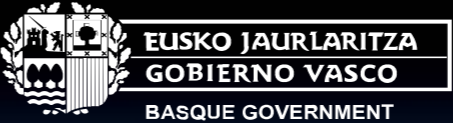




EUSKADI
BASQUE COUNTRY

BASQUE SPACE ECOSYSTEM

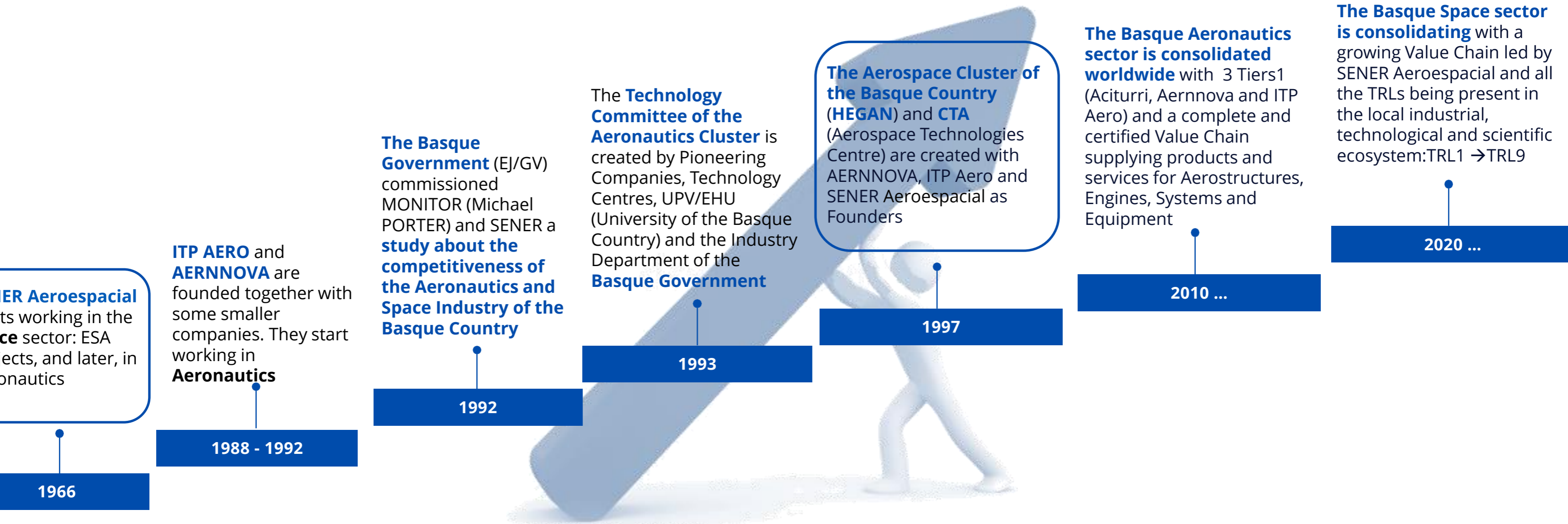
Nov. 2022

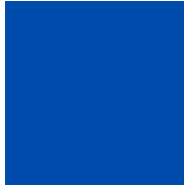


INTRODUCTION

In 2021 24 Basque Entities carried out Space activities (21 Manufacturing companies / 3 R&D Entities. CTA becomes one of the few RTD Centers worldwide with specific facilities for space testing **certified by NASA**.

In 2022, HEGAN, BASQUE AEROSPACE CLUSTER, reaches 70 members (52 business Groups and SMEs, 8 RTD Entities, 5 Universities and 5 Allies





BASQUE SPACE SECTOR FIGURES



More than 25 Entities



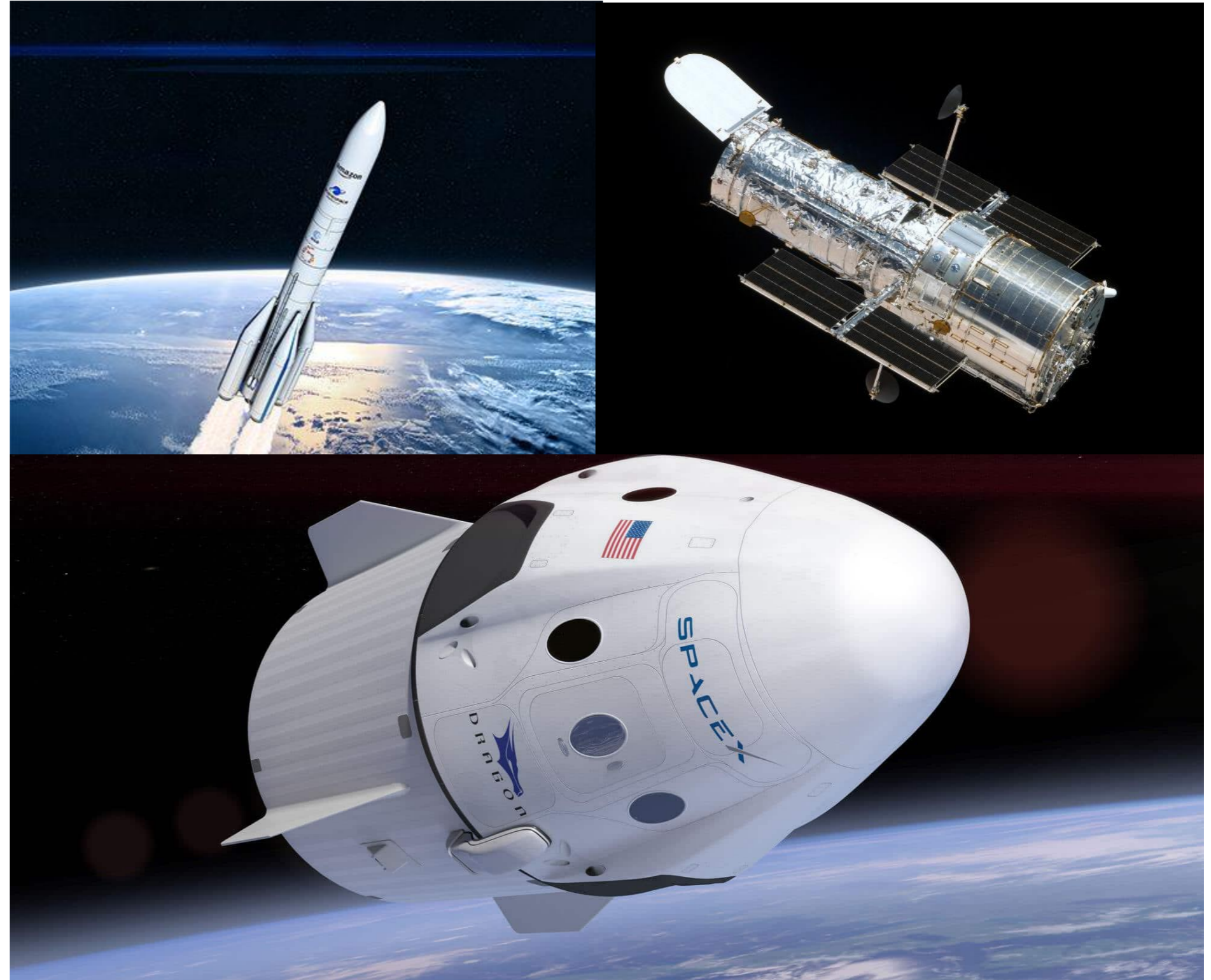
More than 900 employees

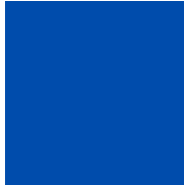


More than 55 projects executed

PROJECTS / PROGRAMS / CLIENTS WITH BASQUE PARTICIPATION

ESA/NASA ARTEMIS, ANTHENA, AURORA, CX-OLEV, EGNOS, ENVISAT, EUCLID, EUREKA, EXOMARS, GTAB, HERMES, HERCHEL-PLANCK, HUBBLE SPACE TELESCOPE, HIPPARCOS, INTEGRAL, ISEE-B/AURORI/CRV, MELISSA, METEOSAT, METOP, MSG, MTG, NSL, PROBA-3, ROSETTA, SENTINEL, SOHO, SOLAR ORBITER, SPACELAB, ULISSES, XMM-NEWTON, OTHERS AMC21, AMOS3, ARABSAT 4A/B, ARIANESPACE, ASTRA1M, ASTRIUM, CIEL-2, CHINASAT9, EXPRESS AM33/44, GE 1i/2i, GALAXY 17, GALILEO, HELIOS I/II, HISPASAT 1C/D, KOREASAT5, MINISAT, NETLANDER, OLYMPUS, PLEIADES, SPACE X, SPOT-4, SYRACUSE 3B, SUPERBIRD7, SPAINSAT, TURKSAT 3A, WSL, YAMAL 200...and many others in working progress





