RAL
DESIGN & DISCOVERY
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RUTHERFORD APPLETON LABORATORY
SCIENCE AND ENGINEERING RESEARCH COUNCIL

METEOSAT

Introduction

During the 1960s, interest in weather pictures taken from space by meteorological satellites rose rapidly. At the beginning of the 1970s, the European meteorological community decided to enter the field.

The Meteosat Programme was initiated by the French, and in 1978, the European Space Agency (ESA) undertook the task of operating the Programme. Not only did Meteosat meet the needs of the European meteorological services, it also represented the European contribution to two programmes set up by the World Meteorological Organisation (WMO): the World Weather Watch (WWW), a permanent programme to monitor the state of the earth's atmosphere, and the Global Atmospheric Research Programme (GARP).

Meteosat-1 was launched on 23 November 1977, and operated for 2 years. Data are currently being received from Meteosat-3 and Meteosat-4.

The System

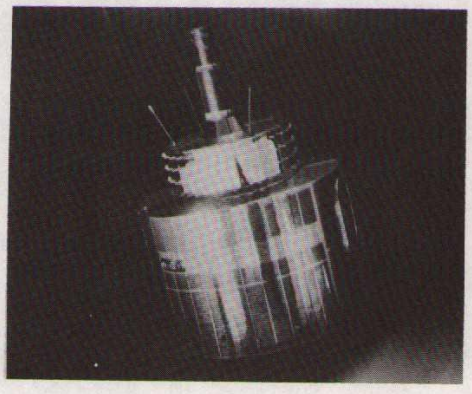
The two main components of the System are the Space Segment and the Ground Segment. The Space Segment consists of one or more spin-stabilised satellites in geostationary orbit, at a height of 35800 km. The primary satellite is stationed over the Gulf of Guinea at the crossing between the Equator and the Greenwich Meridian (0degN, 0degE). Standby satellites are located nearby. The Ground Segment consists of the Meteosat Operations Control Centre (MOCC), which also performs the data processing, and the Tracking Station. They are part of the European Space Operations Centre, in Darmstadt, West Germany.

The main functions of the Meteosat Operational System are:

- Earth imaging
- Dissemination of image and other meteorological data
- Data collection and distribution
- Meteorological processing
- Data archiving and retrieval

Data collected by Meteosat, together with the spacecraft's status, and data transmitted to it by Data Collection Platforms, such as weather ships, are transmitted to the Tracking Station. These data are then processed by the computers at the MOCC and relayed to Meteosat for transmission to receiving stations. The full earth disk is split up into 9 segments, each being transmitted separately at set times throughout the day. The full earth disk, giving an overall picture of the weather, is also transmitted at certain times during the day.

The Satellite



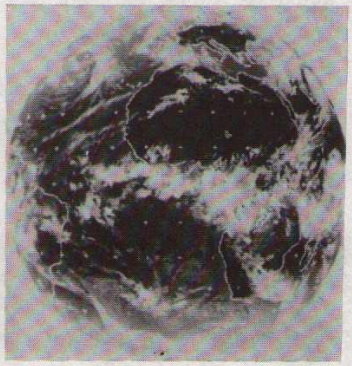
The satellite is 2.1m in diameter and 3.2m long, and spins at 100 rpm about its main axis, which

is aligned to the North-South axis of the earth. The main payload is the three-spectral-band high-resolution radiometer. This allows continuous imaging of the earth, the full earth disk being scanned in 25 minutes. The three spectral bands used are visible, infra-red water vapour and thermal infra-red. The visible and infra-red signals are collected optically by various on-board detectors. There are 8 detectors on board and at any one time, two visible detectors, one water vapour detector and one infra-red detector are in operation.

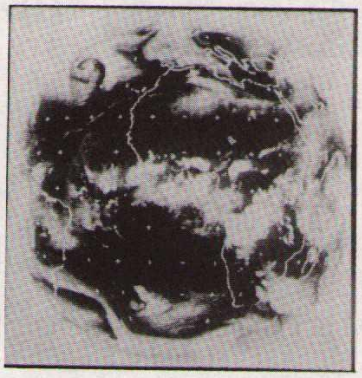
What we see

To provide accurate weather forecasts, especially long-term ones, satellites are needed to give continuous information on the weather on a global scale. Meteosat provides weather information for Europe, Africa and the Middle East. The three types of images received are visible (VIS), infra-red (IR) and water vapour (WV).

The visible channel measures the solar radiation reflected from the earth's surface and the atmosphere, so the oceans appear dark, the land grey, and the cloud tops white.



The infra-red channel measures the thermal radiation from these surfaces, and so the dark regions represent warm areas such as the land, oceans and low cloud, while the white areas represent cold regions of high clouds.



The water vapour channel measures the thermal radiation emitted by water vapour in the atmosphere. This is mainly from the middle and upper regions of the trophosphere, where most of the world's weather systems form. The dark areas represent regions of low humidity and the bright areas regions of high humidity.

The data received at RAL from Meteosat will be used as a quick-look facility for the Along Track Scanning Radiometer (ATSR), on board the ERS-1 satellite.

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