IAF SPACE OPERATIONS SYMPOSIUM (B6)
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EVOLUTION OF THE ECLIPSE OPERATIONS CONCEPT FOR ESA'S X-RAY OBSERVATORY XMM-NEWTON

Abstract

ESA's XMM-Newton space observatory launched in 1999, is the flagship of European X-ray astronomy and the most powerful X-ray telescope ever placed in orbit. In this work, the evolution of performing eclipse operations, moving away from the manual activities to an automated approach used today, is described. Approximately every six months and for few revolutions, eclipses are overlaid to the nominal perigee passages. Preconditions for the survival during an eclipse are of course the health and the capacity of the batteries. Before entering eclipse, a reconfiguration of the satellite to eclipse mode has to be performed. Respectively a reconfiguration back to nominal mode for all subsystems is necessary after exiting from eclipse. In the earlier times, it was only possible to predict accurate eclipse times just a few days before the eclipse. Impeding inclusion of eclipse related commands in the automatic timeline at the mission planning level. So human operator had to uplink necessary commands for configuration of spacecraft manually near to eclipse entry. At a later stage of mission, XMM-Newton's subsystem engineers came up with an accepted level of accuracy to eclipse entry and exit times and with the availability of better flight dynamics analysis tools, it was reckoned that eclipse times can be predicted, with the accepted level of accuracy, well in advance than the actual eclipse. Hence enabling mission planners to include all eclipse related commands in automatic timeline at the mission planning level. The usage of the said FD analysis in conjunction with standard mission planning tools made the preparation of eclipse operations relatively efficient. In addition, they helped in reducing the stress on the human operator to a certain degree. Automation level achieved by using the automatic timeline was a bare minimum. The human operator still had to confirm their correct execution in real time. As most of these commands are related to spacecraft reconfiguration when entering and exiting eclipse, the spacecraft controller had to cope with huge number of telemetry checks during short time intervals. To further the level of automation used these eclipse operations have been re-designed to be executed from an automation system. This automation system required the activities to be segmented in a logical manner. Also included, in this work, are the details of implementation of these operational segments in the said automation system.