EUMETSAT Future Satellite Programs: User Preparation

1-4 October 2018

EWGLAM-SRNWP Meeting

Salzburg, Austria

Current operational EUMETSAT satellites

METOP-A & -B (98.7° incl.)

LOW EARTH, SUN-SYNCHRONOUS ORBIT
EUMETSAT POLAR SYSTEM (EPS) / INITIAL JOINT POLAR SYSTEM

JASON-2 & -3 (63° incl.)

LOW EARTH, NON-SYNCHRONOUS ORBIT
OCEAN SURFACE TOPOGRAPHY MISSION, SHARED WITH CNES/NOAA/EU

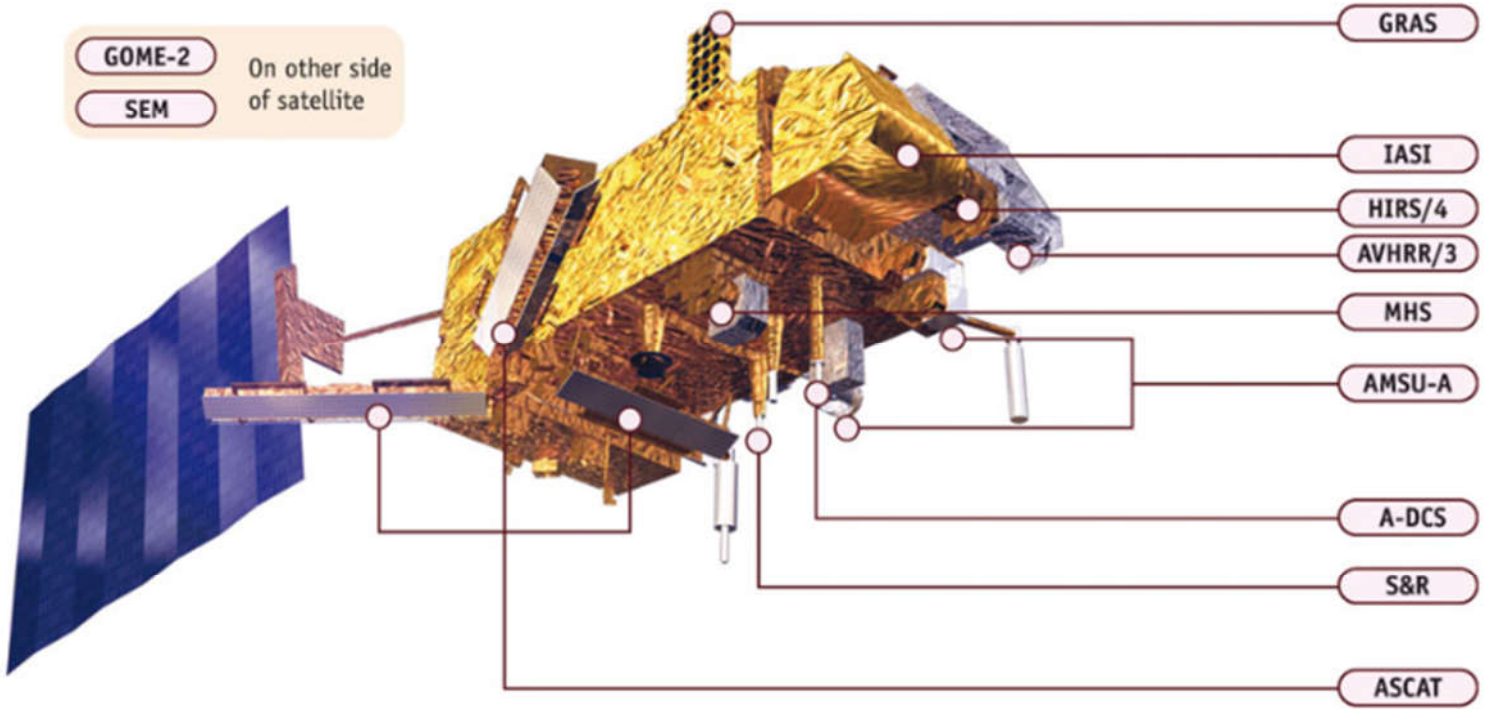
METEOSAT-8 (41.5° E)

