SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts (2)

Author: Mr. Andreas Rudolph
European Space Agency (ESA), Germany

Dr. David Milligan
European Space Agency (ESA), Germany
Mr. Edmund Serpell
VEGA Space GmbH, Germany
Mr. Frank Budnik
Germany
Mr. William O'Mullane
Spain
Mr. Giovanni Colangelo
The Netherlands

GAIA MISSION OPERATIONS CONCEPT AND GROUND SEGMENT DESIGN - THE CHALLENGES AND CURRENT STATUS

Abstract

Gaia is one of the European Space Agency's (ESA) science cornerstone missions currently under development and is due to be launched in 2013 on a Soyuz-Fregat from Kourou, French Guyana. The GAIA mission will rely on the proven principles of ESA's Hipparcos mission to solve one of the most difficult yet deeply fundamental challenges in modern astronomy: to create an extraordinarily precise three-dimensional map of about one billion stars aiming at star magnitudes as faint as 20 throughout our Galaxy and beyond (in comparison, the earlier Hipparcos mission completed in 1993 provided measurements of around 120,000 stars).

For a science mission Gaia is unqiue both in the required astrometric performance, which goes down to 8 μ-arcsec, and the volume of data, some 48 Tbytes, that will be generated during the 5 years nominal mission lifetime. The requirements on performance lead to a very stable thermal design with no moving parts, an onboard atomic clock and an operational Lissajous orbit around the Earth-Sun second Lagrange point. A Phased Array Antenna is used to downlink data via X-band through selectable GMSK modulated, convolutional punctured coding rates.

This paper describes the ground segment design and operations concept of the Gaia mission, focusing on many of the novel aspects. These include a mission planning and operations concept that supports fully data driven operations and highly automated pass operations. The paper will also address the ground segment design and development that implements a dedicated Science data Server at ESOC and that will produce a mission data system Science Kernel (allowing future mission reuse of science specific functionality not included in the standard ESOC SCOS 2000 infrastructure). Further novel aspects required to meet the Gaia operational challenges include: control and data gap filling; high precision science data time-stamping and performance enhancements to meet the high data rates and precise orbit determination using optical observations of the satellite from ground. The paper will also provide a summary of the current development status of the ground segment and address some of the experience and lessons learnt to date.