Terma is managing the development of the Atmosphere-Space Interactions Monitor (ASIM) instrument that is intended to fly on the exterior of International Space Station (ISS).

The Atmosphere-Space Interactions Monitor (ASIM) is an observatory to be placed on the exterior of the ISS. It will measure high altitude lightning that is discharged from thunderclouds, stretching up to the ionosphere at altitudes of 90-100 km. These formations of lightning are known as ”red sprites”, ”blue jets”, and ”elves”. In addition, the ASIM project will study the discharges observed in the form of energetic bursts of X-rays and gamma rays, likewise discharged from violent lightning.

In science terms the optical events are referred to as Transient Luminous Events (TLEs), and the X- and Gamma ray events as Terrestrial Gamma Flashes (TGFs).

ASIM Instruments
ASIM consists of two optical cameras, 3 photometers, and one large X- and Gamma ray detector. The instruments will be installed on the Columbus External Pallet to be mounted on the exterior of the Columbus module, housing ESA's laboratory on the ISS.

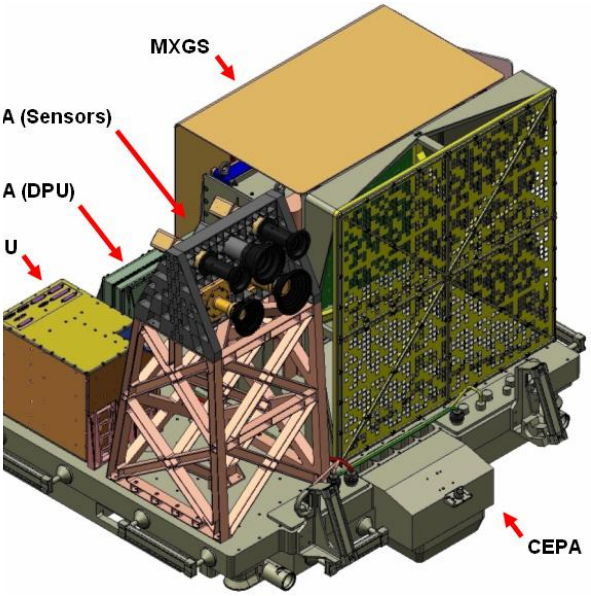
The optical assembly referred to as the Modular Multi-spectral Imaging Array (MMIA), comprises two optical narrow band cameras and three photometers with related optical and signal processing capabilities, including autonomous event detection algorithms to identify and prioritize events for download to earth.

The MMIA instrument will be combined with the X- and Gamma Ray detector into the Nadir Viewing Assembly looking directly down on top of thunderstorms according above the earth.

The Modular X and Gamma ray Sensor module (MXGS) is designed to detect radiation from Terrestrial Gamma Flashes and from lightning induced electron precipitation. The detector is built around a Bismuth Germanium as well as Cadmium Zinc Telluride semiconductor detection plane of 32cm x 32cm with possible imaging capabilities.

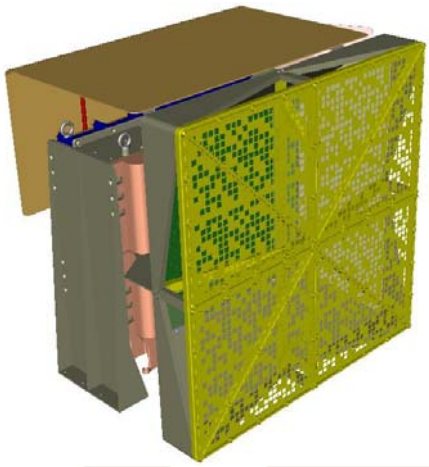
Fast electronic circuitry used in the MXGS will provide time history and spectra over the course of the expected lifetime of 1-5 ms for each TGF. Also, a TGF burst trigger signal is passed to the adjacent MMIA module (and visa versa) for synchronization of the two types of observation.

ASIM Project
The project has been a Danish initiative, from the very start, headed in the initial phase by the DTU Space, National Space Institute, with participation of the University of Valencia and the University of Bergen. The development phase of ASIM has an estimate time span of 3½ years leading up to the launch and operational phases. ASIM is scheduled to be launched in 2014 by the Japan Aerospace Exploration Agency (JAXA) with the new H-2B heavy lift rocket carrying the H-2 Transfer Vehicle (HTV) to the International Space Station.



