# MetOp

## Facts & Figures

MetOp will be Europe's first polar-orbiting satellite dedicated to operational meteorology. It represents the European contribution to a new cooperative venture with the United States providing data that will be used to monitor our climate and improve weather forecasting.

The Initial Joint Polar System (IJPS) is a co-operative agreement between the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and NOAA to replace the current U,S. mid-morning service by an improved European service – the EUMETSAT Polar System (EPS). The MetOp satellites have been developed for this purpose.

A new generation of European instruments that offer improved remote sensing capabilities to both meteorologists and climatologists will be carried with a set of 'heritage' instruments provided by the United States. The new European instruments will augment the accuracy of:

- temperature and humidity measurements
- wind speed and wind direction measurements, especially over the ocean
- profiles of ozone in the atmosphere

MetOp is a series of three satellites to be launched sequentially to provide data over the next 14 years, starting in 2006, and forms the space segment of EUMETSAT's Polar System (EPS).

The MetOp programme was jointly established by the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). In the resulting joint programme, ESA is responsible for the development of the space segment and EUMETSAT for the development of the overall system, the ground segment and the operations over the mission duration. As partners to this cooperative venture, the Centre National d'Etudes Spatiales (CNES) in France and the United States National Oceanic and Atmospheric Administration (NOAA), provide payload instruments embarked on MetOp.

## PAYLOAD

**Main Payload consists of the following meteorological Instruments**:

The new European instruments are respectively developed by ESA (ASCAT, GRAS, GOME/2), CNES (IASI) and EUMETSAT (MHS) and will offer advanced sounding capabilities, the measurement of ocean surface wind as well as improved observation of ozone and other trace gases. Providing unprecedented accuracy in meteorological data, the European contribution will lead to a better understanding of our climate.

• IASI - Infrared Atmospheric Sounding Interferometer

IASI will provide improved infrared soundings of the temperature profiles in the troposphere and lower stratosphere, moisture profiles in the troposphere, as well as some of the chemical components playing a key role in the climate monitoring, global change and atmospheric chemistry.

The instrument's overall mass is 236 kg and its power consumption is nominally 210 W during operations.

• GOME-2 - Global Ozone Monitoring Experiment–2

GOME-2 is a spectrometer that collects light arriving from the Sun-illuminated Earth's atmosphere or a direct view to the Sun and decomposes it into its spectral components. The recorded spectra are used to derive a detailed picture of the atmospheric content and profile of ozone, nitrogen dioxide, water vapour, oxygen / oxygen dimmer, bromine oxide and other gases.

• MHS - Microwave Humidity Sounder

MHS collects information on various aspects of the Earth's atmosphere and surface, in particular, atmospheric humidity and surface radiation (temperature). The MHS is a five channel, self-calibrating, total power, microwave scanning radiometer. The data from these five channels provide information on humidity at various altitudes in the atmosphere, including atmospheric ice, cloud cover and precipitation (rain, snow, hail and sleet). Temperature information at the Earth's surface can also be determined.

• ASCAT - Advanced Scatterometer

The enhanced follow-on instrument to the highly successful scatterometers flown on ESA's ERS-1 and ERS2 satellites. Its use of six antennas allows the simultaneous coverage of two swaths on either side of the satellite ground track and hence provides twice the information of the earlier instruments. On an experimental basis, ASCAT also provides measurements at a higher than nominal resolution.

In addition to wind measurements, ASCAT will also contribute to activities in areas as diverse as land and sea ice monitoring, soil moisture, snow properties and soil thawing.

• GRAS - Global navigation satellite systems GNSS radio occultation Receiver for Atmospheric Sounding

This instrument is a GPS (Global Positioning Satellite) receiver that operates as an atmospheric-sounding instrument. GRAS provides a minimum of 500 atmospheric profiles per day through a process of GPS radio occultation. GRAS will provide atmospheric soundings of the temperature and humidity of the Earth’s atmosphere. In addition GRAS will provide navigation solutions of the MetOp satellite position along its orbit. These profiles will be assimilated into Numerical Weather Prediction (NWP) models.

**Meteorological ‘heritage’ instruments provided by the United States**

These instruments are part of the complement of American instruments provided by the National Oceanic and Atmospheric Administration (NOAA) to fly on MetOp-A and -B, and, with the exception of HIRS, also on MetOp-C.

