**STATUS OF SENTINEL-3**

GMES is covering several areas of applications, among which EUMETSAT has targeted to play a key role as satellite data provider for the oceanography and atmosphere user communities.

As part of GMES, Sentinel-3 will provide crucial data for information services to the European Union and its Member States. The services cover areas such as climate change, sustainable development, environmental policies, European civil protection, development aid, humanitarian aid and the European Common Foreign & Security Policy.

The Sentinel-3 mission will produce a consistent, long-term set of remotely-sensed marine and land data for (operational) ocean state analysis, forecasting and service provision.

In its role as operator of Sentinel-3 oceanography mission, EUMETSAT will:
- Generate and disseminate all Sentinel-3 products routinely required by the GMES Marine Core Service and its related downstream services;
- Serve the offline requests of the Operational Oceanography User Community for Sentinel-3 products (using a distributed network of centres of expertise);
- Monitor and control the spacecraft and flight operations segment;
- Acquire payload data, in a mode consistent with the GMES ground segment design which is under ESA's responsibility.

To fulfill this operational role, EUMETSAT has undertaken, under a co-operation agreement with ESA, the developement of a ground segment to serve the needs of the Sentinel-3 mission as well as for the routine operations to be engineered, validated and rehearsed by a dedicated operations team.

This paper presents the status of the Sentinel-3 development activities by EUMETSAT.

**Status of Sentinel-3**

# 1    INTRODUCTION

Sentinel-3 will provide crucial data for information services to the European Union and its Member States as part of GMES. The services to be fed data cover areas such as climate change, sustainable development, environmental policies, European civil protection, development aid, humanitarian aid and the European Common Foreign & Security Policy.

The Sentinel-3 mission will produce a consistent, long-term set of remotely-sensed marine and land data for (operational) ocean state analysis, forecasting and service provision. A comprehensive measurement system facilitating global ocean and land observation is required in order to provide data for advanced numerical forecasting models.

The Sentinel-3 adopted concept is based on EUMETSAT being the operator of the marine mission of Sentinel-3, serving the Marine User Community both with routine and off-line products.

The concept relies on a joint ESA and EUMETSAT work approach having been formalised in a cooperation agreement defining the responsibilities and the tasks to be fulfilled by the two Organisations.

# 2    BACKGROUND

In response to the need for data in near real-time, together with guaranteed service levels, EUMETSAT will serve the Marine User Community both with routine and off-line products.

Starting from the successful completion of the In-Orbit Commissioning of the first Sentinel-3 spacecraft, the scope of EUMETSAT's operational role will be:

> Monitoring and control of spacecraft and flight operations segment;

> Payload data acquisition, consistent with the overall GMES ground segment design under ESA's responsibility;

> Product generation and dissemination of all Sentinel-3 products routinely required by the Marine User Community and the related downstream services;

> Serving the offline requests of the Marine User Community for Sentinel-3 products.

Complementing the Marine part of the mission, ESA will serve the Land Services Community, including:

> Product generation and dissemination of all Sentinel-3 Land products routinely required by the Land community and the related downstream services;

> Serving the offline requests of the Land User Community for Sentinel-3 products.

The role for EUMETSAT in the provision of the Sentinel-3 Services over the mission lifetime takes benefit from, and builds upon, the significant infrastructure investments that have already been made, and will be continue to be made, by EUMETSAT in the areas of:

Multi-mission operations within a unified Operational centre (MTP, MSG, EPS and Jason);

A common gateway to enable users to have straightforward access to all EUMETSAT's data and products (via the EUMETSAT unified archive and retrieval facility and its interface to the future ESA Heterogeneous Mission Accessibility (HMA);

Ground segment infrastructure, which allows the addition of further missions/services.

This concept requires a EUMETSAT ground segment to be developed to serve the needs of the marine part of the Sentinel-3 mission as well as for the routine operations to be engineered, validated and rehearsed by a dedicated operations team.

The concept relies on a joint ESA and EUMETSAT work approach formalised in a dedicated Sentinel-3 Implementation Arrangement defining the responsibilities and the tasks to be fulfilled by the two Organisations as well as the programmatic and financial elements.


## 3    THE SENTINEL-3 MISSION


The GMES Sentinel-3 satellite will carry an optical instrument suite providing data from the visible to thermal infrared at medium (e.g. 250 m) to low (e.g. 1000 m) spatial resolution for ocean colour, sea surface temperature and global land mapping. An altimeter package will continue altimetry ocean observations required by meteorological (e.g. ECMWF) and oceanographic services and will complement Jason and Altika. The combination of the altimeter package and wide swath radiometers will provide a European source of data required for the MCS and LMCS fast track services in particular. It will also satisfy observation requirements of future potential GMES services that would be built upon projects such as Marcoast, GMFS, GlobCover, GlobCarbon, Globcolour, Medspiration, Geoland, Mersea and Gems. It provides continuity to ENVISAT MERIS, (A)ATSR and RA-2 and VGT instruments and will complement MetOp (and NPOESS) series for measurements of ocean surface winds and temperature.