Layout of ASIM Instrumentation


Nadir Viewing Optical Assembly (MMIA)


Nadir Viewing X- and Gamma Ray Detector (MXGS)

ASIM Mission

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

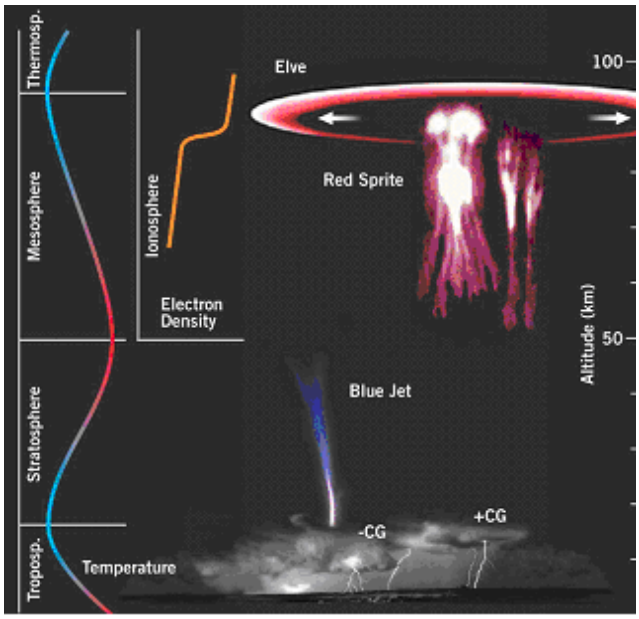
- Understanding of the processes involved in thunderstorm initiated electrical discharges
- Understand their impact on atmospheric processes and possible links to climate determining factors
- Development of new technologies with spin-off into terrestrial applications for advanced process control and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

The nature of the electrical phenomena is illustrated in the chart to the right and exemplified with the observations of giant lightning over the South Chinese Sea (25 frames/sec).

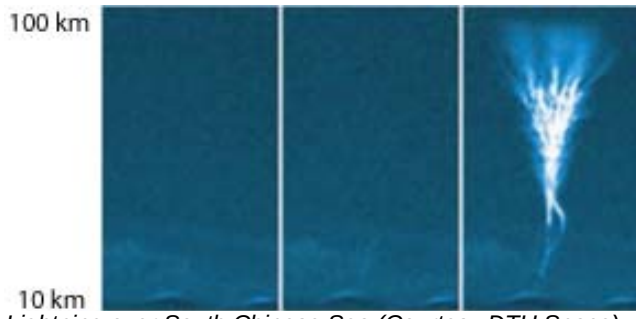
These discharges are linked to violent storms in the tropics and inject water vapour, NOx and other greenhouse gases into the stratosphere where they become part of the climate moderators.

ASIM 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.

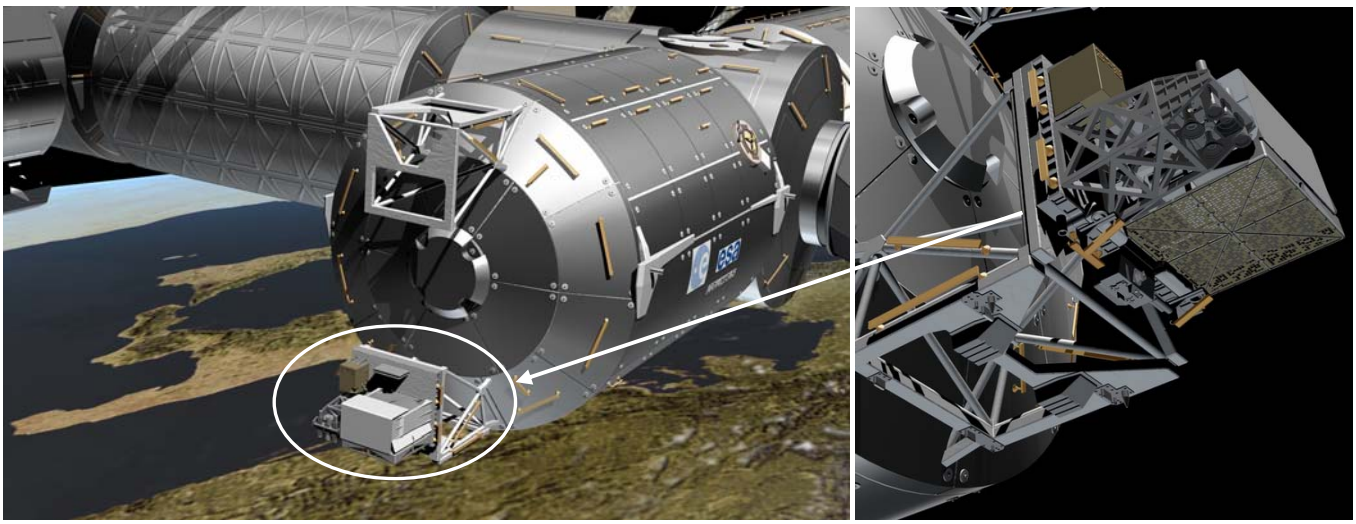
Flying the ASIM instrument package on the ISS provides a unique opportunity for systematic monitoring of these phenomena on a global scale. Furthermore, the advanced detector technology to be used for ASIM will have spin-off into a range of important terrestrial applications.



Lightning Phenomena (Courtesy DTU Space)



Lightning over South Chinese Sea (Courtesy DTU Space)



ASIM mounted on Columbus external location of the International Space Station
(Artists impression, Courtesy ESA and DTU Space)