
C3S
Designed
to Explore
LARGE SAT RELIABILITY,
SMALL SAT SPIRIT

When New Trends Meet the Traditional Satellite Industry

C3S LLC is a key player in the space industry, being **the only company in the world that simultaneously represents new space trends and the traditional large satellite industry,** where the company has successfully integrated into their supply chain over the past decade. This unique position allows the company to deliver unparalleled reliability and longevity for it's clients space assets while offering innovative solutions that meet the high demands of both segments.

Our commitment

We are committed to delivering highly reliable large satellite electronics solutions, along with scalable 3-16U platforms and robust, redundant subsystems, all manufactured in-house. From concept to orbit, our full range of services includes mission planning, platform manufacturing, integration testing, launch management, and satellite operations—ensuring the success of our mission.

35+
space projects

35+
custom space subsystem design

100+
months spent in space

50+
team member

Our impact on the future

At C3S LLC, we are at the forefront of space missions that address the critical global challenges of the 21st century, such as food security, climate change, and telecommunications. Our pioneering developments are leading the way in tackling these issues.

Our decades of flight experience, flawless satellite operations record, and the reliability and longevity of our CubeSat platforms and data management services support our mission, enabling us to create a lasting impact on the future.

Photo captured by VIREO

VIREO

CubeSat Technology

At C3S LLC, we combine cutting-edge technology with meticulous craftsmanship to deliver nanosatellite solutions that excel in reliability and innovation.

Big Solutions in Small Packages

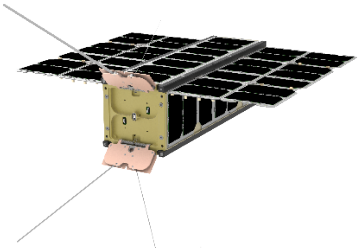
C3S LLC is a key player in the international nanosatellite industry, offering solutions that serve both scientific and industrial needs. We specialize in 3-16U high-reliability platforms, subsystems, prelaunch simulation software, hardware, and mission operation environments. Our strength lies in integrating advanced large-scale satellite technologies into nano formats, ensuring exceptional durability and reliability. Our CubeSat platform is a proven, cost-effective solution designed to meet any mission's unique demands. It allows our customers to focus on their own mission and payload, while streamlining their path to orbit for faster results and top performance.

Key features

- **Redundant systems:** to enhance reliability and ensure continuous operation by incorporating duplicate components or pathways
- **In-house development:** Complete in-house development including design, manufacturing (ESA certified hand soldering, transformer winding, EGSE), and testing to guarantee high standard quality.
- **Manual integration:** Expert manual assembly to ensure precision and performance, featuring certified hand soldering for optimal reliability and quality.
- **Cleanroom assembly:** Assembling space-grade components in a cleanroom environment for optimal performance.
- **Mission management:** Comprehensive mission management services to support every stage of the mission lifecycle.
- **Vibration testing:** Rigorous vibration testing to simulate space conditions and ensure durability.
- **Thermal vacuum testing:** Advanced thermal chamber testing to validate performance in extreme temperatures.

3-16 CubeSat Platforms

3U



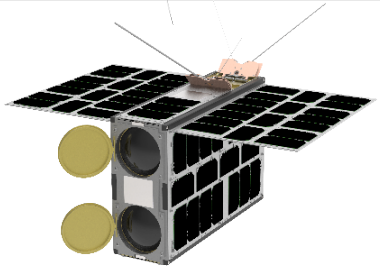
DIMENSIONS
100 x 100 x 340.5 mm

MASS
3.3 kg

PAYLOAD ALLOWANCE VOLUME
1 - 1.8 U (Units = Liters)

PEAK POWER
35 W

6U



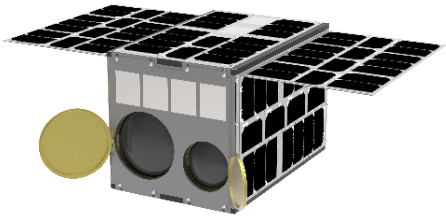
DIMENSIONS
226.3 x 100 x 366 mm

MASS
5 kg

PAYLOAD ALLOWANCE VOLUME
4.9 - 5.3 U (Units = Liters)

PEAK POWER
up to 165 W

12U



DIMENSIONS
226.3 x 226.3 x 366 mm

MASS
13 kg

PAYLOAD ALLOWANCE VOLUME
12.3 - 13.1 U (Units = Liters)

PEAK POWER
165 W

16U

DIMENSIONS
226.3 x 226.3 x 454 mm

MASS
19 kg

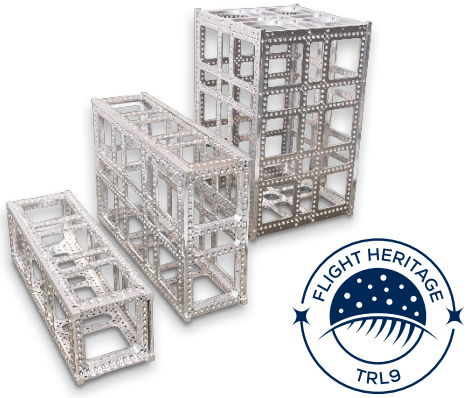
PAYLOAD ALLOWANCE VOLUME
15.5 – 16.5 U (Units = Liters)

