IAF SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Architectures (2)

Author: Dr. Stefania Tonetti
Deimos Space SLU, Spain, stefania.tonetti@deimos-space.com

Ms. Stefania Cornara
Deimos Space S.L., Spain, stefania.cornara@deimos-space.com
Mr. Gonzalo Vicario de Miguel
Deimos Space S.L., Spain, gonzalo.vicario@deimos-space.com
Mr. Stephane Pierotti
Thales Alenia Space France, France, stephane.pierotti@thalesaleniaspace.com
Mrs. Judith Cote
Thales Alenia Space France, France, judith.cote@thalesaleniaspace.com
Mr. Carles Araguz
Technical University of Catalonia (UPC), Spain, carles.araguz@upc.edu
Dr. Eduard Alarcón
Universitat Politecnica de Catalunya (UPC), Spain, ealarcon@eel.upc.edu
Mr. Adriano Camps
Universitat Politecnica de Catalunya (UPC), Spain, camps@tsc.upc.edu
Mr. David Llaveria
Technical University of Catalonia (UPC), Spain, david.llaveria@upc.edu
Ms. Estefany Lancheros
Universitat Politecnica de Catalunya-BarcelonaTech, Spain, estefany@tsc.upc.edu
Mr. Joan Adrià Ruiz de Azúa Ortega
Technical University of Catalonia (UPC), Spain, joan.adria@tsc.upc.edu
Ms. Elisenda Bou-Balust
Technical University of Catalonia (UPC), Spain, elisenda.bou@upc.edu
Mr. Pedro Rodríguez
Thales Alenia Space Espana, Spain, pedro.r@thalesaleniaspace.com
Mr. Mateusz Sochacki
Warsaw University of Technology (WUT), Poland, msochacki@meil.pw.edu.pl
Prof. Janusz Narkiewicz
Warsaw University of Technology (WUT), Poland, jnark@meil.pw.edu.pl

MISSION AND SYSTEM ARCHITECTURE FOR AN OPERATIONAL NETWORK OF EARTH OBSERVATION SATELLITE NODES

Abstract

Over the next few years, Europe will take important steps towards implementing the architecture of the Copernicus Space Component for Earth Observation (EO), fulfilling the needs of stakeholders concerned with land monitoring, marine monitoring, atmosphere monitoring, emergency management, security, and climate change. Nowadays, constellations and distributed networks of satellites are emerging as clear development trends in the space system market to enable augmentation, enhancement, and possibilities

of new applications for future EO Missions. It is of paramount importance for Europe to properly analyse these trends and assess whether or not they could provide a competitive advantage for EO systems. The paper presents the mission and system architecture design of the H2020 ONION project, a European Union research activity that proposes a system concept to supplement in a progressive way the current European EO infrastructures and to serve emerging needs in an optimal fashion. Among several use cases considered, the ONION project focussed on proposing system architectures to provide competitive revisit time, data latency and image resolution for two demanding application scenarios of interest: marine weather forecast (MWF) and agricultural hydric stress. A set of promising system architectures has been subject of a comprehensive assessment, based on mission analysis expertise and detailed simulation for evaluating several key parameters such as revisit time and data latency of each measurement of interest, on-board memory evolution and power budget of each satellite of the constellation, ground station contacts and inter-satellite links. The architectures are built with several heterogeneous satellite nodes distributed in different orbital planes. Each platform can embark different instrument sets, which provide the required measurements for each use case. A detailed mission analysis has then been applied to the selected architecture for the MWF use case, including refined data flow analysis to optimize system resources; refined power budget analysis; delta-V and fuel budget analysis considering all the possible phases of the mission, encompassing correction of launcher injection errors and acquisition of nominal satellite position inside the constellation, orbit maintenance to control altitude, collision avoidance to avoid collision with space debris objects and end-of-life disposal to comply with EOL guidelines. The relevance of the system architecture selected for the MWF has been evaluated for 3 use cases of interest (Arctic sea-ice monitoring, maritime fishery pressure and aquaculture, agricultural hydric stress) to show the versatility and the feasibility of the chosen architecture to be adapted for other EO applications.