

IXO mission studies

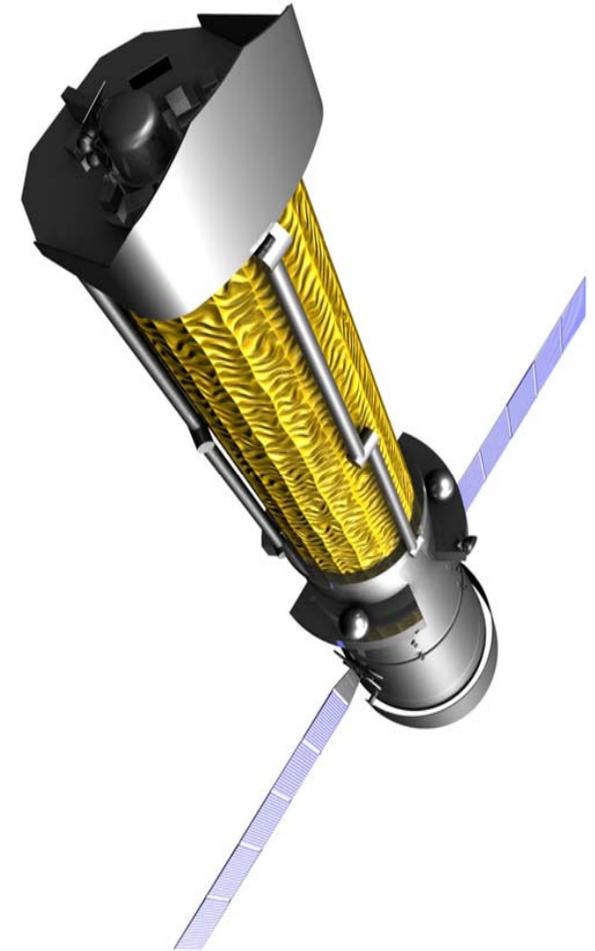
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(on behalf of the IXO study team)

IXO science meeting - Rome, 15 Mar 2011

Layout

- Timeline and key events
- Summary of assessment study results
- ESA technical & programmatic review
- Recent activities
- Conclusions

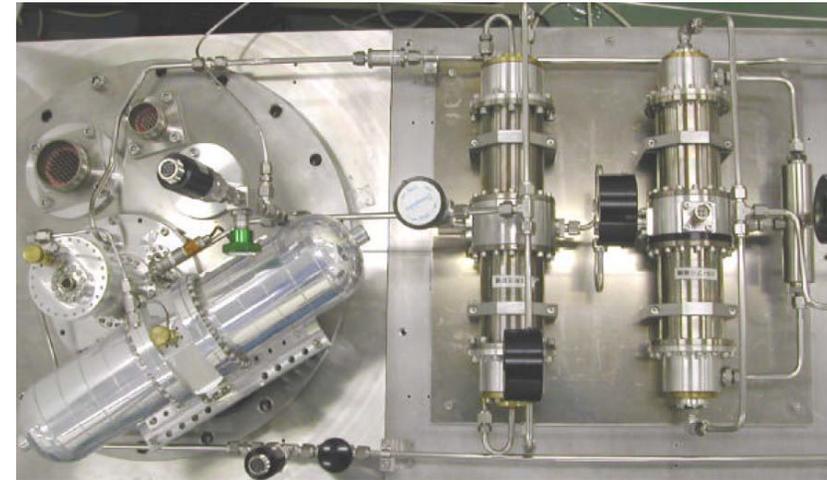
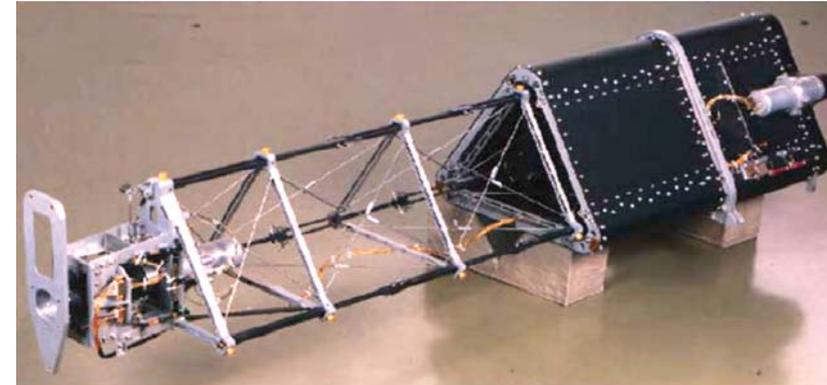


