

Operating in the aerospace, defense, and security sector, Terma supports customers and partners all over the world. With more than 1,400 committed employees globally, we develop and manufacture mission-critical products and solutions that meet exacting customer requirements.

At Terma, we believe in the premise that creating customer value is not just about strong engineering and manufacturing skills. It is also about being able to apply these skills in the context of our customers' specific needs. Only through close collaboration and dialog can we deliver a level of partnership and integration unmatched in the industry.

Our business activities, products, and systems include: command and control systems; radar systems; self-protection systems for ships and aircraft; space technology; and advanced aerostructures for the aircraft industry.

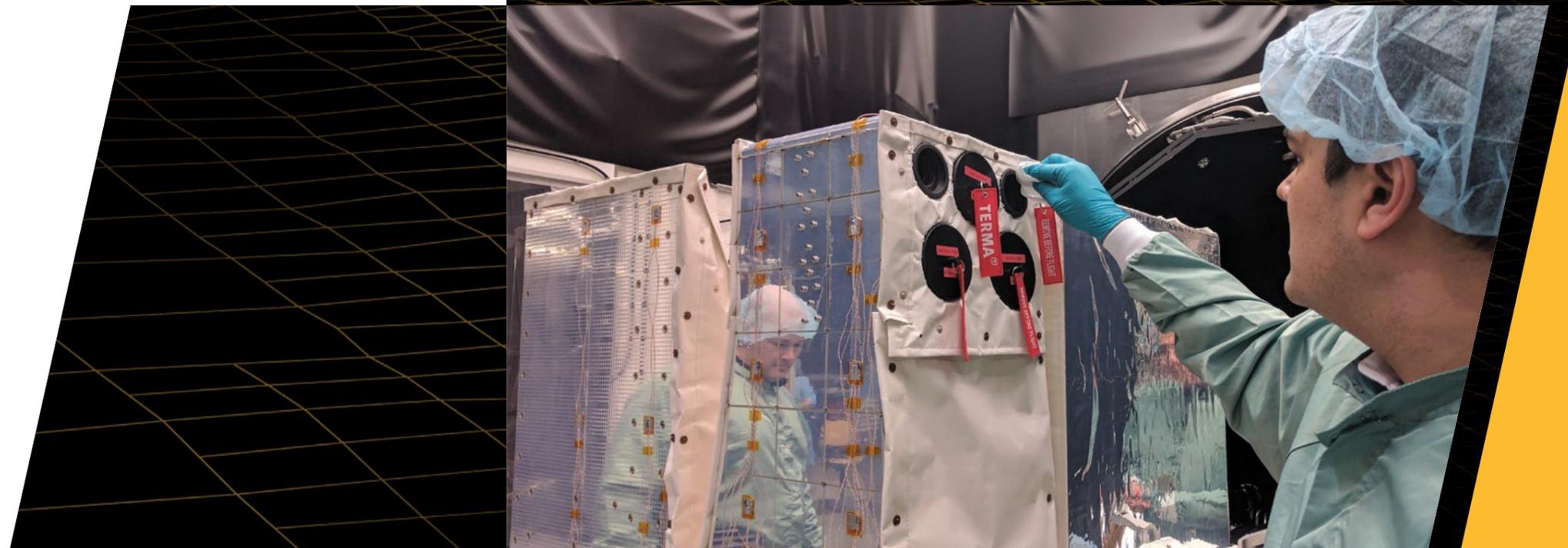
Terma has decades of hands-on know-how in supporting and maintaining mission-critical systems in some of the world's most hostile areas. Terma Global Support & Services offers Through Life support of all our products to maximize operational availability, enhance platform lifetime, and ensure the best possible cost of ownership.

Headquartered in Aarhus, Denmark, Terma has subsidiaries and operations in the Netherlands, Germany, Belgium, UK, India, UAE, Singapore as well as a wholly-owned U.S. subsidiary, Terma North America Inc. Terma North America Inc. is headquartered in Arlington, in the Washington D.C. area, with other offices in Georgia, Texas, and Virginia.



