

The XMM 20 year reunion – some random thoughts for the panel discussion.

Brian Taylor (formerly Head of Astrophysics Division, Space Science Department, ESTEC)

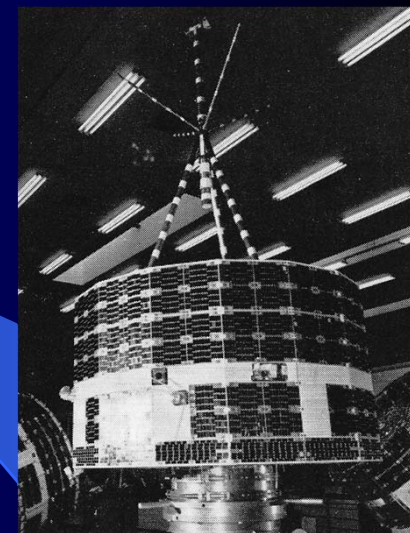
The longevity of space missions truly amazing compared with early space missions:

- first ESRO missions: typical design life one year and budget to operate for two,
- now, technological advances, miniaturization, reduction of power demand etc.,
- HEOS 1, ESRO's 3rd satellite (I was project scientist), launched in 1968, to study solar wind and cosmic rays, into 4.5 day period orbit,
 - 12bps VHF downlink, instruments either on or off !

Now we have XMM operating for 20 years, maybe 30.

Always a financial crisis:

- ESRO science budget cut to make room for applications satellites, advent of ESA 1975,
- missions always quite different, no commonality in spacecraft design,
- expanding space science community,
- need in mid-70s to join with NASA e.g. IUE and ISEE missions for a viable programme,
- delay in the launching of EXOSAT conceived in early 70s, launched in 1983,
- however unique missions also approved and undertaken e.g. Hipparcos and ISO.



HEOS 1

Turning to Early X-ray Astrophysics:

- in ESRO/ESA, X-ray astronomy initially lost out to gamma-ray astronomy (COS-B),
- ‘resurrection’ in the form of HELOS, using lunar occultation to determine the precise location (\sim arcsecs) of X-ray sources,
- HELOS morphed into EXOSAT with the advent of NASA’s Einstein.

EXOSAT the first ESA satellite with:

- \sim arcsec pointing and stability,
- star trackers,
- on-board computer,
- pioneering replicated X-ray optics > adopted for XMM,
- HEO for long uninterrupted observations. Athena at L2 even better.

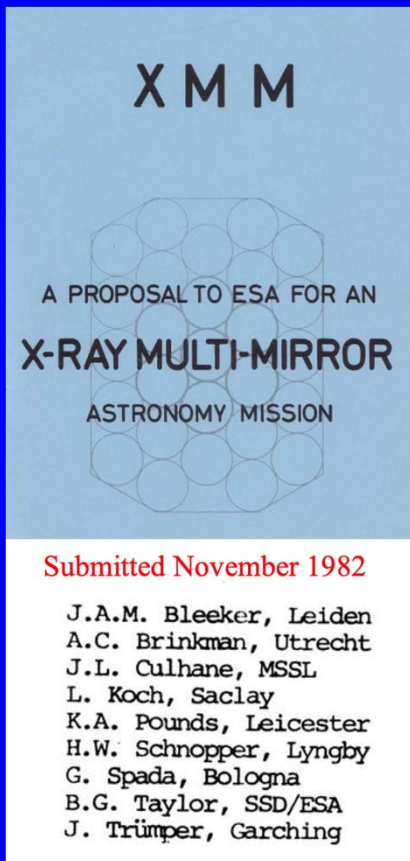
Operations:

- value of co-location of MOC and SOC,
- operated for \sim 3 years, \sim 1800 pointed observations,
- observatory open to ‘guest observers’ (a la IUE),

First ESA mission with a ‘post operations/archive phase’



A successor to EXOSAT proposed in response to an ESA 'Call for ideas' in 1982 before EXOSAT was launched.



A High Throughput X-ray Spectroscopy Mission,

(Complementary to Riccardo Giacconi's 1.2m, 0.5" telescope > AXAF/Chandra)

The proposal featured:

7 'high energy telescopes' to 10keV, with 0.5m² and 30" HEW,
20 'low energy telescopes' to 5keV, with 1.0m² and 10" HEW,
with foil, diamond turning and replication optic options and
with PSPC, GSCP, MCP, and CCD focal plane detectors, together with crystal spectrometers, transmission and reflection gratings etc.etc.

