



exail

**SOLUTIONS FOR SPACE
APPLICATIONS**

Competencies & capabilities in Space

Exail is a leading high-tech industrial group specializing in cutting-edge robotics, maritime, navigation, aerospace and photonics technologies. With a strong entrepreneurial culture, Exail delivers unrivaled performance, reliability and safety to its civil and defense clients operating in severe environments. From the deep sea to outer space, Exail expands their capabilities with a full range of robust in-house manufactured components, products and systems.

With a dedicated team for space products for more than 20 years, Exail has end to end control of its value chain, from the R&D carried out in its engineering offices through manufacturing in the company's own production shops and quality control.

Production sites have large clean rooms for the manufacturing of space components and systems. Numerous skillful experts are available together with all the required means to develop, test and qualify products for space. Exail supplies numerous space actors following ECSS standards.

exail at a glance

80

YEARS OF
EXPERIENCE

250+

MILLION EUROS
OF TURNOVER

80%

OF TURNOVER
ACHIEVED ABROAD

1500+

EMPLOYEES

10

REFERENCES OF
SPACE GRADE FIBERS
(GUARANTEED RIA)

1000+

KM OF SPACE QUALIFIED
FIBERS FLYING

200+

MODULATORS
IN SPACE

30+

SATELLITES EQUIPPED
WITH ASTRIX
GYROSCOPES

6+

MILLIONS HOURS IN
ORBIT FOR ASTRIX
GYROSCOPES

INNOVATIVE SOLUTIONS FOR SPACE NAVIGATION AND COMMUNICATION

Navigation, guidance and AOCS systems for all orbits

Exail, in partnership with Airbus Defense & Space, provides high-performance space-grade 3-axis Fiber-Optic Gyroscopes that deliver highly accurate and reliable navigation, guidance and AOCS for satellites and launchers.

Leveraging 30 years of experience and 6 million hours in orbit without incident, the Astrix Series is a versatile and fail-safe inertial solution able to operate in all orbits.

Cost-effective navigation solutions for New Space

To answer the needs for smaller and cost-effective navigation solutions for whole constellations of satellites, Exail has developed a dedicated gyroscope: the Astrix NS, a reliable compact and high-performance gyroscope.

Through the EURISA European Space programme, Exail has been trusted to develop the very first cost-effective European Inertial Measurement Unit (IMU).

Auto-track solutions for satellite ground stations

Exail develops a complete monopulse auto-track system that offers highly accurate and reliable automatic tracking capabilities at all satellite frequencies and for all types of antenna feed:

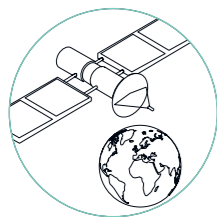
- Compact Tracking Receivers (CTR)
- Tracking Down Converters (TDC)
- Beacon Receivers / Step Track Receivers (STR)

This complete system ensures efficient, reliable and accurate antenna pointing for High Throughput (HTS) and High Frequency (Ku, Ka, Q Band...) satellites.

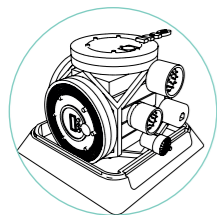
RF transmission system simulation

Exail offers a simulation system able to test and measure, in a laboratory environment, the end-to-end performance of a transmission system (from base station to satellite payload, through transmitters), simulating real radio conditions and providing users with representative environment.

Navigation



6 million
hours in orbit
without incident



1400+
Inertial navigation
systems delivered in 2022

Navigation & guidance

Inertial Measurement Unit (IMU) for safe landing on other planets and scientific missions

Attitude & Orbit Control Systems (AOCS)