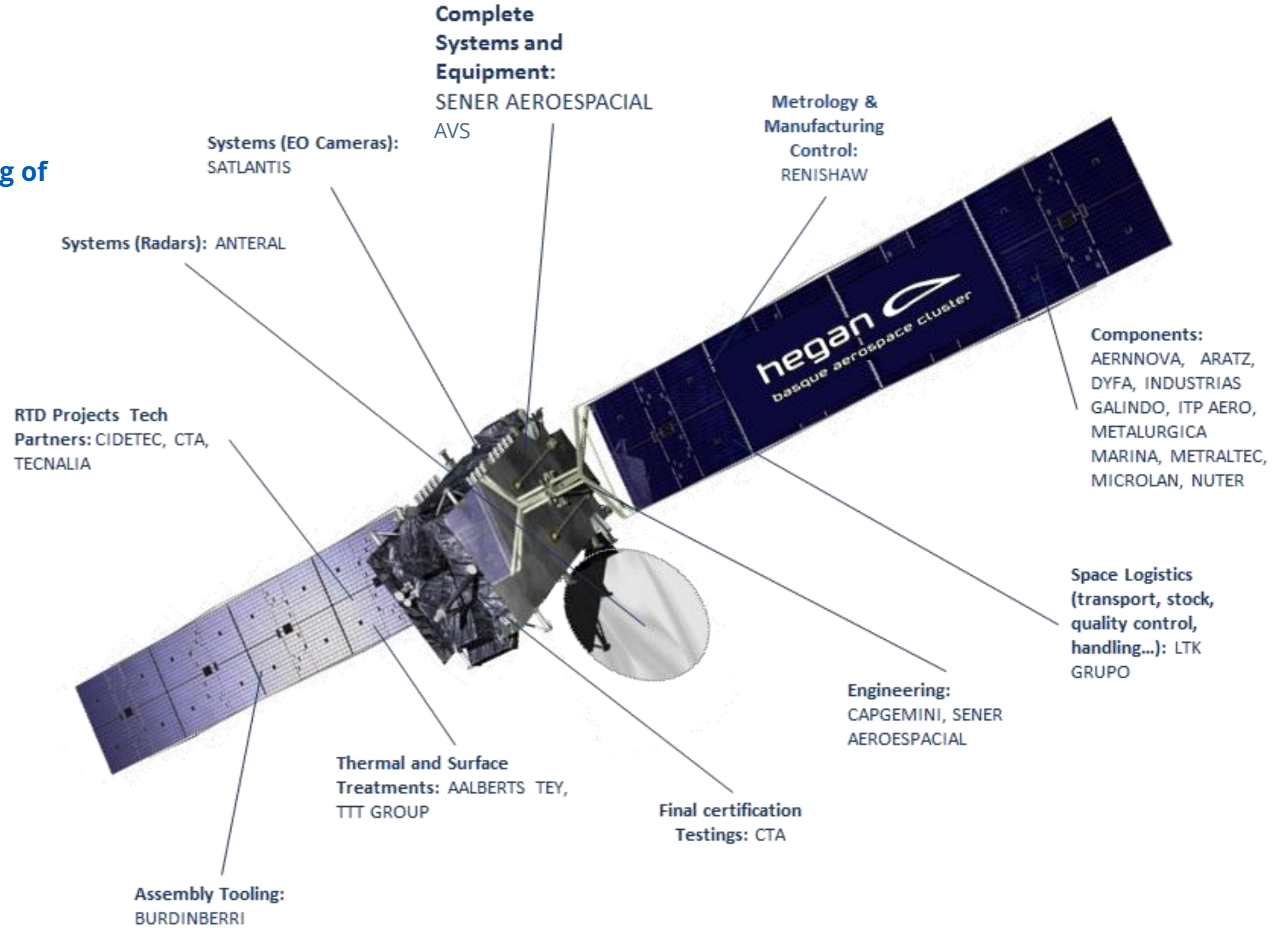
SPACE CAPABILITIES

Development, Design and Manufacturing of complete subsystems

- Electromechanical systems
- Navigation systems
- Communication systems
- Optomechanical systems
- Observation systems
- Antennas and Radars
- Mechatronic systems
- Design and manufacturing of Structures
- Engine components
- Propulsion systems....

Industrial support & Value Chain

- Engineering
- Tooling
- Thermal and surface Treatment
- 4.0 Solutions and Smart Industry
- Machined components
- Composites
- Sheet Metal (welding / Forming)
- Metrology
- Additive Manufacturing
- Casting
- Testing and Certification...





MAIN ENTITIES



DRIVING COMPANY. SENER AEROESPACIAL

SENER is an international leader in the space industry, with more than 275 pieces of equipment and systems successfully supplied to satellites and space vehicles for **NASA, ESA, JAXA and Roscosmos**. Institutes and companies such as CNES, Airbus Space & Defense, Thales Space, OHB, RUAG, SELEX and CSIC also number among its clients.

In **Space and Astronomy**, SENER provides engineering and production services in five spheres of activity, where it has the capacity to cover complete systems as a principal contractor:

- **Electromechanical components and systems** (deployment, precision and control electronics).
- **Steerable Antennas.**
- **Guidance, navigation and control, and attitude and orbit control systems** (GNC/AOCS).
- **Microgravity and life support systems.**

SENER has been active in ground-based astronomy and major scientific facilities since 2000 and boasts an extensive portfolio of projects that guarantee the quality of its solutions for clients such as the Southern European Observatory (ESO).

Contact

<https://www.aeroespacial.sener/en>

Headquartes

Avda. de Zugazarte 56 (ENTRADA por Cervantes, 8)
48930 Getxo, Bizkaia
Spain
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DRIVING COMPANY. SENER AEROESPACIAL

SENER's work in Astronomy encompasses:

- Optical systems: including structural elements and mechanisms for optical and focal plane systems.
- Electromechanical components and systems.
- Instrumentation systems: for space missions and scientific facilities, including Synchrotron radiation facilities. In addition, SENER offers engineering support for experimental beamline users who need to develop custom instruments for their stations. The company's expertise has been demonstrated through projects with benchmark European facilities, such as the European Synchrotron Research Facility (ESRF) and other Particle Physics research groups.
- Telescope mirror positioning systems: precision positioning and pointing systems for optical components, such as mirrors, lenses, filters, etc. The company specializes in developing custom high-performance activation and positioning systems for all types of mirrors, including units of large dimensions and weight (positioned in five degrees of freedom, with hexapods with micron-level precision and tip-tilt mechanisms for field correction and infra-red observation).

In the area of positioning systems, SENER's services include:

- Opto-mechanical and electronic design.
- Control software.
- Analysis and simulation.
- Manufacturing.
- Sub-contracting of the mirrors.
- Assembly and integration.
- Equipment validation and testing with optical instrumentation in seismically isolated facilities.



LEADING COMPANIES. AVS (ADDED VALUE SOLUTIONS)

One of the world's leading companies for the design and development of complex and critical equipment :

AVS can develop the full engineering process up to the commissioning, i.e Calculations, Detail design, Drafting, Procurement, Manufacturing, Assembly, Integration and Test.

Know How: Robotics, Mechatronics, Optomechanics, Thermal Control, Harsh Environments, Propulsion, Complete Space Missions, Volume Manufacturing.

Areas: Astrophysics, Acelerators, Fusion, Synchrotron, Neutron, Laser, Space.

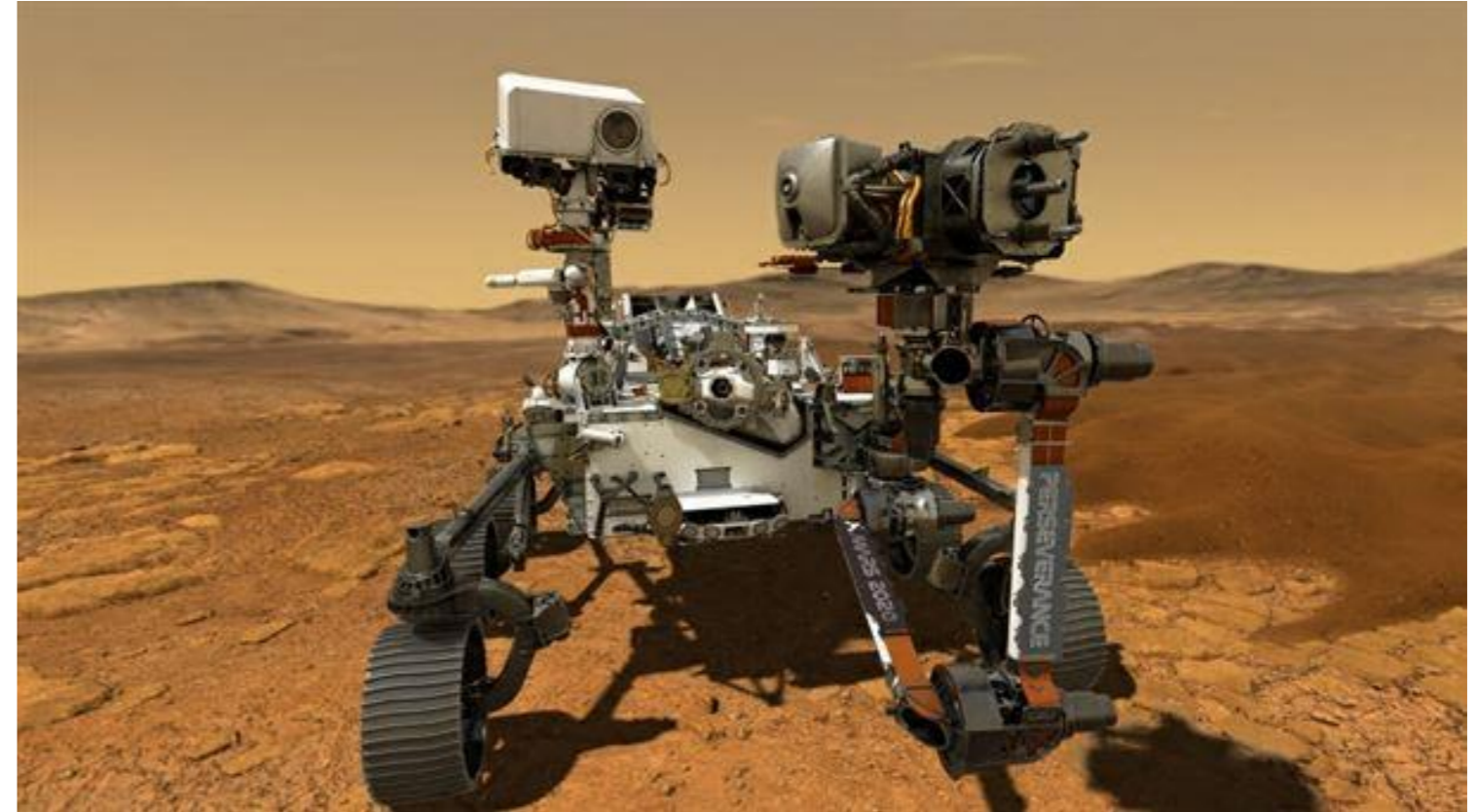
AVS delivers on time, meeting very demanding requirements with high quality standards.

Contact

<https://www.a-v-s.es/>

Headquarters

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Pabellón 1020870 Elgoibar, Gipuzkoa
T +34 943 821 841
avs@a-v-s.es



LEADING COMPANIES. AVS (ADDED VALUE SOLUTIONS)

MARS

Uncovering the secrets of the Red Planet and supporting first human interplanetary missions through critical robotics and mechatronic technologies.

- | ENVIRONMENTAL MONITORING.
- | SCIENTIFIC INSTRUMENTS.
- | ROBOTICS.
- | DUST PROTECTION.

DEEP SPACE

Expanding human knowledge of the solar system through exploration of asteroids, comets and planetary bodies.

- | ELECTRIC THRUSTER POINTING MECHANISMS.
- | ASTEROID MATERIAL EXTRACTION MECHANISMS.
- | ACTIVE LANDING SYSTEMS.

MOON

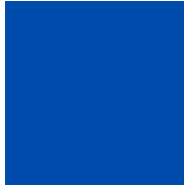
Supporting exploration and human return to our Moon through critical technologies in robotics, rovers and in-situ resource utilization.

- | MOON ROVERS.
- | ROBOTICS FOR SURFACE OPERATIONS.
- | IN SITU RESOURCE UTILISATION.
- | ENVIRONMENTAL MONITORING.

EARTH

Space as a lever to better life on Earth. Developing technologies to enable humanity for the challenges that the Earth is facing this century.

- | EARTH OBSERVATION MISSIONS.
- | MECHANISMS FOR OBSERVATION INSTRUMENTS.
- | ACTIVE THERMAL CONTROL.
- | IN ORBIT SERVICING.



