EPS SECOND GENERATION

FACTS AND FIGURES

EPS-SG

MONITORING WEATHER AND CLIMATE FROM SPACE

EUMETSAT

EPS SECOND GENERATION (EPS-SG)

The EUMETSAT Polar System-Second Generation (EPS-SG) will bring global observations of weather and climate from the polar orbit to a new standard from 2022-23

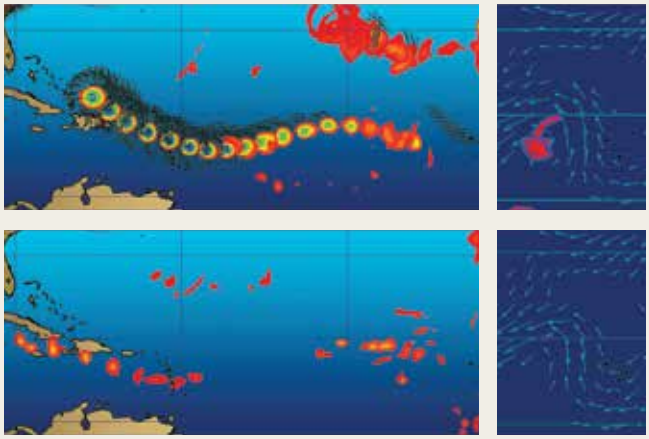
Providing new and better observational inputs for numerical weather prediction (NWP), EPS-SG will further improve weather forecasts up to 10 days ahead in Europe and worldwide, benefiting citizens and the economy. Its observations will also improve air quality forecasting and serve many other operational applications, relating to hydrology, oceanography and land.

The EPS-SG system comprises two types of Metop-SG satellites - Metop-SG A and B - equipped with complementary instruments. They will fly together on the same mid-morning polar orbit as the current Metop satellites that have been exploited by EUMETSAT since 2006.

The other key component of the system is a comprehensive ground segment including all facilities required to control the satellites, acquire and process the data and deliver the extracted products to users worldwide.

The EPS-SG programme will deploy three successive pairs of Metop-SG A and Metop-SG B spacecraft to provide 21 years of service, starting in 2022-23.

EPS-SG is Europe's contribution to the Joint Polar System (JPS) shared with the United States. The JPS forms the backbone of the polar orbit system also involving Chinese meteorological satellites to fulfil the requirements of the World Meteorological Organisation.



The initial conditions largely determined by satellite observations (top right) were essential for ECMWF to forecast the development and trajectory of Hurricane Irma four days in advance, shown at intervals of 12 hours (top left). Without satellite observations (bottom) the model would have missed the initial development of Irma. (Source: ECMWF)

