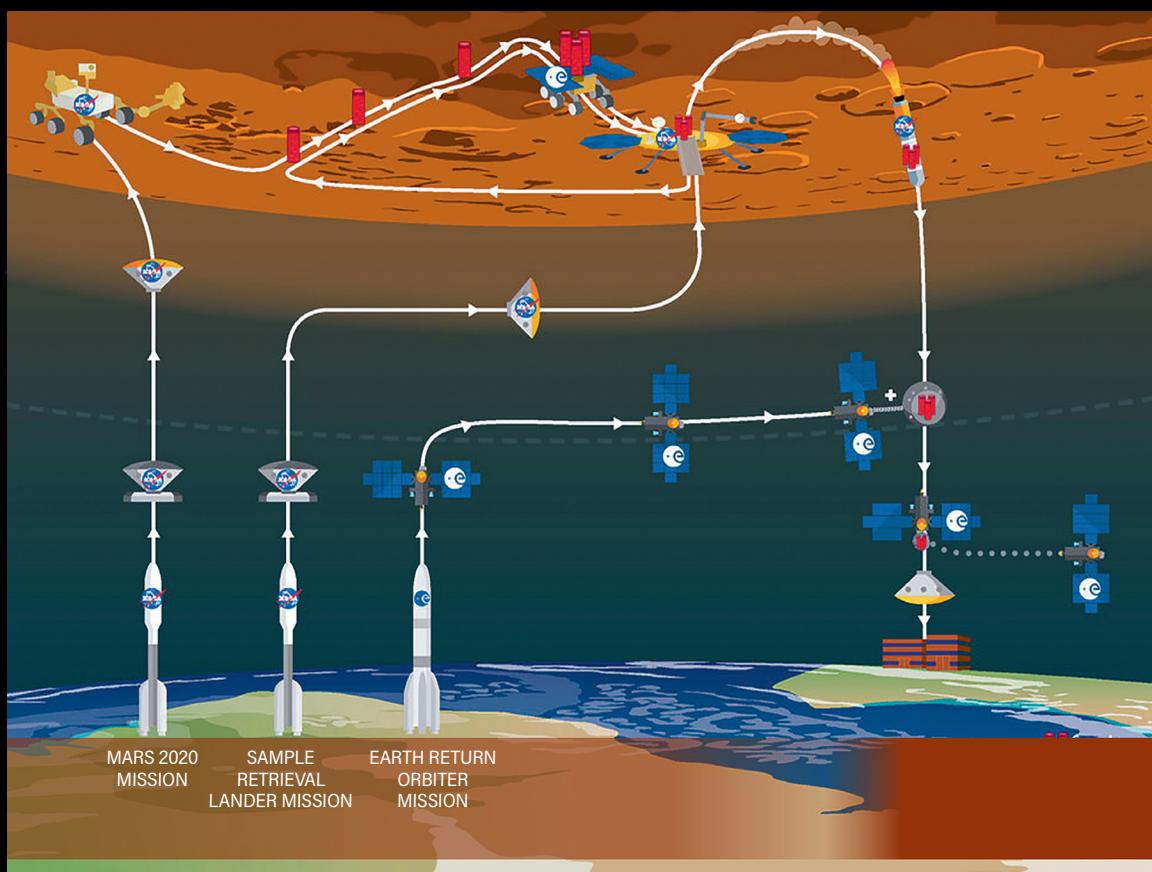
storms that cover the planet in dark clouds for weeks or months. It also lacks an ozone layer that blocks the sun's radiation. Not to mention that its mean annual temperature is less than fifty degrees Celsius below zero.

Despite these evidences that defy life as we know it, Mars is still the destination par excellence in the projections of space agencies and scientific communities for a possible future colonization. And for a good reason: Mars is the only planet currently reachable by humankind that has similarities with Earth. In addition to the presence of frozen water on its surface, these include its solid rock structure, its seasonal cycles (with four marked seasons with temperatures ranging from 20°C in the summer to -130°C in winter) and its density which,

while lower than Earth's, allows for the traversal of the Martian deserts, valleys and mountains at a brisk pace, with 38% of Earth's gravity, during the almost 25 hours of the Martian day, gazing at the rising and setting of its two moons: Deimos and Phobos.

With this quick and dirty overview of the feasibility of living on the arid lands of Mars, we could say that it remains a coveted destination in the space field and a first rate scientific field of research.

## MARS SAMPLE RETURN



# First stop, the Moon

A LAYOVER on the Moon has become a common theme in the planning of crewed Mars missions. Our small natural satellite serves as the testing ground for the first extraterrestrial human expedition in an exposed and hostile environment, with barely any gravity or atmosphere. NASA's Artemis program expects to send two astronauts to our satellite in 2024 as part of its third mission: it will be preceded by a first uncrewed mission to test the Orion spacecraft and a second, crewed one without landing on the Moon, to test the life support, communication and navigation systems.



**“THE LUNAR GATEWAY IS BEING BUILT AS PART OF ARTEMIS IN COLLABORATION WITH OTHER SPACE AGENCIES”**

During the presentation of the program, NASA gave three reasons: first, to guarantee the leadership of the USA in space exploration before its competing countries; second, to gain enough experience in crewed planetary exploration missions to take the leap to Mars; and third, to enable private American companies and their strategic partners to take part of that Moon exploration.

The Lunar Gateway is being built as part of Artemis in collaboration with other space agencies and with the participation of Spanish companies, which will serve as a port for arriving and departing astronauts. Once on the Moon, the astronauts will learn to live and operate on a planetary body, but three days away from Earth, unlike the more than two years that a mission to Mars and back would imply: in the best distance and gravitational conditions, just a crewed trip from Earth to Mars and back is estimated to take between 400 and 450 Earth days.

The use of Gateway is not expected to take place in 2024, however. The American plan consists of taking the crew aboard the Orion spacecraft to the orbit of the Moon. From there, they will descend in a lander and spend approximately one week on the Moon. NASA is studying the possibility of Orion also docking with Gateway in that first trip, but for now, the plan would be for the spacecraft to be standalone, while it would indeed use Gateway for the subsequent Moon missions of the Artemis program.

The first few things required for the human exploration of the Moon include a fixed communications system, LunaNet, and a permanent lunar base, Artemis Base Camp, which will have the necessary communication, energy, radiation shielding, water supply and storage infrastructure to guarantee missions one to two months in duration.

Within Artemis, Gateway is an example of international collaboration: led by NASA, it will count with modules and components of the European Space Agency, the Canadian Space Agency (CSA) and the Japanese Space Agency (JAXA); and the Space Agency of the Russian Federation (Roscosmos) has also shown interest in collaborating. In addition, NASA has implemented the CLPS program (Commercial Lunar Payload Services) as part of Artemis, in which 14 private companies have been contracted to provide scientific experiments and technology demonstrators on the surface of the Moon, in a public-private partnership that offers a corporate approach that, they estimate, is necessary to set in motion future crewed missions to Mars and acknowledges the unavoidable role played by new companies of what is known as New Space. In this regard, and unrelated to the contracts awarded by NASA, SpaceX, in collaboration with Japanese multimillionaire Yusaku Maezawa, have announced the first all-civilian flight to the Moon by 2023 a six-day space tourism flight to lunar orbit as part of its DearMoon program, while Blue Origin is developing its

own lunar landing system called “Blue Moon,” for the “safe, repetitive and affordable” transportation of goods to the Moon’s surface, which it expects to be able to offer to governments, scientific institutions and commercial clients starting 2024, as a first step toward the development of a lunar colony.

For their part, countries such as China, with its Chang’e lunar exploration program, and Russia, have announced crewed missions to the Moon since 2024, while India and the United Arab Emirates, among others, are working on missions to the Moon uncrewed, for now. The progress of all of these efforts, international synergies and public-private partnerships will set the stage for future crewed exploration missions to Mars.

Indeed, this first stop on the Moon, in addition to serving as a real world platform to validate future crewed missions, stresses the need for international cooperation in the field of space exploration. The success of the Moon missions will, in turn, increase the awareness and involvement needed by current and future generations in relation to planetary exploration, as was the case in 1969 with the Moon landing of the Apollo mission.

# Human Technology on Mars: the exploration missions

**PERSEVERANCE** is the sixth operational rover on Mars. It was preceded by Zhurong a success that turned China into the second country, after the US, to put an exploration vehicle on the planet, Curiosity (which landed in 2006 and is still operational), Spirit and Opportunity (two twin rovers that landed in 2004, with the latter being still operational) and 1997's Sojourner, the first rover to ever function on another planet. All of these, with the exception of Zhurong, are NASA vehicles. The European Space Agency launched a probe in 2016 aboard the ExoMars mission, but the Schiaparelli descent module did not survive the landing. The European agency is already preparing its next attempt, ExoMars 2022, this time carrying the Franklin Rosalind rover. The United Kingdom also launched a probe the Beagle 2 in 2003, but was unable to deploy its solar panels after the landing, the communications antenna was blocked and it lost contact with Earth. To these exploration vehicles we could add the Phoenix landing module, which set down on the north pole in 2008, and its subsequent evolution, the InSight mission, which did as much on Elysium Planitia on the equator. Both are fixed NASA modules with the ability to drill to study the subsoil. InSight, which is currently operational, is a geophysics robot equipped with a seismometer.

In addition to the missions that have landed, more than 40 space probes are orbiting the planet, which we have listed in edition 39 of our magazine. The most recent ones are NASA's MAVEN (Mars Atmosphere and Volatile EvolutioN), which orbits the planet since 2014; ESA's ExoMars which, despite the accident with its rover, left an orbiter that has been operational since 2016; Hope Mars, a mission of the United Arab Emirates that has been orbiting the planet since February of 2021; Tianwen-1, the Chinese probe that carried the Zhurong rover; and Mars 2020, NASA's satellite that carried Perseverance.

Announced future milestones include state run missions by the European, North American, Indian, Japanese, Russian and Chinese space agencies, in addition to private initiatives announced by SpaceX. Some of them involve a partnership between agencies, such as ExoMars 2022 a joint ESA and Roscosmos mission and Mars Sample Return (MSR) an ESA and NASA initiative that is expected to launch in 2026.

This last mission aims to send Martian soil samples to Earth for thorough analysis by scientists, and therefore includes the first launch from Mars with Earth as a destination, a

required step to plan a crewed mission. The MSR program includes three launches to carry out this ambitious mission: a first mission, which has already been successfully launched, has been Mars 2020 and its Perseverance rover, which is currently operating on the surface of Mars. One of Perseverance's objectives is to obtain rock samples and store them in tubes, which it must then place in strategic zones.

The second mission, the Sample Retrieval Lander, will involve landing a platform next to the Jezero crater, where Perseverance is operating. A small rover will descend from this lander – the Sample Fetch Rover – to locate the tubes that were previously laid down by Perseverance in the strategic zones and collect them. Once this is done, the rover will return to the platform and place them in a single container in the MAV (Mars Ascent Vehicle), found on the same platform. The MAV will need to achieve a true milestone in the space program: the first liftoff from another planet. Its objective will be to place the container, the size of a basketball, in the orbit of Mars.

After this milestone, the third and last mission of the program will be set in motion, called Earth Return Orbiter mission:

**"THIS LAST MISSION AIMS TO SEND MARTIAN  
SOIL SAMPLES TO EARTH FOR THOROUGH  
ANALYSIS BY SCIENTISTS"**

an orbiter will be launched toward Mars to capture the container. Once this is accomplished, the orbiter will seal the samples in a reentry capsule and head toward Earth, where it will release it to be received by the scientists.

After the success of the first mission, Mars 2020, whose rover Perseverance landed in early 2021 and is operating nominally on the planet, the planned dates for the other two missions are July 2026 for the launch of the lander and September of that same year for the launch of the orbiter. This probe would enter the orbit of Mars in October of 2027, while the lander would set down on Mars in August of 2028. If everything goes to plan, the samples would arrive to Earth in 2031 a five year mission to bring back a capsule the size of a basketball. The technical complexity of Mars Sample Return is considerable, but it is still a far cry from the requirements that the spacecraft that will carry the first humans to Mars will need to meet.