GEOSTATIONARY ORBIT
METEOSAT 2ND GENERATION PROVIDING IODC FROM FEBRUARY 2017 – MID-2020

METEOSAT-9, -10, -11

GEOSTATIONARY ORBIT	TWO-SATELLITE SYSTEM
METEOSAT 2ND GENERATION	FULL DISC IMAGERY MISSION (15 MINS) (METEOSAT-11 (0°)) RAPID SCAN SERVICE OVER EUROPE (5 MINS) (METEOSAT-10 (9.5° E)) *METEOSAT-9 BACKS UP MET-11 AND MET-10*

Metop – Current



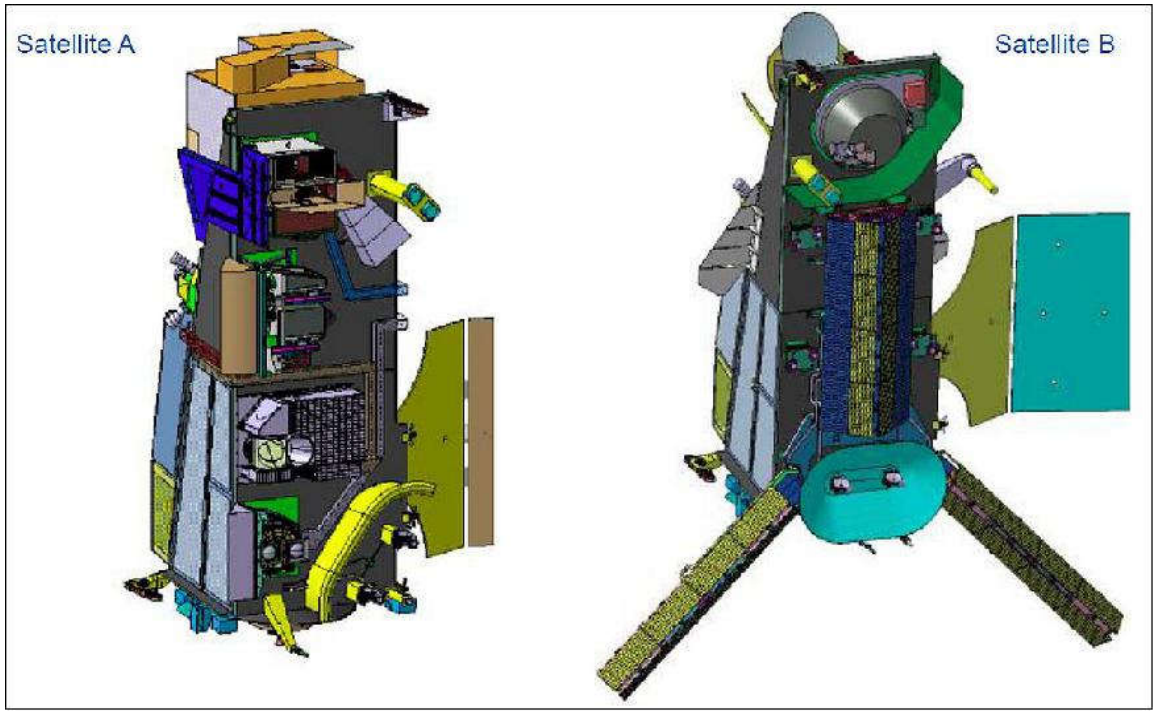
- Metop – A launched in 2006
- Metop – B launched in 2012
- Metop – C to be launched in 2018 (next month)

EPS-SG Programme - Objectives

- Primary mission: further improve observational inputs to Global and Regional NWP.
- Continuation and enhancement of service from mid morning polar orbit in 2021 – 2042.
- Significant contributions to other real time applications:
  - Nowcasting at high latitudes
  - Marine meteorology and operational oceanography
  - Operational hydrology
  - Air quality monitoring
- Climate monitoring: expand by 20+ years the climate data records initiated in 2006 with EPS (first generation).