• AMSU-A1 and A2 Advanced Microwave Sounding Units

The AMSU-A instruments measure scene radiance in the microwave spectrum. The data from these instrument are used in conjunction with the High-resolution Infrared Sounder (HIRS) instrument to calculate the global atmospheric temperature and humidity profiles from the Earth's surface to the upper stratosphere. The data are used to provide precipitation and surface measurements including snow cover, sea ice concentration.

• HIRS/4 High Resolution Infrared Radiation Sounder

This is a 20-channel radiometric sounder measuring radiance in the infrared (IR) spectrum. Data from HIRS/4 are used in conjunction with data from the Advanced Microwave Sounding Unit (AMSU) instruments to calculate the atmosphere's vertical temperature profile and pressure from the Earth's surface to about 40 km altitude. HIRS/4 data are also used to determine ocean surface temperatures, total atmospheric ozone levels, precipitable water, cloud height and coverage and surface radiance (albedo).

AVHRR Advanced Very High Resolution Radiometer

AVHRR/3 scans the Earth’s surface in six spectral bands in the range 0.58 - 12.5 microns. It provides day and night imaging of land, water and clouds and measures sea surface temperature, ice, snow and vegetation cover.

**Data collection system**

• A-DCS Advanced Data Collection System

The A-DCS, also known as Argos, is an advanced version of the system presently jointly operated by NOAA and CNES. With the A-DCS instruments installed on MetOp-1, 2 and 3 EUMETSAT will become the third agency to operate the Argos system. A-DCS will provide a worldwide in-situ environmental data collection and Doppler-derived location service with the basic objective of studying and protecting the Earth’s environment.

**Space weather instrument**

This instrument is part of the complement of American instruments provided by the National Oceanic and Atmospheric Administration (NOAA) to fly on MetOp-1 and -2.

• SEM-2 Space Environment Monitor

The SEM-2 is a spectrometer that provides measurements to determine the intensity of the Earth's radiation belts and the flux of charged particles at the satellite altitude. It provides knowledge of solar terrestrial phenomena and also provides warnings of solar wind occurrences that may impair long-range communication, high-altitude operations, damage to satellite circuits and solar panels, or cause changes in drag and magnetic torque on satellites.

**Search and Rescue instruments**

These instruments are also part of the complement of American instruments provided by the National Oceanic and Atmospheric Administration (NOAA) to fly on MetOp-1 and 2.

• SARP-3 Search And Rescue Processor

SARP-3 receives and processes emergency signals from the 406 MHz beacons of aircraft and ships in distress. It determines the name, frequency and time of the signal. These pre-processed data are then fed into the SARR instrument for immediate transmission to SARSAT (Search and Rescue Satellite) distress terminals on the ground.

• SARR Search And Rescue Repeater

The SARR receives and down-links emergency signals from aircraft and ships in distress. In addition, it provides a down-link for data received by the Search and Rescue Processor (SARP-3). The SARR receives distress beacon signals on three separate frequencies, translates them and retransmits them to Local User Terminals (LUTs) on the ground. These terminals process the signals, determine location of the beacons, and forward this information to a rescue mission control centre .

## SATELLITE:

Type: Polar orbiting meteorological satellite

Purpose: To ensure continuity, improvement and availability of operational meteorological observations from a morning polar orbit. To provide Europe with an enhanced capability for the routine observation of the Earth from space, in particular, to further increase Europe's capability for long-term climate monitoring.

Dimensions: 6.3 m high, 2.5 m by 2.5 m wide (in-Orbit configuration 17.6 m x 6.6 m x 5.0 m) and mass 4085 kg.
Power: 1813 W power demand

Orbit: Sun-synchronous at an altitude between 800 to 850 km. The satellite will not pass exactly over the geographic poles and is slightly inclined at an angle of 98.7° to the equator.

Costs (at 2006 e.c.): Total programme including three satellites, launchers, ground segment and operations costs 2.4 billion Euro, of which 1.85 billion Euro are financed by EUMETSAT and 550 million Euro by ESA for satellite development.

Lifetime: Nominal life in orbit of five years

Main contractors: EADS-Astrium (France): satellite prime contractor EADS-Astrium (Germany): Payload module, ASCAT and GRAS instruments 50 sub-contractors from 12 European States

Launch (MetOp-A): Scheduled for 17 October 2006 onboard SOYUZ-ST from the Baikonur Space Centre in Kazakhstan

.