# Technological and scientific advances

**ONGOING MISSIONS** bring discoveries that help the scientific community better understand the past and present of the red planet, its composition and its possible evolution. In fact, among the reasons to go to Mars claimed by the European Space Agency, the main one is the great interest this planet has to understanding the evolution of life on Earth. According to scientists, Mars was once a very similar place to what our home is today, with oceans and rivers, a dense atmosphere and, probably, life. NASA's websites regularly publish the scientific discoveries made thanks to data collected by its exploration missions –from the massive volcanic eruptions that rocked the planet in the past, altering its climate, to the evidence of water on its surface, now only present as ice, which may have harbored microbial life.

In addition to the scientific exploration data itself, each launch is still a technical challenge of engineering that brings us ever closer to a future crewed mission. In April, the MOXIE (Mars Oxygen In-Situ Resource Utilization Experiment) scientific instrument aboard Perseverance managed to produce five grams of oxygen by extracting it from the Martian atmosphere. A true breakthrough for a future facility that is capable of harboring human life on the surface of the inhospitable red planet. Likewise, the amount of goods and consumables required to maintain a crew for three years (the approximate time that a mission to Mars would last) would require significant space atop the launch vehicle. To address this problem, efforts are being undertaken to grow food outside of Earth,

in space farms installed both in the International Space Station (ISS) and aboard exploration missions: in 2019, China succeeded in having seeds sprout on the Moon for the first time, inside a sealed container installed in the Chang'e-4 lander. Both ESA, in programs such as MELiSSA (Micro-Ecological Life Support System Alternative), and NASA, at Johnson Space Center Engineering, are working on support systems that allow the first explorers to grow their own nutrients.

So far, only China and the US have announced crewed missions to Mars by the 2030s. We will first have to wait for the success of the crewed missions to the Moon, which will give us much more reliable clues about the now-remote possibility of putting the first human being on this planet that is as inhospitable as fascinating.

**“IN ADDITION TO THE SCIENTIFIC EXPLORATION DATA ITSELF, EACH LAUNCH IS STILL A TECHNICAL CHALLENGE OF ENGINEERING THAT BRINGS US EVER CLOSER TO A FUTURE CREWED MISSION”**



# The Spanish contribution to exploration missions

**WHETHER THE TARGET IS THE MOON** or Mars, Spain has been taking part of the exploration missions since the first dew missions to the red planet, first with ground stations such as Robledo de Chavela, and later through the contribution of Spanish scientists to pioneering missions such as Phobos I and II (Roscosmos) and Mars 96 (Roscosmos in partnership with ESA), which saw the involvement of Spanish universities, institutions and industry in the development of part of their scientific instruments. Starting with the Rosetta mission in 2004, the Spanish space industry has participated in ESA's Mars missions and in some of NASA and Roscosmos: Mars Science Laboratory (NASA) in 2011, Phobos Grunt (Roscosmos) in 2011, Exomars (ESA) in 2016, Mars 2020 (NASA) in 2020 and ExoMars 2022.

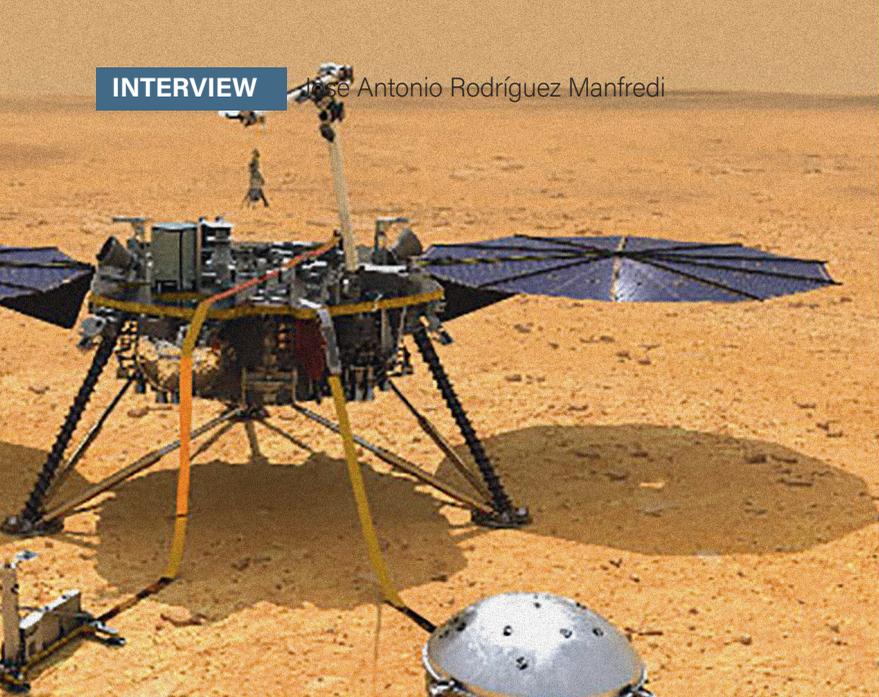
Just to mention NASA's latest missions, in MSL's Curiosity, the Spanish industry contributed with the high gain antenna (HGAS) and the REMS (Rover Environmental Monitoring Station) scientific instrument; Mars 2020's Perseverance, it once again provided the high gain antenna (HGAS) and the MEDA (Mars Environmental Dynamics Analyzer) weather station. For its part, InSight carried a Spanish manufactured instrument: the TWINS station that performs seismic measurements.

As for ESA missions, ExoMars 2020 saw a significant involvement by the Spanish industry, both in the TGO orbiter and in the Schiaparelli module, which ultimately failed to make a successful landing. This Spanish contribution will once again take place in ExoMars 2022, with national technology from almost twenty aerospace companies and scientific institutions, both in onboard instruments and in key components of the orbiter and rover.

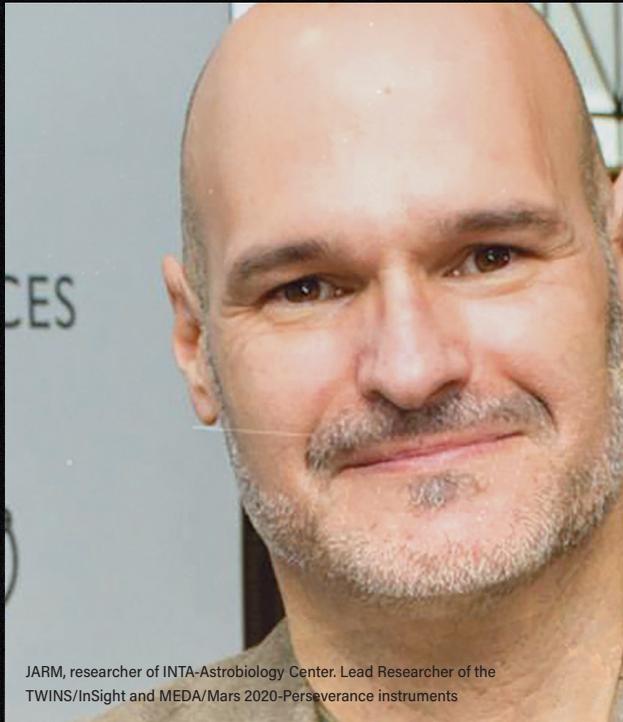
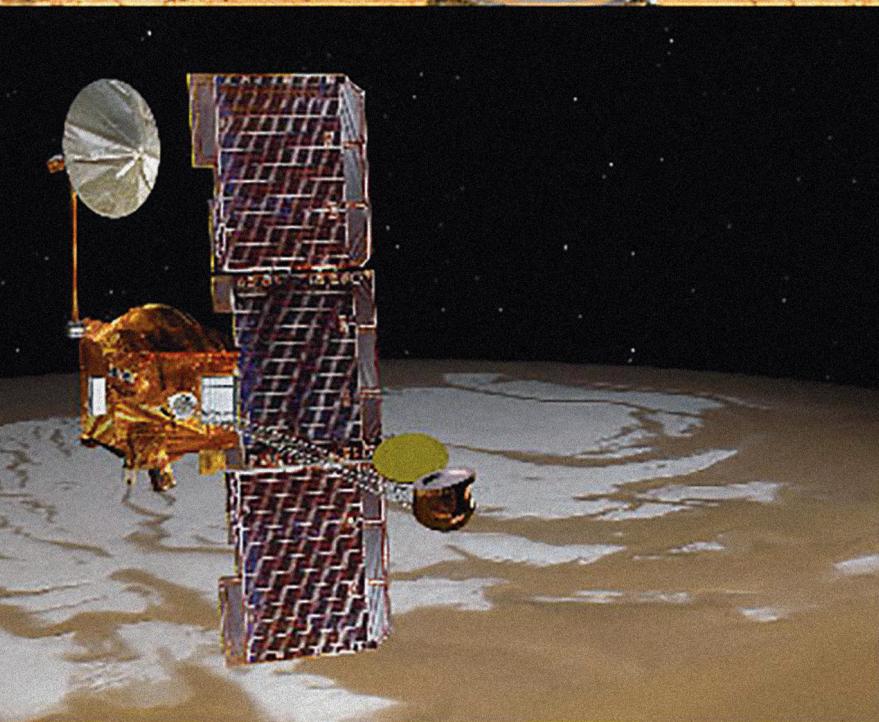
Spain has also played an important part in the exploration of our satellite, in the form of the Fresnedillas (Madrid), Robledo de Chavela (Madrid) and Maspalomas (Gran Canaria) tracking stations. These centers had an essential role in all Apollo missions, including the one that put the first man on the Moon. In the 21st century, several Spanish companies have announced contracts for the design and construction of the Gateway lunar station, meaning that several modules will count with national technology.

The continued participation of Spanish companies, institutions and universities in NASA, ESA and Roscosmos missions is evidence of the good health of the national space sector.

*Text: Francisco Lechón,  
José Antonio García  
y Oihana Casas*



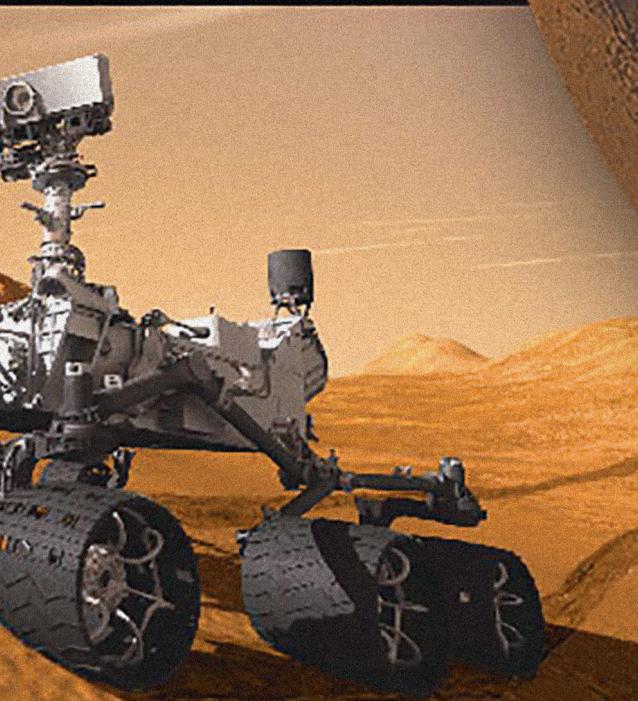
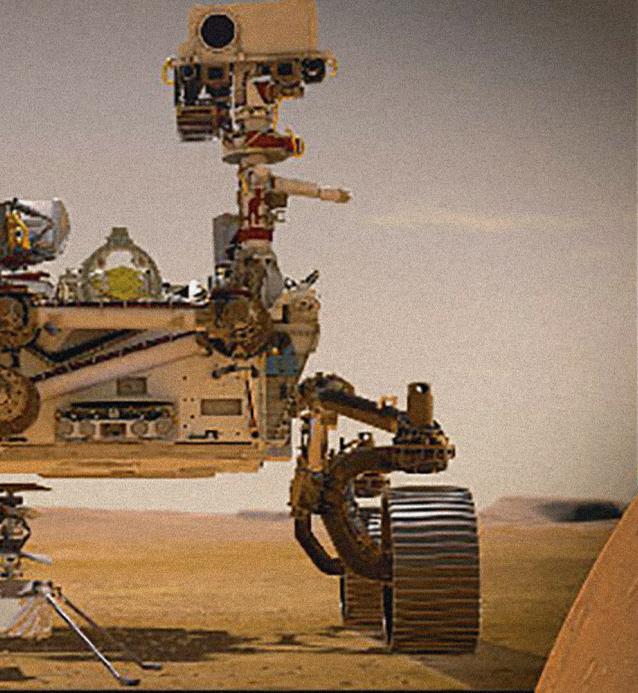
Spanish technology is present in the last three NASA missions: Mars Science Laboratory / Curiosity (on Mars since 2012), InSight (2018) and Mars 2020 / Perseverance (2021).