LEADING COMPANIES. AVS (ADDED VALUE SOLUTIONS)



KNOW HOW

MECHATRONICS

Pointing, positioning, scanning, deployment, Hold down and release.

THERMAL CONTROL

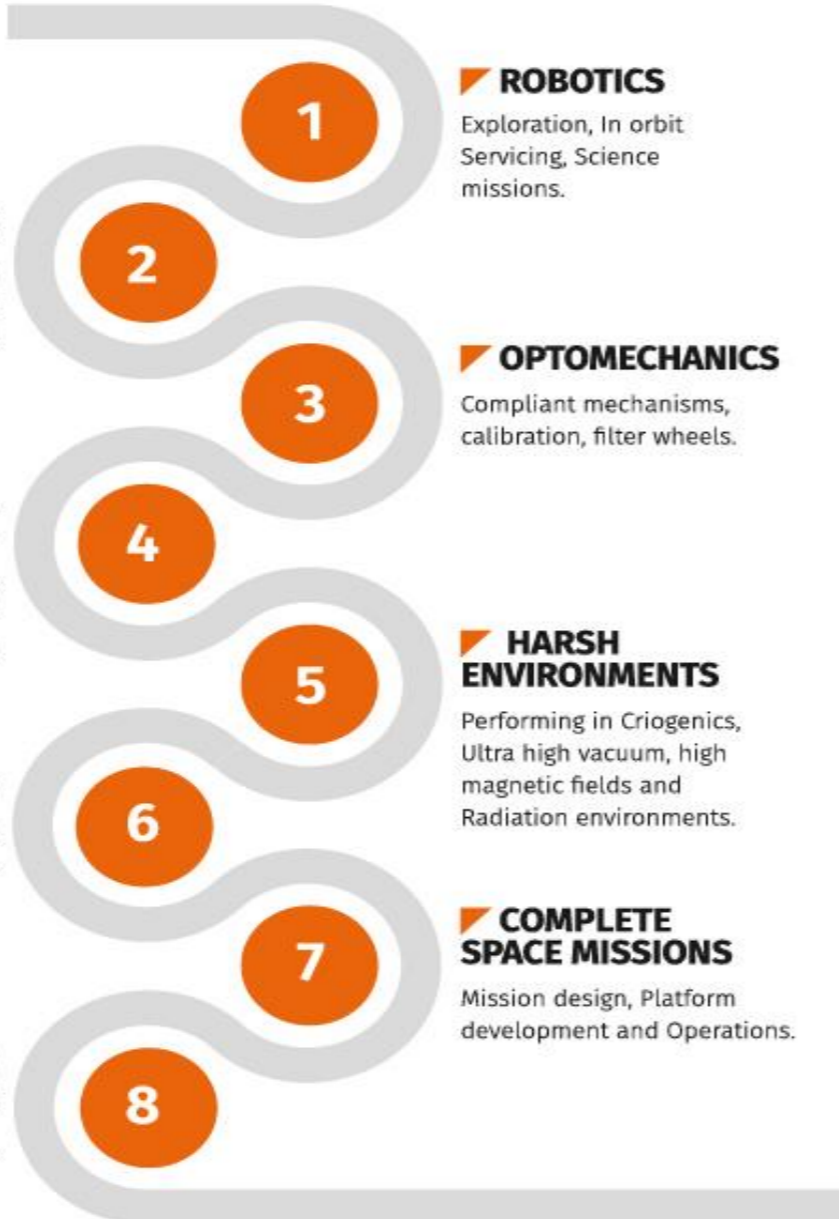
One and two pase Mechanically Pumped Loops, Pumps..

PROPULSION

Electrical and chemical complete systems.

VOLUME MANUFACTURING

10.000 sqm AIT facilities .



CONTACT US

Get in touch with us if you like to know more about our projects, mission, or initiatives.

EUROPE

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Email: avs@a-v-s.es

UK

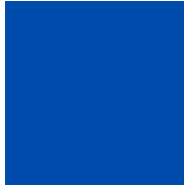
Westcott Venture Park, Aylesbury,
Buckinghamshire HP18 0XB, UK.
Phone: +44 1296 792 806
Email: avs@a-v-s.uk

USA

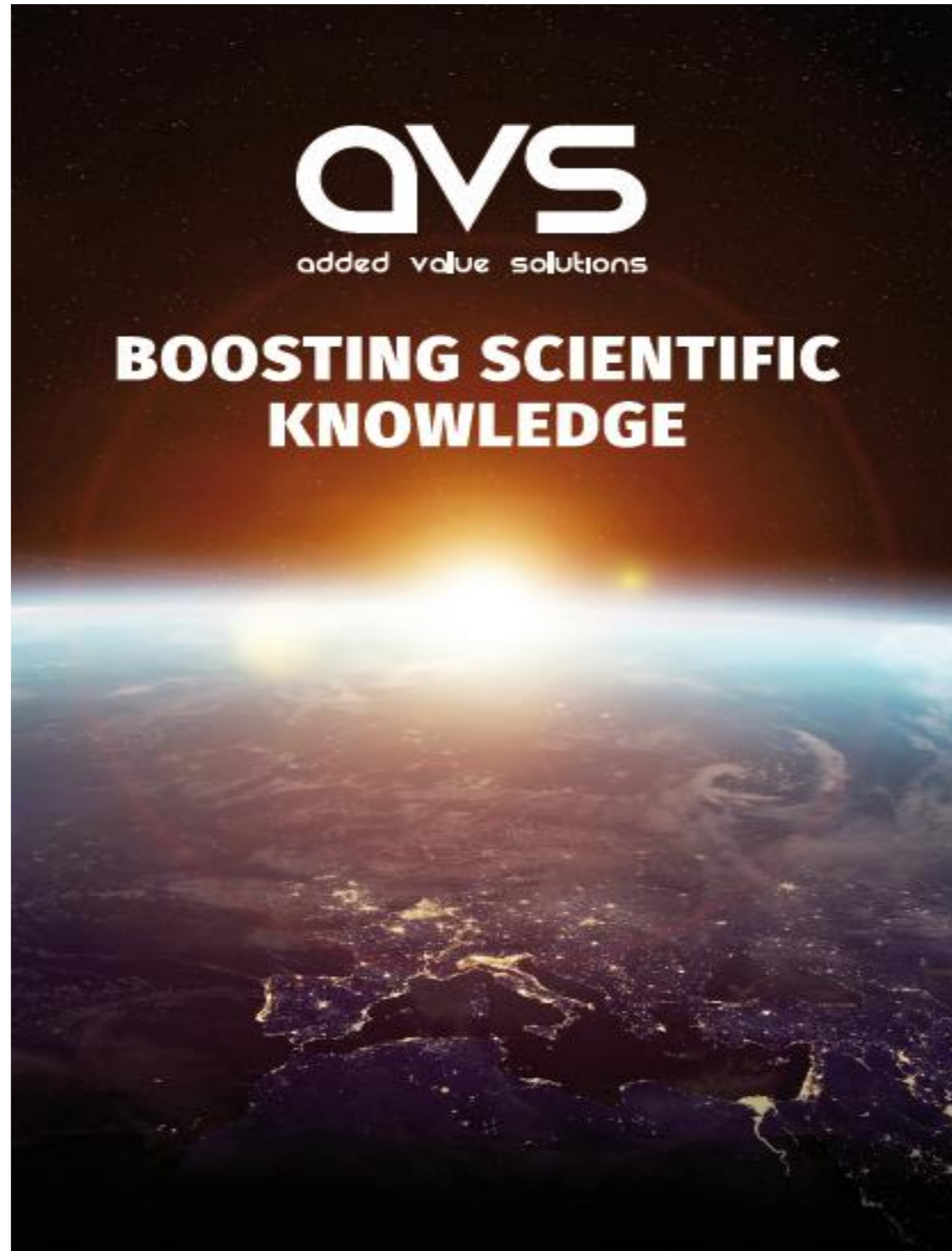
126 Ridge Rd. Lansing - NY 14882
Phone: +1 607 533 3531
Email: avsus@a-v-s.us

www.a-v-s.es





LEADING COMPANIES. AVS (ADDED VALUE SOLUTIONS)



ABOUT US AVS IS A GLOBAL SME SET UP IN 2006

"OUR SUCCESS OUR PEOPLE"

Today we are proud of being one of the world's leading companies for the design and development of complex and critical equipment for the Big Science and Space markets worldwide.

"FROM CONCEPT THROUGH COMMISSIONING"

We are capable of understanding scientific requirements and defining engineering requirements that lead to a conceptual design. From then on, we can develop the full engineering process up to the operation, i.e Analysis, Detail design, Drafting, Procurement, Manufacturing, Assembly, Integration and Test.



LEADING COMPANIES. SATLANTIS

SATLANTIS is a Space Technology Company for Earth & Universe Observation.

SATLANTIS is a user-driven organization providing reliable and innovative End-to-End Satellite Solutions built around customizable High and Very High-Resolution optical payloads.

With strategic partners, SATLANTIS provides Full Solutions for Small Satellites by controlling its own optical channels embarked in agile small sensor buses, operated in intelligent missions that generate unique customer proprietary data, capturing critical spectral information through software, hardware, and services for remote sensing applications.

A user-driven approach, together with a disruptive core technology, allows the company to tackle a wide range of applications, like:

- infrastructure (monitoring of plants, assets and pipelines),
- security (maritime and borders surveillance),
- environment (detection of methane leaks, oil spills, plastics at sea), among others.

Satlantis is member of YEES (Young European Enterprises Syndicate for Space), the syndicate to facilitate and accelerate the New Space dynamic in Europe.