Metop-SG Mission – Satellites A and B

Both satellites in the same mid-morning orbit



Launch dates:

Metop-SG 1A – fourth quarter 2022
Metop-SG 1B – December 2022

Metop-SG 2A – September 2028
Metop-SG 2B – December 2029

Metop-SG 3A – September 2035
Metop-SG 3B – December 2036

EPS-SG Programme – Payload Complement and Heritage

Metop-SG A Optical Imagery and Sounding	Heritage(Metop)	Heritage (Other Missions)
Infrared Atmospheric Sounding (IASI-NG)	IASI	AIRS
Microwave Sounding (MWS)	AMSU-A+MHS	ATMS
Visible-infrared Imaging (MetImage)	AVHRR	VIIRS
Radio Occultation (RO)	GRAS	COSMIC
UV/VIS/NIR/SWIR Sounding (UVNS)-Sentinel-5	GOME-2	SCIAMACHY
Multi-viewing, -channel, -polarisation Imaging (3MI)	-/-	POLDER
Metop-SG B **Microwave Imaging**	**Heritage(Metop)**	**Heritage (Other Missions)**
Scatterometer (SCA)	ASCAT	QuickSCAT
Radio Occultation (RO)	GRAS	COSMIC
Microwave Imaging for Precipitation (MWI)	-/-	SSMIS
Ice Cloud Imager (ICI)	-/-	MLS
Advanced Data Collection System (ADCS)	A-DCS	A-DCS

EPS-AVHRR v/s EPSSG-MetImage

Wavelength Region	AVHRR- Metop	MetImage - MetopSG	Information from additional channels
Visible (µm)	0.63, 0.865	0.443, 0.555, 0.668, 0.752, 0.763, 0.865	Aerosols, Clouds (cloud top height)
Near Infrared (µm)	1.61	0.914, 1.24, 1.375, 1.63, 2.25	Water vapour Imagery, Total water vapour column, cloud
Infrared (µm)	3.74, 10.8, 12	3.74, 3.959, 4.05, 6.725, 7.325, 8.54, 10.69, 12.02, 13.345	Water vapour imagery with polar winds, clouds (cirrus clouds, cloud microphysics), temperature profile information

EPS-AVHRR v/s EPSSG-MetImage

	AVHRR	MetImage
Instantaneous field of view	1.08 km	250-500 m
Pixels per scan	2048	3144
Swath width	2400 km	2670 km

- Better radiometric sensitivity and spectral sampling
- Better global coverage
- Improved resolution

The Meteosat Programme – overview in time

1977 **Meteosat First Generation (MFG)**

- MVIRI (3 channels)

2002 **Meteosat Second Generation (MSG)**

- SEVIRI (12 channel imager)
- GERB (radiometer)

2021/ 2023 **Meteosat Third Generation (MTG)**

- FCI (16 channels)
- LI
- IRS
- UVN

Current: Meteosat Second Generation

- Meteosat-11
  - prime operational geostationary satellite, positioned at 0 degrees, providing full disc imagery every 15 minutes. It also provides Search and Rescue monitoring and Data Collection Platform relay service.
- Meteosat-10
  - provides the Rapid Scanning Service, delivering more frequent images every five minutes over parts of Europe, Africa and adjacent seas. It also provides Search and Rescue monitoring.
- Meteosat-9
  - provides a backup service to Meteosat-11 Full Earth scanning and a gap filling service to Meteosat-10 Rapid Scanning.
- Meteosat-8
  - Full earth scanning over the Indian Ocean. It also provides Search and Rescue monitoring and Data Collection Platform relay service (which includes relay of Tsunami warnings).

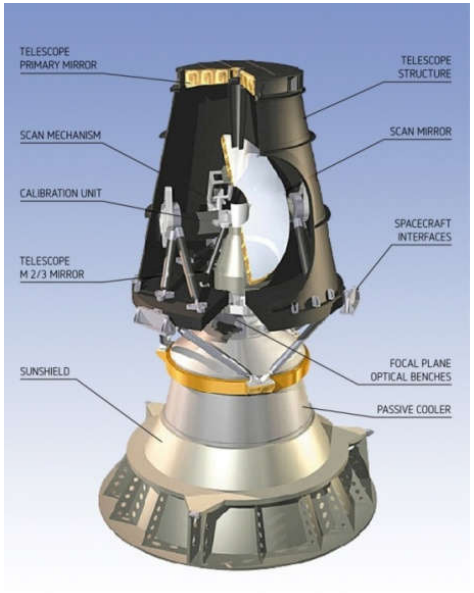
Meteosat Third Generation (MTG)

- Primary mission: support nowcasting/ Short Range Forecasting of high impact weather
  - Continuity and enhancement of MSG imagery – Flexible Combined Imager (FCI)
  - Addition of a new lightning imaging capability – Lightning Imager (LI)
  - New, innovative infrared hyper-spectral sounding – Infra red Sounder (IRS)
- Secondary mission: air quality monitoring over Europe
  - Synergy between Sentinel-4, IRS and imagery