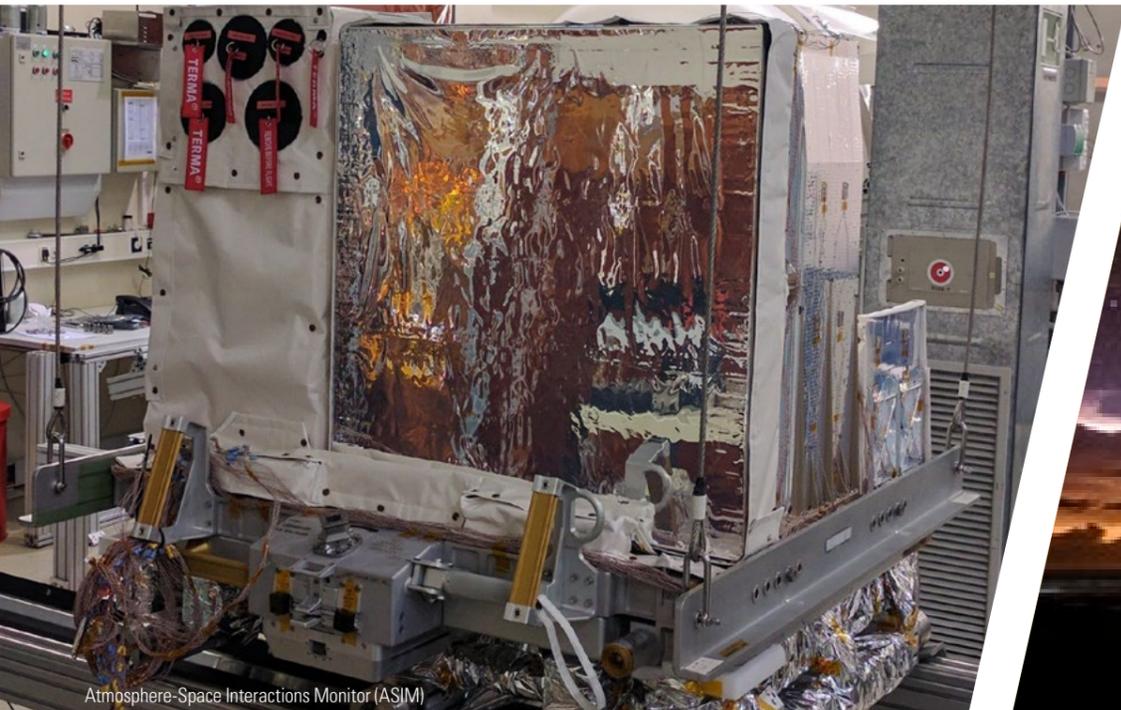
# ASIM

## Atmosphere-Space Interactions Monitor

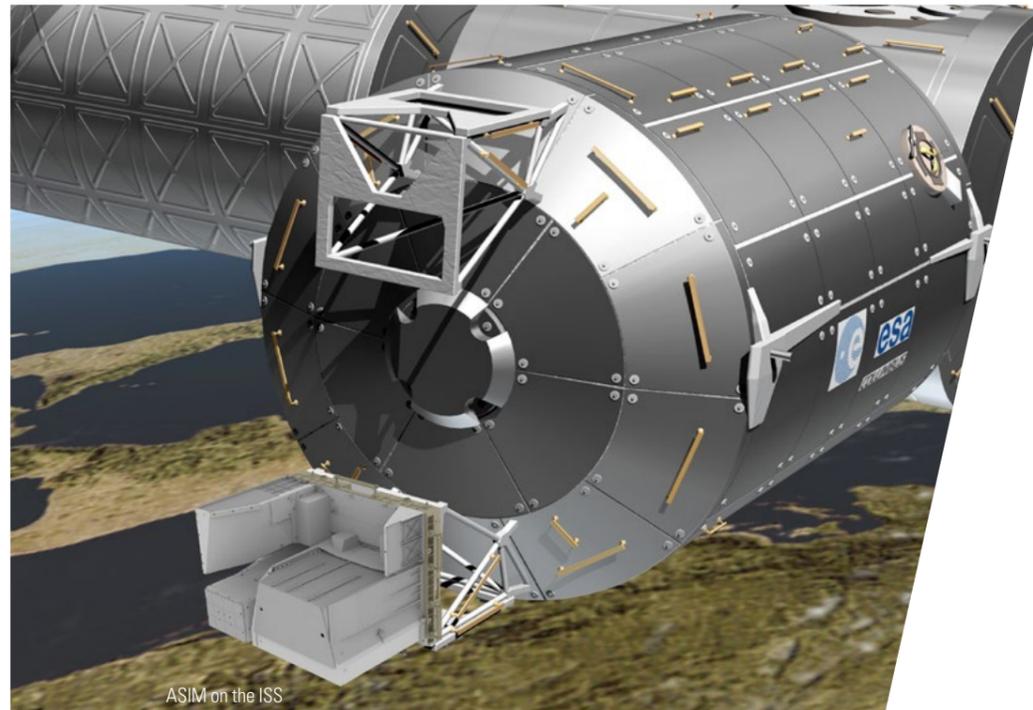


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Image courtesy: European Space Agency



Atmosphere-Space Interactions Monitor (ASIM)



ASIM on the ISS

# ASIM

Terma is the project prime for the development of 'The Atmosphere-Space Interactions Monitor' (ASIM). ASIM is the the largest space project for Terma.