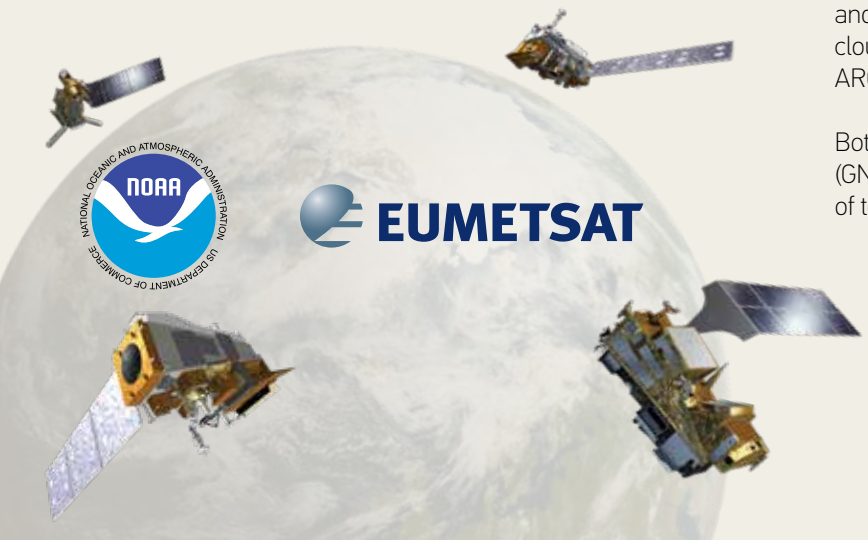
TWO MULTI-INSTRUMENT SATELLITES FOR SYNERGETIC OBSERVATIONS

Metop-SG A is an atmosphere sounding and imaging satellite equipped with a suite of microwave and hyperspectral infrared instruments and two advanced optical imagers. This payload provides simultaneous and co-registered observations of clouds and vertical profiles of temperature and moisture in the atmosphere. Metop-SGA also carries the Copernicus Sentinel-5 spectrometer for measurements of trace gases in synergy with the IASI-NG hyperspectral infrared instrument.

Metop-SG B is a microwave imaging satellite delivering radar observations of ocean surface wind and soil moisture and passive microwave observations of precipitation and ice clouds. Metop-SG B also carries a receiver supporting the ARGOS localisation and data collection mission.

Both satellites carry a Global Navigation Satellite System (GNSS) radio-occultation instrument (RO) for limb sounding of temperature and humidity at high vertical resolution.

EUMETSAT and NOAA currently collaborate in the Initial Joint Polar System, comprising two polar-orbiting systems



SATELLITES AND INSTRUMENTS

METOP-SG A

Dimensions
6.5m x 13.7m x 3.5m

Mass in orbit
4,400kg

Power
3.0kw

Design lifetime
7.5 years

Orbit
Sun-synchronous orbit, 835km latitude

Repeat Cycle
29 days

Orbit revolution
101 minutes

Payload mass
3,600kg

Payload
1. IASI-NG *(Infrared Atmospheric Sounding)*
2. MWS *(Microwave Sounding)*
3. METIMAGE *(Visible-Infrared Imaging)*
4. RO *(Radio Occultation)*
5. 3MI *(Multi-viewing, -channel, -polarisation Imaging)*
6. COPERNICUS Sentinel-5 UVNS *(UN/VIS/NIR/SWIR Sounding)*

METOP-SG B

Dimensions
6.2m x 15.8m x 3.5m

Mass in orbit
4,110kg

Power
2.6kw

Design lifetime
7.5 years

Orbit
Sun-synchronous orbit, 835km latitude

Repeat Cycle
29 days

Orbit revolution
101 minutes

Payload mass
3370kg

Payload
1. SCA *(Scatterometer)*
2. RO *(Radio Occultation)*
3. MWI *(Microwave Imaging for Precipitation)*
4. ICI *(Ice Cloud Imager)*
5. ARGOS-4 *(Advanced Data Collection System)*

A EUROPEAN PARTNERSHIP...

The EPS-SG system is developed in cooperation with the European Space Agency (ESA) following the model which has made Europe a world leader in satellite meteorology.

ESA develops Metop-SG satellites, fulfilling EUMETSAT's requirements and procures recurring satellites on its behalf. Based on the same model, CNES and DLR develop and procure Metop-SG A's IASI-NG and METimage instruments.

EUMETSAT procures all launch services, develops the full ground infrastructure and integrates and validates the full system. EUMETSAT then exploits the system and develops additional products using new algorithms.