JARM, researcher of INTA-Astrobiology Center. Lead Researcher of the TWINS/InSight and MEDA/Mars 2020-Perseverance instruments

Few of our neighboring countries can claim to have actively participated in the exploration of Mars of the last few decades in such a significant manner as Spain has.





**José Antonio Rodríguez Manfredi**, Doctor of Engineering in Telecommunications, started working as an engineering at the University of Seville, in the Department of Systems Engineering and Automation, between the years 1999 and 2001. This same year he obtained, through the INTA, a scholarship for engineers and doctors at the recently formed Center of Astrobiology a joint effort of INTA and CSIC, and he moved to Madrid. There he held the position of director of the Advanced Instrumentation Department from 2010 to 2015 and of lead researcher of the Space Instrumentation Research Group since its formation in 2012 until today.

## JOSÉ ANTONIO RODRÍGUEZ MANFREDI

---

Jose Antonio is the lead researcher for the Temperature and Winds for InSight (TWINS) instrument of NASA's InSight mission, which is on Mars since 2018. He is also the lead researcher for the Mars Environmental Dynamics Analyzer (MEDA) instrument aboard the Perseverance rover, which is part of the Mars 2020 mission, also of NASA. His research focuses on the study and development of the space instrumentation for the exploration and environmental and geobiological characterization of other planets or moons, as well as of extreme environments on Earth. For this reason, we thought it was a great moment to interview him because of the great breakthroughs attained by the Perseverance rover.

## HOW DID YOUR RELATIONSHIP WITH NASA START, AND WHAT IS YOUR DAILY WORK AS A RESEARCHER AT INTA LIKE?

Since the moment I arrived at INTA, where I currently work, a number of great opportunities started to emerge. Probably, it all began when, in 2003, we started working with NASA at Riotinto (Huelva). The American space agency clearly saw the interest of this site and, being acquainted with the local landscape, we started working with them. At first we did not have a lot of experience in instrumentation for space applications, but we quickly learned that common language (I am not referring to English) and how to work with them. It was then that we saw that we could build a broad and strategic partnership.

A little later came the opportunity to fly to Mars as part of the Mars Science Laboratory / Curiosity mission. We had to learn on the go, but it was tremendously enriching. Space implies continuously being at the top of your game; everything needs to be highly tested and offer the highest chances of things going right, so you need to be very careful when defining your goals as well. We barely had any experience building or working with environmental stations, but we seized that huge opportunity.

Later, not long after the landing of Curiosity in 2012, NASA published selection for the upcoming Mars mission: InSight. So, while visiting the JPL, we proposed the mission team

**“Perseverance is collecting soil and rock samples that can be brought back to Earth for a more detailed analysis”**

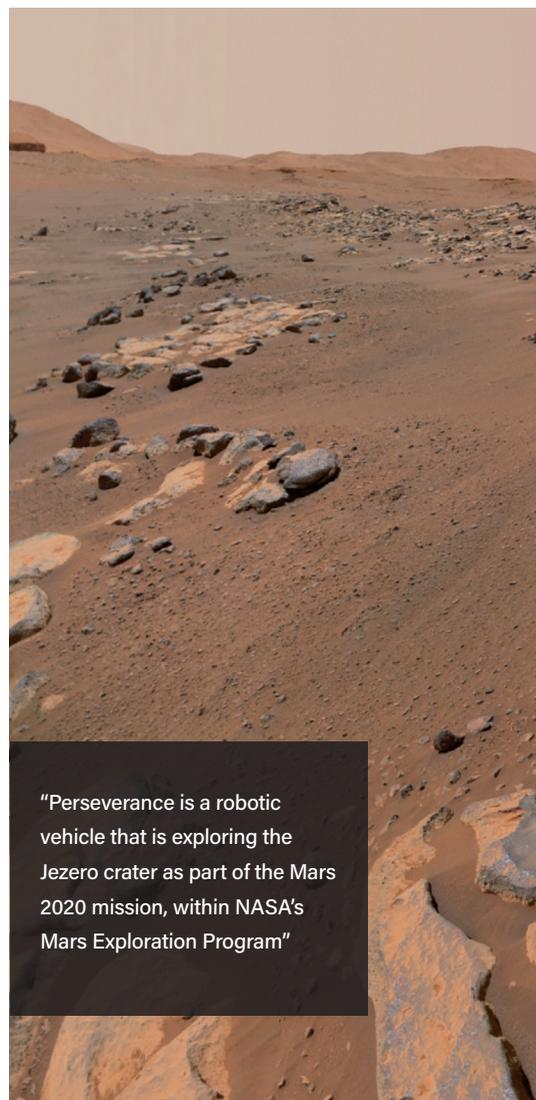
to use the REMS spare units as the weather station for that new mission. They immediately saw the advantages (an already developed instrument, risk free and correctly working on Mars aboard Curiosity) and we started working on adapting that hardware to the requirements and demands of InSight.

At the time we are enjoying the interesting data that the third environmental station that we have developed during the last few years the MEDA station aboard Mars 2020 / Perseverance is sending us every day since its arrival to Mars last February. When compared to its “older sisters,” this last instrument is a new generation of environmental stations that makes the most out of all the scientific and technological experience acquired with the previous systems.

## HOW IMPORTANT IS THE SPANISH CONTRIBUTION TO THE EXPLORATION OF MARS, AND SPECIFICALLY, THE PERSEVERANCE ROVER?

Few of our neighboring countries can claim to have actively participated in the exploration of Mars of the last few decades in such a significant manner as Spain has.

In our country there is a fair amount of research groups and companies that contribute toward the study of our neighboring planet one way or the other, and toward the development of technology to that end.



“Perseverance is a robotic vehicle that is exploring the Jezero crater as part of the Mars 2020 mission, within NASA’s Mars Exploration Program”

The INTA and the Astrobiology Center (CAB), together with other institutions and industries that compose the national consortium of the MEDA instrument, have the privilege of being at the forefront in the exploration of other worlds, both scientifically and technologically. This consortium, led by INTA-CAB, is formed by the Consejo Superior de Investigaciones Científicas, the University of Alcalá, the Polytechnic University of Catalonia, the Polytechnic University of Madrid, the University of the Basque Country, the University of Seville and the Institute of



Microelectronics of Seville, as domestic partners, and the Jet Propulsion Laboratory, Finnish Meteorological Institute, NASA Goddard Space Flight Center, Cornell University, Carnegie Institution, University of Michigan, Space Science Institute, Lunar and Planetary Institute, Aeolis Corporation, Southwest Research Institute, John Hopkins APL, and the Università degli Studi di Padova as international research partners. We also counted with the important contribution of Airbus-CRISA, Added-Value-Solutions (A-V-S), and ALTER Technology.

We also have the good fortune of having the three stations that were sent currently operational, which makes up a Spanish mini meteorological network, if you will, on another planet, which is of significant value to validate Martian atmospheric models. Through them, we contribute to a better understanding of the environmental dynamics of the planet, which is particularly important when considering future crewed missions.

In addition to our involvement in Perseverance, another Spanish group

led by the University of Valladolid is part of this NASA mission with the SuperCam instrument. Airbus CASA Espacio – CDTI has also developed the high gain antenna that the robot uses to communicate with Earth. And the technology contributions to the exploration of Mars do not stop there: other groups are also participating in the ExoMars mission, both with the Rosalind Franklin vehicle and with the Kazachok platform. This is in addition to research groups that analyze the data received from orbiters, surface missions and ground telescopes,

and make significant contributions to gaining a better knowledge of our neighboring planet.

Because of all of this, I think it is important to recognize the privileged position of our country, not only when it comes to the study of the Martian atmosphere both scientifically and technologically, but also at the heart of the international Mars planetary community.

**WHICH VEHICLES SENT TO MARS CARRY TECHNOLOGY FOR WHICH YOU HAVE BEEN INVOLVED IN ITS CREATION?**

Spanish technology is present in the last three NASA missions: Mars Science Laboratory / Curiosity (on Mars since 2012), InSight (2018), and Mars 2020 / Perseverance (2021). These contributions are evidence of the high scientific and technological level of our country.

In addition to the environmental stations that we have already discussed and in which I have been involved, as

I was saying, Spain has contributed with high gain antennas that allow both Curiosity and Perseverance to communicate with Earth and with the calibration patterns of the SuperCam American-French instrument.

On the other hand, the European Space Agency and Roscosmos will launch the next stage of the ExoMars mission next year, the Rosalind Franklin vehicle and the Kazachok platform. Both of them will also have a significant Spanish contribution: a Raman spectrometer, part of the meteorological package, and the anisotropic magnetoresistance sensor.

**UNTIL NOW, MARS STUDIES FOCUSED MORE ON ITS SURFACE. HOW IS THIS MISSION DIFFERENT FROM THE PREVIOUS ONES? WHY IS IT IMPORTANT TO EXPLORE THE SUBSOIL OF MARS? WHAT MILESTONES HAS THIS MISSION ATTAINED AND WHICH ARE YET TO BE ACHIEVED?**

In today's context of an arid, barren Mars, the subsoil turns out to be a somewhat more benign environment for any potential life that may have emerged to be able to survive and adapt.

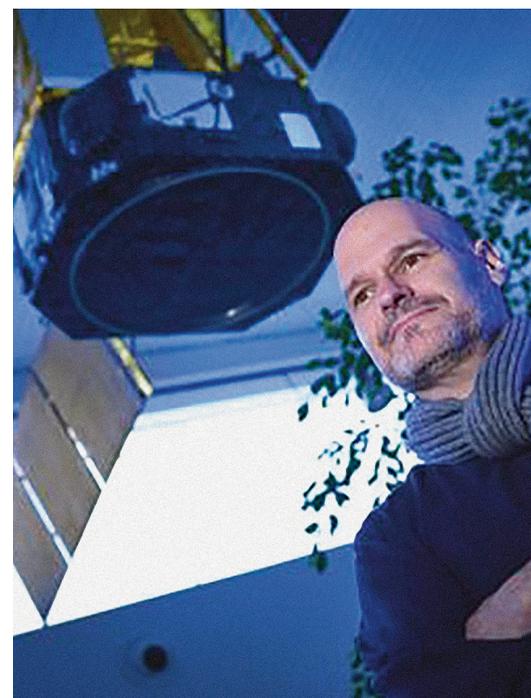
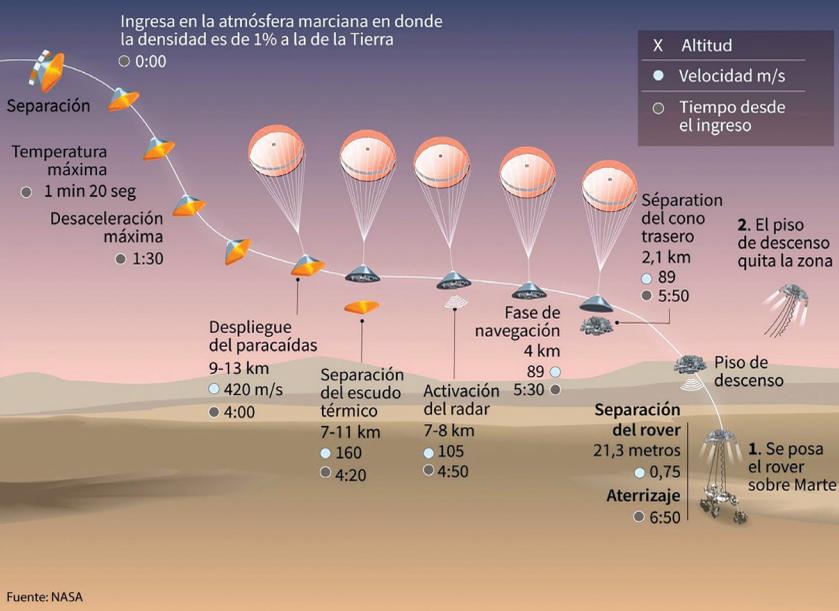
Due to the light atmosphere that is present, the harmful ionizing radiation that strikes the surface reaches sufficiently high doses to preclude (or at least significantly hamper) life from thriving in that environment. However, when going a few millimeters deeper, that radiation is significantly filtered out by the dust and material deposits that cover the soil.