PEAK POWER
155 W

Subsystems

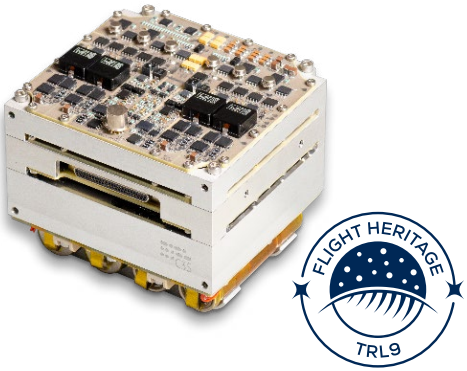
In-house manufacturing for trusted satellite components

We produce all the subsystems for our CubeSats internally, which allows us to manage lead times, pricing, quality, and supply chain redundancy effectively. Each subsystem is designed for high reliability, scalability, and redundancy, and has demonstrated proven performance in space through rigorous testing.



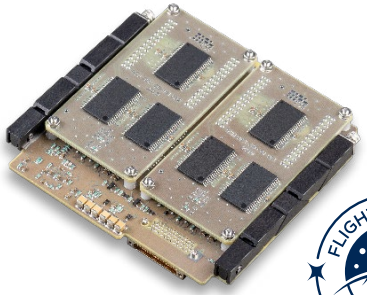
Flexible and Innovative Structures for 3, 6, 12U

C3S develops CubeSat structures to provide optimal configurability. The design is based on modular elements and standard attachment points, allowing for versatile integration. It supports various subunit architectures, including stacked PCBs, backplanes, PCB card retainers, and cable harness designs. Additionally, internal separation subframes and flexible interfaces enhance the adaptability of the system, facilitating customization to meet specific requirements.



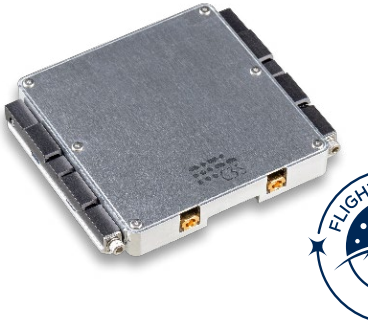
Electrical Power System (EPS)

Our system incorporates cold redundancy and graceful degradation to maintain continuous operation and minimize disruptions in case of component failure. It is designed with single-point failure tolerance to prevent widespread system failures from isolated issues. Additionally, the system has undergone radiation testing (TID) to ensure resilience to space radiation. Both hardware and firmware include mitigation measures for Single Event Upsets (SEUs) to protect against transient errors caused by radiation.



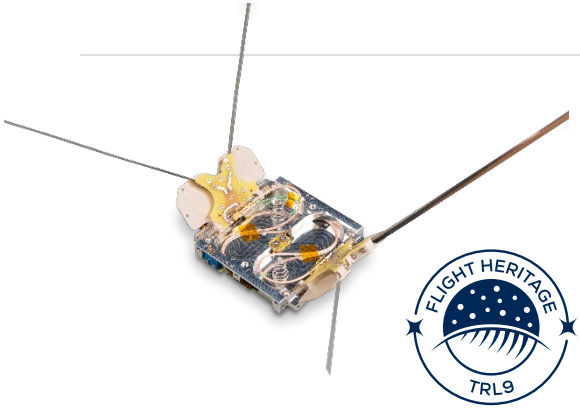
On-board Computer (OBC)

Our on-board computer is distinguished by its single-point failure tolerant design, which ensures high reliability. It features module-level redundancy with separate power supplies, enabling both cold and hot redundant system architecture. Additionally, it supports on-board command list execution (batch service) for flexible operation and in-flight firmware updates for continuous improvements. The system includes differential serial communication links with 2xCAN and 4xUART (M-LVDS or optionally RS-422) buses. It also offers mass storage capabilities of 20GB eMMC and 16MB MRAM, further enhancing its operational efficiency.



Communication Subsystem (COM)

Our communication subsystem is designed with single-point failure tolerance, ensuring exceptional reliability. It supports data rates from 1250 bps to 150 kbps. The system is thermally optimized and features cold redundancy for both transmission and reception, with optional hot redundancy for receiving, further enhancing operational dependability.



Antenna System (ANT)

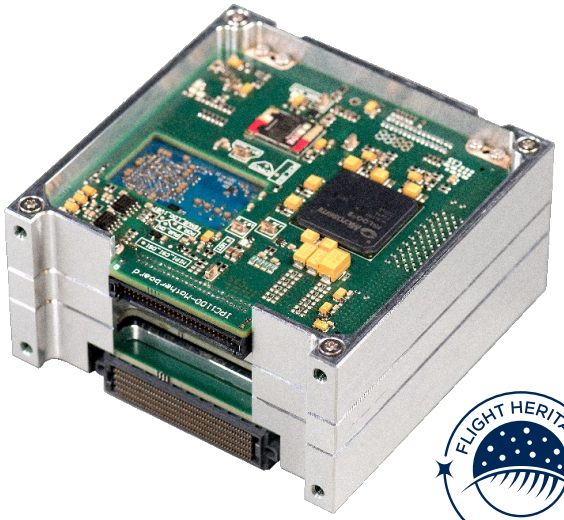
Our antenna system features cold redundancy for uninterrupted performance and high bandwidth to support extensive data transfer. It also ensures quick and reliable deployment.

