Full-SiC Derotator Optics for METimage
Detailed Design and Early Model Results

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INTRODUCTION

The EUMETSAT Polar System – Second Generation (EPS-SG) shall provide global observations from which information on variables of the atmosphere and the ocean and land surfaces can be derived. The observation data shall cover a broad spectral range (from UV to MW), are related to different spatial coverage (global and regional) and are characterised by a variety of different time scales, in order to continue and enhance the services offered by the EPS system. The EPS-SG mission encompasses various observation missions and consists of space and ground-based elements.

The Meteorological Operational Satellite – Second Generation (MetOp-SG) is the space segment of the EPS-SG mission. It is composed of two separate satellites (Fig. 2), each carrying a different payload instruments complement.

These satellites are operating in a low-earth, near-polar, sun-synchronous orbit with a midmorning mean local solar time descending node. They are 3-axis stabilised and Nadir-pointing with a yaw steering mode.

METimage is embarked on MetOp-SG satellite A. METimage is implemented as passive imaging spectro-radiometer, capable of measuring thermal radiance emitted by the Earth and solar backscattered radiation in 20 spectral bands from 443 nm to 13.345 µm. The instrument achieves global coverage with 500 m square pixels by continuous scanning orthogonal to the flight direction. It employs in-field separation of the spectral channels. Due to the scan motion, the image moves sequentially over the detector channels. By proper timing of the sampling, a certain pixel in the image is measured sequentially by different spectral channels. The definition of the spectral range for the spectral bands is performed by filters in front of the detectors. The instrument is implemented as in-beam scanner with static telescope and synchronous field de-rotation. Calibration is performed during each scan with different calibration sources without interrupting the scientific observation. The observation principle is depicted in Fig 1.

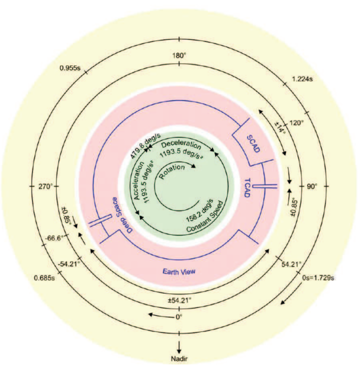

Fig. 1 METimage observation principle

DESIGN

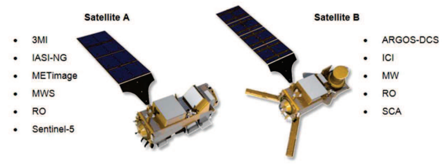

Fig. 2 MetOp-SG, the two-satellite space segment

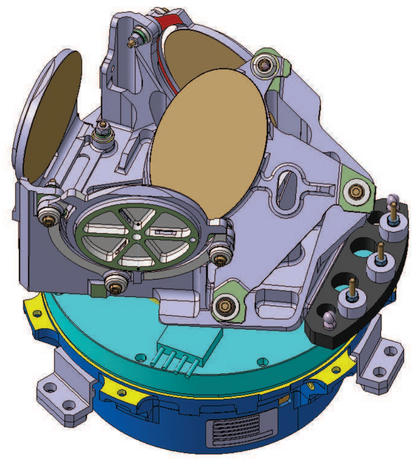

Fig. 3 METimage Derotator Assembly (including mechanism, courtesy of Airbus Defence & Space)

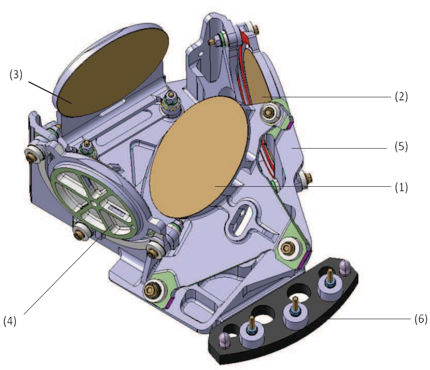

Fig. 4 Derotator Optical Assembly: (5) structural baseplate, (6) counterweight, (1) M1-M5 duplex flat mirror, (2) M2, (3) M3, (4) M4

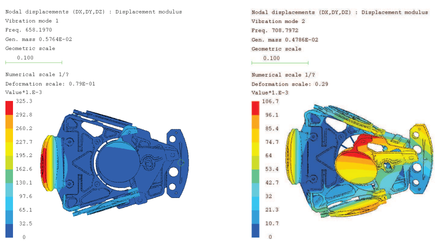

Fig. 5 F.E.M. analysis results (First two modes at 658Hz and 709Hz)

EARLY MODEL

Fig. 6 Early model (STM) photographs

VERIFICATIONS

After successful integration, the STM passed the following test sequence:

- Initial metrology health check (with 3D CMM)
- Shock
- Metrology re-check (with 3D CMM)
- Vibration (frequency search, sine, random)
- Metrology re-check (with 3D CMM)
- Thermal-vacuum cycling (8 cycles between non-operational temperature limits + qualification margins)
- Metrology re-check (with 3D CMM)
- Dimensional verifications
- Mass properties (mass, CoG, balancing)
- Electrical properties

ACKOWLEDGEMENTS

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