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Sentinel-2 Optical High Resolution Mission for GMES Land Operational Services

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Long-term availability of Earth observation-based services and continuity of consistent high quality data is – apart from meteorological services – not guaranteed in Europe. In order to contribute to improve its response to ever growing challenges of global safety and climate change, Europe requires an independent sustained and reliable Earth observation system. The Global Monitoring for Environment and Security (GMES) is a European programme for the implementation of a European capacity to provide independent and permanent access to reliable Earth observation data. To ensure the operational provision of appropriate Earth-observation data the GMES Space Component (GSC) includes a series of five space missions called 'Sentinels', which are being developed by ESA specifically for GMES.

The European Space Agency (ESA) in partnership with the European Commission (EC) is developing the Sentinel-2 optical imaging mission devoted to the operational monitoring of land and coastal areas. The Sentinel-2 mission is based on a twin satellites configuration deployed in polar sun-synchronous orbit and designed to offer a unique combination of systematic global coverage, high revisit (five days at equator with two satellites) and high spatial resolution imagery (10/20/60m). The Multi-Spectral Imager (MSI) features 13 spectral bands, going from visible to short wave infrared domains. The instrument is designed to provide in orbit calibration, excellent radiometric and geometric performance, and with a capability to support accurate image geo-location and co-registration. The Sentinel-2 mission is more particularly tailored to the monitoring of land terrains, including vegetation and urban areas. Sentinel-2 will ensure data continuity with the SPOT and Landsat multi-spectral sensors, while accounting for future service evolution.

The lifetime of each Sentinel-2 spacecraft is specified as 7 years and propellant is sized for 12 years, including provision for de-orbiting manoeuvres at end-of-life. The satellite will be three-axis stabilized with an AOCS based on high-rate multi-head star trackers, mounted on the instrument structure for better pointing accuracy and stability, as well as a fiber-optics gyroscope and a dual-frequency GNSS receiver. The Multi-Spectral Instrument (MSI) is based on the pushbroom concept. It features a Three Mirror Anastigmat (TMA) telescope with a pupil diameter of about 150 mm, and achieves a very good imaging quality all across its wide Field of View (290 km swath width, significantly enlarged with respect to Landsat and SPOT). The telescope structure and the mirrors are made of silicon carbide for minimizing thermal gradients and thermo-elastic deformations. The visible and near-infrared (VNIR) focal plane is based on monolithic CMOS (Complementary Metal–Oxide–Semiconductor) detectors while the shortwave infrared (SWIR) focal plane is based on a mercury cadmium telluride (MCT) detector hybridised on a CMOS read-out circuit. A dichroic beam-splitter provides the spectral separation of VNIR and SWIR channels. A combination of on-board calibration with a sun diffuser and vicarious calibration with ground targets is foreseen to guarantee a high quality radiometric performance. The observation data are digitized on 12 bit. State-of-the-art lossy compression based on wavelet transform is applied to reduce the data volume. The compression ratio will be fine tuned for each spectral band to ensure negligible impact on image quality.

The ground segment includes the FOS (Flight Operations Segment), for satellite command, monitoring and control, and the PDGS (Payload Data Ground Segment), for mission planning, payload data reception, processing, archiving, quality control and dissemination.

The presentation will provide an overview of the mission and the related scientific studies.