Cutting-Edge Solutions for the New CubeSat Generation

Customizable High-Performance On-Board Computer (CHP-OBC)

SCAN ME

General-purpose computation platform for complex shared-payload spacecraft. It is essentially a full-featured single-board computer providing an efficient, Linux-based software development environment for payload control and data pre-processing purposes. The central system-on-chip is supported by an on-board FPGA, which enables the access of a uniquely broad, customizable set of data interfaces. The module includes up to 256 GB of non-volatile storage for payload data, and it is capable of providing up to 12 LCL channels with OC/OV protection for payload subsystems.



FLIGHT HERITAGE
TRL9

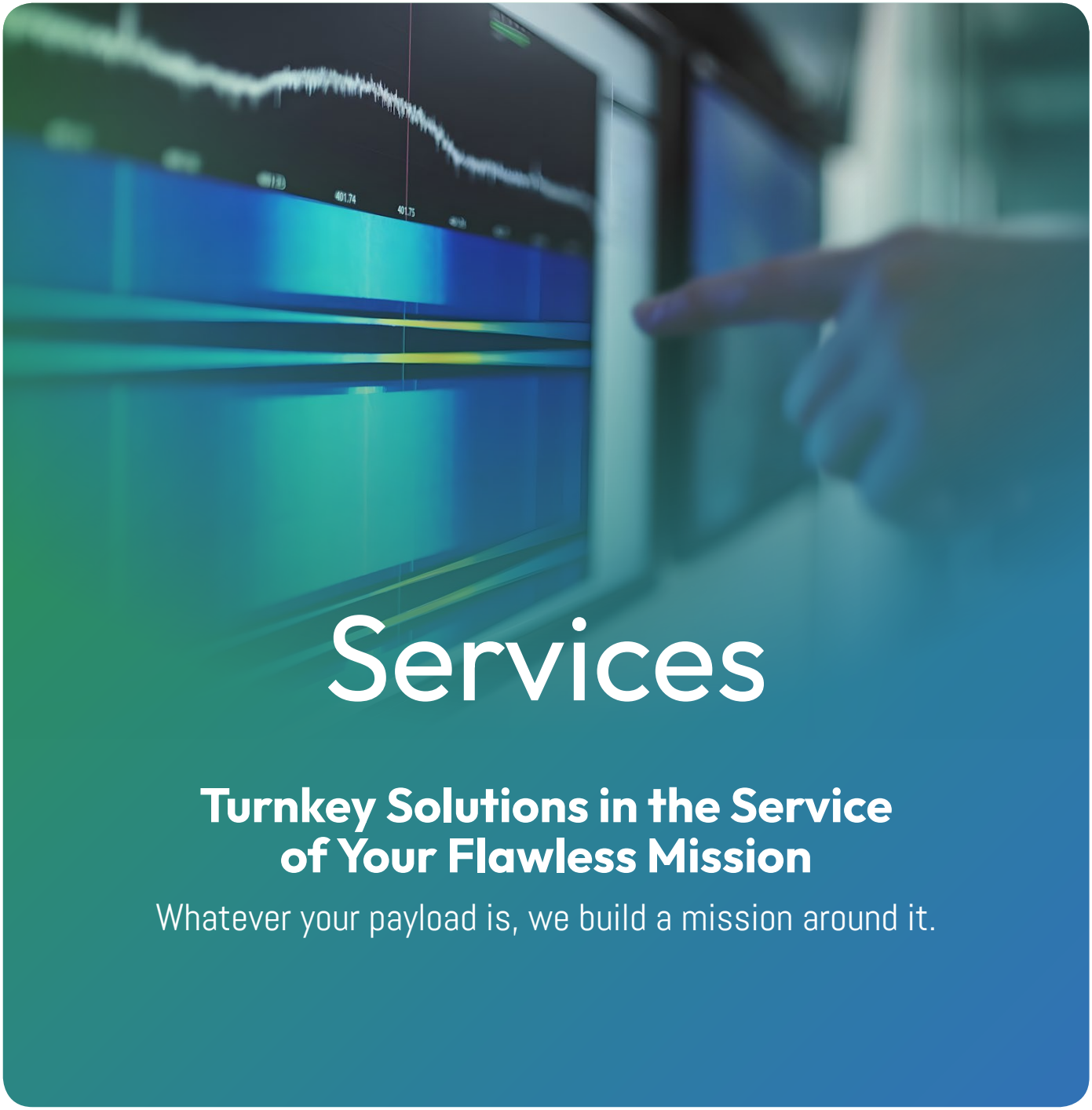
SCAN ME

Orbital Whereabout Locator (OWL)

The OWL is a GNSS-based subsystem for nanosatellites, to support early mission phases after the launch. It transmits location and telemetry data in the VHF range, enabling operators to track the satellite during the most critical moments. Easily integrated into CubeSats, it broadcasts identification and position data for immediate tracking. Its key feature is precise localization through beacon messages, including a unique identifier (SVN) and GNSS data for orbit determination, essential for initial communication and functionality verification in the initial operational days.

Key features

- **Independent operation:** Capable of operating independently from the host satellite through its own battery.
- **Integrated electrical system:** Equipped with its own power supply system, on-board computer, and radio communication transmitter.
- **Compact design:** Designed to fit within a "tuna can" volume, minimizing the impact on valuable payload space within the host satellite.
- **Plug and play:** Can be attached to the host satellite with just four screws, simplifying the integration.
- **RF interface:** The COM system implements the radio frequency interface to Earth, enabling the transmission of beacon frames to the ground stations.
- **Useful telemetry data:** On-board measurements are also transmitted in the beacon messages, like radiation (TID) data, angular velocity measurements and temperature data.
- **On-board data access:** The GNSS data and on-board measurements are available for the host satellite if the optional communication interface is implemented by the host satellite side.