Contact

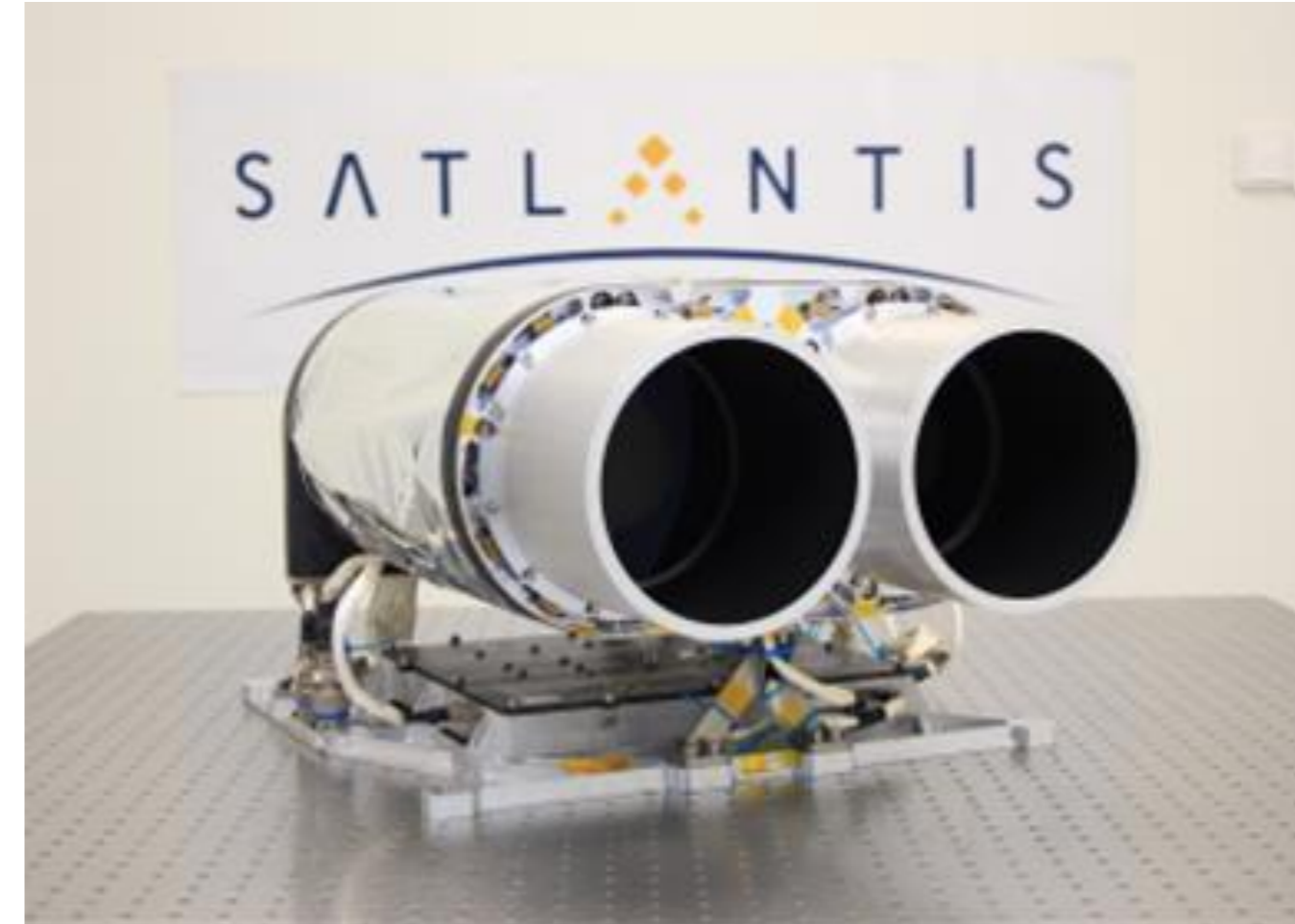
<https://satlantis.com/>

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SPAIN

Satlantis, LLC

Innovation Hub
University of Florida
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Gainesville, FL 32601
USA





LEADING COMPANIES. SATLANTIS

Who We Are



SATLANTIS is a Spanish technological SME funded in 2014, supported by a strong **Public-Private alliance**, with **ENAGAS** as a key client for this technology.



We focus on the **language of light**, capturing **critical spectral information** through software, hardware and services for **remote sensing applications**



We build **Small Sat Full Solutions**, around the iSIM-technology, to answer **End-users' problems and challenges**

LEADING COMPANIES. SATLANTIS

WHY SATLANTIS?

We are a user driven organization that provides **customized, reliable and innovative satellite solutions** that fully meet our customers' demands

FLEXIBLE

We offer an extensive portfolio of flight proven products and customizable solutions to fully meet customers and partners needs.

INNOVATIVE

Agility, Ultra High Resolution (UHR) technology, visual IoT, cutting edge onboard processing, are a few of the registered set of technologies that grow customer service efficiency.

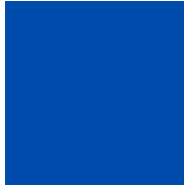
QUALITY FOCUSED

Quality is our commitment, having arrived at the best and most precise spectral images of the market

USER DRIVEN

Our embarked set of channels provide dedicated focus into customer spectral needs enable high quality EO applications.

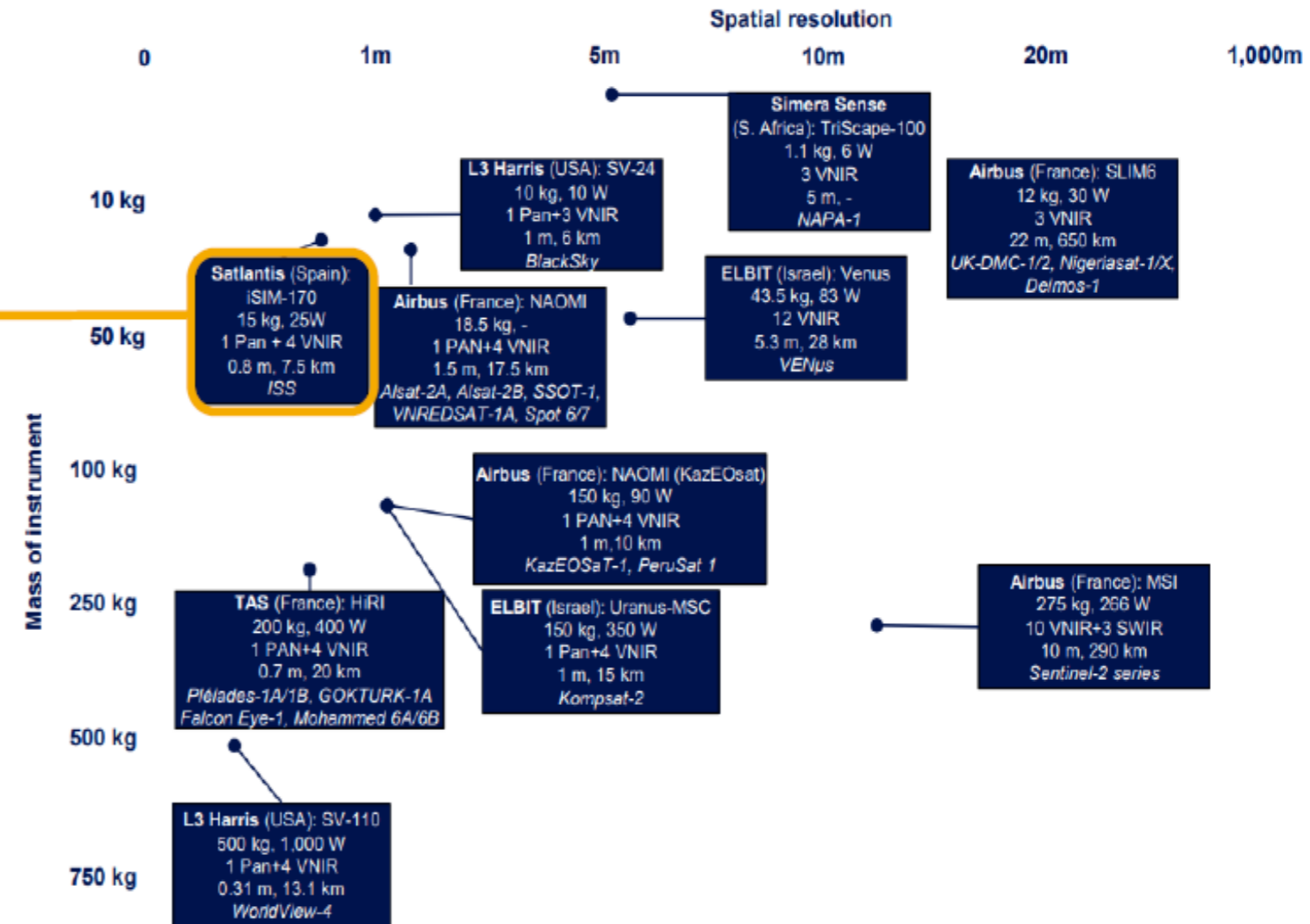




LEADING COMPANIES. SATLANTIS

OUR PRODUCTS

Euroconsult report highlights our cameras positioning as leader in the global EO satellite market

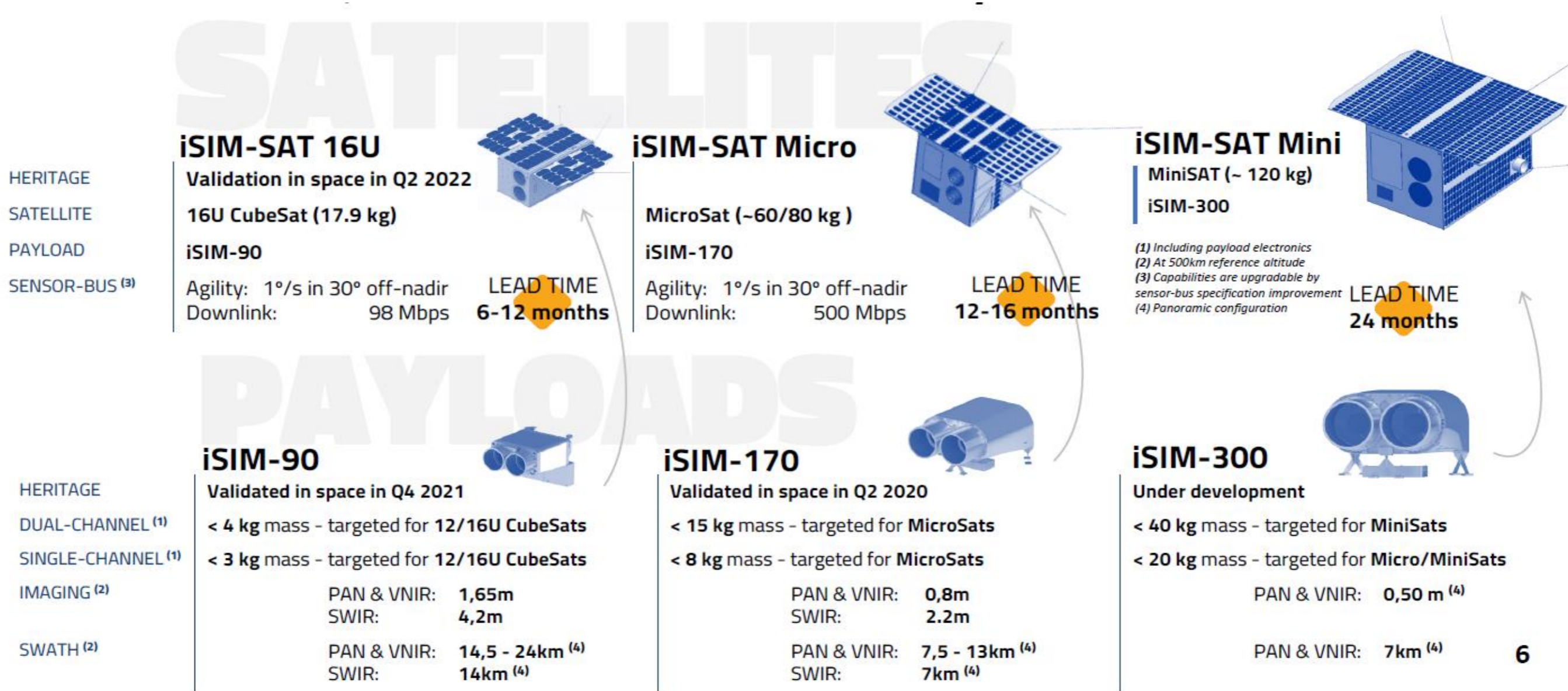


Euroconsult EARTH OBSERVATION SATELLITE SYSTEMS MARKET



LEADING COMPANIES. SATLANTIS

OUR PRODUCTS.
Portfolio: iSIM family





LEADING COMPANIES. SATLANTIS

OUR PRODUCTS.