Therefore, a somewhat more benign environment such as the Martian subsoil, which also contains the necessary chemicals, water reservoirs and a certain access to energy sources, could well constitute a biosphere where Martian microbial life may have survived... if it ever emerged.

For now, we have no proof that life ever emerged on the red planet, let alone of it still being present. Those are the proofs sought by the scientific community through Perseverance, Rosalind Franklin and the future

**Los "7 minutos de terror" de Perseverance en Marte**

El aterrizaje del rover de la Nasa, previsto el 18 de febrero, es la fase crítica de su viaje



missions that we will send in the next few years, as I already mentioned.

## **WILL THIS LATEST NASA MISSION BE ABLE TO SEEK DIRECT AND UNQUESTIONABLE PROOF OF LIFE ON MARS, OR WILL WE HAVE TO WAIT UNTIL A POSSIBLE CREWED MISSION TO THE RED PLANET?**

The previous missions mainly Mars Exploration Rovers / Spirit and Opportunity, and Mars Science Laboratory / Curiosity yielded important evidence of a humid past and favorable habitability conditions for microbial life, present many billions of years ago, before the great Martian climate change.

However, before that climate cataclysm took place, it is possible that life had already emerged in the neighboring planet (at least, that is our hypothesis), as it had already on Earth under very similar environmental conditions to those on Mars.



Perseverance was launched on July 30 from Cape Canaveral, Florida, and landed on Mars on February 18, 2021.

So, this time around, Perseverance is not only going to perform a thorough analysis of the geological and mineralogical environment and the habitability of the landing site the Jezero crater, like Curiosity has been doing at Gale crater since its landing in 2012. In addition to this, the Perseverance rover will go a little further in the study of the astrobiological environment, focusing on the search for potential traces of past Martian life.

In this context, the Rover will use its advanced instruments to identify the samples of rock and soil that maximize the chances of finding traces of that potential past life. It will collect them, store them and later deposit them on the ground, lying in wait for a future mission to pick them up and bring them to Earth for detailed study someday. The European Space Agency and NASA are already working jointly on that program, called "Mars Sample Return."

So, strictly speaking, and with the lessons learned from the Viking missions, Perseverance's objectives do not aim to definitely prove the existence of past life on Mars, or otherwise. This mission needs to be seen as the first step in the ambitious strategic program that will enable us to reach that conclusion (hopefully) by collecting, bringing back to Earth, and thoroughly analyzing the samples with all of our scientific and technological capabilities. In this way, as Carl Sagan is usually attributed with saying, we will be able to find the extraordinary evidence required for the confirmation of the existence of life outside of our planet.

## **HOW MUCH OF THE KNOWLEDGE GENERATED ABOUT MARS LEADS TO A BETTER KNOWLEDGE OF EARTH AND THE SOLAR SYSTEM IN GENERAL?**

During the first 1-1.5 billion years since the formation of the Solar System, right before the Martian climate change that we discussed earlier, the evolution of

Mars and Earth ran in parallel. While the cooling down of the neighboring planet led its evolution to the current state that we now know it is in, it is also true that the end of its volcanic activity and its tectonics have allowed Mars to offer us a unique window into what a rocky, terrestrial, habitable planet can be in its infancy.

That window allows us to better understand and know the formation and geologic history of our own planet through the comparative studies that we perform; how the Martian climate has shifted so significantly throughout time, and how that change has affected and has been preserved in its morphology and surface composition.

## **HAS STUDYING MARS FOR SO MANY YEARS CHANGED YOUR OUTLOOK ON LIFE ON EARTH?**

Absolutely. Astronauts usually say that when they see Earth from space they are overcome by a feeling of significance, pondering on how small we are in an almost infinite universe. Differences aside, something similar happens to me.

*Text: Iñaki Latasa*



# Back to the Moon

Apollo 17 was the last crewed mission to land on the Moon in December of 1972. Today, almost fifty years later, we are preparing to give the first step in the next era of human exploration. The Artemis program led by NASA in collaboration with commercial and international partners will establish, during this decade, a sustainable presence on the Moon to learn and prepare the next step: crewed missions to Mars.

On this occasion, the Spanish industry is part of this enterprise. Our equipment will be aboard the Orion spacecraft that will take the astronauts to lunar orbit and back to Earth. We will also be present on Gateway, the spacecraft that will support the missions on the lunar surface.

## ABOUT THE IMAGE

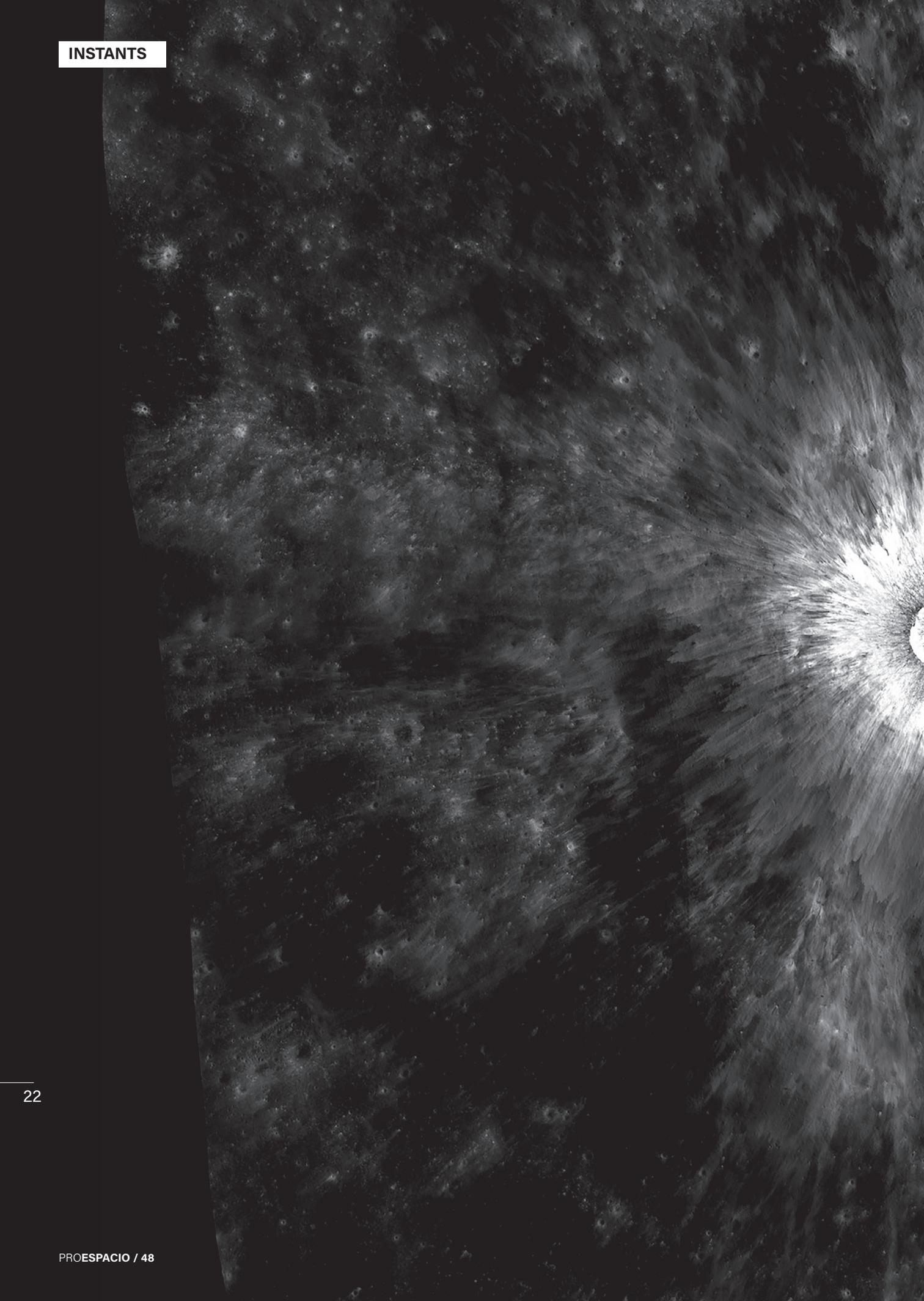
### Apollo 17 Extravehicular Activity

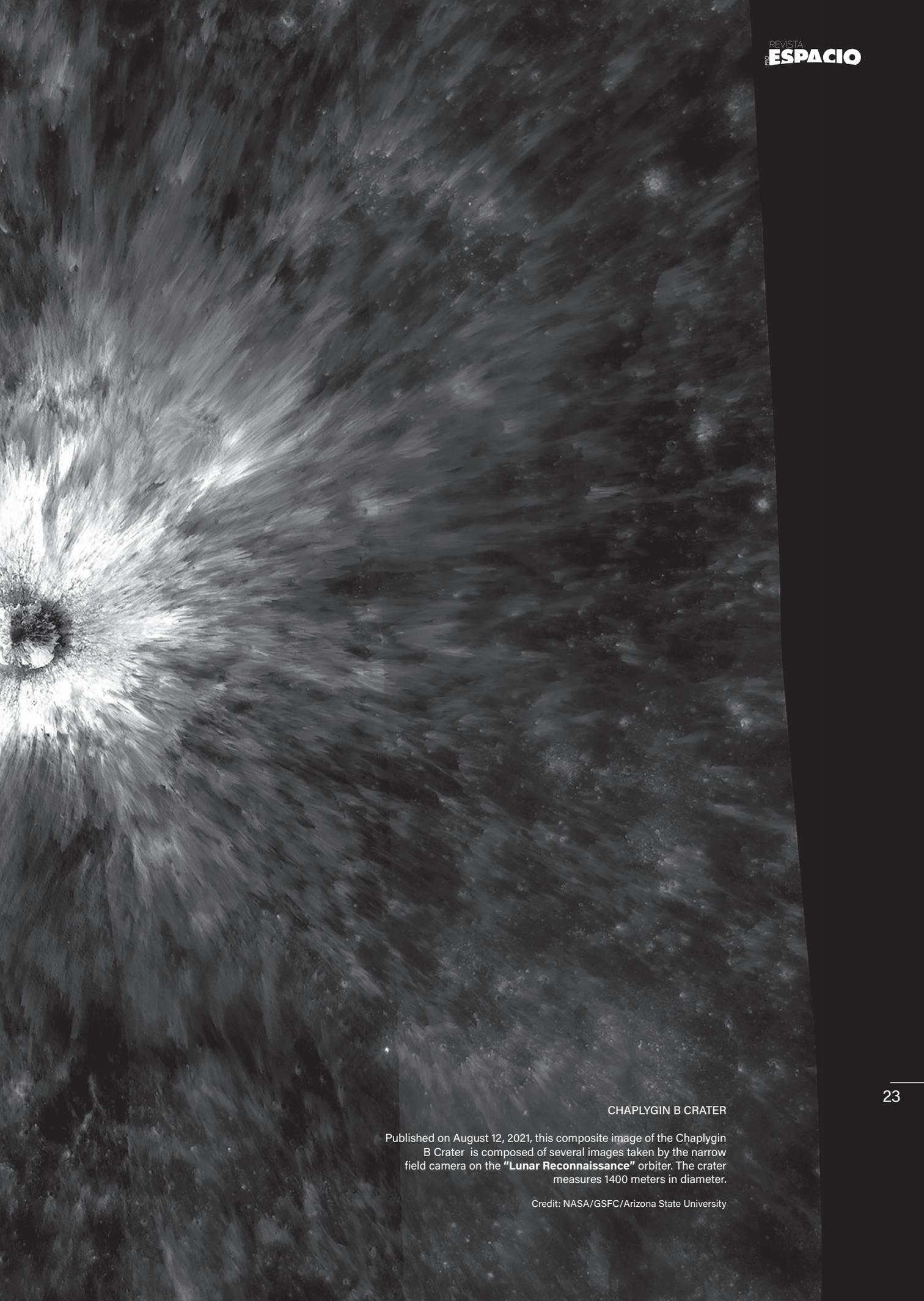
Composite made from two photographs taken with Apollo 17's Hasselblad in 1972. Astronaut Harrison H. Schmitt can be seen during the mission's third extravehicular activity.

