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Author: Mrs. Itziar Barat
ESA - European Space Agency, The Netherlands

Mr. Berthyl Duesmann
ESA - European Space Agency, The Netherlands
Ms. Claudia Dietze
European Space Agency (ESA), Germany
Mr. Mark Tuttlebee
ESA - European Space Agency, Germany
Dr. Sérgio Brás
HE Space, The Netherlands
Mr. Massimo Romanazzo
ESA - European Space Agency, Germany
Mr. Bernd Seitz
ESA - European Space Agency, The Netherlands
Mr. Dominique Montero
EUMETSAT, Germany
Mr. Pier Luigi Righetti
EUMETSAT, Germany

SENTINEL-3 TANDEM: FROM CONCEPT TO IMPLEMENTATION

Abstract

Sentinel-3 carries an Ocean and Land Colour Instrument (OLCI), a Sea and Land Surface Temperature Radiometer (SLSTR), a SAR Radar altimeter (SRAL) supported by a Microwave Radiometer (MWR) and a suite of orbit determination instruments. Sentinel-3 mission will maintain two satellites on-orbit with 140deg phase difference to meet stringent product coverage requirements. Sentinel-3A was successfully launched on 16 February 2016. Sentinel-3B is targeted for a launch April of 2018. Accurate knowledge of the inter-satellite instrument bias is essential to the end-user community. Therefore, before Sentinel-3B achieves its final orbit position, it is planned to fly both satellites for a limited duration in tandem flight. In this way oceanographic and atmospheric variability is minimized between successive satellite measurements to the extent that it can be ignored.

The along track separation of the Sentinel-3 satellites configured in a tandem phase shall be nominally 30 seconds, with a tolerance between 20 to 60 seconds, having both the same ground-track on Earth. During this phase Sentinel-3A shall maintain normal operations, that is, maneuvers for maintaining the tandem position shall be performed by the Sentinel-3B. It shall be noted that during this phase Sentinel-3A will be controlled by Eumetsat, while Sentinel-3B will be operated by ESA's control center ESOC, therefore excellent collaboration between both mission control centers is a must for the success of the tandem phase.

An a-priori tandem acquisition strategy taking into account operational, satellite and launcher constraints was defined in order to derive the injection orbit requirements. The resulting initial injection orbit is 10 km higher than the nominal one, with a biased MLST as function of the launch date. In this way Sentinel-3B is placed 30 seconds ahead of Sentinel-3A with the same ground-track, regardless of the

launch dispersion nor the altitude profile followed to drift to this relative position.

During the tandem phase an hybrid control-box approach is selected. In this control the out of plane manoeuvres of both satellites are coordinated, while the in-plane manoeuvres to compensate for the drag remain independent. This kind of approach is optimal for satellites controlled by different agencies and that maintain its ground-track within limited boundaries much tighter than the along-track separation between them. It results in a very safe control, simplifying the interface between control centers.

This paper provides a detailed explanation of the tandem acquisition and maintenance concept and describes the interfaces put in place between both control centers.