Services

Turnkey Solutions in the Service of Your Flawless Mission

Whatever your payload is, we build a mission around it.

From the Circuit to the Space

Launch Management

We provide launch opportunities, arrange launch deployment, and oversee the management, supervision, and coordination of technical interfaces, equipment, and documentation required for launch acceptance. Launch vehicle integration involves the final flight preparation, satellite checkout, and integration with the launch vehicle at the launch site.

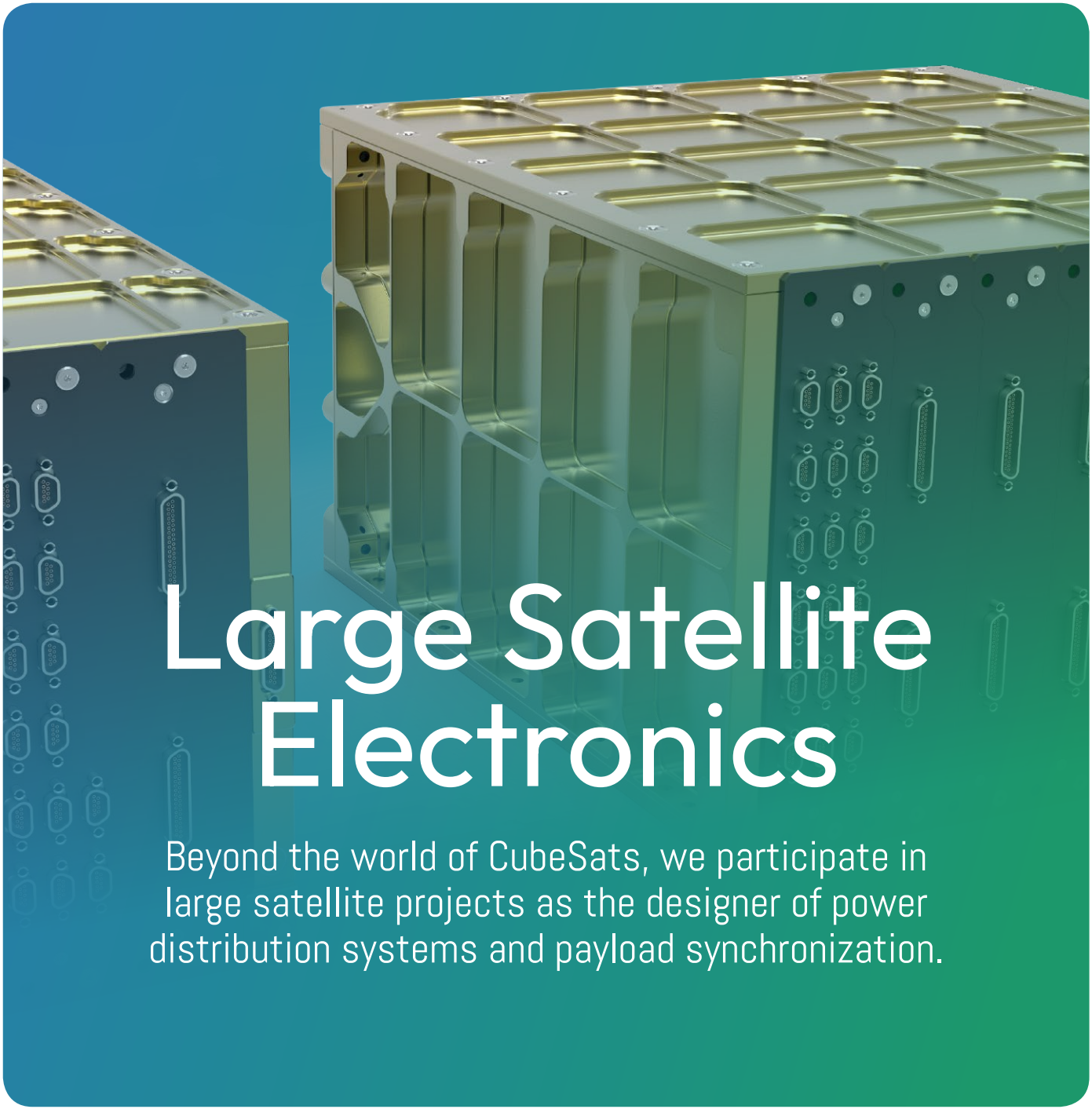
Ground Operations

Our UHF and VHF ground stations ensure low-latency connection to orbiting small satellites, facilitates reliable tracking, offers stable communication.

Our 2.4 m parabolic dish antenna features an advanced antenna feed with an integrated low-noise block for S-band downlink and uplink with circular polarization.

Mission Operation Center (MOC)

C3S MOC is a comprehensive system for managing satellites and tracking stations, handling TC/TM data, offering customizable interfaces for third-party connections, and providing an integrated on-site satellite testing solution. Track and command your satellite from launch until deorbiting.



Large Satellite Electronics

Beyond the world of CubeSats, we participate in large satellite projects as the designer of power distribution systems and payload synchronization.