For Terma, it has been very exciting and challenging to lead the management and technical development during the last 10 years since the contract was secured with ESA as our customer. ASIM is the largest space project that Terma has been involved in – and one of the most complex and challenging tasks, comprising a number of new developments building on the deep heritage of the Terma space electronics and software product domains. The total price of the ASIM project is in the area of MDKK 350.

ASIM is an observatory, which will be installed on the European Columbus module of the International Space Station (ISS) at the beginning of 2018. ASIM will be used by scientists all over the world for Earth observation in order to study high-altitude electrical discharges in the stratosphere and mesosphere above severe thunderstorms, the so-called red sprites, blue jets, haloes, and elves. The scientific studies are highly supported by pictures taken by the Danish astronaut Andreas Mogensen during his space flight in 2015.

As the prime contractor, Terma, is responsible for ensuring progress and technical management of the project and for the coordination with ESA and subcontractors, and not least for delivering the ASIM observatory for handover to ESA, NASA, and SpaceX at Kennedy Space Center (KSC) in Florida. ASIM will then undergo final inspection and be installed into the Dragon spacecraft, which is expected to be launched to ISS by the SpaceX Falcon 9 rocket in March 2018.

Development and manufacturing of the ASIM observatory, computers, and systems have been carried out in collaboration with Danish and European companies and universities.

Terma was tasked with the development of the MMIA instrument in close collaboration with DTU Space which has been responsible for the development of the MXGS instrument in collaboration with the universities of Bergen, Valencia, and Warsaw. The main ASIM computer has been developed by OHB Italia in Milan.

## Main subsystems developed for ASIM

### MMIA

Modular Multi-spectral Imaging Array is an instrument which performs optical measurements.

### MXGS

Modular X-ray and Gamma-ray Sensor measures x-ray and gamma-ray radiation from thunderstorms.

### DHPU

Data Handling and Power Unit provides the electrical and communication interface between ASIM and ISS.

After launch, Terma will contribute to the ASIM installation on ISS and the commissioning of the observatory in collaboration with ISS operations. Terma experts will support the staff at the control center in Belgium with calibration and adjustment of the instruments to provide optimum scientific measurements to the scientists at ASIM Data Science Center in Lyngby, Denmark, and worldwide.

**ASIM mass and dimensions:** 314 kg; 122 cm x 134 cm x 99 cm

## ASIM mission

ASIM will address a variety of important scientific and technological aspects which will include:

- Understanding of the processes involved in thunderstorm initiated electrical discharges
- Understanding their impact on atmospheric processes and possible links to climate determining factors
- Development of new technologies with spin-off into terrestrial applications for advanced process control and optical instrumentation
- Demonstration of the fruitful utilization of the collaborative investments

These discharges, to be observed by ASIM, are linked to violent storms in the tropics and inject water vapor, NO<sub>x</sub>, and other greenhouse gases into the stratosphere where they become part of the climate moderators.

Based on ASIM data, scientists will study these effects as well as the electrical influence on the ionosphere and the atmospheric interactions with the particle radiation from the Sun. Both of which also have a direct bearing on the Earth's climate.

Flying the ASIM observatory on ISS provides a unique opportunity for systematic monitoring of these phenomena on a global scale. Furthermore, the advanced detector technology to be used for ASIM will have spin-off into a range of important terrestrial applications.

## Project prime and project management

- Terma A/S, Denmark

## MMIA instrument team

- Terma A/S, Denmark
- DTU Space, Denmark

## MXGS instrument team

- DTU Space, Denmark
- University of Bergen, Norway
- University of Valencia, Spain
- Space Research Centre at Polish Academy of Science, Poland

## ASIM principal investigator

- DTU Space, Denmark (T. Neubert)

## Co-investigators

- University of Valencia, Spain (V. Reglero)
- University of Bergen, Norway (N. Østgaard)
- Commissariat à l'Énergie Atomique, France (E. Blanc)

## ESA ASIM science coordinator

- ESA, the Netherlands (A. Orr)