Credit: NASA/Eugene Cernan

Texts: NASA/Mar López





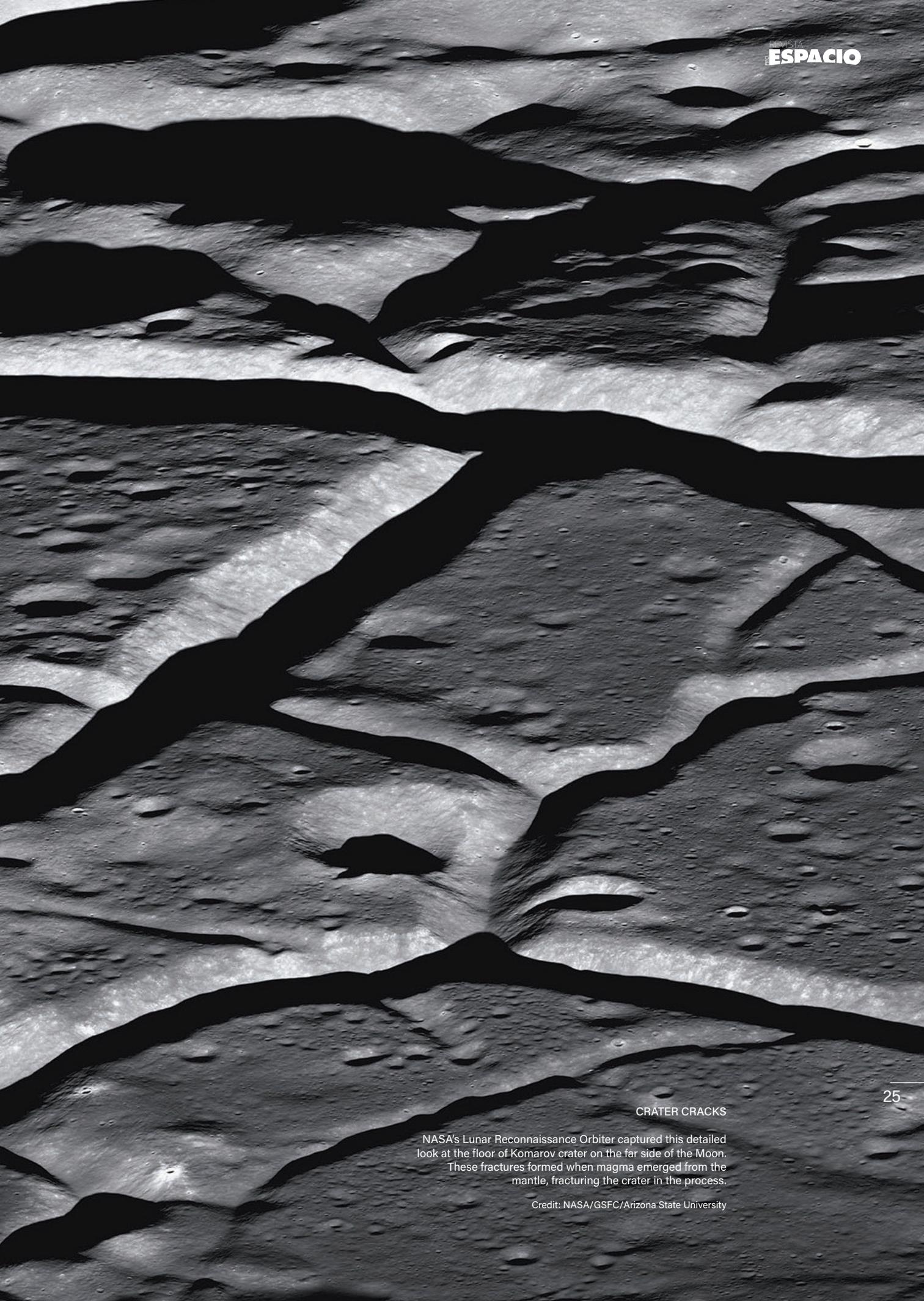


CHAPLYGIN B CRATER

Published on August 12, 2021, this composite image of the Chaplygin B Crater is composed of several images taken by the narrow field camera on the "Lunar Reconnaissance" orbiter. The crater measures 1400 meters in diameter.

Credit: NASA/GSFC/Arizona State University





CRÁTER CRACKS

NASA's Lunar Reconnaissance Orbiter captured this detailed look at the floor of Komarov crater on the far side of the Moon. These fractures formed when magma emerged from the mantle, fracturing the crater in the process.

Credit: NASA/GSFC/Arizona State University





FULL MOON FROM THE ISS

The full moon photographed as the International Space Station orbited at 400 Km over the Pacific, north-east of Guam.

Credits/Editor: Mark Garcia

Held from September 1 through 3  
in Santander (Cantabria)

# Space, vital for military operations

The annual AMETIC Seminar "Satellites as a key element for the security and defense of government applications" reached its 13th edition, after its interruption in 2020 due to the pandemic. A much expected gathering with a tight schedule that addressed a number of fundamental issues for the Spanish Space Industry, the Armed Forces and the Administration in relation to space, both as a country and within the European landscape.

In a special opening speech by **Admiral General Teodoro Esteban López Calderón, Defense Chief of Staff (JEMAD)**, he stressed that "space assets are of strategic importance in the fields of security and defense, and are conditioned by technological innovation."

He also highlighted the importance of satellite capabilities for command, control & communication operations; Earth observation for geospatial intelligence, navigation systems, *meteosat data* and *targeting*.

in addition, he analyzed the current and future projects that the Ministry of Defense is focusing on and which are vital to its military activities, which include: the bandwidth increase via the UHF of the new SPAINSAT NG satellites, the acquisition of a proprietary optical satellite (Helios II is nearing the end of its service life), the acquisition of a new radar system to replace the PAZ satellite at the end of its service life, and the importance of the services offered by Galileo.

The Admiral remembered the milestone reached with the creation of the Centro de Operaciones de Vigilancia Espacial (Space Surveillance Operations Center, COVE) in 2019, with the mission of surveilling and knowing the situation of space and providing support services to all other operations carried out by the Armed Forces, which will reach its top operational capabilities by 2023.

His speech can be summarized as achievements and projects, where he insisted on the "importance of outer space in all military operations."

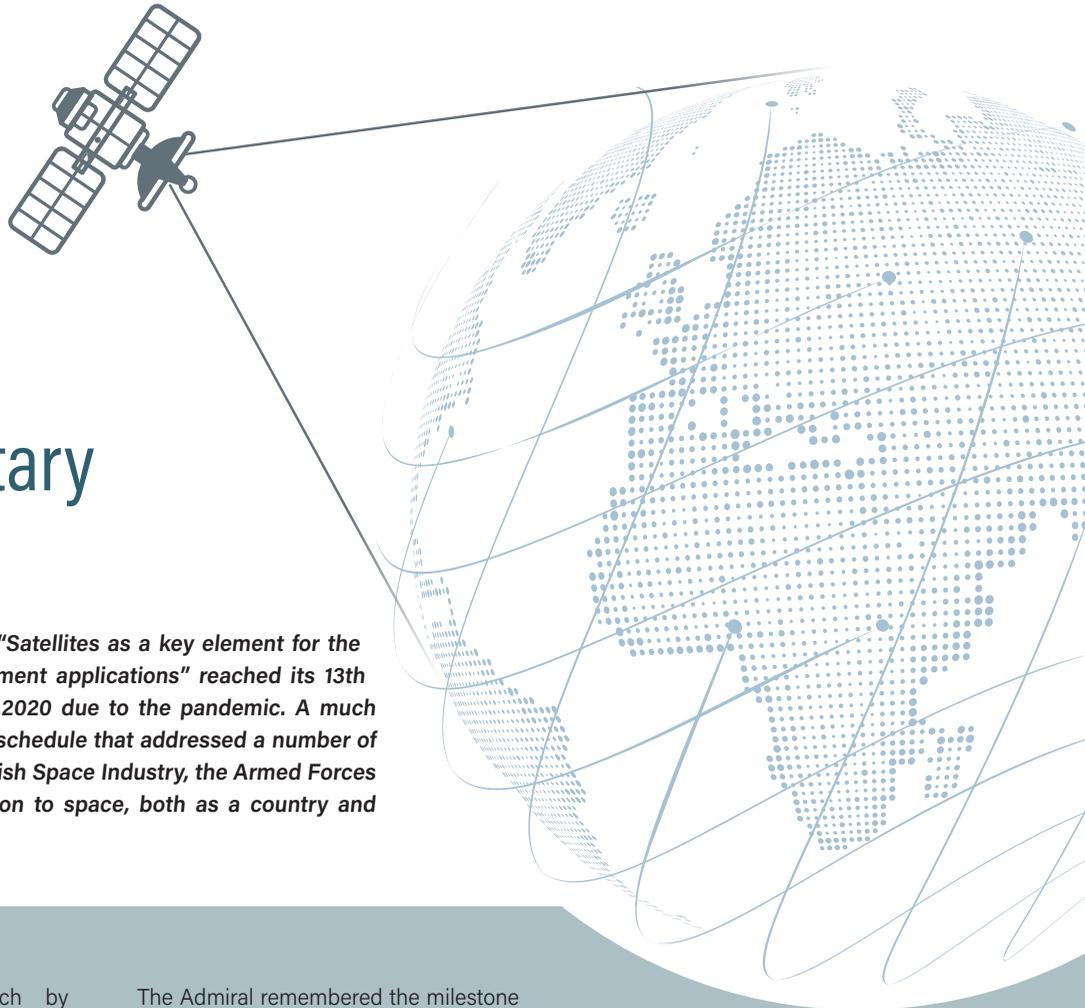
## THE IMPORTANCE OF SATELLITES IN OPERATIONS AND MISSIONS ASSIGNED TO THE ARMED FORCES

The first roundtable related to the title above included a number of experts of the three branches of the armed forces. During his talk, the **Chief of the Fuerza Terrestre (Land Forces), Lieutenant General José Rodríguez García**, highlighted that "units

must be prepared to perform missions under the best conditions, and their needs include satellite capabilities that increase redundancy in high intensity combat, humanitarian efforts and the orientation of antennas for a higher mobility."

The **Chairman of the Joint Chiefs of Staff (JEMACON), Lieutenant General Fernando Gonzalez**, firmly stated that "in all military operations, it is essential to control space, and for this reason it must be secured." He gave examples of the important role of satellites in scenarios such as Afghanistan and the Ceuta border, in addition to stressing the challenges of the militarization of space, calling on the audience to reflect on the level of national ambition in this regard.

For his part, the **Commander of the Mando de Operaciones (Operations Command), Lieutenant General Francisco Braco Carbó**, pointed to the need for a Law that regulates space. And



“SPACE IS INCREASINGLY CLUTTERED BY SPACE JUNK, WE NEED TO MOVE FORWARD WITH A CIVILIAN AND MILITARY SPACE MANAGEMENT SYSTEM”

GD. JUAN FRANCISCO SANZ

Roundtable on the subject of SST



Lieutenant General Francisco González-Espresati, Chief of the Mando Aéreo de Combate (Aerial Combat Command) highlighted “the importance of space superiority in a country, with special focus on capabilities that guarantee a decisive control over the operations.”

