



MASTER IN SCIENZA E TECNOLOGIA SPAZIALE – UNIVERSITA' DI ROMA "TOR VERGATA"

Internship at Serco SPA

Operational Scenarios of the EarthCARE Mission



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Introduction

Preamble

The current paper summarizes the focus of my work done at Serco S.P.A from June 2016 to March 2017 about the Operational Scenarios of the Payload Data Ground Segment (PDGS) of the EarthCare mission.

Motivation

Drafting the Mission Operational Scenarios in advance is an extremely important practice in the wider system engineering context because it helps the stakeholders to provide clear requirements, which in turn minimises the risk of modifying the requirements after the system has been developed and introduce delays and additional costs.

The Operational Scenarios respond to the answer: *HOW the ESA PDGS will be used?*

They are intended to:

- serving as an input to the definition of the PDGS Integration and Validation Plan
- serving as an input to the definition and drawing up of the PDGS Operational Plan
- acting as guides for preparation of all necessary procedures during the operational phase for all subsystems of PDGS
- supporting all the management project activities, in order to identify the needed skills and the needed resources, also in terms of contracts and work schedules

My activity of definition of the EarthCare Operational Scenarios has been carried out according to what was already defined in the ESA *EarthCARE Payload Data Ground Segment Operation Concept* document, by expanding the already defined scenarios and by focusing not only on the identification of activities to be performed during the MOP- Measurement/Operational Phase- of the mission, but above all by focusing on the identification of resources and skills that must be provided for such activities. Indeed the tracked scenarios in the ESA document were built from a point of view of the software developers and we have identified several gaps from the operational side. Thus we have overhauled all the previously planned scenarios and all the involved activities and we have added all the activities that were missing and that have an important role in the operational phase of the EarthCARE mission. The scenarios have been often heavily rearranged and in some case we have identified new scenarios as well, filling in such a way all the identified gaps.

EarthCARE mission and PDGS activity

The EarthCARE mission is being developed as a joint venture between ESA and the Japan Aerospace Exploration Agency. Its launch is foreseen for August 2019.

The EarthCARE system is composed of the Satellite, the Ground segment, including the Flight Operation Segment and the Payload Data Ground Segment and the Users. In the context of my activity only the PDGS activities have been analysed and the Operational Scenarios that I have filled are regarding those part of the EarthCARE system.

In particular the PDGS is in charge to implement a vast set of functionalities, from the payload planning strategy definition and payload calibration to the data acquisition, data processing and data quality control, in order manage the storage and the data distribution to the user as reliable as possible

All those activities are managed by the related facilities and in the fully essay an analysis has been performed on that in order to identify the proper PDGS Operational Scenarios

Operational Scenarios

For the management of all the PDGS activities I have identified in my work the following Operational Scenarios:

- Mission Planning Scenario that is divided in two sub-scenarios:
 - Main Scenario, describing the routine Mission Planning and Delta-Planning activities
 - Instrument Parameter Update Scenario, describing the special case of planning performed to modify the configuration of the instruments on board
- Data Acquisition Scenario
- Processing scenario that is divided in three sub-scenarios:
 - Level0 Processing Scenario
 - Level1 Processing Scenario
 - Level2 Processing Scenario
- Reprocessing Scenario
- Off-line Quality Control Scenario
- Calibration Scenarios articulated in:
 - On-line Calibration
 - Off-line Calibration
- End-to-end monitoring Scenario
- Ingestion, Circulation and Archiving Scenario that is articulated in two sub-scenarios:

Each scenario has been identified by a specific naming convention and a specific ID, in order to identify univocally the scenario in scope and according to the ECSS.

For each scenario a short description has been provided as well as tables, with the list of all the activities that have to be performed. Each activity within a scenario is numbered with increasing numbers, corresponding to the activities performed in chronological order.

Moreover in each table a column is referred to the actors involved in the managements of each activity. This is a plus of my work related to the already defined scenarios, as they were planned in *EarthCARE Payload Data Ground Segment Operation Concept* document. Indeed in such a way, during the project managements activity, it will be possible to get a quick and clear overview of the all needed resources that are going to be employed, because it will be possible to identify all the activities that will be triggered or performed thanks to human intervention and the other ones that will be performed in an automatic way. In the last row of the table all the applicable documents related to the scenario have been listed as well.

Furthermore, a synthetic list of all the exchange data/file flows has been provided for each Scenario in order to underline the relation among different facilities.

Finally each Operational Scenario has been described also thanks to Sequence Diagrams that provide a convenient graphical representation and underline the relations between different facilities.

Hereafter the Mission Planning Sequence Diagram is shown. It means as an example of the matters we have just discussed.

Please refer to the fully essay for a clear vision of the identified and analysed Scenarios and of my Master degree activity.