State-of-the-Art

DCDC Converter

DCDC converters are essential components of satellite power supply systems, enabling the conversion of varying DC voltages from solar panels into tailored voltage and power levels. During recent years, C3S has developed various

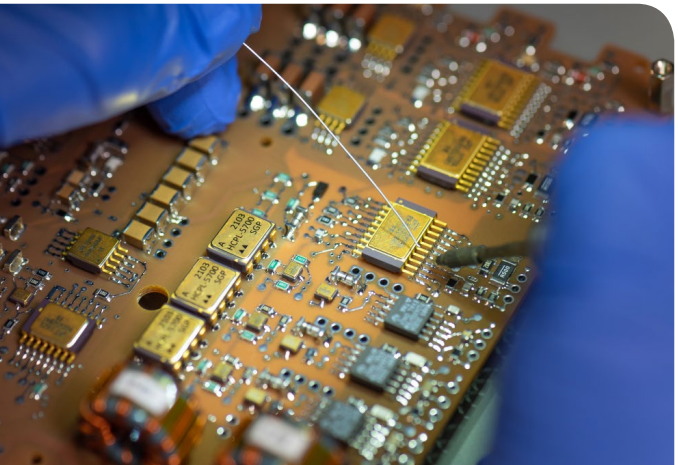
Power System designs for:

Small Satellite needs

- Design driver: Reliable operation in a Low size
- Redundant operations using COTS components
- Lifetime: 1-3 years

Large Satellite needs

- Design driver: Fulfilling stringent platform requirements (high reliability, redundancy, low noise, high efficiency, etc.)
- Space-Grade components
- Long lifetime: 5-10+ years



The Technology Readiness Level (TRL) of the converter has been finalized at TRL6. This development has resulted in a robust converter that meets the rigorous demands of the space industry, ensuring reliable power supply for future satellite missions.

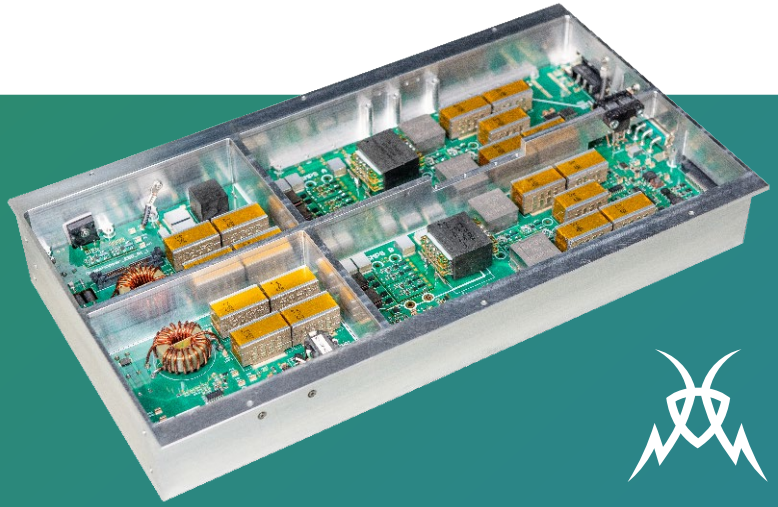
GRASSHOPPER

(GaN-based Resonant Aerospace Switching-mode Supply, for High Output Power with Promising Efficiency and Reliability)

Developed for an ESA tender, GRASSHOPPER represents an ambitious advancement in space converters, utilizing Gallium Nitride **(GaN)** semiconductors to enhance **efficiency and reliability**. This innovative design delivers **750W power**, converting voltage **from 90-150V** unregulated power buses **to a regulated 28V**, achieving an impressive efficiency of 94-97%.

The design includes **galvanic isolation** for safety and reliability, scalability, and **parallelization options** for improved performance. With a Technology Readiness Level (TRL) of 5, it is well-suited for stratospheric and Low Earth Orbit applications.

Unveiled at the 2023 European Space Power Conference (ESPC), GRASSHOPPER aims to cater to the European space market, with adaptations for Smallsat and High Altitude Platform Station (HAPS) applications, while also bringing the advantages of GaN FETs to larger satellites.



ESPC 2023

GRASSHOPPER

Advancing Space Power Technology

C3S Power System Capabilities

	Large satellite power systems		
Attributes	**PLATO** (F-AEU, N-AEU)	**SMILE**	**DCDC converter**
Converter architecture	Flyback + Forward	Forward	Forward
Input voltage range	26-29V	23.5-32.5V	22-38V
Output voltages	32V, 18V, +6.5V, -6.5V, 5.5V, 4.4V	32V, 16V, +6.5V, -6.5V, 4.5V	+44V, -44V, +15V
Output power	~50W	~10W	~75W
Protections	UVLO, OVLO, OCP, OVP	Input LCL, UVLO, OVLO, OCP, OVP	Reverse polarity protection, UVLO, OVLO, OCP, OVP
Additional features	FPGA, SpaceWire TMTC, 50MHz camera sync signal generation (up to 12)	Ultra low noise, FPGA-based TMTC collection, linear regulators on outputs	ECSS-based TMTC, PLL for synchronization
TRL	TRL-3 (closed)	TRL-4 (closed)	TRL 6 (with rad-hard components)
Type	Power + FPGA-based TMTC system for large satellites	Power + FPGA-based TMTC system for large satellites	Power system for large satellites