Assessment study process at ESA

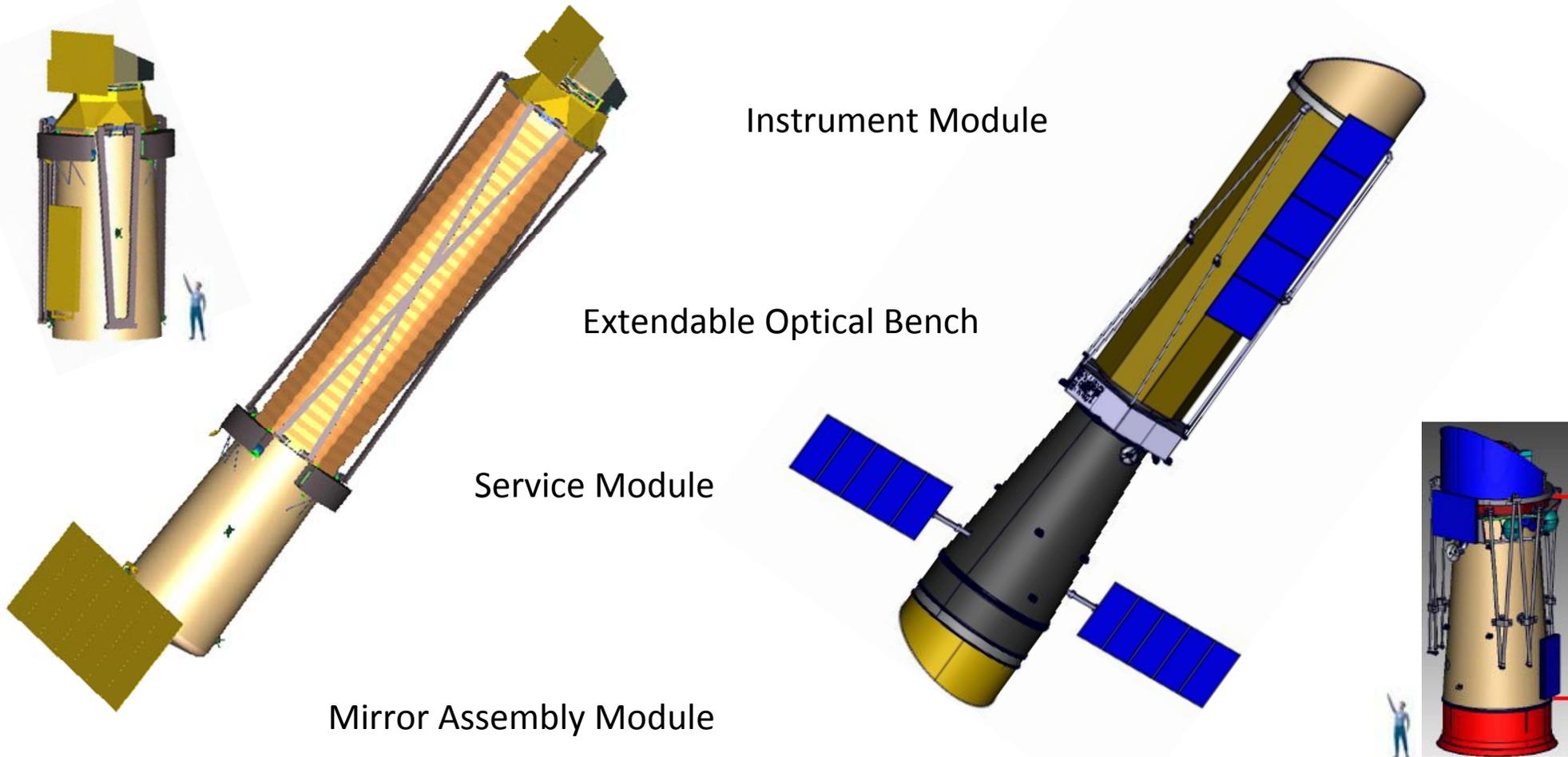
Original L class proposal submission (<i>Cosmic Vision 15-25</i>)	Q2/2007
IXO, science requirements and model payload.	Q1 and Q2 2008
Mission concept studies at ESA: two CDF studies at ESA, one at mission level and one focused on telescope assembly	Q4/08 – Q1/09
ESA call for Declaration of Interest - IXO instruments studies.	Q3/09 till Q3/10
Two parallel competitive industrial studies at ESA at system level (EADS-Astrium and Thales Alenia Space).	
X-ray optics development (Silicon Pore/Slumped Glass Optics)	Running in parallel
Completion of assessment study activities.	September 2010
Internal, technical and programmatic review by ESA.	November 2010
Public presentation on assessment study results	February 2011
Inter-agency negotiations – L class plan update	Q1/2011 → Q1/2012