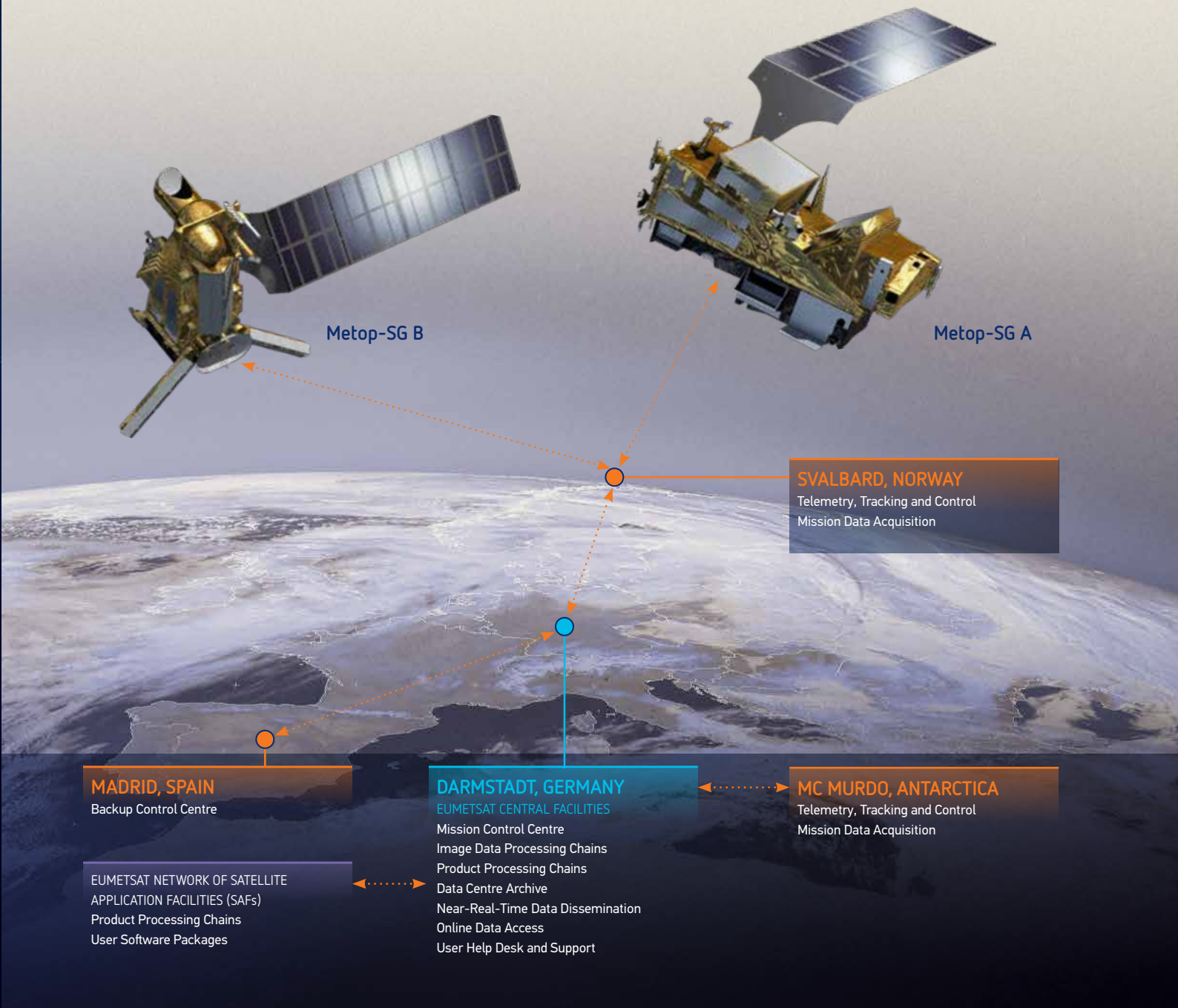
The Metop-SG satellites are developed under ESA contract by a European industrial consortium led by Airbus Defence and Space, which also develops the IASI-NG, METimage and Sentinel-5 instruments under CNES, DLR and ESA contracts. CNES provides in kind Metop-SG B's ARGOS receiver.

... AND A EUROPEAN GROUND SEGMENT

The EPS-SG ground segment consists of a mission control and operations (MCO) chain and a payload data acquisition and processing (PDAP) chain. This is complemented by NOAA ground stations deployed in the Antarctic and EUMETSAT's multi-mission systems for the delivery of data and support services to users.

The product extraction is jointly distributed between EUMETSAT headquarters and a European network of eight Satellite Application Facilities.

The two main chains are developed under EUMETSAT contracts by consortia led by Thales Alenia Space and GMV.