iSIM Payload: Key features

Seven reasons to select iSIM

- Image Quality**
 - iSIM delivers homogenous quality images**
 - The instrument keeps the same quality in the entire field of view.
 - Good SNR & MTF.
- Smart Image Acquisition**
 - Dynamically selected the acquisition Mode**
 - Image, video, and combine SNR, resolution and contrast for any acquisition depending of the application
- Superb Swath**
 - The Panoramic version of iSIM family offers a large swath**
 - e.g., iSIM-90, Panoramic delivers 24km @ 500km
- Multispectral / Panchromatic**
 - All spectral bands contain the same information**
 - It allows to deliver PAN & MS bands with the same resolution instead of ¼ degradation PAN/MS
- Customer Configuration**
 - The iSIM family of payloads can adapt to specific needs**
 - Wide array of possibilities of configuration and personalization
 - e.g. 10 different configurations available for iSIM-90
- Lightweight Payload**
 - iSIM -90: Binocular 4kg / 8U - Monocular 3kg / 5U**
 - Resolution 1,65m (GSD @500km)
 - Wide Spectral Coverage (PAN-VNIR-SWIR)
- Agility**
 - Unique capability in the market.**
 - Allows capturing high quality images **continuously** while satellite observes along and across its orbit, following irregular trajectories



LEADING COMPANIES. SATLANTIS

EO Missions:
Current Contracted &
Planned

2020 ➤

M1 - IOD
Jaxa launch to ISS
+Ultra High Resolution
+Video

Q2-2020



M2 - CASPR
DoD / NASA launch to ISS
+Multispectrality
+Agility

Q4-2021



2022 ➤

M3 - ArmSAT1
Launch of first iSIM-SAT
16U-CubeSat
+ iSIM-90 VNIR

Q2-2022



M4 - MANTIS
Our contribution: iSIM-90 VNIR
+Mission for Oil&Gas
+ESA Launch of a 12U-CubeSat

Q1-2023

2023 ➤

M5 - GEI-SAT Precursor
Launch of ISIM-SAT
16U CubeSat for CH4
+ iSIM-90 VNIR-SWIR

Q2-2023

M6 - URDANETA 2
Launch of iSIM-SAT
16U-CubeSat
+ iSIM-90 VNIR-SWIR

Q4-2023

M7 - 2 x GARAI
Launch of ISIM-SAT
MicroSat
+ iSIM-170 & iSIM-90 VNIR-SWIR

Q1-2024

M8 - GEI-SAT Constellation
Constellation of 3 MicroSats
Dedicated to CH4/GHG & Environment
+ *Expanding spectral capabilities (2.5 μm)*
2025-26 (TBC)

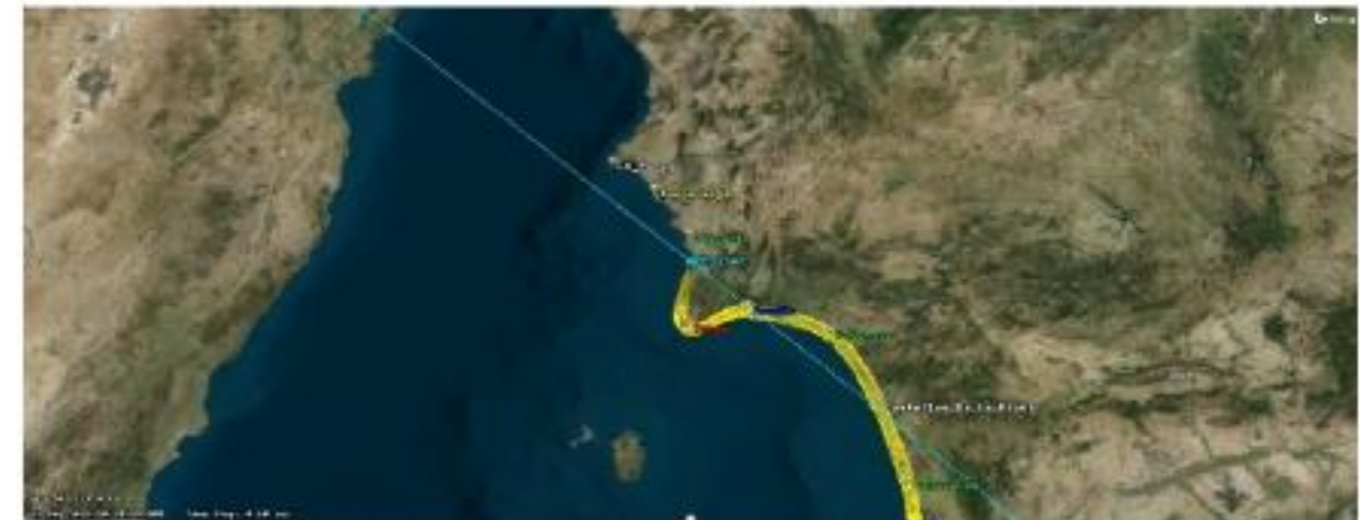
M9 - Tandem4EO
Constellation of two radar and two
VHR optical satellites.
Partnership with ICEYE