Fiber-Optic Gyroscopes (FOG) for telecom satellites

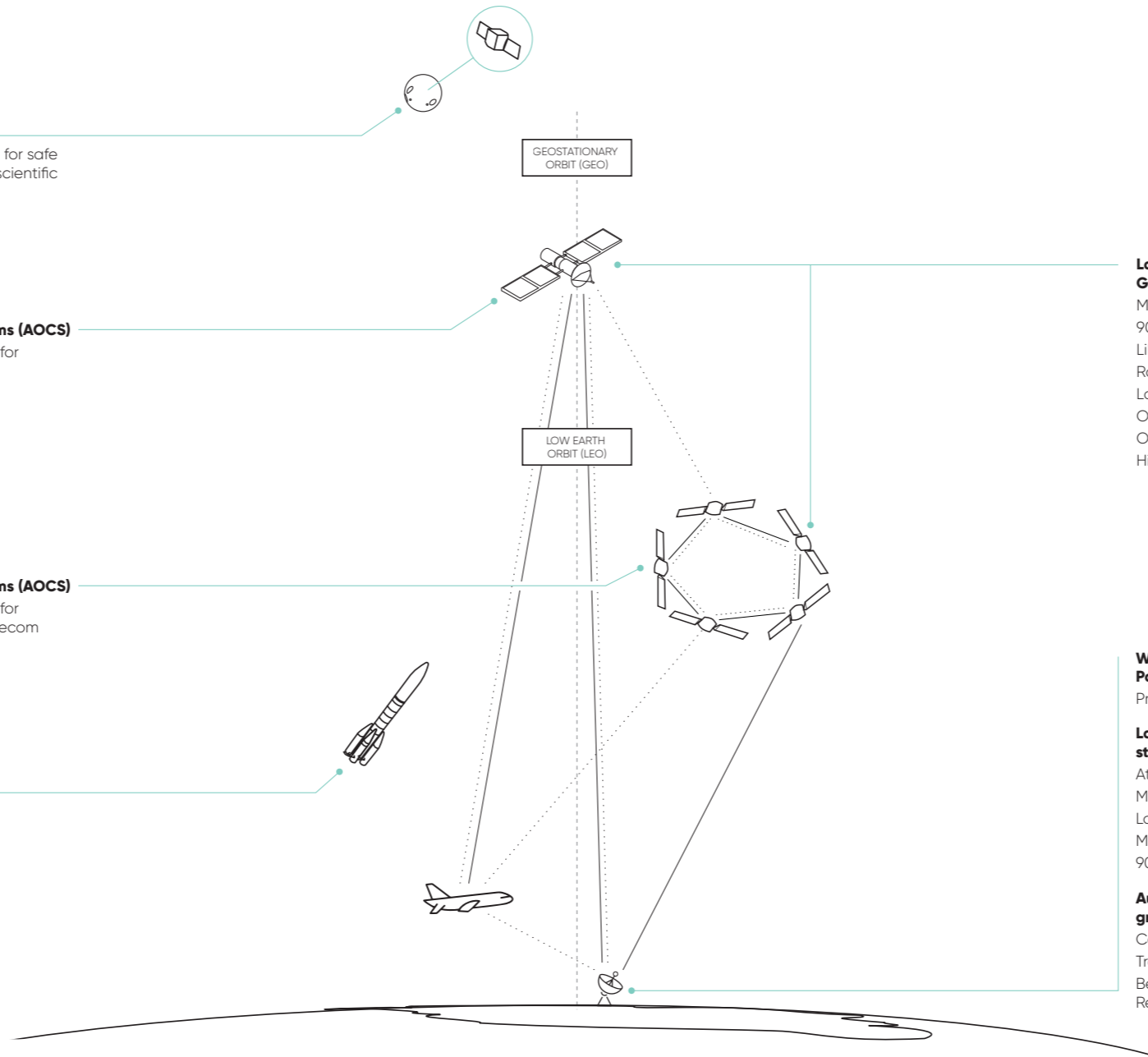
Attitude & Orbit Control Systems (AOCS)

Fiber-Optic Gyroscopes (FOG) for Earth observation, strategic telecom satellites and constellations

Navigation & guidance

Inertial Navigation Systems for launchers

..... Optical channel
—— Radio frequencies



Communication

Laser communications between GEO, LEO satellites and Earth

Multiplexers / Demultiplexers
90° Hybrids
LiNbO₃ Modulators
Rad Hard Fibers and FBGs
Low Noise Optical Amplifiers
Optical Channel Emitters
Optical Channel Receivers
High-speed Transceivers

Wideband Satellite Link & Payload Emulator

Propagation Channel Emulator

Laser communications between ground stations, aircraft and satellites

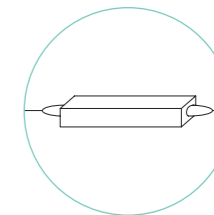
Atomic clocks
ModBox OGS Transceivers
Low Noise Optical Amplifiers
Multiplexers / Demultiplexers
90° Hybrids

Auto-track solutions for satellite ground stations

Compact Tracking Receiver (CTR)
Tracking Down Converter (TDC)
Beacon Receivers / Step Track Receivers (STR)



Exail masters the manufacturing of "flight proven" optical components and high-performance systems



200+
Modulators in space

PIONEER IN SPACE PROVEN COMPONENTS AND INTEGRATED SYSTEMS FOR OPTICAL COMMUNICATION

Mastering “flight proven” optical components and systems

Main challenges of optical communication in space is to overcome interferences, long-distance and harsh conditions with highly reliable components and systems. Exail's space-grade products and systems are robust by design and based on proven technology deployed in the harshest orbit (GEO).

They also fit many requirements of the New Space market for LEO/ MEO satellites and constellations.

