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IN-ORBIT PERFORMANCE ASSESSMENT OF ARGO 1.0 STAR TRACKER FOR SMALLSATS

Abstract

The paper presents the in-orbit performance assessment of the ARGO 1.0 star tracker, the first model of the innovative ARGO product line conceived by EICAS, paving the way towards next generation spacecraft autonomous attitude determination and targeting the needs of the SmallSats market. Based on star observation only, ARGO smart multicamera star trackers aim to offer high accuracy, flexibility, robustness and scalability at affordable price. The innovation consists in relaxing the on-ground metrological constraints of the cameras, thanks to a sagacious observation of the starry sky, the best metrological standard ever available. An intelligent data fusion and smart calibration procedures enable the in-flight auto-calibration both of the geometrical camera model and of the relative attitude among the cameras, ensuring high stability of performance for the entire mission duration. ARGO has been recognized as a disruptive innovation, receiving funding from the EU Horizon 2020 Programme (GA no. 738589) for the development of the first model ARGO 1.0 and its in orbit assessment. The main outcomes were a successful on-ground validation and qualification campaign till TRL 8 and a monocamera version of ARGO 1.0 currently being in-orbit for TRL 9 validation as a third-party payload of the Pulse Mission by D-Orbit S.p.A. The IOD's performance assessment includes - but it is not limited to - attitude determination and tracking capabilities in different operative conditions, assessment of the in-orbit innovative calibration procedures of the camera model, robustness tests like f.i. maneuvers to study the straylight effects of Sun, Earth and Moon in FOV at different aspect angles. The applied method exploits a deep analysis of the star tracker telemetry - also synchronized with the spacecraft's telemetry - conducted by EICAS with several smart on-ground analysis tools and procedures, enabling a fast and efficient off-line repetition of all the in-orbit experiments through EICASLAB SW Suite, EICASLAB SLOW MOTION Tool and EICAS ARGO Multicamera Simulator. The implemented architecture also allows to upload updates of the on board parameters, star catalogues and the overall Application Software, creating a laboratory in space for exploring different strategies and refinements. The results of the ARGO 1.0 IOD will be exploited for the refinement and improvement of the ARGO SW in benefits of both ARGO 1.0 multicamera version and of a second multicamera architecture - ARGO 2.0 for constellations - currently under development as a part of the ESA ARTES C$G Programme.