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XMM-NEWTON'S OPERATIONS PREPARATION FOR THE 4 WHEEL DRIVE PROJECT

**Abstract**

The AOCS of XMM-Newton was designed to use three reaction wheels (RW) with a fourth wheel in cold redundancy. The 3 wheels configuration has been used for more than 13 years for the momentum management, to re-orientate the S/C with slews in order to achieve the required science pointing. With 3 wheels, frequent reaction wheel unloading is used both to compensate the external torque and to re-orientate the angular momentum to allow the slew execution, which results in fuel consumption of around 6 Kg per year. A fourth wheel in control gives the advantage of a higher momentum envelope and introduces the null space in the wheels matrix, allowing a wheel speed variation without changing the total angular momentum. With four wheels the reaction wheel bias will compensate only for the accumulation of angular momentum due to the external torque, resulting in saving a significant amount of fuel and extending the mission lifetime. The use of all four reaction wheels implied the development of new attitude control algorithms and a software change on board which needs to be made in parallel to execution of the science mission. A design phase of this change was successfully completed and the project is right now in the middle of the implementation phase, which includes the consolidation of the design, the software implementation, and the verification and validation phase. The objective is to upload the new patch and to switch from 3 wheels to 4 wheels control by the late summer 2013. From operations point of view this is a major change, since the review of the nominal and contingency procedure will be needed, together with mission control system (MCS) changes. The Flight Dynamics System (FDS) as well needs to be adapted to the new 4 wheel drive concept, with the new algorithm reflected in its system. At the end of the software implementation and validation, after the necessary changes on the MCS and on the FDS side, an end-to-end test campaign needs to be performed. This paper describes the activities carried out to implement the 4 wheel drive project and the operations preparation to be ready for a completely new mission phase.