GEI-SAT: Proprietary Methane Detection & Quantification Satellites



LEADING COMPANIES. SATLANTIS

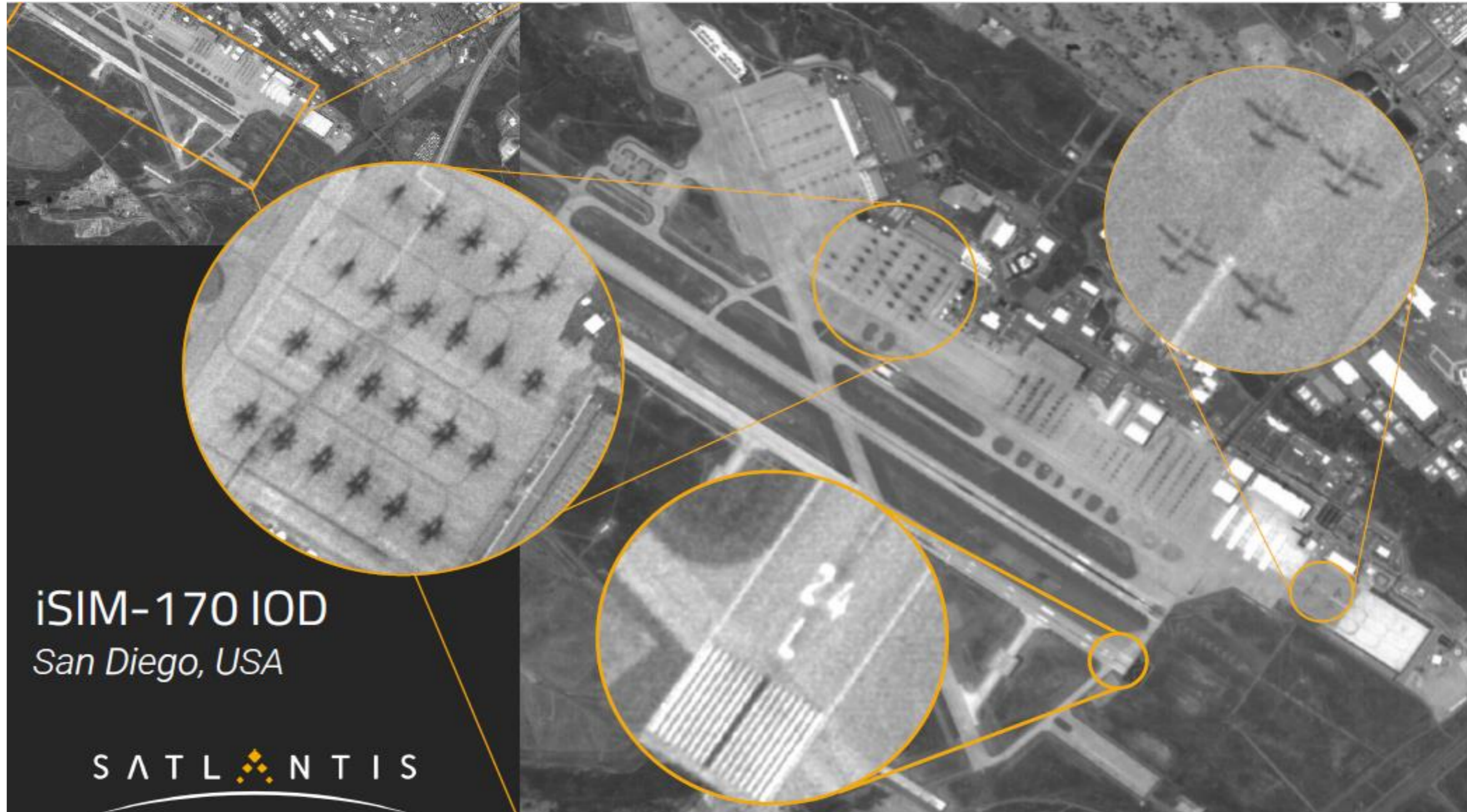
iSIM Payload:
Key features





LEADING COMPANIES. SATLANTIS

iSIM Payload:
Key features



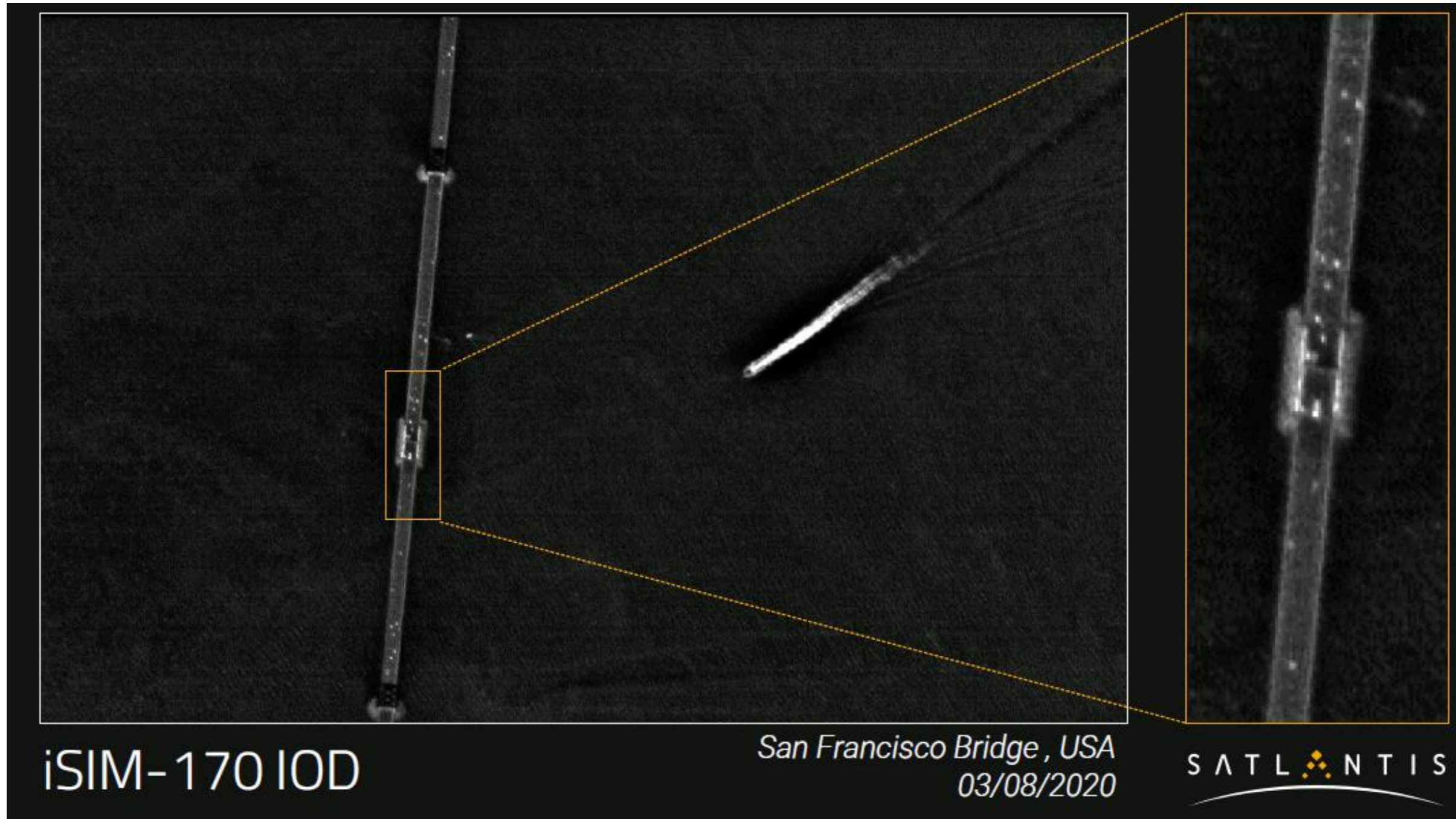
iSIM-170 IOD
San Diego, USA

SATLANTIS



LEADING COMPANIES. SATLANTIS

iSIM Payload:
Key features





LEADING COMPANIES. SATLANTIS

Urdaneta: End-To-End Solution



Example case for SATLANTIS Full Solutions





LEADING COMPANIES. SATLANTIS

GEI-SAT Constellation

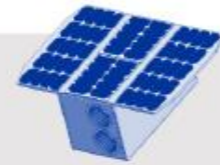


Mission objective Perform atmospheric **CH4 measurements** with **high spatio-temporal resolution** and simultaneous geolocation of source emitters, to be used for the **monitorisation and quantification of methane emissions** in the Oil&Gas industry.

Constellation deployment roadmap

Q2 2023

GEI-SAT
Precursor



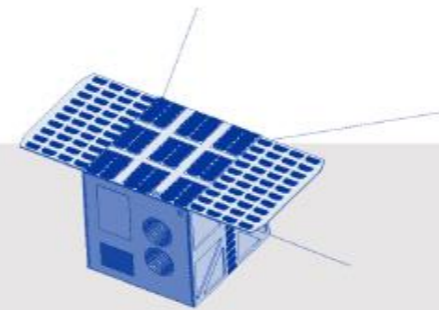
Satellite
Payload
Spatial resolution
Spectral range

16U CubeSat (17.4 kg)
iSIM-90 VNIR + SWIR
VNIR 1.65m; SWIR 13m
up to 1700 nm



Q1 2024

GARAI

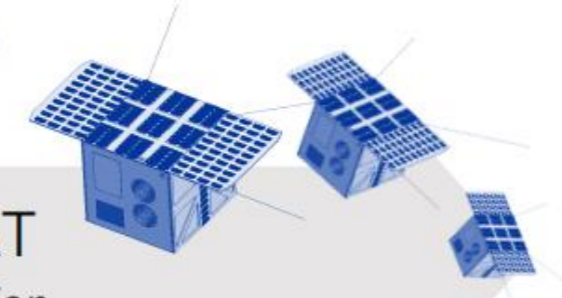


2 Microsat (92 kg)
iSIM-170 & ISIM-90 VNIR + SWIR
VNIR 0.8m; SWIR 7m
up to 1700 nm



2025/26

GEI-SAT
Constellation



3 Microsats (92 kg)
iSIM-170 VNIR + SWIR
VNIR 0.8m; SWIR 9m
up to **2500 nm**



*Expanding spectral capabilities (2.5 μm)
& improving detection threshold.*

*Orbit to be defined,
reference values at 500km*

13

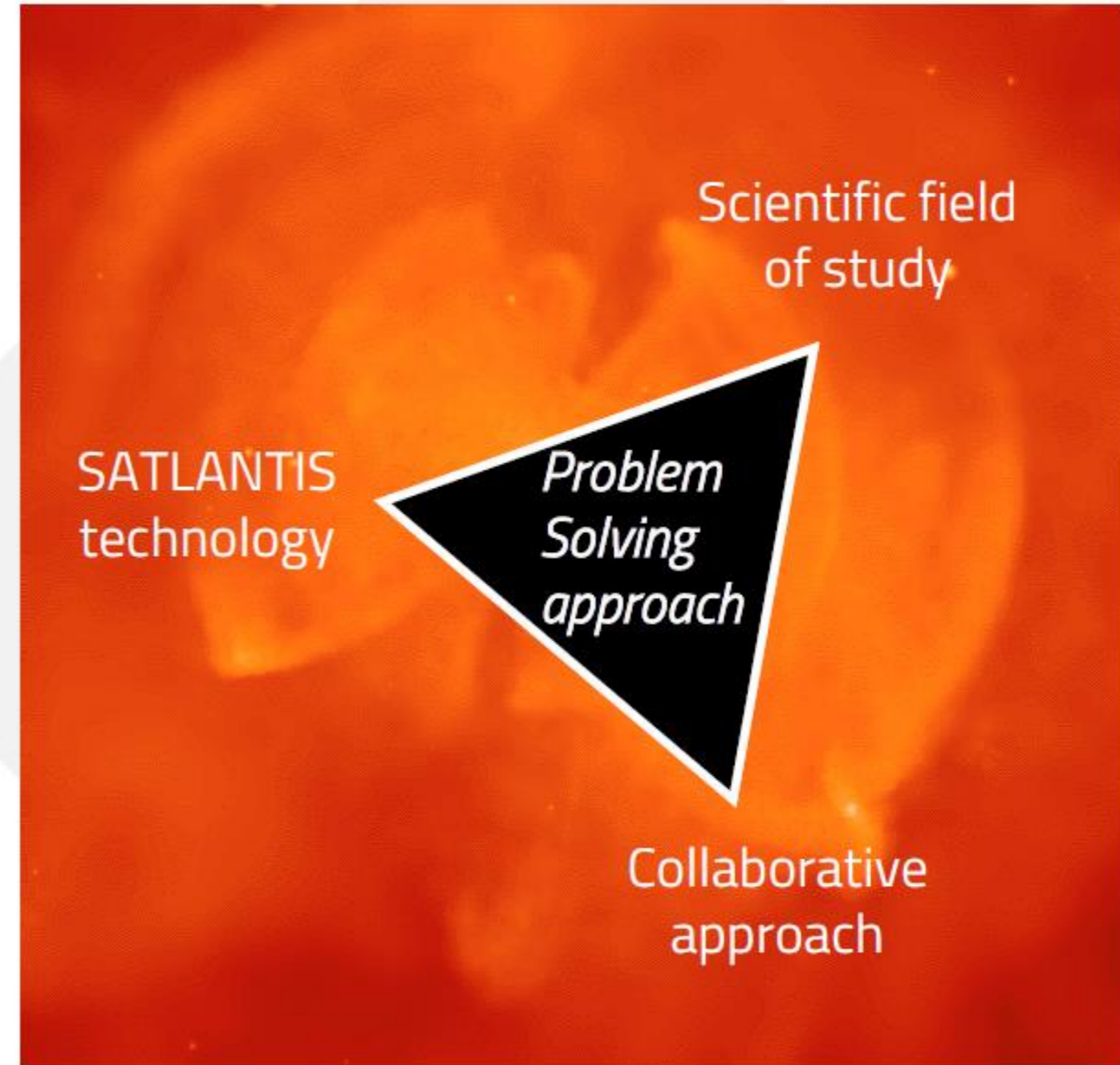


LEADING COMPANIES. SATLANTIS

Support to SCIENCE



SATLANTIS' **technology** and **collaborative approach** with the **scientific community** allows to fully understand their **needs**, resulting in a more efficient support to their support studies in **Astrophysics**.



