SPACE DEBRIS SYMPOSIUM (A6)
Operations in Space Debris Environment, Situational Awareness (7)

Author: Ms. Noelia Sánchez-Ortiz
Deimos Space S.L., Spain, noelia.sanchez@deimos-space.com

Mrs. Nuria Guijarro
Deimos Space S.L., Spain, nuria.guijarro@deimos-space.com
Mr. Raúl Domínguez-González
Deimos Space S.L., Spain, raul.dominguez@deimos-space.com
Ms. Esther Parrilla Endrino
Deimos Space S.L., Spain, esther.parrilla@deimos-space.com
Mrs. Ana Isabel Mediavilla Garay
Deimos Space S.L., Spain, anabel.mediavilla@deimos-space.com
Mr. Luis Martin
GMV Aerospace & Defence SAU, Spain, luis.martin@esa.int
Mr. Vicente Navarro
ESA, Spain, vicente.navarro@esa.int
Mr. Emmet Fletcher
European Space Agency (ESA), Spain, emmet.fletcher@esa.int

SENSOR SIMULATOR SUPPORTING THE PROTOTYPE PILOT DATA CENTRES FOR THE ESA SPACE SITUATIONAL AWARENESS (SSA) PREPARATORY PROGRAMME

Abstract

The complete Data Center of the future Space Surveillance and Tracking (SST) segment will be composed of several functionalities fulfilling the main objective: Generation and maintenance of a catalogue of man-made space orbiting objects and the evaluation of such catalogue for diminishing the risk posed on assets in space and casualty at ground derived from satellites and space debris. In the frame of ESA SSA Preparatory Program, some elements of a Pilot Data Centre for SSA are developed. Among others, an activity is concentrated on the design, development and deployment of the SST Data Processing Center (DPC), Sensor Planning System (SPS) and Sensor Simulator (SSIM).

This paper focuses on the Sensor Simulator, and how it is defined to support testing and evaluation of Sensor Planning System and Data Processing Chain previous to the deployment of Sensors. If real sensors exist, the SPS shall command them to execute the observational tasks, sensors will provide observations to the NEO (Near-Earth Objects) and SST data processing chains to maintain catalogue of NEO and SST objects. In the event that the cataloguing system requires additional observations of an object to improve the orbit knowledge, SPS will be requested to allocate new observations. In this way, the three systems shall share a common approach.

The Sensor Simulator for the Pilot Data Centers reproduces physical models for all system elements involved in the data generation process: observations constraints and strategies (tracking and survey), debris orbits propagation, NEO orbits propagation, generation of radar, ground based optical and space based optical measurements. A brief review of the capabilities, main models and algorithms is presented in this paper. The paper provides also detailed comparison of simulated observations by SSIM with real observation data coming from the operational tracking campaigns performed during a previous ESA activity. More than 15 satellites at different orbital regimes (LEO, MEO and GEO) were observed

from both radar and optical ground based sensors during several observation campaigns. Two radar observation campaigns and three optical campaigns lasting about one week each. The observation data is complemented with accurate orbital reference data of the observed objects obtained from flight dynamics teams operating the satellites.

The paper shows the suitability of the developed SSIM to simulate space-objects observations and show its flexibility to simulate tracking and survey campaigns that allow to support sensor design, catalogue processing approach definition and surveillance system demonstration prior to sensor availability.