Industrial assessment studies

- Two parallel, competitive industrial studies (Phase 0/A level).
- EADS-Astrium Space and Thales Alenia Space, 1 yr duration (July 2009 – July 2010).
- A feasible design identified by both EADS-Astrium and Thales Alenia.
- System configuration consistent with NASA design.
- Resource budgets with margins exceeding the required level (SLM ~22%).
- Reference scenario takes into account heritage & expertise from previous developments (Astro-H, SPO, XMS).
- No significant developments required at S/C level.
- Flight heritage on payload elements (e.g. WFI APS Vs. BepiColombo MIXS).



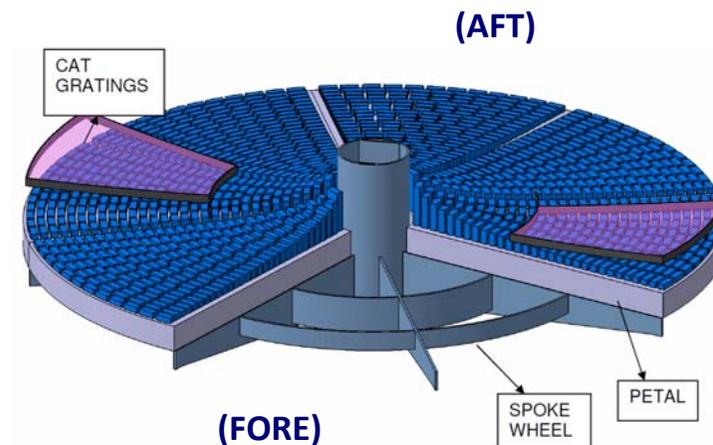
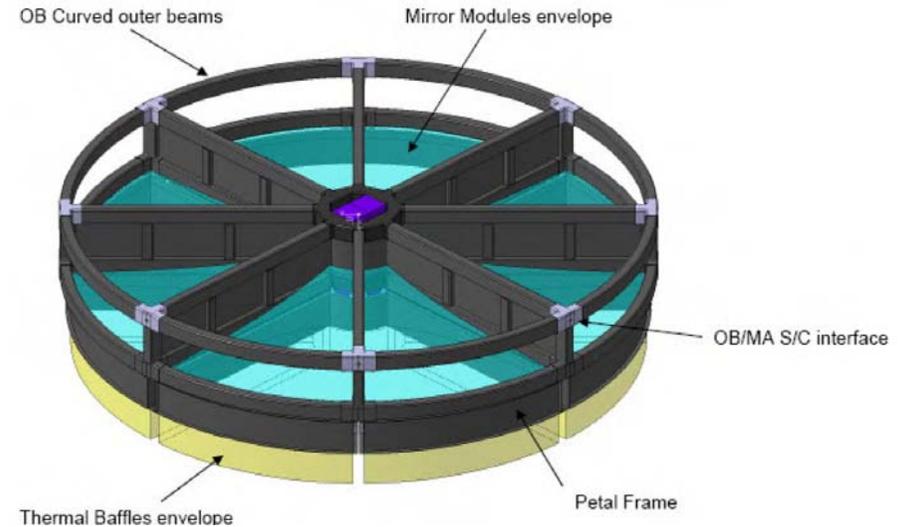
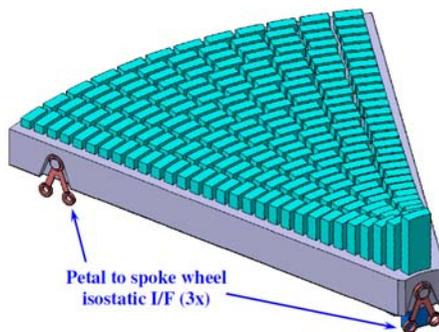
Industrial assessment



Mirror Assembly Module

ESA contribution.

