Paper ID: 63266
oral

19th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Operations in Space Debris Environment, Situational Awareness - SSA (7)

Author: Mr. Jerome Thomassin
Centre National d'Etudes Spatiales (CNES), France

Dr. Sophie Laurens
Centre National d'Etudes Spatiales (CNES), France
Mr. François Toussaint
Centre National d'Etudes Spatiales (CNES), France

ASTERIA : AUTONOMOUS COLLISION RISKS MANAGEMENT

Abstract

For a few years now, CNES has been developing ASTERIA, an on-board autonomy concept combining autonomous station-keeping and collision risks management for Low Earth Orbit (LEO) satellite. ASTERIA, acronym for **A**utonomous **St**ation-keeping **T**echnology with **E**mbedded collision **RI**sk **A**voidance system, enables both in-track and cross-track control for different LEO missions. The on-board collision risk management process is fully integrated into the autonomous station-keeping in order to maintain the satellite orbit as best as possible and to minimize mission unavailability resulting from the avoidance maneuvers.

Collision risk management requires the best possible knowledge of the future trajectory of the primary satellite, up-to-date information on secondary objects, as well as a calculation process with a large amount of data and the propagation of orbital states and covariance. That's why, so far, collision risk management has always been a ground segment activity. But this strongly limits on-board autonomy by imposing a timing and a knowledge of the station-keeping manoeuvers not very suitable with a reactive Autonomous Orbit Control (AOC) system. On the contrary, management by the spacecraft itself offers interesting prospects for responsiveness and increased autonomy, but requires to carry out on-board risk calculation, to identify relevant risk assessments and to implement efficient avoidance solutions.

The paper will show the completeness of the ASTERIA concept. First, the principles of on-board collision risk management will be described. Then, the paper will present the study of the on-board computational load, the accuracy of risk estimation and the performance of risk avoidance strategies. The ability to operate such a system will then be demonstrated through the study of the related operational management process. The concept has been tested and validated by in flight experiments on the ESOC OPS-SAT 3-Units CubeSat. Some preliminary results of this ongoing experiment will be presented. Finally, the issues related to an autonomous system will be discussed, particularly those concerning space traffic management.