

XMM-Newton

Overall Mission Status

Fred Jansen, SCI-00

UGM #17, ESAC

7-8 June 2016

➤ Mission Manager

- Apologises for not being able to attend meeting in person

➤ 2016 Mission extension cycle

- MEOR : Was successfully held 31-May-2016
 - Confirmation of 2017-2018
 - Indicative extension for 2019-2020
- Gaia as a new, additional, mission for an extension request
- Proposals go to November 2016 SPC

Status of XMM-Newton is largely similar to UG #16. However:

- Fuel usage slightly further decreased because of additional operations changes
- Reaction wheel caging continues to be OK
- Fuel replenishment/migration analysed, prepared and planned
- MOS1 camera of the EPIC instrument experienced an anomaly during instrument switch on after the end of eclipse (end-2015)
 - Failure is almost identical in nature to one suffered by the MOS2 camera in December 2010
 - MOS1 effect repeated itself during the power-on sequence in the following eclipses (like it did in MOS2 in 2010)
 - Switch over to the B-side electronics, like in the case of MOS2, was implemented and has been running without problems since.
 - Effect is probably caused by aging (radiation dose, normal aging etc).
- MM assumes that over the years more and more externally supplied XMM-Newton support will have to be supported at the SOC

- EPIC Cross calibration : EPIC-PN <-> EPIC-MOS <-> ACIS <-> NuStar
 - User group defined priorities
 - Recalculation of mirror effective areas → in progress
 - Recalculation of 2D-PSF and encircled energy functions → in progress
 - Comparison of EPIC-pn and NuSTAR → in progress
 - Refinement of EPIC-MOS QE at Si edge → done

- EPIC-PN
 - Burst mode calibration items still open – as an aside, Burst mode is now being used for science purposes not foreseen at, and first years after, launch
 - Calibration of energy scale over the whole mission being revised → done
 - Calibration of spectral resolution over the whole mission → done

- RGS
 - Update CTI/gain calibration – routine work
 - Time dependent relative calibration of RGS1 and RGS2 responses – to be released in next SAS (CCF)

- The following should be noted
 - With the arrival of extremely long observations the requirements on calibration accuracy increases
 - Some 'new' science also poses very specific calibration requirements
 - Project scientist updated the original XMM-Newton calibration requirements (also approved by UG): a solid baseline exists against which the calibration objectives and results achieved are being measured.

- Loss of key personnel – also a MOC concern
 - A number of experienced staff/contractors have left and/or are leaving – the knowledge transfer requires careful management
 - People coming up to retirement age over next 3-4 years
 - Also elsewhere
- Increase of SOC tasks
 - SAS tasks, calibration work etc
 - Respond to new scientific needs (e.g. implement a new trigger to follow LIGO GW detection)
 - More coordinated programmes (~ 3Ms with NuSTAR) and significant ToOs → increase load on mission planning, but shouldn't be reduced because of the high scientific return of these programmes
 - Non-essential SOC tasks reduced already, no place to further reduction without hitting science
 - Long term items to be addressed: **Post-Operations and Post-Mission Roadmap (see later VG's)**
- Personnel being used for non-XMM-Newton activities
 - Effectively 1-1.5 FTE permanently used to support other activities – assumed to be constant

Complexities and performance reduction induced by a three-party (Gaia, XMM-Newton, Integral) SPACON arrangement are being evaluated.

Following the discontinuation of the Perth groundstation XMM-Newton moved to a mixture of Yatharagga, Kourou and Santiago groundstations – cost debate ongoing

Automation of simple, repetitive operations, ongoing. RM crash recovery completed, other options are G/S handover, OM recovery etc

Instruments thermal control loop (a major improvement for eclipse operations) implemented

- ESOC performed an analysis which looks complete and is the best we can currently do.
 - The SOC's of the respective missions have not (yet) been involved, but it is believed that looking at the ESOC science return statistics is sufficient to make a decision
- The SPACON merge proposal would reduce the SPACON total from 9 (6 XMM/INT - 3 Gaia) to 7 (6 for 24/7, 1 daytime function)
- The science impact on the missions has been evaluated using the missions digital logs for a recent 1 month period, and these were folded through the new scenario.
- It is believed the science return loss percentages are on the pessimistic side and will significantly improve with time (1-2 years) to be closer to the current science return performance with losses of a few percent remaining.
- It is also believed that the necessary supporting activities needed up front to make the new constellation work (some 6 WP's totaling an investment of almost 2 man years) will make operations for all missions more robust in general.
- Top level requirement of S/C and instrument safety will continue to be met in ALL cases

- The initial estimated science return losses – compared to current performance - are:
 - Integral: Up to 15 % worst case, on average < 10% (expected with time to reduce further)
 - XMM-Newton science operations proper: 5-8% (expected with time to reduce to 3-4%)
 - XMM-Newton losses because of Gaia priority: additional 3-5 % absolute worst case (expected to rapidly reduce to < 1% after introduction of special planning tool)
 - XMM-Newton ToO response time: Could be a two hour additional delay in a limited number of cases on top of the current minimum 5 hours
- As a reminder, at the time of removing the XMM-Newton INSCON function from ESAC, a potential worst case science return reduction to 70% was agreed (from the then ~90% levels) – some 10% was indicated as an initial estimate to the UG . At that time there was a dip in science return which was quickly recovered to the 90% plus levels
- Should Integral be discontinued and XMM-Newton not merge with Gaia, there will be a very significant cost increase/year for XMM-Newton
- Discussions with senior ESA management ongoing – no conclusion to date

- Important legacy of XMM-Newton will be its data archive in the phase when the SOC no longer exists and XMM-Newton funds cease to exist.
- As, in this mission phase requirements exist to re-analyse data, this would require
 - cheap and maintainable way to analyse XMM-Newton data in the archive
- ESA management has indicated that we should prepare for this during the operational phase of the mission (= now)
- In this post-mission phase SAS will only be able to survive some 5/10 (more ?) years (single distribution virtual machine, neither updated nor maintained)
- On-demand processing using calibrated event lists, light curves etc could be a significantly simpler, and cheaper to maintain, package
- Will start a process to see how much of the post-mission data analysis requirements could be fulfilled and report back to the UG
- As also now resources available are very limited, the mission manager would like to receive the views of the users' group on this.

In line with the UG recommendation, the following was started at the SOC:

- Preparation of roadmap to implement part of post-mission requirements during operational mission was started. Not a simple exercise.
 - Primary focus: Enhance archive products to serve 95% of the optimum set of requirements
 - Secondary focus: SAS longevity
 - Where to find the manpower – potentially painful and difficult trade-offs to be made

1. The scientific performance of XMM-Newton remains outstanding and continues to provide a very high scientific return
2. Potentially implement three-party (Gaia, XMM-Newton, Integral) SPACON arrangement are being evaluated – preliminary long term science impact estimate on XMM-Newton 3-4 %
 - UG requested to express its opinion
3. Finalise roadmap document – agree implementation with group leaders
 - UG requested to provide guidance on priorities for areas NOT to be touched to find the required effort: SAS, TOO planning, Calibration
4. Essential mission elements are stable and trouble free with sufficient consumables and life-limited items allow operation to 2028+