Vice Admiral José María Núñez Torrente, Commander of the Cuartel General Marítimo de Alta Disponibilidad (High Availability Maritime Headquarters) gave a number of important messages, highlighting the fact that “there are no military operations without space, and space is cross cutting, it is necessary to guarantee space superiority.” As head of the ATALANTA operation against piracy, he highlighted that “the naval force will continue relying more and more on satellites and UAVs.” In the field of communications, “the SPAIN-SAT NG Program will provide us with new capabilities and we are already working on other virtual twin concepts with NAVANTIA, the creation of virtual remote platforms and artificial intelligence.” In closing, he brought forward “the

challenge of guaranteeing access and interoperability with allied navies.”

Next, the “New challenges of the Spanish Space and Defense Industry: Next Generation Funds” conference was given by the president of TEDAE, Ricardo Martí Fluxá, who insisted on “acknowledging the leadership of our country as a European leader in Space and Defense and taking advantage of the European recovery funds.” He also stressed the importance of increasing cybersecurity and proposing new, more competitive business models.”

### THE SST EUROPEAN PROGRAM

This important subject was the focus of another roundtable moderated by Alfonso Pérez de Nanclares, Commander of the Satellite and Cyberdefense Command of the General Sub directorate of Programs of the DGAM. **The Chief of the Aerospace Surveillance and Control System of the Aerial Combat Command, Division General Juan Sanz Díaz**, highlighted “the current situation of space, which is

increasingly cluttered by space junk, and the need to move forward with a civilian and military space management system.”

The ground and operations segment of GMV also gave their opinion through Miguel Angel Molina, Strategy and Business Development Director, expressing the will to “turn it into a leading program of the European Union.”

### LTHE SPACE INDUSTRY AND THE NATIONAL CHALLENGES

With an optimistic outlook on the current situation of the industry, and summarizing the Strategic Projects for Recovery and Transformation of the Economy (PERTE), Raul Blanco, Secretary General of Industry and SMEs, part of the Ministry of Industry, Commerce and Tourism, claimed that they are “working on the Statements of Interest of several space programs focused on different fields which include Earth Observation Satellite capabilities, quantum communications, etc.” And he closed by saying that “all projects that are set in motion today will allow us to grow during the next twenty years.”

## THE NATIONAL STRATEGY IN EUROPE'S GNSS

The Administration also gave its view on the GALILEO program, the European satellite navigation and positioning system of the EU managed by ESA and operated by the European Union Agency for the Space Program (EUSPA). **María José Rallo, Secretary General of Transportation of the Ministry of Transport, Mobility and Urban Agenda**, stated that "Galileo has demonstrated that Spain is highly competitive, especially in the next generation satellite control and construction segment."

Galileo's services include the Public Regulated Service (PRS), which was born out of an analysis of possible threats to the Galileo system and the identification of scenarios where jamming its signal could harm national security or economic activities in important geographic regions. According to Rallo, "taking part of the PRS modules has essential economic benefits for us." He concluded by raising awareness about the potential challenge that is brewing in relation to commercial space transportation.

## EARTH OBSERVATION

Three years after the PAZ radar satellite was put in orbit, its performance and operability was assessed in a positive light, while also discussing other new requirements that have emerged during that time that must be taken into account in a future radar system set to replace the current one at the end of its service life.

The **Chief of the Center for Aerospace Observation Systems (CESAEROB)**, Colonel **Francisco Javier Hidalgo Rivero**, highlighted "how important it is for the national defense system to have the independence and discretion offered by PAZ, which has made us addicted to the radar spectrum, thanks, in part, to its great performance."

With sights set on the mid term future, he noted the new technological needs they have been faced with: "a demand for more spatial resolutions and a higher radiometric performance, in addition to increasing the accessibility to objectives and the real time obtainment of images and the memory aboard satellites." He

closed his enthusiastic talk by insisting on going one step further with PAZ: "we want a system that is faster, more robust and reliable."

His talk was followed by the Hisdesat Payload Director, **Basilio Garrido**, who informed the audience that during these three years in operation, the PAZ satellite has provided the Ministry of Defense with over 35,000 images. He also highlighted a few milestones reached since last year, such as: two new modes of operation (making a total of five now) without service interruption, the adaptation of the operational space and ground segments and a consolidated service working at peak performance. He stressed the need to increase its speed to less than 60 seconds per shot, to have a revisit capacity of less than 24 hours, and to achieve a higher resolution and bandwidth, despite these being conflicting requirements. He insisted that "there is no system like PAZ operating at the time in the entire globe."

The PAZ satellite contractor, Airbus D&S, through the words of **Alfonso Martínez, Director of Systems Engineering**, revealed that "the experience acquired



Roundtable on satellites and the Armed Forces.



through the operation of PAZ is invaluable and we must apply it to a future PAZ 2." In regard to the idea of developing a new system, the company proposes an active antenna, multiplying the image resolution by four, adding a 12 TB memory and the NEO platform. He highlighted that "over 65% of a new radar satellite can be developed by the Spanish space industry."

**Diego Rodríguez, director of the Space Department of SENER Aeroespacial,** pointed to "the need to count with driving programs that get started as soon as possible."

### EDIDP Y EDF

The conference of the Assistant Director General of Planning, Technology and Innovation (DGAM), Division General José Luis Murga, entitled "a window into industrial growth," started with him pointing out "the need to guarantee the access to space, give an increasing level of attention to New Space initiatives and foster a coherence in the planning of capabilities and resources of the EU and the Ministry of Defense."

He highlighted the importance of the programs that are being undertaken within the framework of the European Defence Industry Development Program (EDIDP), such as: GEODE (GALILEO for EU Defense), OPTISSE (very high resolution optical payload for Smallsat for Defense Applications), PEONEER (Persistent EO for actionable intelligence, surveillance and reconnaissance), in addition to another four programs: NEMOS (Navy Earth Map Observation Sat), INTEGRAL (International Gamma Ray Astrophysics Laboratory), SAURON (Scalable Multidimensional Situation Awareness Solution For Protecting European Ports) and ODIN'S Eye (multinational initiative for a missile early warning architecture based in space).

### I3D Y ESPACIO

Within the framework of the Integral Information Infrastructure for the Ministry of Defense (I3D), the **Director of the Center for Defense Information and Communication Technology Systems (CESTIC), Division General José María Millán Martínez,** stated his

satisfaction over the good results yielded by the Personnel Support Systems in Operating Areas Program (SAPZO). This initiative, led by UTE, Telefónica and Hisdesat, takes quality "welfare" services to international land and sea operating regions, allowing Spanish troops deployed off country to have access to multimedia streaming contents (TV series, movies, documentaries, etc.), educational content (languages, training courses, etc.), access to broadband internet and safe telephony services, through their own devices, whether mobiles, tablets or personal computers. This used to be entrusted to local providers, implying a significant vulnerability.

The General also praised the great investment project for 65 million euros within six years for essential capabilities to be provided by the new SPAINSAT NG satellites, with a significant impact on the I3D: "the X capacity will be multiplied by 4, Ka by 35, and we will count with 760MHzx2 on the X band and 648MHzx2 on the Ka band."



GNSS,  
María José Rallo, Secretary General of Transportation of the Ministry of Transport, Mobility and Urban Agenda.

**"GALILEO HAS DEMONSTRATED THAT SPAIN IS HIGHLY COMPETITIVE, ESPECIALLY IN THE NEXT GENERATION SATELLITE CONTROL AND CONSTRUCTION SEGMENT"**



## CHALLENGES FACING THE NEW (2021-2027) EU MFF

This roundtable raised great concern around the feasibility of managing the European funds and retaining talent in the corporate world.

**Manuel Lobeira, general director of ACORDE Technologies**, called for "reorienting the technological focuses in the face of the problem of having too many funds to execute programs and little time to do so, on top of the issue of the lack of qualified personnel." Along this same line, another participant, **Sergio Gamo, Telefónica's Defense and Intelligence Strategic Account Manager**, stated the "need to focus funds while retaining talent, choosing projects well, betting on New Space and projecting what was learned in Europe to implement initiatives in Latin America.

**"SPAIN NEEDS TO BE IN THE LEAD IN THE NEW SPACE GROUP AND FOR THIS IT IS NECESSARY TO ESTABLISH A CONVERGENCE STRATEGY BY BEING STRONG IN THAT FIELD AND POSITIONING THE INDUSTRY IN THE TRADITIONAL LARGE SATELLITE SECTOR"**

GENERAL DIRECTOR OF THE INTA  
LTG José M<sup>a</sup> Salom

To summarize, the roundtable's moderator, **Division General Antonio Planells**, assigned to the DIGAM, concluded by highlighting the need to establish a "space leadership, work toward a unique digital market, dual usability and the fostering of opportunities for SMEs."

## SPACE STRATEGY IN THE EU

As stated by **Pascual Navarro**, the **Director General for Europe** of the Ministry of Foreign Affairs, the ministry's vision is that "it is necessary to foster an innovative industry, with autonomous

access to space, simplify the governance and guarantee the continued leadership in Europe, maximizing the benefits of space." He also highlighted Europe's work on space traffic through research activities, the development of capabilities, the standardization, the definition of operational capabilities and safety.

## INTA AND THE CHALLENGES OF SPACE

**Lieutenant General José María Salom, director general of INTA**, reflected, during the final moments of the seminar, about space as a "strategic, horizontal and dual use" element and highlighted the



importance of the public sector as a "user, promoter and regulator."

He stated that "Spain must be in the lead in the New Space group and, for this, it is necessary to establish a convergence strategy by being strong in that field and positioning the industry in the traditional large satellite sector." And he closed his speech by saying that "space is dual use and the sector must be developed with that duality as the most efficient approach."

## CHALLENGES AND NORMALITY

The last roundtable addressed the unavoidable subject that has driven our personal and work agendas this past year, under the title "The defense industrial and space sector in the post Covid era." Many companies, like Airbus D&S, Hisdesat, TASE, INDRA, and ISDEFE, gave their specific views based on their experiences during this difficult period, where they made special efforts to adapt their personnel, facilities and projects while taking care of the business side, which has continued operating generating positive results.



**Pedro Fuster, Assistant Director General of Inspection, Regulation and Industrial Strategy for Defense (DGAM)** and moderator of the roundtable, thanked the attendees and the organizers for resuming this annual gathering, which he qualified as a "space summit" that serves as a starting point for the space related work of the Spanish Administration and Industry.

**The Director General of Armament and Materiel, Admiral Santiago Ramón**, was in charge of closing the Seminar.

Text and photos: **Araceli Serrano**

*At home, I was the youngest of  
all siblings and I grew up orbiting  
the candies jar*



## INTERNATIONAL SPACE UNIVERSITY (ISU) SUMMER COURSE

A new edition of the International Space University's (ISU) "Space Studies Program" (SSP) has been held this summer in Granada, from June 28 to August 27.

The program is targeted at graduate students and professionals from all fields who wish to broaden their knowledge, since it covers the most important fields related to space both technical and non-technical: policies and law, business and administration, humanities and life sciences, engineering, physical sciences and space applications.

One of the most outstanding characteristics of this study program is that each year it is held at a different place in the world, in line with this clear international character. This year round, the courses have

been distributed between Granada and Strasburg (ISU headquarters) as on-site classes, online conferences, team projects and via remote learning.

The president of TEDAE, Ricardo Martí Fluxá, participated in the inauguration and then moderated the "Spanish space industry for the world" roundtable where he

was joined by representatives from several Spanish companies of the sector such as Hispasat, GMV and CRISA. At this forum, he invited all space students of the world to join the Spanish space industry, which is in need of great talent to continue with its space program.

*Text: Elena Lendinez*



## THE SECOND EDITION OF FEINDEF 2021 IS AROUND THE CORNER

The International Defense and Security Exhibition (FEINDEF), which will host its second edition on November 3, 4 and 5, 2021 at IFEMA (Madrid), is a leading forum that gathers together the Defense and Security sector in Spain to innovate, cooperate internationally and share knowledge between companies, institutions, universities and other organizations as a global response to the issue of security.

