ESA's Atmosphere-Space Interactions Monitor (ASIM) for the ISS

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The Atmosphere-Space Interaction Monitor (ASIM) is an Earth observation facility on the external platform on the Columbus module of the International Space Station. It will mainly study the giant electrical discharges (lightning) in the high-altitude atmosphere above thunderstorms. The discharges are seen as optical-, X- and Gamma-ray flashes in the stratosphere and mesosphere. The optical emissions are called "red sprites", "blue jets", and "elves" or "Transient Luminous Events" (TLEs). The X- and Gamma ray emissions are referred to as "Terrestrial Gamma-Ray flashes" (TGFs). ASIM is part of ESA's "European Programme for Life and Physical Sciences" (ELIPS). This poster describes the science goals of ASIM, the payload and current status of the project.

1. The ASIM mission

ASIM is part of ESA's "**E**uropean **P**rogramme for **L**ife and **P**hysical **S**ciences" (ELIPS).

The ASIM instrument concept was first submitted in 2003 to an ESA call for external payloads issued to national delegates.

ASIM was submitted again to ESA's announcement of opportunity AO-2004 by part of the team. The scientific merit in the peer review was judged "excellent".

ASIM entered an Instrument Pre-Phase A study with the Danish National Space Centre in December 2003. The study was completed in June 2004 with the recommendation to enlarge to a broader European mission including European partners such as Norway and Spain, in charge of co-developing the upgraded version of the X and Gamma-ray sensor MXGS.

A Payload Pre-Phase A study using ESA's CDF (Concurrent Design Facility) was performed in October 2004 at ESA/ESTEC.

A Payload Phase A study took place in 2005-2006. the Phase B from 2007-2009. Phase C/D started in August 2010, with TERMA A/S (DK) as prime contractor.

The main funding comes from ESA and from Denmark, Spain, Norway and Italy.

2. ASIM science payload

The ASIM Science payload is composed of nadir-looking detectors which cover the optical waveband and the X to Gamma-ray waveband:

The Modular Multi-Spectral Imaging Array (MMIA) composed of:

- 2 cameras (C1: 337.0/5nm; C2: 777.4/5nm) and
- 3 photometers (P1: 337.0/5nm; P2: 180-230nm; P3: 777.4/5nm)

The Modular X- and Gamma-ray Sensor (MXGS). MXGS is a soft gamma-ray imager with extended spectroscopic capabilities up to 20 MeV. It includes 2 detector planes:

- 1024 cm2 CdZnTe detector plane multiplexed by a coded mask: 15-400 keV
- 900 cm2 BGO detector assembly: 200 keV-20MeV

3. ASIM Science Objectives

Research objectives related to climate:

- Provide the most comprehensive global survey of TLEs and TGFs
- Study the physics of TLEs, TGFs and lightening
- Study high-altitude cloud formation
- Determine the characteristics of thunderstorms that make them effective in the perturbation of the high-altitude atmosphere

Research objectives related to Space Science:

- Study of Aurora
- Study effects of thunderstorms on the ionosphere and the radiation belts
- Determine the distribution of meteors in the Earth's environment and quantify their effect on the atmosphere
- Lightening-induced electron precipitation and relativistic electron precipitation.

Research objectives related to Earth Observation:

- Dust storms and their effect on cloud formation and electrification
- Mega-cities and the effect of pollutants on cloud formation and electrification
- Forest fires and volcanoes and the relation to cloud formation and electrification
- Intensification of hurricanes and its relation to eye-wall lightning activity

4. ASIM Science Team

As part of its ELIPS programme ESA supports the scientific community by sponsoring scientific meetings in order to promote dialogue, coordination and synergies among the science community in various research topics related to microgravity research and ISS utilization. This is done by setting up so-called “Topical Teams”.

The Topical Team related to ASIM is composed of more than 100 scientists from Europe and beyond.