	Small satellite power systems		
GRASSHOPPER	**EPS1000** CubeSat size	**EPS2000** CubeSat, SmallSat size	**OWL1000** CubeSat size
PSFB (GaN FET- based)	SEPIC + Buck	SEPIC + GaN Buck	SEPIC + Buck
90-150V	6-25V (SA)	6-60V (SA)	3-16.8V
28V	9.9-12.3V, 3.3V, 5.1V	28V unregulated	6.6-8.4V, 3.3V
750W	max. 70W	max. 950W	~1.5W
Reverse polarity protection, UVLO, OVLO, OCP, OVP	UVLO, OVP, OCP, OT, Battery UVP, heater and balancer	UVLO, OVP, OCP, OT, Battery UVP, heater	UVLO, OVLO, OCP
Parallelization, ECSS-based TMTC	Single point failure tolerant (except BAT pack), graceful degradation, cold redundancy Hardware and firmware single event upset (SEU) mitigation	Single point failure tolerant (including the BAT pack), graceful degradation, cold redundancy, Hardware and firmware single event upset (SEU) mitigation Scalable BAT pack size and MPPT channel number	Independent battery from the platform Host satellite protection with input LCL stage Single point failure tolerant input LCL
TRL 5	TRL 9 (RadCube, VIREO)	TRL 7 (2025 Q2)	TRL 9
Highly efficient, scalable power system for micro – large satellites	Complete Power System for small satellites	Complete Power System for small satellites	Complete Power System for „Tuna Can” size module

Space Missions

Inside and Beyond the Solar System

MISSION-ACCOMPLISHED ✔

RadCube 2021

The RadCube mission, implemented under the European Space Agency's GSTP programme was launched in 2021 to demonstrate the miniaturized, onboard instrument technologies of our 3U CubeSat platform. Its primary scientific objective was to perform in-situ measurements of space radiation and the magnetic field environment in LEO for re-al-time monitoring of space weather, including the radiation that spacecraft, spacecraft components, and astronauts are exposed to.

Originally, the mission was planned for six months. However, both the satellite and its subsystems, along with the payloads, continued to operate flawlessly, sending exciting data to our Mission Operation Center. Remarkably, it kept transmitting data until the very last hour before deorbiting.

LIFETIME:

August 2021 - August 2024

26 376
hours in space

16 667
orbited the earth

4 343 292
telemetry packets

MISSION-ACCOMPLISHED ✔

VIREO 2023

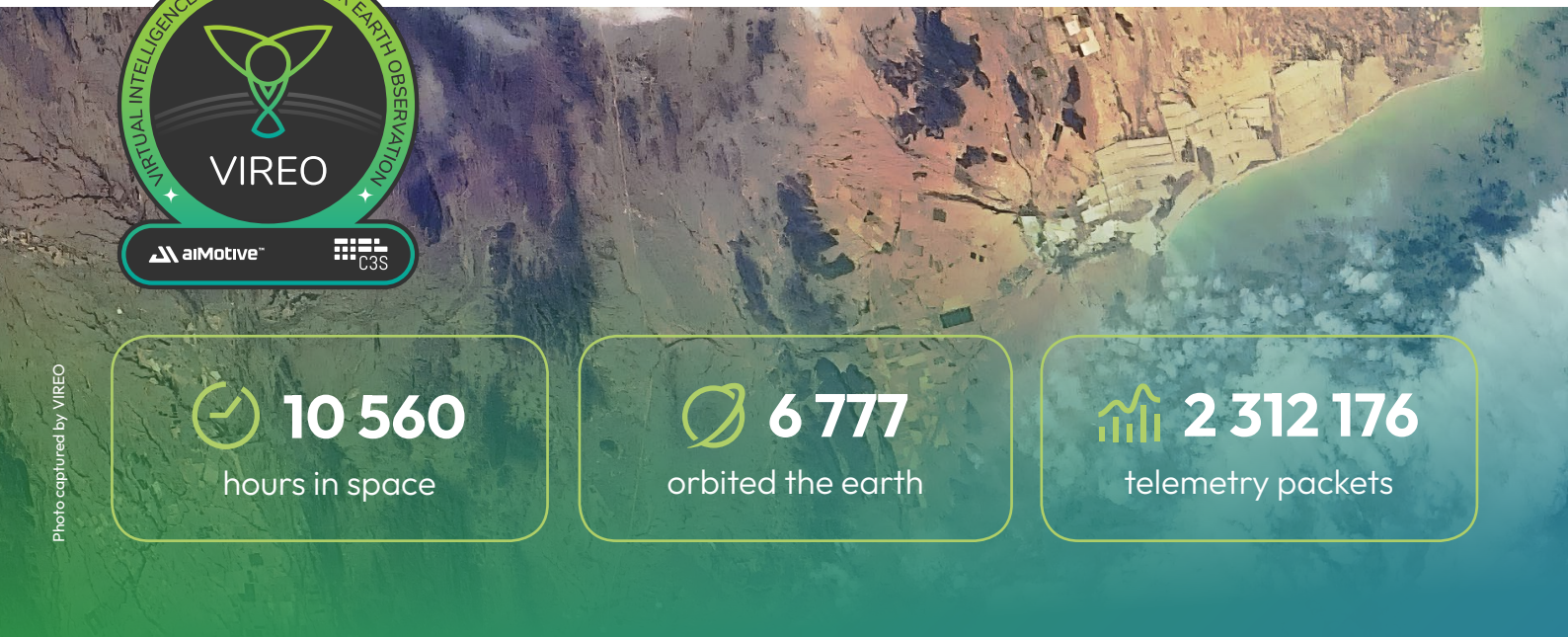
(Virtual Intelligence Realization for Earth Observation)

LIFETIME:

April 2023 - August 2024

It was launched in April 2023. The IOD mission demonstrated how the capabilities of CNN-based AI solutions can be integrated onboard nanosatellites. The payload was developed as a collaborative project between C3S and aiMotive, consisting of two high-performance single-board computers with two pairs of RGB-only and RGB/IR camera modules.