This second edition will take place in halls 8 and 10 of IFEMA, and will focus on dual use technologies as the cornerstone of the future of Europe. In over 31,000 m<sup>2</sup>, around 300 exhibitors from the national and international Defense sector will join over 60 international delegations to showcase the latest military programs based on dual use Defense technology with the goal of bringing the industry closer to executives and SMEs. At the time, there are over 230 booths reserved for the event.

*Text: E.L.*

## THE HUBBLE TELESCOPE CAPTURES AN AMAZING IMAGE, A HERBIG-HARO OBJECT

Hubble's Wide Field Camera 3 takes images in visible and infrared light, which allows astronomers to see objects through space gas and dust more clearly.

A newborn star system some 1,400 light years from Earth was captured in all of its splendor in a new photo of the Hubble space telescope.

This amazing object, called HH 111, was photographed using Wide Field Camera 3 (WFC3) of the telescope and

only develops under highly specific circumstances. More specifically, they occur when newly formed stars expel very narrow jets of ionized gas that moves at high speed, which makes the gas highly charged.

The system is called IRAS 05491 + 0247 and is at the center of a particularly rare cosmic interaction known as a Herbig-Haro object actually release significant amounts of light in the visible spectrum, but are difficult to observe because the dust

and gas around them absorb most of the visible light. Therefore, WFC3's ability to make observations in the infrared spectrum, where they are not as affected by the gas and dust, is crucial to be able to successfully observe Herbig-Haro objects.

*Text: Israel Segoviano*



Image of NASA's Hubble telescope

# THE COPERNICUS PROGRAM OF THE EUROPEAN UNION OFFERS DAILY REPORTS ON THE ACTIVITY AND EVOLUTION OF THE LA PALMA VOLCANO

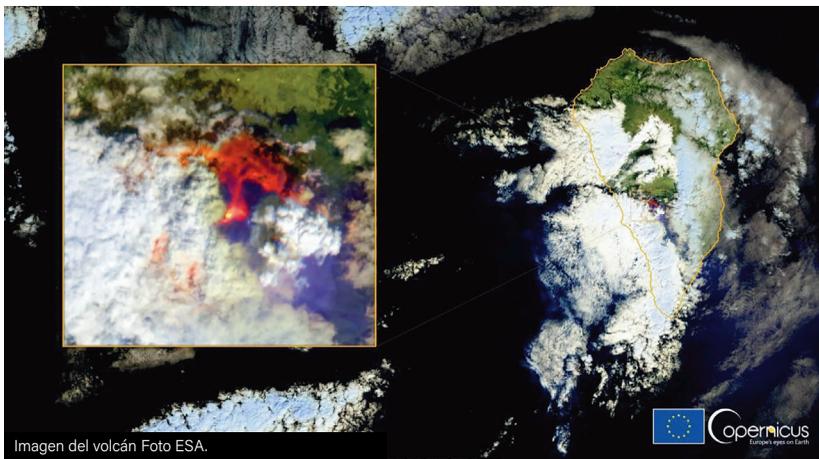


Imagen del volcán Foto ESA.

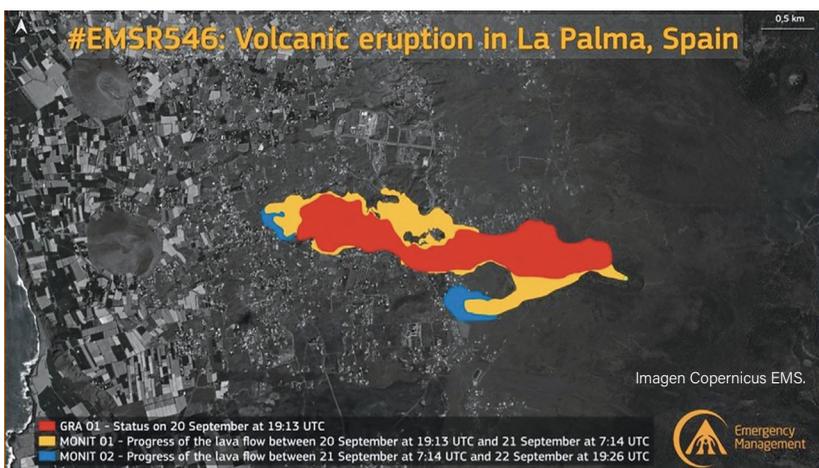


Imagen Copernicus EMS.

■ GRA 01 - Status on 20 September at 19:13 UTC  
■ MONIT 01 - Progress of the lava flow between 20 September at 19:13 UTC and 21 September at 7:14 UTC  
■ MONIT 02 - Progress of the lava flow between 21 September at 7:14 UTC and 22 September at 19:26 UTC

The volcano erupted on September 19 at 'Cumbre Vieja' (La Palma) and, since then, satellites Sentinel-2 and Paz have been assisting authorities in examining the damages and forecasting the path of the lava flow.

The European Union has activated the Copernicus service to keep the region where the La Palma volcano eruption took place under control; this enables the visualization of the lava flow, its size and the buildings affected in its path.

The data collected by the Sentinel-2 and Paz satellites offers information on the deformation of the land surface and the state of roads; and the atmospheric services offer information

on the emissions that are taking place as a result of the eruption, such as sulfur dioxide.

The Copernicus satellite based Earth Observation space program started in 2008 and the quality of its data, products and services, as well as the 'open and free' policy applied to the data it provides, have turned it into a model of excellence around the world.

It is comprised of a satellite component, with satellites called 'Sentinels', and national and private missions providing additional support.

Text: I.S.



© contains modified Copernicus Sentinel data (2021), processed by ESA, CC BY-SA 3.0 IGO.

Sentinel 2 / Copernicus



## LA PALMA'S LAVA FLOWS TOWARD THE SEA

This image, captured by the Copernicus Sentinel-2 mission on September 30 shows the flow of lava from the erupting volcano in the Spanish island of La Palma. The lava flow can be seen pouring into the Atlantic Ocean, extending the size of the coastline. This "lava delta" covered 20 hectares when the image was taken.

A crack opened up in the Cumbre Vieja volcano, on September 19th, spewing columns of ash and lava into the air. The lava flowed past the mountain and through the towns, engulfing everything in its path. By September 28st, the 6 km flow of lava had reached the ocean on the west coast of the island. Clouds of white steam were

reported where the red hot lava reached the water in the Playa Nueva area.

This image of Sentinel-2 has been processed in true color, using the short wave infrared channel to highlight the lava flow. The Sentinel-2 mission is based on a constellation of two identical satellites, each with an innovative wide swath high resolution multispectral image generator with 13 spectral bands to monitor changes in the soil and vegetation of the Earth.

Text: ESA

## A VERY SPECIAL LAUNCH

On July 30th, Ariane 5 launched the Eutelsat-Quantum satellite. The first commercial telecommunications satellite with a fully flexible payload and much of it thanks to the active antenna designed and built by Airbus Barajas.

Flight 254 launched a second passenger (Star-One-D2) held by an Airbus adapter with a plaque in memory of a dear colleague (DEP), program manager for the Ariane 5 adapters: this was one of the last programmes that he managed.



## SATLANTIS TAKES PART IN A MISSION FOR THE US DEPARTMENT OF DEFENSE

SATLANTIS' high resolution optical payload for nanosatellites iSIM-90 will be launched next December to the International Space Station, as one of the payloads selected by the US Department of Defence for NASA's STP program. The mission, called CASPR, is carried out in collaboration with the University of Pittsburgh.

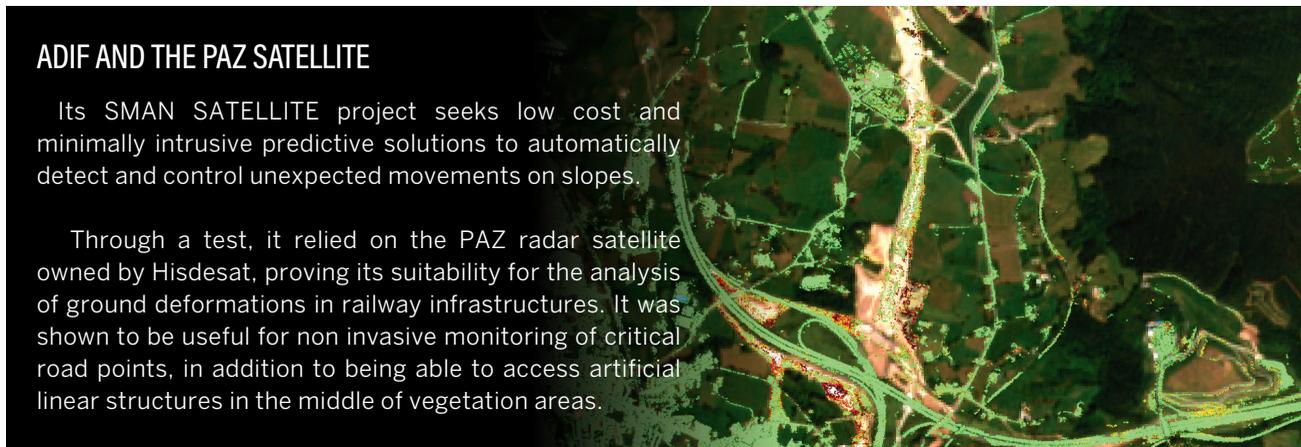
The mission aims at demonstrating in orbit the resolution, multispectral capacity, and agility of iSIM-90, plus performing the operations planned with the partners.



## ALTER TECHNOLOGY TO SET UP NEW PHOTONICS DESIGN CENTRE

The Photonics Design Centre will focus on developing highly integrated, miniaturised and robust photonic products to be used in the Quantum enabled Positioning, Navigation and Timing Systems and Photonic based Satellite optical communications.

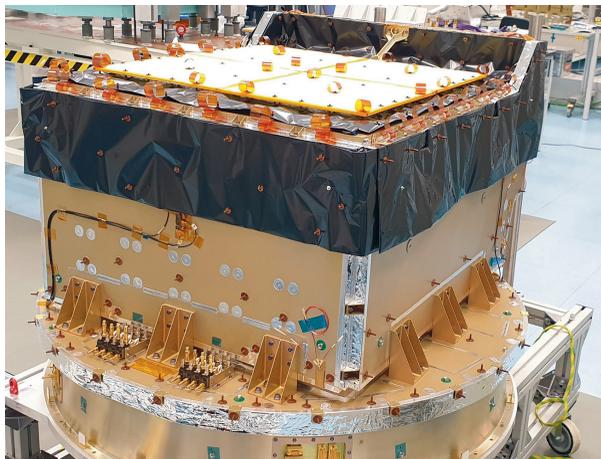
The Design Centre will complement the current manufacturing, test, qualification, and sales operations of Alter Technology with significant advancements in both design and advanced manufacturing technologies.



## ADIF AND THE PAZ SATELLITE

Its SMAN SATELLITE project seeks low cost and minimally intrusive predictive solutions to automatically detect and control unexpected movements on slopes.

Through a test, it relied on the PAZ radar satellite owned by Hisdesat, proving its suitability for the analysis of ground deformations in railway infrastructures. It was shown to be useful for non invasive monitoring of critical road points, in addition to being able to access artificial linear structures in the middle of vegetation areas.



## SUCCESSFULLY LAUNCH OF EUTELSAT QUANTUM WITH THE ELSA+ ANTENNA ON BOARD

Electronically Steerable Antenna +, the active antenna developed by AIRBUS Madrid, is already successfully in orbit with its extraordinary electronic reconfiguration capabilities.

INVENTIA participated with an important role, developing special machines to carry out RF functional tests on ground, simulating the environmental conditions to which the antenna electronics will be subjected.

This satellite, positions AIRBUS, and particularly Spain, as the European leader in active antennas.