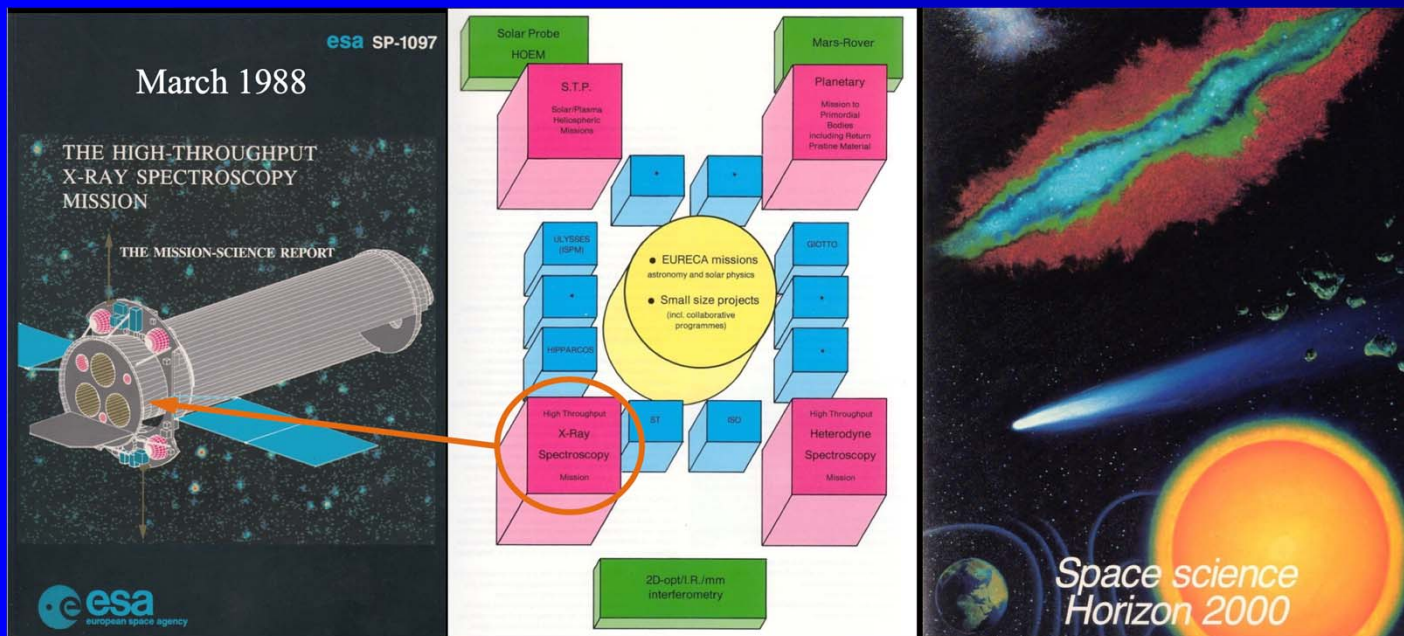
A veritable Christmas tree but the proposal brought all major European groups together.

ESA's first 'long-term' Space Science plan Horizon 2000 formulated in 1984

(instigated by Roger Bonnet, Director of Science and Johan Bleeker, Chair of the Space Science Advisory Committee.)

The first increase in real terms in the ESA science programme since its founding.

Within Horizon 2000, XMM was selected as 'Cornerstone 2' and planned for launch in..... 2000.

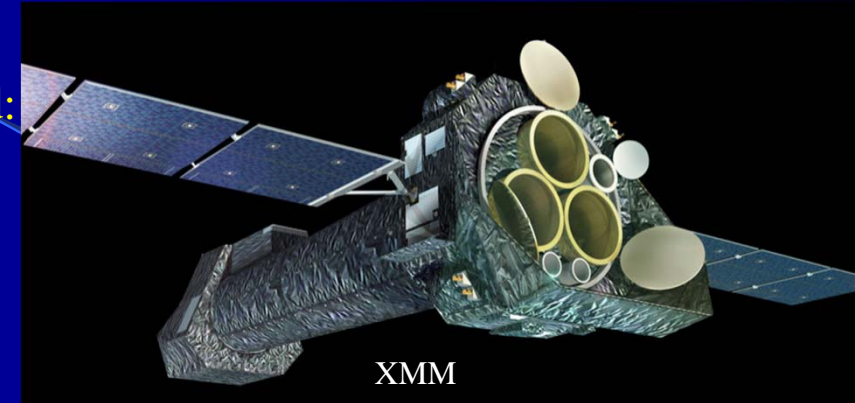


Without the development of the XMM 'bus' there may not have been INTEGRAL and without the Rosetta 'bus' there may not have been Mars Express and Venus Express, within the cost and time scale of those 'medium missions.'

XMM Mission Science Report issued and mission given SPC approval in 1988 with:

3 Wolter-1 mirror modules, focal length 8m, apertures 70cm to yield:

- 6000cm^2 at 2keV, 3000cm^2 at 7keV,
- spatial resolution $< 30''$ HPW,
 - CCD focal plane cameras on all 3 telescopes,
 - reflection gratings on 2 telescopes.



Complimented with Optical Monitor (from EXOSAT operational experience) – not on Athena?

Mirror modules manufactured by replication technique – responsibility of ESA,

Focal plane instruments, reflection gratings, OM – responsibility of institutes,

- development of X-ray CCDs by e2V supported by ESA Technology Research Programme.

Ariane 4 launcher with 24 hour period (compromise) eccentric orbit,

- changed to Ariane 5 (with switch to Nickel mirror carriers) and (the original) 48 hour orbit.

Comments on: Science Operations, Post Operations and Archives – Villafranca/ESAC

EXOSAT was the first ESA mission with a ‘Post Operations and Archive Phase’ (POAP), 1986 to 1990. The work of the EXOSAT Observatory Team led to the introduction of the Survey Science Centre in XMM.

IUE and ISO science operations at Villafranca through 90s >> experienced team in place for XMM.

Both missions showed advantage of science ground segment ‘developers’ and ‘users’ co-located.

Consolidation of all ESA astronomy mission SOC and POAP at Villafranca >> ESAC

- manpower and infrastructure efficiencies,
- maintenance of expertise for future missions.

Data from ‘solar system’ missions now archived at ESAC.

Lesson learned:

- long gone is the concept of such activities ‘on a case by case basis.’



Some personal acknowledgements.

XMM had two very capable Project Scientists from my division initially Tone Peacock then later Fred Jansen. It's right and proper here to thank them (and many other colleagues in SSD) for their excellent work on XMM during the preparatory, development and operational phases.

I recall the return to ESA of Robert Lainé to take up the position of XMM Project Manager. Robert worked with me within the EXOSAT payload team but, beyond that, he was also instrumental in redesigning that spacecraft, already in the hands of industry, to properly accommodate the imaging telescopes and attitude measurement system.

He was certainly the right guy to have in place to solve the XMM mirror problem!