MORE, BETTER AND NEW OBSERVATIONS FOR EARTH SYSTEM FORECASTING AND A WEALTH OF OTHER APPLICATIONS

Metop-SG satellites' next generation instruments will continue and substantially improve all observations already available from the current Metop satellites. This is necessary for both weather forecasting and climate monitoring.

In addition, three new instruments, two of which have never been flown before on an operational satellite, will provide observations of precipitation, aerosols and ice clouds.

Altogether, observational products will be available from the EPS-SG system for a wealth of Earth system parameters, including:

- Vertical profiles of temperature and humidity in the atmosphere, even in the presence of clouds
- Wind vectors in the troposphere of the polar regions
- Optical and physical properties of clouds and aerosols, including volcanic ash
- Vertical profiles or column concentrations of O_3, NO_2, BrO, HCHO, SO_2, CO, CH_4, CO_2 and other atmospheric constituents
- UV radiation
- Sea surface temperature, ocean surface wind vector and sea ice parameters
- Precipitation, soil moisture, snow cover
- Vegetation parameters, surface albedo, land surface temperature, fire radiative power
- Ionospheric electron content.

The primary objective of these more accurate and new observations is to maintain the EUMETSAT Polar System's role as the source of observations with the highest positive impact on global numerical weather prediction up to 10 days ahead.

The data directly broadcast by the Metop-SG satellites to a European network of X band stations will also enable the delivery of regional observations within 15 to 30 minutes from sensing to high resolution models nested into global models that are used for very short and short-range forecasts in Europe. The same regional observations will support nowcasting of "polar lows" and other high-impact weather in the Arctic regions not observed by Meteosat satellites.

The combination of the atmospheric composition observations of the Copernicus Sentinel-5 spectrometer with those of IASI-NG, 3MI and METimage will improve air quality forecasts produced by the Copernicus Atmosphere Monitoring Service for protecting the health of citizens.

All EPS-SG observations will be reprocessed for the production of climate records of a large number of essential climate variables.

Overall, EPS-SG observational products will serve a very broad range of operational applications, including in the areas of hydrology, oceanography, agriculture, climate services and even space weather monitoring.

EPS-SG payload complement and targeted applications

EPS-SG Satellite-A missions	*Instrument (and provider)*	*Predecessor on Metop*	*Applications benefitting*
Infrared Atmospheric Sounding (IAS)	*IASI-NG (CNES)*	*IASI (CNES)*	
Microwave Sounding (MWS)	*MWS (ESA)*	*AMSU-A (NOAA)* *MHS (EUMETSAT)* *AVHRR (NOAA)*	
Visible-Infrared Imaging (VII)	*METIMAGE (DLR)*		
Radio Occultation (RO)	*RO (ESA)*	*GRAS (ESA)*	
UV/VIS/NIR/SWIR Sounding (UVNS)	*SENTINEL-5 (COPERNICUS, ESA)*	*GOME-2 (ESA)*	
Multi-viewing, -channel, -polarisation Imaging (3MI)	*3MI (ESA)*		
EPS-SG Satellite-B missions	***Instrument (and provider)***	***Predecessor on Metop***	***Applications benefitting***
Scatterometer (SCA)	*SCA (ESA)*	*ASCAT (ESA)*	
Radio Occultation (RO)	*RO #2 (ESA)*	*GRAS (ESA)*	
Microwave Imaging for Precipitation (MWI)	*MWI (ESA)*		
Ice Cloud Imager (ICI)	*ICI (ESA)*		
Advanced Data Collection System (ADCS)	*ARGOS-4 (CNES)*	*A-DCS (CNES)*	

Atmospheric Chemistry · *Climate Monitoring* · *Hydrology* · *Land* · *Nowcasting (NWC) at high latitudes* · *Numerical Weather Prediction (NWP)* · *Oceanography*

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MEMBER STATES

EUMETSAT also has established cooperation agreements with organisations involved in meteorological satellite activities, including the National Meteorological Services of Canada, China, India, Japan, Russia, South Korea and USA

Brochure: PRG.FS.02, V.1