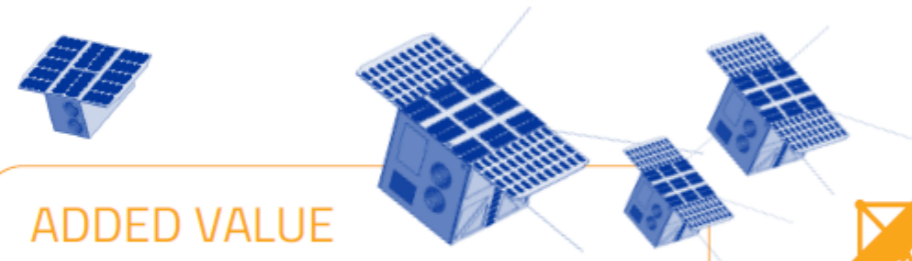


LEADING COMPANIES. SATLANTIS

GEI-SAT Constellation: Methane End-to-End Solution



We provide Full Solutions, from scientific-grade payloads to final data products



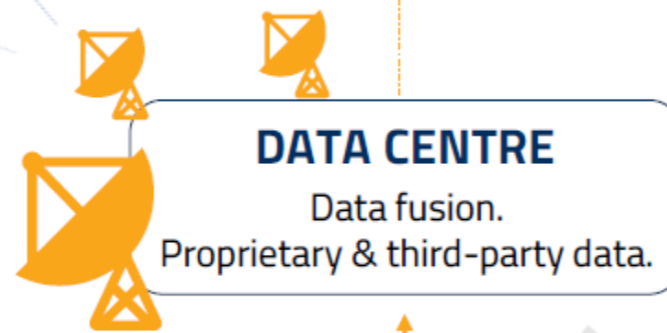
ADDED VALUE PAYLOADS & PLATFORMS

- Customer configuration
- Spectral range tailored for methane, **SWIR up to 2.5um**
- Unique **Agility** for pipeline monitoring



Launch service

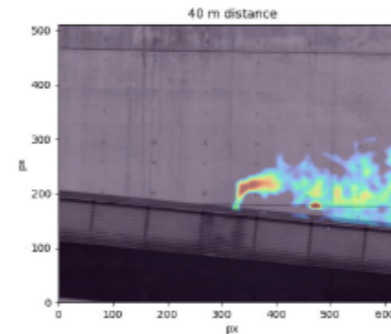
+ Rideshare and Dedicated



Additional datasets

- + Public datasets
- + Complementary third-party data
- + Bottom-Up measurements, ground sensors, drones...

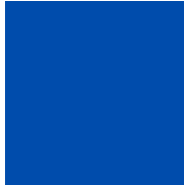
Data analytics for methane measurements with satellite data



+ Periodical O&G reports

USER PLATFORM

Real time data visualization.
Layered maps/thematic mapping.
User-oriented platform.



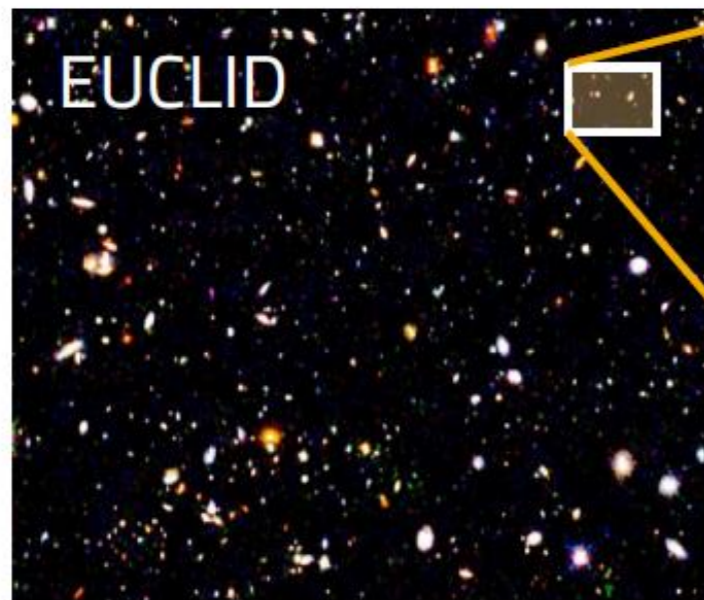
LEADING COMPANIES. SATLANTIS

SATLANTIS for the UNIVERSE



The **NewSpace** approach to astrophysics science, represents a **more flexible** and **cost effective** way to help **scientists advance in their research.**

The **synergy and complementarity** between **New & Traditional Space** approach could be seen between DUNES and ESA's EUCLID mission



EUCLID

Wide area mission for large scale observations

High cost

DUNES

More targeted area of interest with longer-observational slot, focused on nearby galaxies

1/50 of EUCLID's cost



SATLANTIS aims to provide **scientific satellites & payloads** aimed at orbiting **other celestial bodies** apart from Earth, such as **Mars** or the **Moon**.

LEADING COMPANIES. IDOM

IDOM ADA fully develops INSTRUMENTS AND FACILITIES for astronomical observatories. In this field, there is always a demand for the most advanced technology and innovative solutions, time and again involving a breakthrough from what was used before. As important as the technical challenge is the definition and development of the project until the construction and commissioning of the facilities in time and within budget. And this is our commitment.

The company deals with optics, thermo-hydraulics, cryogenics, precision control, large movable structures, etc. IDOM use the most advanced computer simulation techniques and rapid prototyping & testing in order to validate our designs apply proven project management skills for an efficient control of cost and risk.

Among others IDOM was involved on different stages of development for following telescopes:

- Daniel K. Inouye Solar Telescope Enclosure (DKIST), USA
- Telescope field rotator for the Gtc (Gran Telescopio de Canarias), Spain
- MSE – Mauna Kea Spectroscopic Explorer Telescope, USA
- E-ELT Dome & Foundations, Chile
- European Solar Telescope (EST), Spain
- Quijote CMB Experiment: Telescope & Enclosure

Contact

www.idom.com

Headquarters

Avda. Zarandoa 23,
48015 Bilbao. Spain

M: +34 683 544 324 / M: +370 614 13979



DRIVING RTD ENTITY. CTA

CTA is an aerospace test laboratory specialized in testing for development and certification of aerospace materials, systems and structures. Located in the Basque Country in the north of Spain, our company was established in 1996 to meet the aerospace technology and certification needs of aircraft component manufacturers.

CTA bases its activities on the following pillars:

- Experience
- Know-How
- Capacities
- Technology
- Quality

Over the years CTA has provided component testing services for numerous space programmes such as GAIA, BEPICOLOMBO, SENTINEL, GALILEO, MTG EXOMARS and SOLAR ORBITER, including vibration, pyroshock, vacuum, thermal and functional testing of both small, simple parts and larger, more complex components.

Contact

+34 945 29 69 24

cta@ctaero.com



LEADING RTD ENTITIES. TEKNIKER

TEKNIKER is a technology center that aims to develop novel space technology, having as main objective the research and development of new space technology for human and robotic exploration (Moon and Mars) and for science exploration missions. Our specialization and our projects are focused on 8 work areas to face any challenge of the present and future necessities of worldwide space agencies, industry, research institutes, and universities:


- Advanced and additive manufacturing, and micromachining
- Materials and components
- Electronics and control for payloads, ground, and spacecrafts
- Space metrology
- Space robotics
- Complex structures and instrumentation
- Hydrogen
- Space radiation

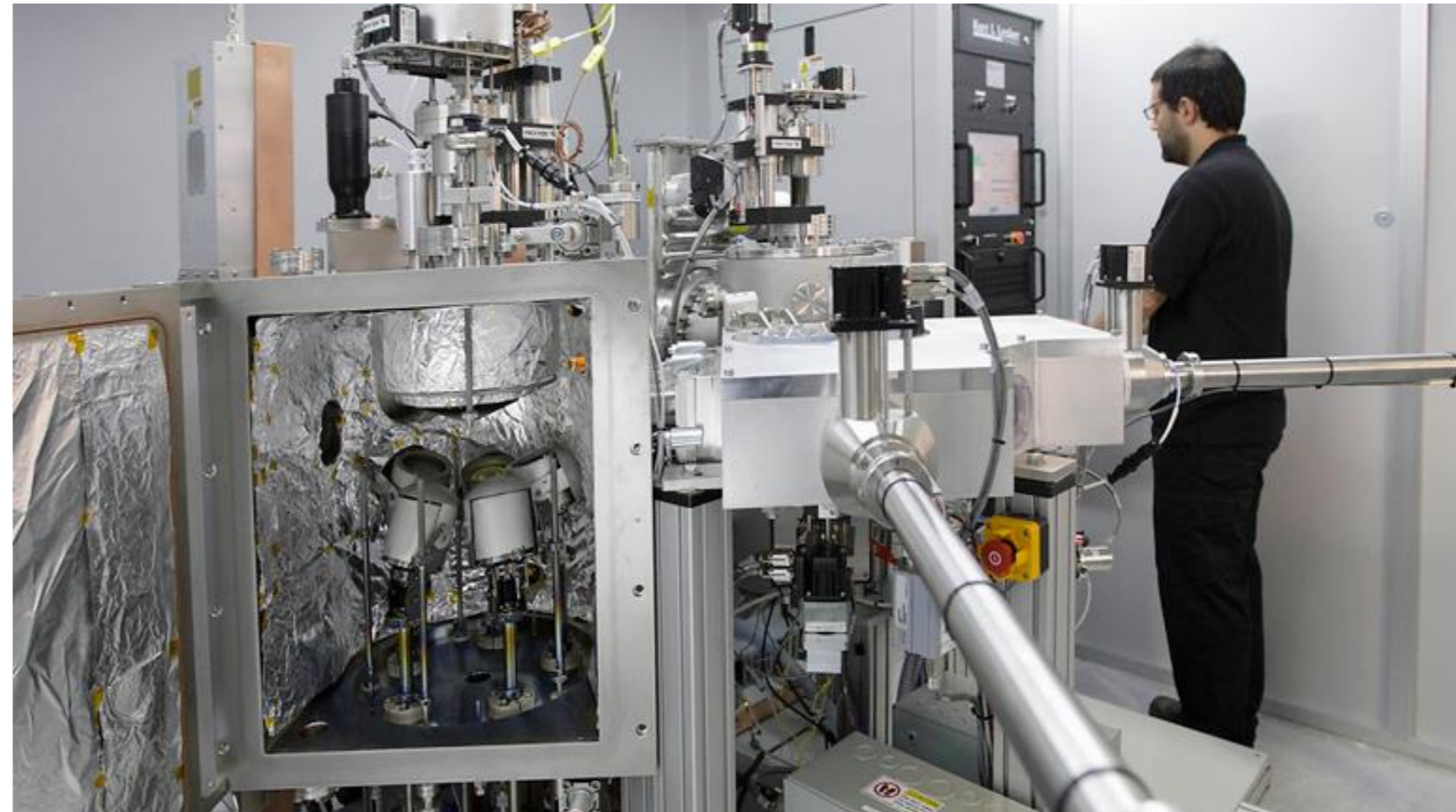
Contact

<https://www.tekniker.es/es>

Borja Pozo (borja.pozo@tekniker.es)

 285

 26,3 M€



LEADING RTD ENTITIES. UNIVERSITY OF THE BASQUE COUNTRY

IBeA-Research and Innovation in Analytical Chemistry

Principal Researcher Mr Jose Manuel Madariaga Professor of Analytical Chemistry has directed the **IBeA Research Group since 1987**, a group that obtained the qualification of excellence in 2002 and has maintained it ever since. Currently, IBeA is made up of 16 permanent professors and researchers and a similar number of pre- and post-doctoral researchers.