The CHP-OBC submodule within the payload served as an interface unit between the platform and the AIOB-X submodule for this specific mission. Additionally, it incorporated a software component from KP Labs, successfully demonstrating that platform-independent AI-powered algorithms could efficiently facilitate Earth observation data analysis.



ONGOING

WREN-1 2024

(Water Resources in Efficient Networks)

LIFETIME:

August 2024 -

The 6U CubeSat was launched in August 2024, the project responded to the rapid expansion of precision agriculture in Hungary and the increased demand for digital agro-meteorological data. Its goal was to predict drought-prone areas based on continuously updated data, thereby mitigating drought-related damages.

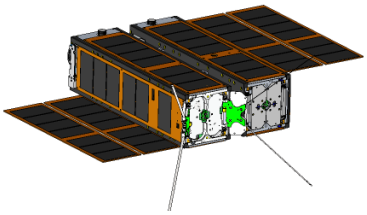
The WREN-1 project focused on assessing the moisture content in the topsoil and monitoring vegetation development. The multispectral imaging system collected data over nearly 10,000 square kilometres at a resolution of 16 x 16 meters, using visible, near infrared, and short-wave infrared wavelengths. One advantage of the satellite was its ability to capture images not only directly beneath it but also to the side, allowing for more frequent updates. After processing the satellite images, the system sent high-resolution biophysical and biochemical data to the ground station, where machine learning algorithms were used for further analysis.

FORTHCOMING >

WISDOM 2025

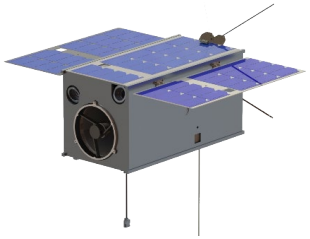
(Wise Integration of Satellites PNT tracking Data using OWL for collision avoidance Management)

The WISDOM project aims to improve space traffic management and collision avoidance through a 6U satellite that separates into two 3U CubeSats. Supported by ESA, it focuses on technologies for positioning, tracking, and satellite communication.



Both CubeSats will have the OWL (Orbital Whereabout Locator) system for independent communication and manoeuvring to reduce collision risks. Key features include successful satellite separation using the HDRM (Hold Down Release Mechanism) and the integration of PNT technologies. For autonomous manoeuvring, the IPC (Intelligent Payload Computer) Wisdom Control software coordinates with propulsion systems and the OWL. One CubeSat is equipped with mini-thrusters, while the other has a plasma brake for deorbiting within two years.

Mauve 2025

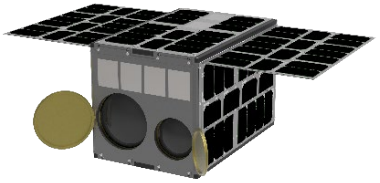


Mauve mission aims to launch a 16U satellite for ultraviolet spectroscopy of M-dwarf stars, crucial for assessing rocky planet habitability. It will offer advanced science data and develop key technologies, such as detector interfaces, thermal design, and precision pointing. This project showcases the ability to create innovative scientific satellites rapidly and cost-effectively, supplying valuable data for exoplanet research and it is a steppingstone for future low-cost scientific satellites. As the platform prime of the international mission consortium, we take charge of the platform design, accommodate the UV spectrometer, and provide redundant intelligent payload controller modules for enhanced platform-payload interaction.