Providing cutting-edge integrated systems for space applications

Exail's expertise in the telecommunication domain, its experience in assembling complex systems and its space background, allows the company to provide integrated systems for the space market, such as:

- Low Noise Optical Amplifier (LNOA): pump diode laser, active fiber
- Optical Channel Emitter (OCE): seed laser, LiNbO₃ modulateur, matching RF amplifier, Mux
- Optical Channel Receiver (OCR): demux, photoreceiver, 90° hybrids

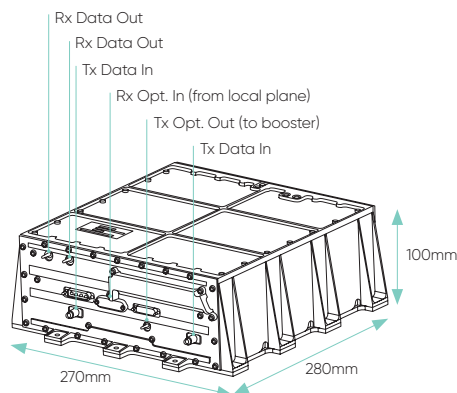
Fully integrated transceiver for high-speed space communications

Exail, within the FOLC* project initiated by ESA, has developed a ready for flight model transmitter and receiver. Exail's fully integrated optical transceiver for space communication, houses:

- 1 to 6 emission channels
- 1 to 8 reception channels
- Data transmission rate of 20 Gbit/s per optical channel
- Customizable total weight
- Customizable maximal power

The transceiver can be used for constellations counting between two to thousands of satellites.

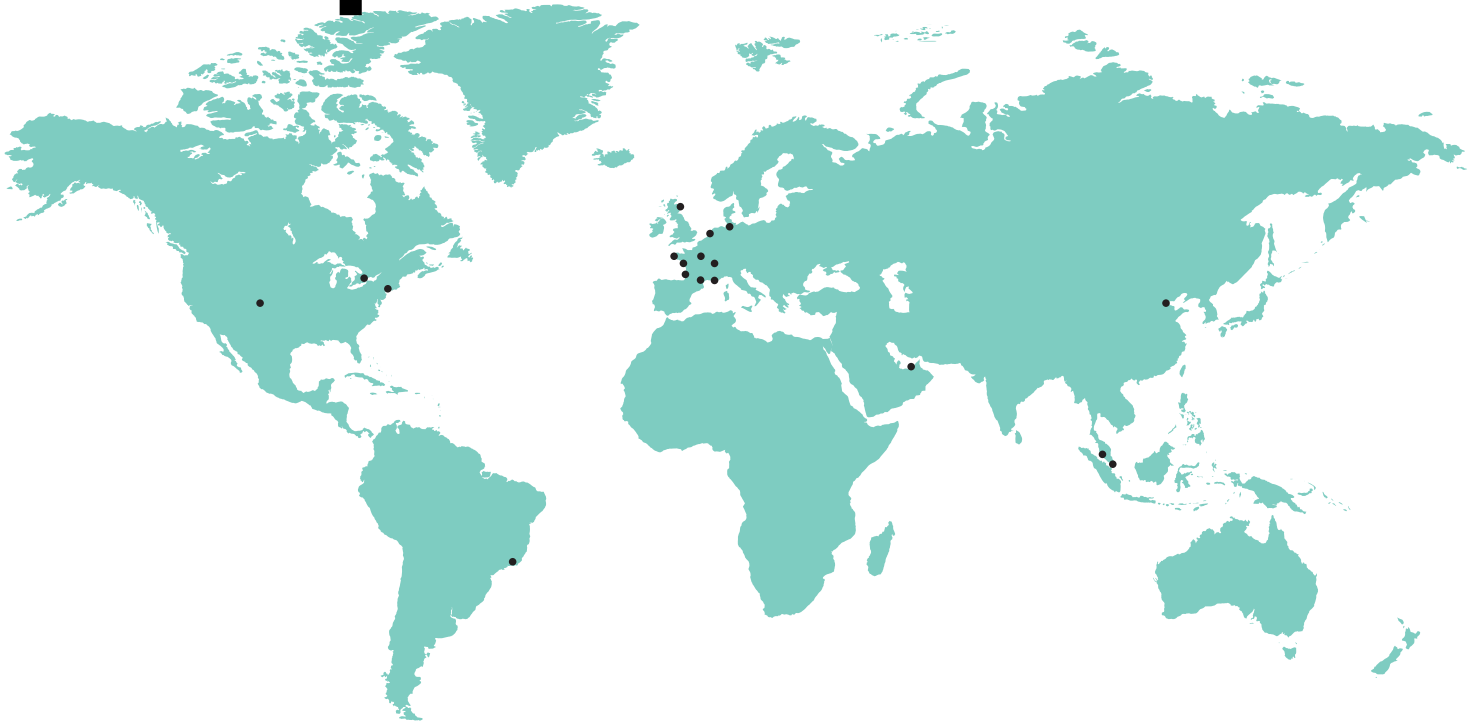
*(Feeder for Optical Link Constellation)



Involved in the largest space projects

As well as for the projects launched for the new space markets, or for the space navigation project, Eurisa. Exail is also involved in the new high-speed space communications project, FOLC. The FOLC project is initiated by ESA, supported by the French Space Agency (CNES), and with Airbus Defence and Space and Exail as partners.

our global footprint



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