Research activities:

Activities on Space started in 2009, analyzing the environmental weathering of impact glasses in Earth found in Libya and Tasmania as examples of two different environments. The expertise gained in those first years in the study of meteorites attract the attention of NASA and our university signed in November 2014 an Agreement with Johnson Space Center (JSC-NASA) to analyze and custody meteorite samples from their Antarctic Meteorite Program (ANSMET). Ibea has been part of the Science Team of the ExoMars (ESA) mission through the RLS (Raman Laser Spectrometer) instrument onboard of Rosalind Franklin rover, part of the Mars2020 mission and currently is working with Earth Analogs of both landing sites (Jezero crater and Oxia Planum respectively) and Martian Meteorites,

Since 2014, there is an official “Laboratory of Materials for Planetary Exploration” funded by the Spanish Ministry for Research, the Basque Government and the UPV/EHU. The facilities included in that laboratory were presented in 2019 to JPL-NASA (in the framework of the Mars2020 mission) and nowadays the laboratory is officially included in the list of Laboratory Analogs to study the Martian Samples that will arrive Earth in the Mars Sample Return (MSR) mission.



Contact

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LEADING RTD ENTITIES. UNIVERSITY OF THE BASQUE COUNTRY

Planetary Sciences Group

Principal Researcher Agustin Sánchez Lavega, Astrophysicist and Full Professor of Physics at the Applied Physics Department at the School of Engineering (UPV/EHU) in Bilbao. He received the Euskadi Research Prize 2016 for his contribution to the promotion of scientific activities.

Research lines:

Development storms models in the atmospheres of planets and their satellites as well as models of the general circulation and winds and on the nature of gigantic anticyclones and cyclones on the giant planets. More particularly:

Giant Planets Atmospheres with emphasis on:

- Atmospheric circulation
- Meteorology and atmospheric dynamics
- Cloud structure (atmospheric optics)

Venus atmosphere:

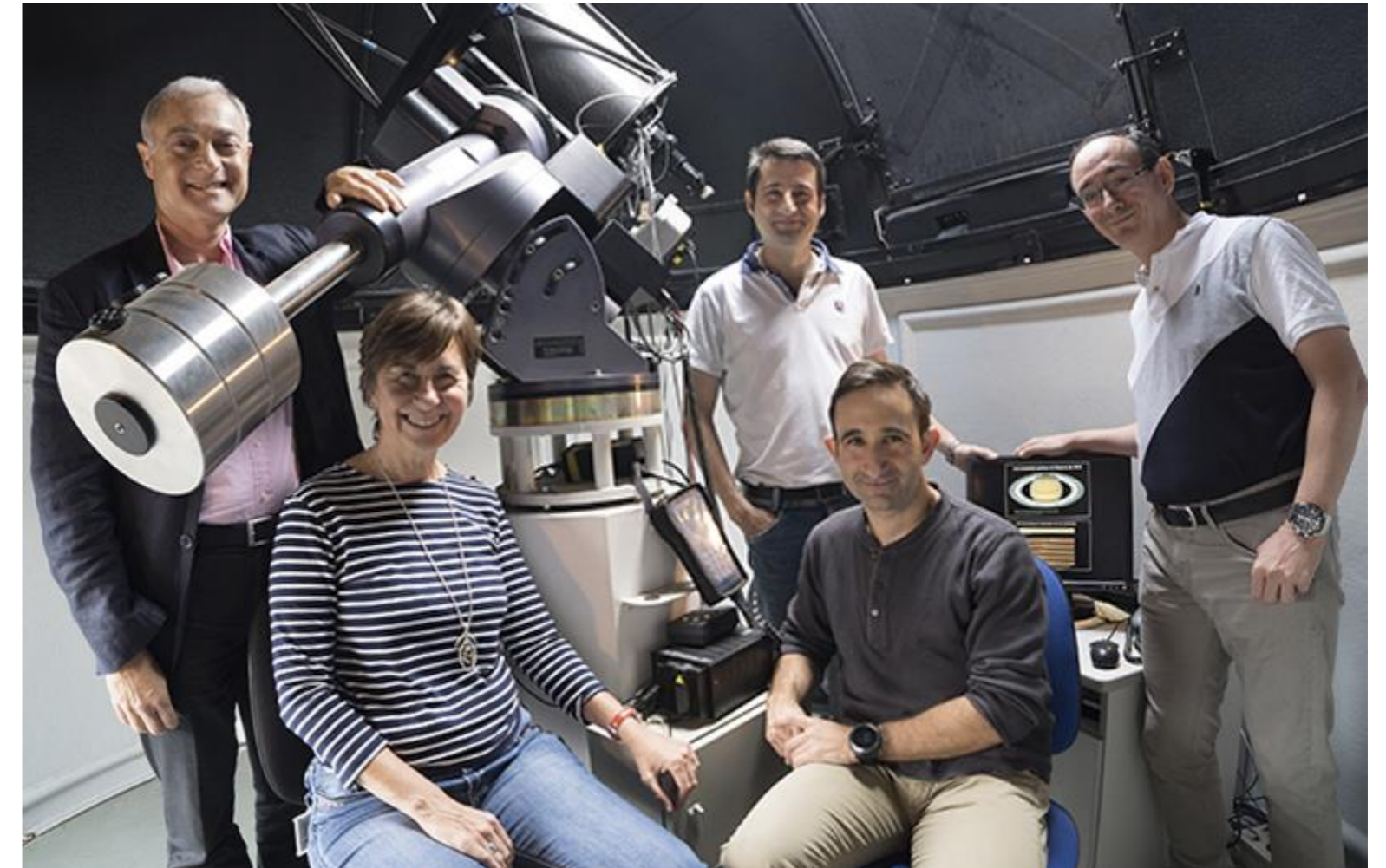
- Atmospheric circulation
- Meteorology and atmospheric dynamics
- Cloud structure (atmospheric optics)

Extrasolar Planets:

- Atmospheres
- Structure

Titan:

- Meteorology and atmospheric dynamics



Contact

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Gravitation and cosmology

Principal Researcher: JOSE MARIA MARTIN SENOVILLA Professor of Theoretical Physics in the University of the Basque Country. He has served as an evaluator for international scientific agencies, member of the Editorial Board of Classical and Quantum Gravity (IOP, London) from 2005-2014, and continues as a member of its advisory committee, member representing Spain of the Committee of the International Society for General Relativity and Gravitation (2001-10)

Research activities

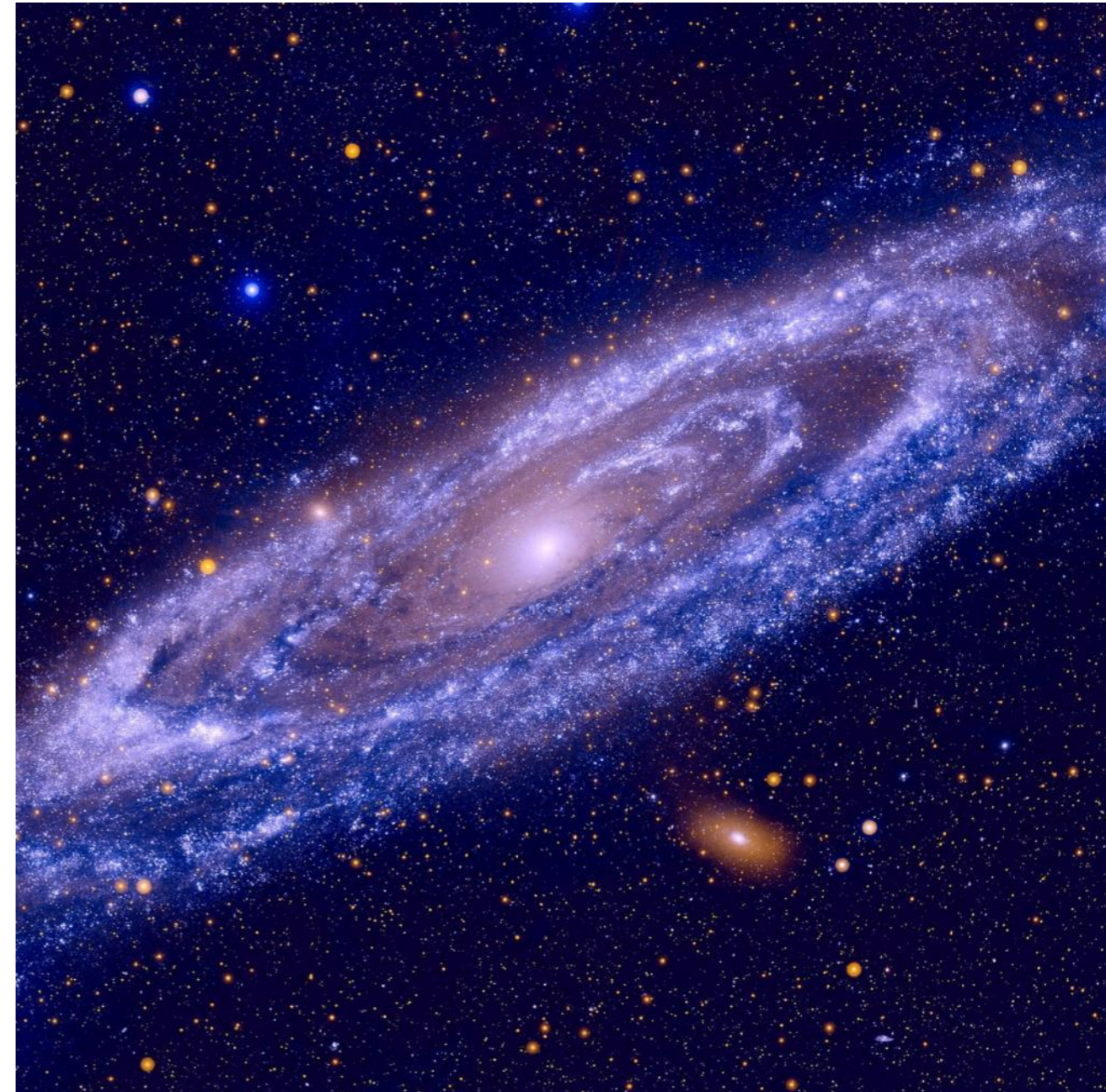
- Very compact astrophysical objects and black holes: Dynamics. Cosmological constant.
- Quantum cosmology and loop quantum gravity: dynamics, semiclassical sector and physical consequences.
- Theoretical and observational cosmology: dark energy and matter, observational tests. Alternative theories of gravity.
- Mathematical relativity: trapped and umbilical submanifolds, algebraic computation, characterization of initial data in gravity and exact solutions.
- Gravitational lensing, formation of galaxies and galaxy clusters, "Panoramic Surveys" and observations from space telescopes.

Contact

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