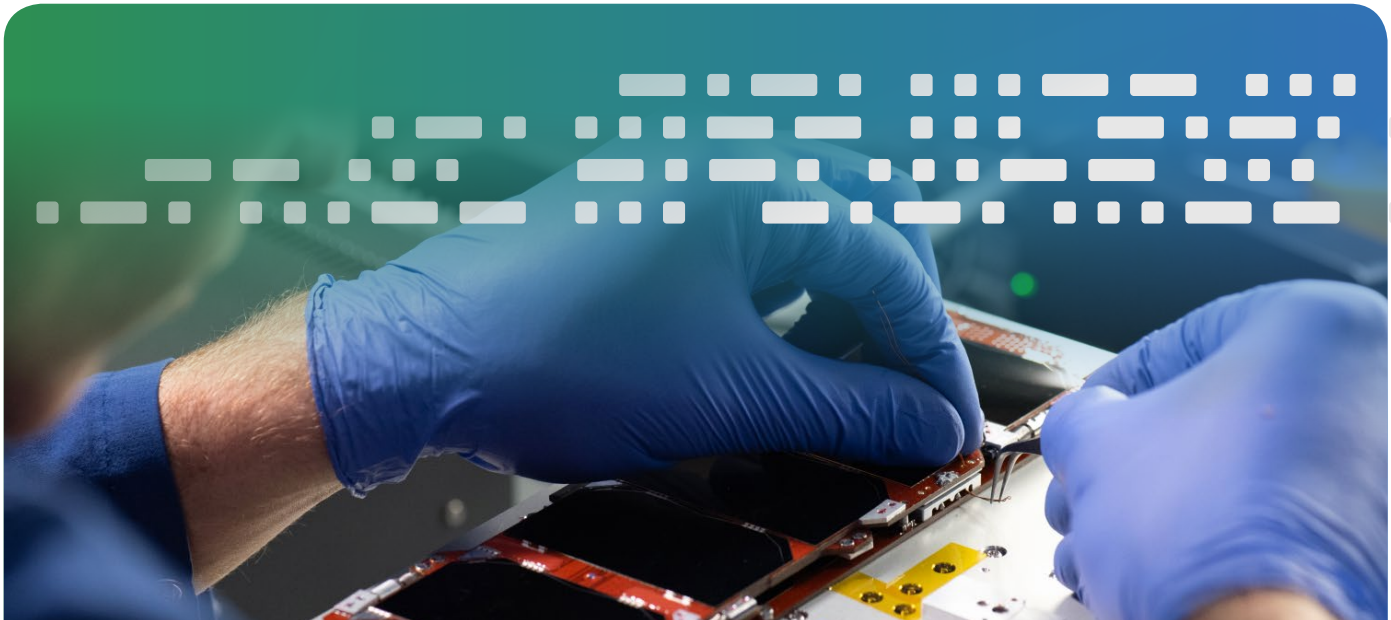
ORIOLE 2026

(Optical Relay and Infrared Optics for LEO Experiments)

The OPS-SAT ORIOLE mission aims to conduct an In-Orbit Demonstration (IOD) of a hybrid optical telecommunication and thermal infrared camera as its main payload. This project is a collaboration between C3S Electronics Development LLC (Hungary), Spaceit OÜ, and Golbriak Space OÜ (Estonia).



The mission focuses on demonstrating full duplex optical communication capabilities from space to ground, with potential for space-to-space communication. It also aims to showcase earth observation capabilities in thermal infrared wavelengths. In addition to technical achievements, the project seeks to establish heritage in the design, manufacturing, and operation of a 12U satellite.



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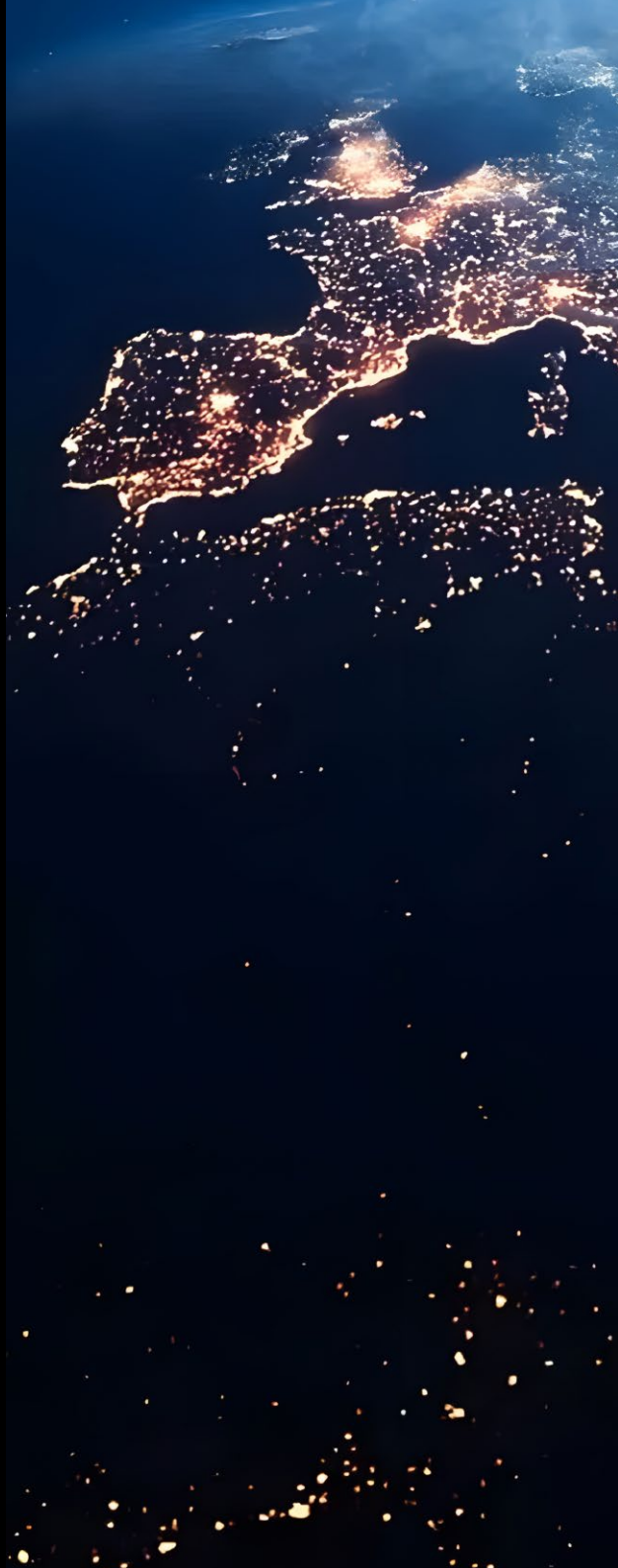

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