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OPTICAL IN-SITU MONITOR - A BREADBOARD SYSTEM TO ENABLE SPACE-BASED OPTICAL OBSERVATIONS OF SPACE DEBRIS

Abstract

The goals of the ESA project "Optical In-Situ Monitor" are to design and integrate a breadboard of a space-based space debris camera and to develop and test its end-to-end processing chain. The corresponding future flight model shall be used for the detection of small-sized (down to 1 mm) space debris in LEO as well as larger objects in GEO. It is intended to be flown on a platform in sun-synchronous orbit near the terminator plane. The activity's breadboard system is comprised of the following three main elements:

- Breadboard Instrument: Acquires images of space debris scenes generated by the Test Set-Up with the characteristics of the future flight model instrument.
- Image processing pipeline: On-board debris detection and data reduction, on-ground astrometry and photometry.
- Test Set-Up: Scene generator for space debris observation scenarios.

The breadboard system will constitute a unique facility to perform realistic tests of the end-to-end chain for debris observations within a controlled environment. This chain starts from signal generation via the scene generator, is followed by the acquisition of images via the breadboard instrument and finally performs the data processing until the astrometric and photometric reduction step. High accuracy is required for the scene generation part regarding motion and photometric accuracy because it serves as ground-truth for the system. As prime contractor, Airbus Defence and Space is responsible for project management, system and performance engineering, the breadboard instrument, and on-board data processing hardware issues. The required image processing software is being developed at the Astronomical Institute of the University of Bern (AIUB). Micos provides the space debris scene generator, emulating both debris and star background. The paper will provide details on requirements and design of the three main elements as well as on the results of the end-to-end performance tests.