## PLD SPACE CELEBRATES ITS 10TH ANNIVERSARY

PLD Space celebrates ten years as a company. In this period the company, founded by Raúl Torres and Raúl Verdú, has obtained the support of ESA, CDTI and public and private organizations that have made possible the progress of MIURA. In these ten years of history, PLD Space has developed and tested its own rocket engine and has developed numerous subsystems essential for the flight of the MIURA 1 and MIURA 5 launchers.



## TECNOBIT - GRUPO OESÍA

Has finished crypto security Project for CPA-INTA for the Galileo PRS National Secondary Channel, the Spanish Company is also working with GMV in a couple of ESA projects for Galileo Second Generation (G2G) in security and crypto issues. Furthermore, is also working on European consortium GEODE developing future Galileo PRS Security modules and receivers. In Flight Segment, within Spainsat NG Project, CDR milestone passed successfully.



## ELECNOR DEIMOS LAUNCHES NEPTUNO SATELLITE

Neptuno, Deimos prototype satellite for a LEO Cubesat constellation dedicated to maritime surveillance, was successfully launched on the 30th June and is now in commissioning phase.

Neptuno will identify and monitor suspicious behaviour patterns in sea to prevent potentially criminal actions. The security authorities of the Spanish Government are the key users of the system.

The satellite was designed and built in DEIMOS facilities in Puertollano, Spain. It is one of the first satellites in orbit with a primary structure fully manufactured in 3D printed thermoplastic.



### THALES ALENIA SPACE INAUGURATES ITS NEW SATELLITE INTEGRATION FACILITY IN SPAIN

With a clean area of 600 m2 and a free height of 12.5 meters in the inside, the new clean room will host the integration of large satellites, payloads and instruments for all types of space missions. The new facility was inaugurated at the site of Thales Alenia Space in Tres Cantos, with the presence of the Minister of Science and Innovation and of high representatives of the Spanish institutions and Industry.



### CORE COMPUTER EN EGNOS

Orbital, a CAF Group company, develops the Core Computer Software for EGNOS (European Geostationary Navigation Overlay Service) ground stations (NLES), an ESA project.

The software will select the optimal message from those generated in the NLES central and will send it to the geostationary satellites for later synchronization with the GPS signal. This allows users to determine their position in real time with an accuracy of 1.5m.

Orbital will certify critical software, qualified as a DAL B.



### GTD TO KICK OFF KASSAV SECOND DEVELOPMENT PHASE

GTD will carry on with the design, development and qualification of the pioneering on board safety system KASSAV2. Along with Safran, the consortium will build on the progress achieved in Flight Termination Systems (FTS) during KASSAV1 already tested on Ariane 5 flights and will be oriented towards its implementation in the future fleet of European launchers.

## CLEARSPACE TRUST IN ARQUIMEA ACTUATORS REACT

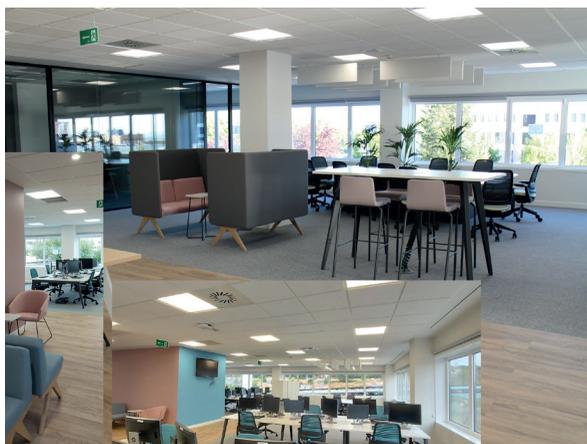
ARQUIMEA, a global technology company with more than 18 years of experience in space, supplies its actuators to ClearSpace, for the first mission to make space more sustainable and safer.

In 2025, ESA will launch ClearSpace-1 that will feature a system with large arms responsible for collecting items left in space. During launch, the arms of the system remain folded, but once in orbit they will unfold thanks to ARQUIMEA's HDRM REACT mechanisms.



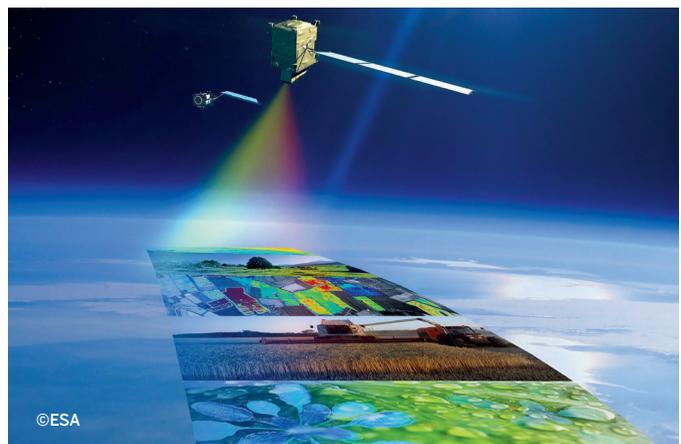
## AIRBUS CRISA: NEW TRES CANTOS

A key milestone in our transformation process we have launched new workspaces specially designed to provide us with a flexible environment fostering multidisciplinary work, collaboration and exchange. This new lay out with our projects as its core, provides with a more comfortable working environment, allows for optimised ways of working and visibly places the customer at the centre of our daily tasks.



## SENER AEROSPACIAL IN THE FLORIS SCIENTIFIC INSTRUMENT OF THE FLEX MISSION

SENER Aeroespacial is participating in ESA's Fluorescence Explorer (FLEX) mission to monitor the condition of plants from space. SENER Aeroespacial is responsible for the Instrument Optical Module Structure (IOMS) of the FLORIS scientific instrument. The IOMS includes the Optical Bench Assembly (OBA) and the Thermal Hardware (THW). In addition, SENER Aeroespacial in Poland is developing the container to transport FLORIS, which forms part of the Mechanical Ground Support Equipment (MGSE) for this space mission.



## HISPASAT OFFERS SATELLITE CONNECTIVITY TO CORREOS

The Spanish operator has started a pilot project with Correos to connect those offices located in towns with difficult access to Internet. This pilot will initially be developed in six locations and could be extended to other rural service points with connectivity difficulties. Thanks to this connectivity, the aforementioned offices will be able to join the Correos computerized network and, in this way, improve their efficiency and agility and expand their service offering.

## INSTER PRESENTS AT UNVEX ITS NEW UAV TECHNOLOGIES

INSTER's conference at UNVEX focused on the future evolution of the UAV-Fulmar, which will incorporate new sensors whose data will be integrated into a central unit with artificial intelligence, multiplying the degree of efficiency of the UAV. Among the sensors to be incorporated are the new frontal and panoramic cameras, with lenses specially designed for this platform, a synthetic aperture radar air-to-air and ground-to-air, a radio direction finder, as well as beyond line-of-sight communications using the new LEO satellite constellations.



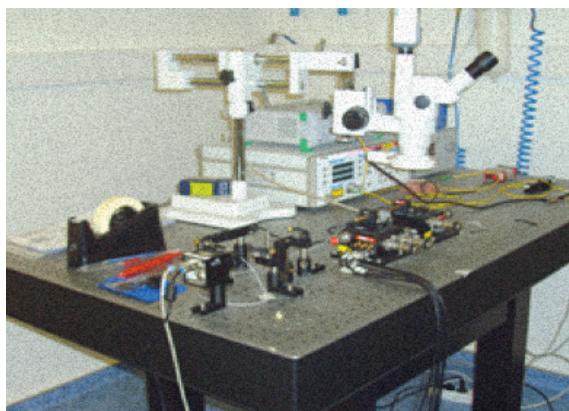
## BOOST FOR THE GALILEO SERVICE CENTRE

Telespazio Iberian will soon renew the Galileo system user support activities under the operations contract, which it has been providing at the Galileo Service Centre since 2017. Telespazio's contribution focuses on Galileo adoption, assisting the user community, market analysis and research into new services. This activity is vital given the exponential growth of Galileo usage, which already counts more than two billion devices.



## YAHSAT TRUSTS IN GMV FOR ITS NEW GENERATION OF SATELLITES

Al Yah Satellite Communications Company (Yahsat), a company from the United Arab Emirates, has selected GMV to supply essential ground elements such as the control centre and the flight dynamics system for its sixth satellite, the Thuraya 4-NGS. The project is based on GMV's vast experience thanks to its line of operational products: Hifly®, FocusSuite® and Flyplan.



## DAS PHOTONICS IS ENDING THE DEMONSTRATOR OF THE RETINA OF THE RETINA

DAS Photonics is ending the demonstrator of the RETINA Project which aims to develop several key RF-phonic building blocks, designing, fabricating and testing: multi beam TTD phased array antennas for X band, a photonic integrated beamforming network, novel configuration active X band antenna array and miniaturized space grade components and subsystems. RETINA integrates such building blocks in a test bed proving the suitability of the architecture in a SAR scenario for 64 beams, demonstrating a flexible SAR payload for missions requiring flexible frequency plans, channelization and dynamic coverage operation.

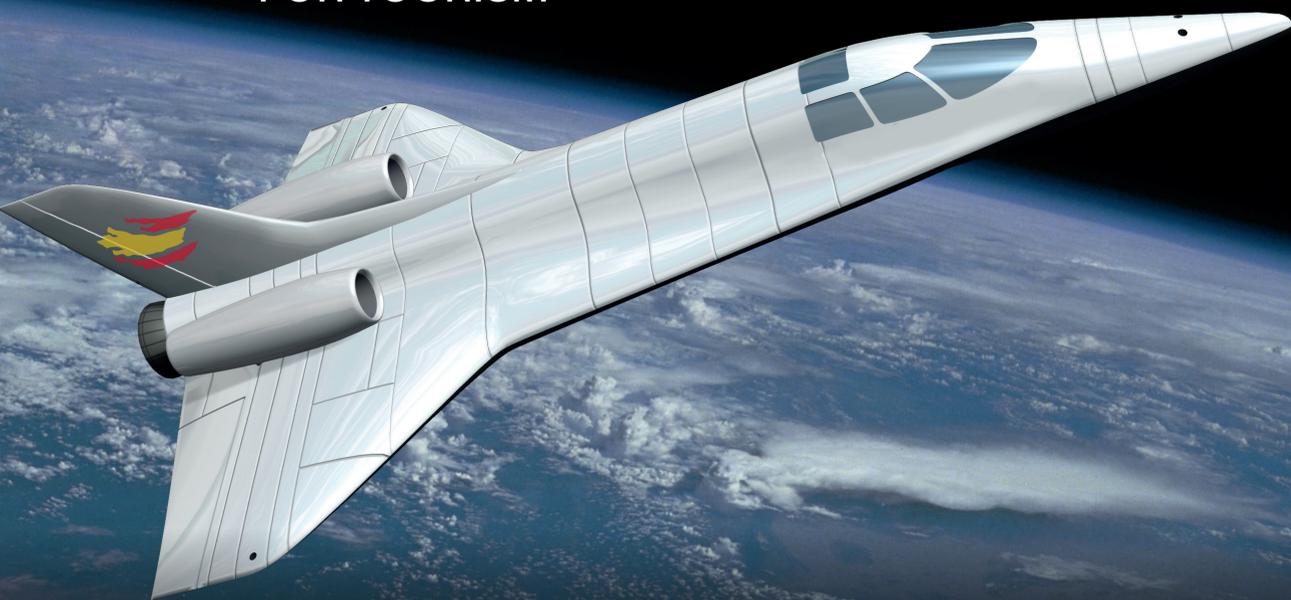
PRO MAGAZINE  
**ESPACIO**

Nº 49 | 2021

next  
issue

# Space tourism

FIRST STEPS IN THE MANUFACTURE  
OF VEHICLES AND ACCOMMODATIONS  
FOR TOURISM



plus all the information on the  
Spanish space sector

**TEDAE**  
Defensa, Seguridad, Aeronáutica y Espacio

№ 48 | OCTOBER | 2021

MAGAZINE

# ESPACIO

ORÇ



# Mars THE ETERNAL DESTINATION

CURRENTS EVENTS  
SPACE,  
vital for military  
operations

INTERVIEW  
JOSÉ ANTONIO  
RODRÍGUEZ  
MANFREDI