SEVIRI to FCI Performance Enhancements

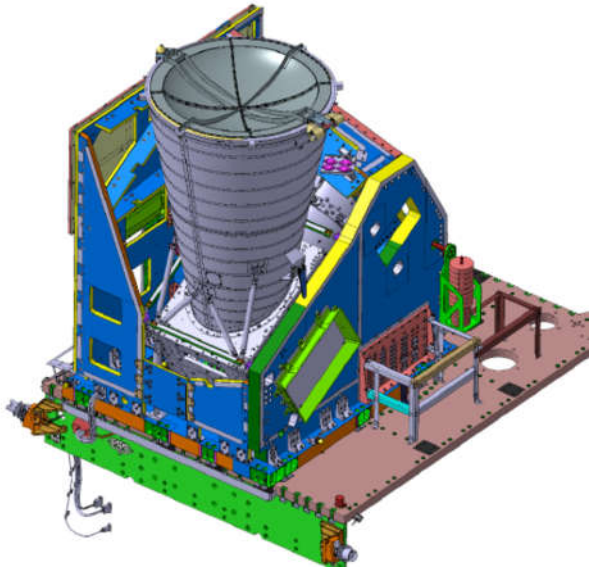
SEVIRI

- 15 min full disc repeat cycle
- SNR 1.2 to 10.1
- NEdT 0.25 to 1.8K
- IR3.9 up to 335K
- 1.0 km HRV
- 3 km non-HRV



FCI

- 10 min full disc repeat cycle
- SNR 12 to 40
- NEdT 0.1 to 0.3K
- IR3.8 up to 450K
- FDHSI:
- 8 x 1 km channels
- 8 x 2 km channels
- HRFI:
- 2 x 0.5 km channels
- 2 x 1 km channels



User Preparation for New Meteorological Satellites

- WMO guidelines on best practices for user-readiness projects to be performed by
  - User Organisations (NMHSs)
  - Satellite Operators

Deliverables from satellite programmes to user readiness projects

- Instrument pre-launch calibration and characterization
- Product specifications
- Data access mechanisms
- Software tools
- Test data
- Operations plans and schedules
- User notification and feedback
- Training

Core of User Preparation Activities in EUMETSAT

- Ensure continuity of operational services by supporting the user community for a smooth transition from
  - MSG to MTG
  - EPS to EPS-SG
- Early adoption of services into operational forecasting

User Preparation for EPS-SG and MTG

- Establish communication platforms (e.g. in terms of regular workshops, web forum, etc.) for the exchange of experience and user feedback on MTG and general user preparation issues. This would address needs for
  - Providing information related to MTG and EPS-SG (Instrument, science, data acquisition)
  - Provision of test data and software tools
  - Training needs

User Preparation – Main activities (mostly MTGUP!)

- First MTGUP user workshop held in November 2017
- New MTG webpage released
- MTG forum and information area has been set up
- Outline plan for Simulated Test Data has been provided
- MTG Training Plan (ongoing)
- Preparation of the combined MTG and EPS-SG User Preparation workshop (November, 2019)
- User Support Application Experts as contact points: Stephan Bojinsky-MTG and Sreerekha Thonipparambil – EPS-SG

Thank You and Have a Look!

https://www.eumetsat.int/website/home/Satellites/FutureSatellites/MeteosatThirdGeneration/index.html

METEOSAT THIRD GENERATION

SATELLITES
CURRENT SATELLITES
FUTURE SATELLITES
METEOSAT THIRD GENERATION
MTG IMAGING SERVICE
MTG SOUNDING SERVICE
MTG DESIGN
MTG DATA
EVOLUTIONS TO EUMETCAST SERVICES FOR THE MTG ERA
MTG IN OPERATIONS
MTG GROUND SEGMENT
MTG RESOURCES
EUMETSAT POLAR SYSTEM - SECOND GENERATION
COPERNICUS SATELLITES
PAST SATELLITES
LAUNCHES AND ORBITS
GROUND SEGMENT
SCIENCE ACTIVITIES
TECHNICAL DOCUMENTS
GLOSSARY

Meteosat Third Generation (MTG) is EUMETSAT's next generation of geostationary satellites, following on from earlier successful missions.

This next generation, following on from ▸Meteosat Second Generation, will provide an evolution of the imaging service, including a new Lightning Imager, and a state-of-the-art atmospheric sounding service providing measurements in the infrared and ultraviolet spectrum.