From the Ground Segment point of view, the main characteristics of Sentinel-3 are:

Its operational nature i.e. commitment in the products delivery with a high level of quality of service (timeliness, accuracy, availability…),

Its systematic and continuous acquisition strategy which does not require users' requests for the sensing of data. Consequently, the flow of data is mainly oriented from the Sentinel-3 system to the Users and this flow is only driven by the reception of data, triggering automatically the generation of observation products (no users' requests for the processing of data).

The payload data will be downlinked at a data rate of 560 Mbps, using a 8PSK modulation. The downlink is done through 2 channels at a speed of 280 Mbps for each channel with instrument data being multiplexed on these 2 channels.

In addition, the Sentinel-3 satellites will be able to downlink data to local stations, in X-band, with an average of 3 local downlinks per orbit and a maximum of 6.

For the time being, two GMES Sentinel-3 satellites have been procured and it is planned to procure at least another recurrent satellite. Their launch is currently planned in 2013 and 2016 timeframe.


## 4    ESA – EUMETSAT CO-OPERATION STATUS

The GMES Framework Agreement sets out the roles and responsibilities of EUMETSAT and ESA in the cooperation on the GMES Space Component (GSC), aiming at preparing for an operational and sustainable GMES Space Component system. Under this Agreement, ESA will be responsible for the procurement of the GMES Sentinel missions, the overall coordination of the GSC and for the interface between the GSC and the GMES Services. EUMETSAT will be responsible for the contribution of its mission data, products and services to GMES, and for the contribution to the establishment of the mission requirements and to the development of the GMES Sentinel missions that EUMETSAT will operate.

The GMES Sentinel-3 Implementing Arrangement sets out the responsibilities of EUMETSAT and ESA concerning the development of the Sentinel-3 Ground Segment in preparation for the operation of the Sentinel-3 mission by EUMETSAT which will cover the generation of products for the Marine User Community and the monitoring and control of the Sentinel-3 satellite. All responsibilities listed in the Arrangement will be carried out in accordance with a Project Implementation Plan, which is established between the ESA and EUMETSAT Project Managers who will be in charge of the implementation of the cooperation under this Arrangement.


## 5    SENTINEL-3 DEVELOPEMENT STATUS

### 5.1    Overall Development Status

The EUMETSAT part of the Ground Segment is mainly composed by two distinct segments:

The EUMETSAT Fligth Operations Segment responsible for the satellite monitoring and control activities during the routine operations following the In-Orbit Commisioning Review (IOCR).

A Payload Data Ground Segment (PDGS) responsible for the instrument data acquisition and product generation, dissemination and archiving. The subset of the PDGS dealing with data products generation, dissemination and archiving will be located at EUMETSAT HQ.

The Ground Segment (GS) and the Flight Operations Segment (FOS) preliminary design phase is now complete with the review of the preliminary design (PDR) organised by ESA, having been performed last May. This now allows for the FOS facility level requirements specification to be finalised by performing final updates to the requirement specification documents, and then allowing for the procurement actions by ESA and EUMETSAT to take place.

**5.2    Flight Operations Segment Status**

The EUMETSAT FOS definition continues to advance with the completion of the GS PDR and ongoing updates to the GS PDR documentation set to reflect the agreed review dispositions and associated action items.

At facility level, the Sentinel-3 Flight Dynamics Facility (FDF) Requirements document and the Sentinel-3 Mission Planning Facility (MPF) Requirements documents have been reviewed in the context of the GS PDR and updated accordingly identifying the delta developments required for the Sentinel-3 Programme.

**5.3    Payload data Ground Segment Status**

The GMES Sentinel-3 PDGS is primarily in charge of all activities necessary for:

   receiving the Sentinel-3 instruments payload data, including satellite House Keeping TeleMetry (HKTM) and navigation data (NAVATT packets);

   ensuring that satellite tasking is performed according to the overall GMES user requirements and satellite capabilities;

   ensuring that suitable Sentinel-3 products meet the expected quality and timeliness for their availability to the Sentinel -3 Users;

   providing on-line access to the Sentinel-3 mission products;

   monitoring the instrument performance, product quality and to perform data calibration and products validation for the whole mission duration;

   ensuring long-term Sentinel-3 data preservation and availability to users.

Together with the functional requirements two additional considerations were addressed when specifying the Sentinel-3 PDGS; the reuse of existing multi-mission elements where feasible to reduce costs and maximise efficiency, and the potential for exploiting the synergy between the 3 Sentinels missions (S1/S2/S3).

The procurement of the different elements of the Payload Data Ground Segment is progressing well with the kick off of the PDGS Core at the end of September.

The Sentinel-3 production is systematic and global with products being generated in three timeliness categories; Near Real-Time (< 3 hours from sensing), Short Time Critical (< 48 hours from sensing) and Non-Time Critical (< 30 days after sensing).  Both ESA and EUMETSAT generate globally the level 0 and level 1 products and then for Level 2, ESA generates the Land Products and EUMETSAT the Marine Products.

**6    CONCLUSIONS**

CGMS is invited to take note of this document.