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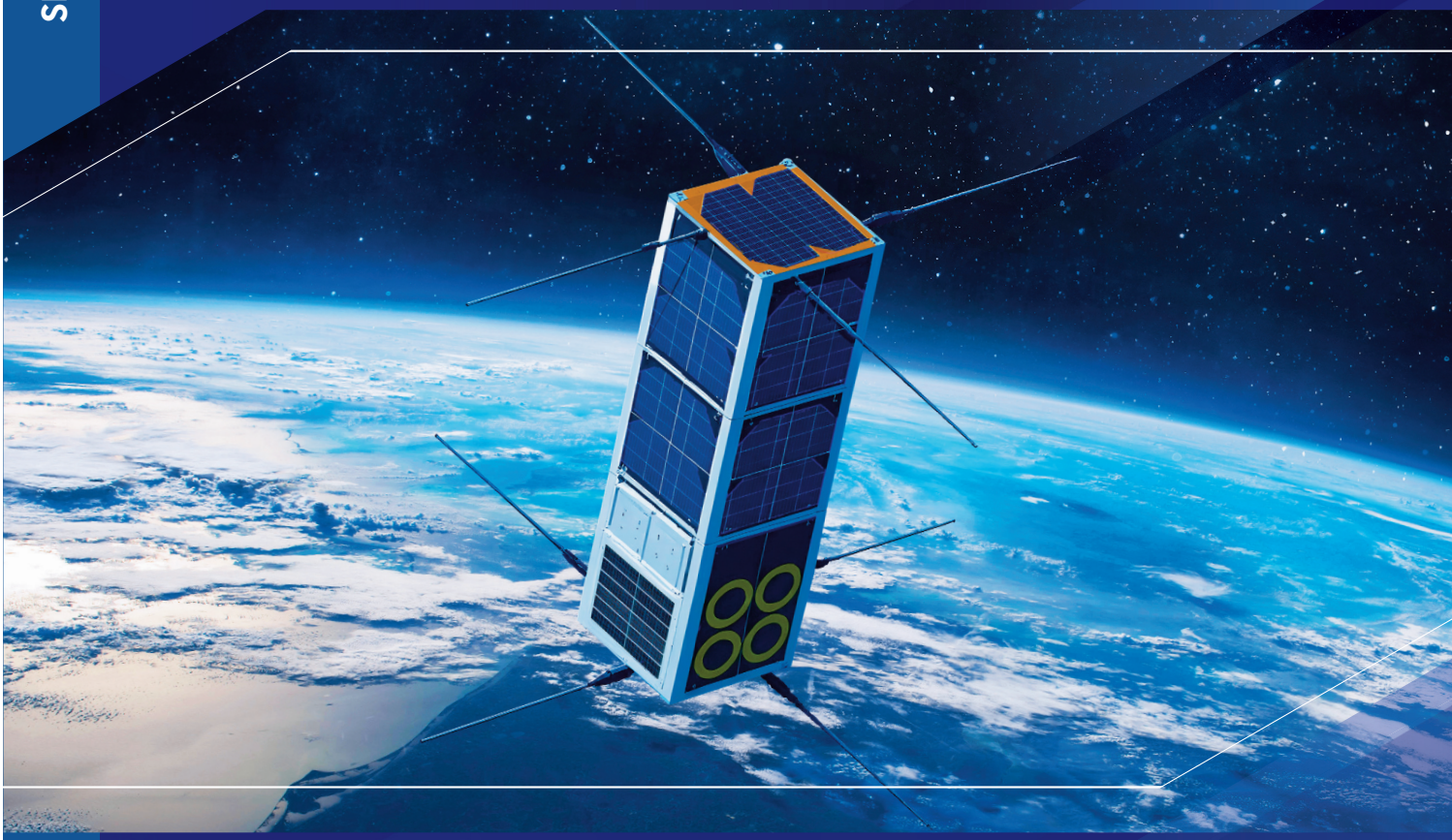
ONERA
THE FRENCH AEROSPACE LAB

SPACE - NEWSPACE

CROCUS

CUTTING-EDGE INSTRUMENTS PUT INTO ORBIT



At a time when innovation is accelerating rapidly thanks to easier access to nano-satellites, ONERA is focusing its activities on operational systems , including the demonstration of technological and scientific payloads in orbit. To meet the objectives of its roadmap Missions and Sensors for New Satellites, ONERA has developed new mission concepts and innovative instruments.