MTG will see the launch of six new geostationary (imaging and sounding) satellites from 2021 onwards. The satellite series will be based on 3-axis platforms and comprise:

- Four Imaging Satellites (MTG-I) (20 years of operational services expected)
- Two Sounding Satellites (MTG-S) (15.5 years of operational services expected)

Three in-orbit satellites deliver a prime MTG-I full disc service, a second MTG-I satellite for the Rapid Scanning Service, and an MTG-S satellite providing the new sounding services.

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WHY THE MTG MISSION?

Key features of the new mission:

1. Continuity of observation in the visible spectrum from geostationary orbit.
2. Better **spatial, temporal & radiometric** resolution data for enhanced **Nowcasting** (NWC) applications.
3. **New lightning** image data to support **Nowcasting** applications.
4. Infrared & ultraviolet/visible soundings for 3D probing of the atmosphere.
5. Enriched input to **Numerical Weather Prediction (NWP) data assimilation** & the future derivation of **quantitative products**.
6. **New ways** to follow weather systems 'from the cradle to grave'.

▸MTG Imaging Service
▸MTG Sounding Service

HOW DOES IT WORK?

The imaging satellites, MTG-I, carries the Flexible Combined Imager (FCI) and the Lightning Imager (LI) instruments. The sounding satellites, MTG-S, include an Interferometer, the Infrared Sounder (IRS) and the Copernicus Sentinel-4 instrument, a high resolution Ultraviolet Visible Near-Infrared (UVN) spectrometer.

For further details on the instruments onboard the MTG satellites, including their scanning modes, follow the respective links:
▸Flexible Combined Imager (FCI)
▸Lightning Imager (LI)
▸Infrared Sounder (IRS)
▸Ultraviolet Sounder (UVN)

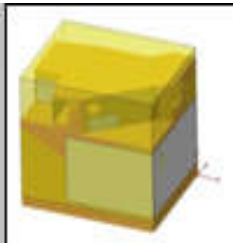
WHAT DATA WILL BE AVAILABLE?

The FCI provides 16 spectral channels of image data, with a basic full disc repeat cycle of 10 mins, and a European regional rapid scan, which covers quarter of the full disk, with a repeat cycle of 2.5 mins. The LI provides real time (goal of 30-sec observations) lightning detection measurements. The IRS provides hyperspectral sounding data every 30 mins over Europe, less frequently over other regions. The UVN monitors trace gas concentrations and aerosols with a high revisit time over Europe. More details on the service and products that will be available:
▸FCI data
▸LI data
▸IRS data
▸SAF data

HOW WILL I GET THE DATA AND IN WHICH FORMAT?

The existing multi-mission dissemination and delivery mechanisms are being evolved to deliver the future MTG data to users. NetCDF-4 is the baseline delivery format for the FCI, LI and IRS instrument level 1 data and level 2 geophysical products. Selected products will also be

EPS-SG Programme
Metop-SG A Satellite - Instruments



IASI-NG
Temperature & Humidity Profiles at High Vertical & Medium Spatial Resolutions

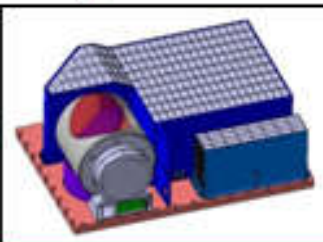
- Interferometer (FOV 98°)
- Wave number range: 645 and 2760 cm-1
- Spectral resolution: 0.25 cm-1

METimage
High Resolution Cloud Products

- Scanning Imaging radiometer (FOV 108°)
- Spectral range: 443 nm to 13.345 µm
- Pixel on ground nadir :500 m

Sentinel-5
Ozone & Other Atmospheric Gases Profile & Column, Aerosols Optical Depth

- Push Broom Spectrometer (FOV 108°)
- Spectral range : 270 nm to 2.385 µm
- Spectral resolution: 0.25-1 nm

