

IAF SPACE OPERATIONS SYMPOSIUM (B6)
Ground Operations - Systems and Solutions (1)

Author: Mr. Riaz Shafi
RHEATECH Ltd, United Kingdom, r.shafi@rheagroup.com

Mr. Gianluca Cerrone
Rhea Group, The Netherlands, g.cerrone@rheagroup.com
Mr. Alberto Fernandez
Astroscale Ltd, United Kingdom, a.fernandez@astroscale.com

Mr. David Garton
Satellite Applications Catapult, United Kingdom, dave.garton@sa.catapult.org.uk

MISSION CONTROL FACILITY FOR ELSA-D. A STATE-OF-THE ART MIXED CONCEPT
CONTROL AND AUTOMATION SYSTEM FOR SMALLSATS**Abstract**

The National Facility for In-Orbit Services Control Centre (IOSCC) based in Harwell, UK, has been established for operating missions to clean up space and conduct other In-Orbit servicing operations. The ELSA-d (End-of-Life Service by Astroscale - Demonstrator) will be the first mission to be operated from the IOSCC. The End-of-Life Service by Astroscale program is a spacecraft retrieval service offered to satellite operators. The ELSA-d Mission Control Facility is being developed for Astroscale - under a contract led by the Satellite Applications Catapult - where RHEA is providing the Mission Control System and Automation Systems. The Mission Control Facility is intended to serve as the baseline facility for future missions operated from the IOSCC. Scheduled to launch in late 2020, ELSA-d consists of two spacecraft - a Chaser and a Target. The chaser is equipped with proximity rendezvous technologies and a capture mechanism, whereas the target has a docking plate which enables it to be captured.

The Mission Control System (MCS) development had to cope with a series of challenges and requirements resulting from, the agile aspect of the mission, the high need for automation, support for File-Based Operations and the unique characteristics of the spacecraft's on-board software.

This paper will describe the development of the state-of-the-art mission control facility, specifically designed to meet the highly dynamic nature of the ELSA-d mission and future similarly complex missions. It will address:

- A rapid development, deployment and integration of a complete Ground Segment using an Agile development approach.
- Design of the MCS Ground Segment Architecture - Including the challenges of developing a control system using a mixture of PUS standards, NASA cFE (core Flight Executive) framework, together with CFDP and File Based Operational concepts.
- End-to-End communication security - using a Message Authentication Code managed on both ground and on-board to validate messages.
- The need to develop a highly automated mission o Onboard automation handling the closed-loop operations when the Chaser is approaching the Target. o RHEA MOIS automation tool for handling the ground station passes to minimise the time when the spacecraft is out of contact during critical operations.
- Consider the wider capabilities of the IOSCC for future mission instances including the rapid tailoring and deployment of the various ground segment components.