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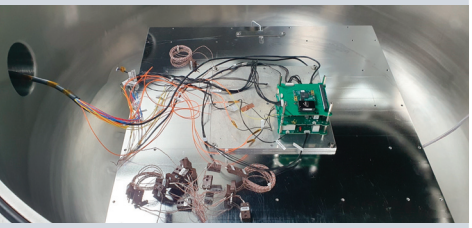
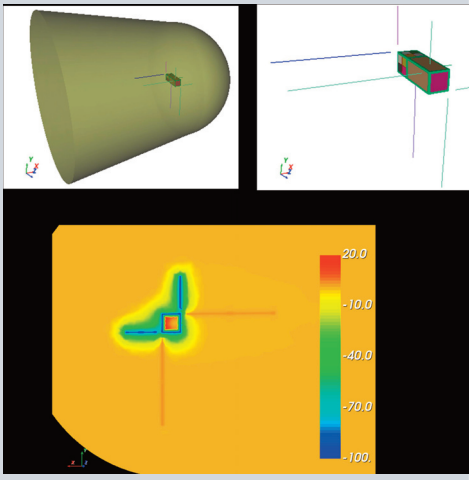
Thermal vacuum chamber.



CubeSIM payload installed in the thermal vacuum chamber.

Ionospheric plasma chamber.



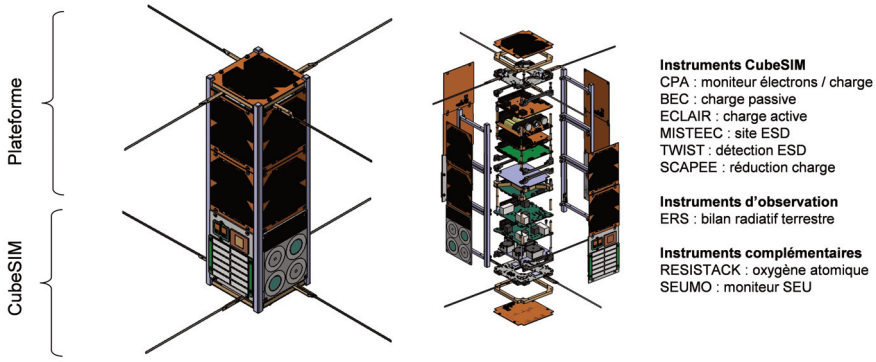
SPIS numerical simulation of the electrical potential (in Volts) of the satellite in its low-Earth orbit environment when ECLAIR is activated.

GOALS

The objective of the CROCUS mission is to provide information on three characteristics of the Earth and its low orbit environment including electron fluxes above 10 keV during auroral arcs, atomic oxygen fluxes and the terrestrial radiative flux. It also aims at characterising electrostatic discharge phenomena and testing technologies to reduce their occurence. The launch of the CROCUS satellite is expected in 2026.

CURRENT DEVELOPMENTS

ONERA is designing the CROCUS nanosatellite (CubeSat 3 U measuring 30 cm x 10 cm x 10 cm). It embeds the CubeSIM (Sensing Impulses and Mitigation on CubeSat) payload, dedicated to measuring electron fluxes and their effects on the satellite, the Resistack instrument, dedicated to assessing atomic oxygen fluxes, and the LATMOS ERS instrument, dedicated to measuring the Earth's radiative flux.
After a prototyping phase, the payload, satellite and ground segment entered the production and testing phase at ONERA.



ASSETS

- **Integration and experimentation resources**: the project is currently supported by a set of assembly, integration and testing resources located in various ONERA laboratories. In its CubeSat integration room, ONERA is currently producing an engineering model and a flight model of the complete satellite under the required cleanliness conditions.
Two thermal vacuum facilities are used to test the elements under -30/+80°C and under -150/+150°C.
An ionospheric plasma chamber (JONAS) is used to represent the space charging environment including electron guns, VUV and plasma sources.
An anechoic chamber is being adapted for radio communication tests
- **Digital resources**: ONERA is also developing an advanced digital simulation laboratory to simulate complex scenarios: the SpaceLab. It can be used to simulate space environment, mission control and constellation or swarm management. The objects simulated range from satellites and launchers to ground and flight sensors. In addition, SPIS (Spacecraft Plasma Interaction Software) is used to model the electrical charging of the CubeSat in space conditions.
- **Multidisciplinarity for cross-disciplinary issues**: ONERA uses its multidisciplinarity to serve this this mission with the participation of 3 scientific departments ((Physics Instrumentation
Space Environment, Electromagnetism and Radar, and Information Processing and Systems).

MAIN PARTNERS

ONERA is working in collaboration with the Ecole Polytechnique Space Centre.

The ERS detector model is developed by the Laboratoire Atmosphères, Observations Spatiales (LATMOS).

CNES, ESA, the Centre Spatial Universitaire de Montpellier (CSUM), the Centre Spatial Universitaire de Grenoble (CSUG), LATMOS and the Institut Royal d'Aéronomie Spatiale de Belgique (BIRA/IASB, Belgium), the Observatoire de Paris - PSL and the Kyushu Institute of Technology (KIT, Japan), contributed to the CROCUS project reviews.

ONERA - May 2025 - Cover : © ONERA - M. Cherfi