SENTINEL-1 MISSION OVERVIEW

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INTRODUCTION

The ESA Sentinels constitute the first series of operational satellites responding to the Earth Observation needs of the EU-ESA Global Monitoring for Environment and Security (GMES) programme. 'Global Monitoring for Environment and Security (GMES)' is a joint initiative of the European Commission (EC) and the European Space Agency (ESA), designed to support Europe's goals regarding sustainable development and global governance of the environment by providing timely and quality data, information, services and knowledge.

In the frame of the GMES programme, ESA is undertaking the development of the European Radar Observatory Sentinel-1, a European constellation of polar orbiting satellites for the continuation of SAR operational applications. Sentinel-1 is an imaging radar mission in C-band, aimed at providing continuity of data for user services, in particular with respect to the ESA ERS and Envisat missions. The Sentinel-1 space segment will be designed and built by an industrial consortium with Thales Alenia Space Italia as prime contractor and EADS Astrium GmbH as C-SAR instrument responsible.

USER REQUIREMENTS

The Sentinel-1 synthetic aperture radar (SAR) constellation represents a completely new approach to SAR mission design by ESA in direct response to the operational needs for SAR data expressed under the EU-ESA Global Monitoring for Environment and Security (GMES) programme. The Sentinel-1 constellation is expected to provide near daily coverage over Europe and Canada, global coverage all independent of weather with delivery of radar data within 1 hour of acquisition – all vast improvements with respect to the existing SAR systems. Data products from the Agency's successful ERS-1, ERS-2 and Envisat missions form the basis for many of the pilot GMES services. Consequently Sentinel-1 data products need to maintain data quality levels of the Agency's previous SAR missions in terms of spatial resolution, sensitivity, accuracy, polarisation and wavelength. In addition to responding directly to current needs of the GMES program, the design of the Sentinel-1 satellite mission with its focus on stability, reliability, global coverage, consistent operations and quick data delivery is expected to enable the development of new applications and meet the evolving needs of GMES, for instance in the area of climate change and associated monitoring needs [1].

SENTINEL-1 SYSTEM

The Sentinel-1 satellite carries a Synthetic Aperture Radar (SAR) instrument with four standard operational modes: Strip Map Mode, Interferometric Wide Swath

Mode, Extra-wide Swath Mode and Wave Mode. Some of their important characteristics are listed below.

Mode	Access Angle (Deg.)	Single Look Resolution Range x Azimuth	Swath Width	Polarisation
Strip Map	20-45	5 x 5 m	> 80 km	HH+HV or VV+VH
Interferometric Wide Swath	> 25	5 x 20 m	> 250 km	HH+HV or VV+VH
Extra Wide Swath	> 20	20 x 40 m	> 400 km	HH+HV or VV+VH
Wave mode	23 and 36.5	20 x 5 m	> 20 x 20 km Vignettes at 100 km intervals	HH or VV

For All Modes	
Radiometric accuracy (3 σ)	1 dB
Noise Equivalent Sigma Zero	-22 dB
Point Target Ambiguity Ratio	-25 dB
Distributed Target Ambiguity Ratio	-22 dB

It is expected that Sentinel-1 be launched in 2011. Once in orbit Sentinel-1 will be operated from two centres on the ground. The Agency's facilities in Darmstadt, Germany will command the satellite ensuring its proper functioning along the orbit. The mission exploitation will be managed at the Agency's facilities in Frascati, Italy, including the planning of the acquisitions by the SAR instrument according to the mission requirements, the processing of the acquired data and the provision of the resulting products to the users.

REFERENCES

[1] E. Attema, *"Mission Requirements Document for the European Radar Observatory Sentinel-1"*, ES-RS-ESA-SY-0007, Issue 1.4, 11 July 2005. (http://esamultimedia.esa.int/docs/GMES/GMES_SENT1_MRD_1-4_approved_version.pdf)