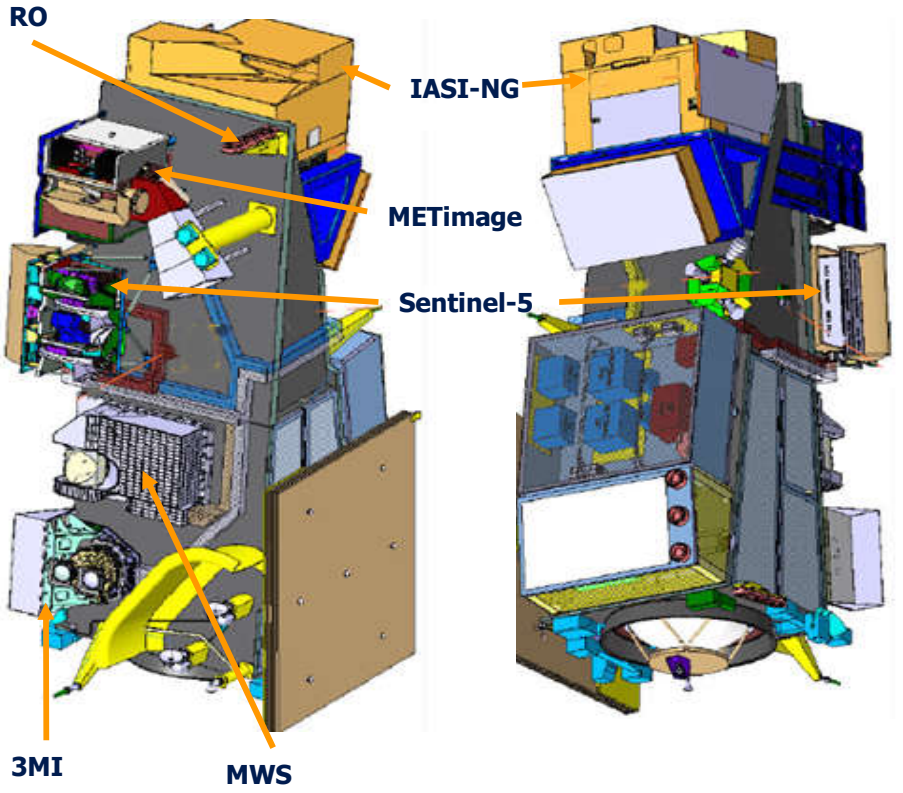


MWS
Temperature & Humidity Profiles in Clear & Cloudy Air, Cloud Liquid Water Total Column

- Scanning MW Radiometer (FOV 98°)
- Frequency range :23.8 to 229 GHz (24 channels)

3MI
Aerosols Optical Thickness, Particle Characterisation, Volcanic Ashes

- Push Broom Imager (FOV 100°)
- Spectral range: 910-2130 nm (VNIR & SWIR) (12 channels)

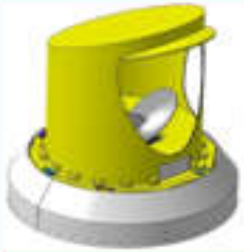


RO
Temperature, Pressure & Humidity Profiles Electrons Contents in Ionosphere

ESA-RUAG AB

- GNSS receiver
- Frequency range:1176 MHz, 1575 MHz (GPS/GALILEO/GLONASS/COMPASS)

EPS-SG Programme
Metop-SG B Satellite - Instruments



MWI
Precipitation & Cloud Products, Water Vapour Profiles & Imagery, Sea-Ice

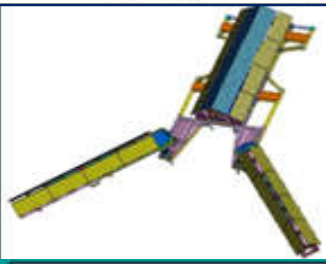
- Scanning MW Radiometer (FOV 130)
- Frequency range : 18.7 to 183.3 GHz (18 channels)
- Pixel on ground 10 and 50 Km

ICI
Cloud Products (in Particular Ice Clouds), Snowfall Detection & Quantification

- Scanning Radiometer (FOV 130°)
- Frequency range : 183 to 664 GHz (11 channels)
- Pixel on ground 15-16 Km

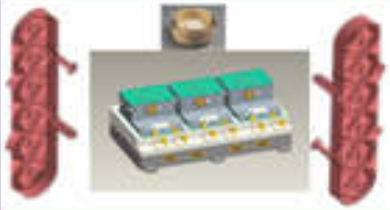
ADCS-4
Advanced Data Collection System

- Frequency : 466 MHz (Tx)-401 (Rx) MHz



SCA
Ocean Surface Wind Vectors and Soil Moisture

- Scatterometer swath 650km
- Frequency range : 5.355 GHz
- Spatial resolution: 25x25km



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- GNSS receiver
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