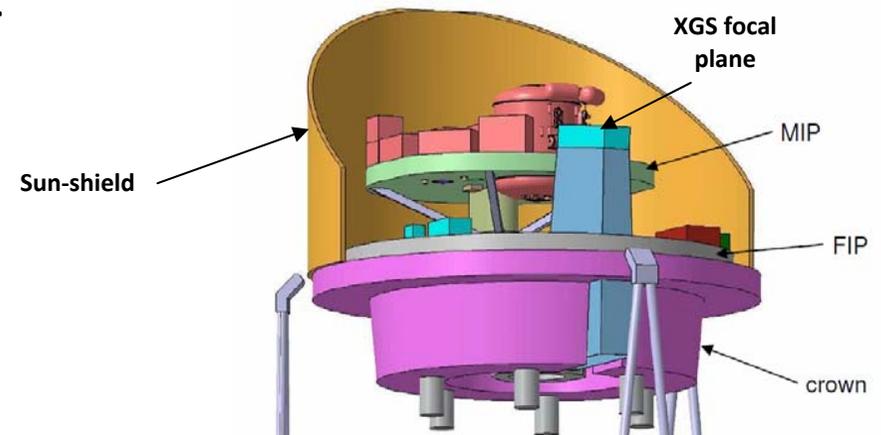
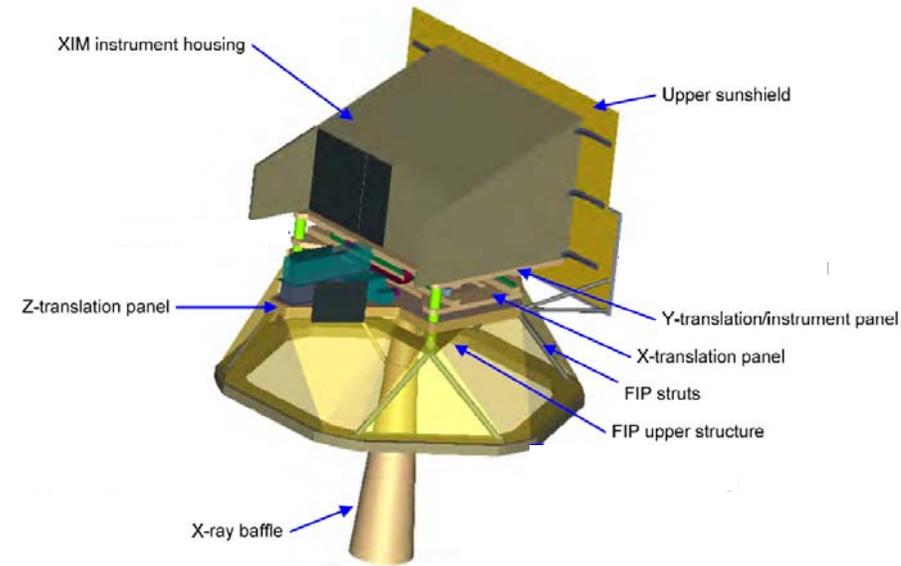
- Main elements:
 - X-ray optics (Mirror Modules)
 - Supporting structure & covers.
 - Thermal control elements.
- Total Mirror Module mass ~ 1700 kg.
- Both designs meet the science requirements.
- Industrial heritage exists in Europe (e.g. accommodation of X-ray optics, petal BB).



Instrument Module

ESA contribution.

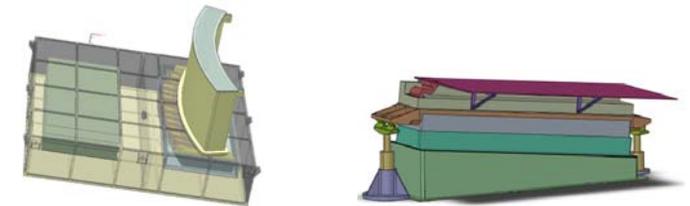
- Main elements:
 - Fixed Platform (FIP),
 - Moving Platform (MIP),
 - Mechanisms and thermal control HW.
- Total module mass ~ 1300 kg (incl. instruments).
- Both designs (rotating/translation mechanism) meet the requirements with comparable resources.
- Instruments accommodation in line with latest results of model payload studies.
- Heritage from recent ESA science missions directly applicable (e.g. accommodation and AIV of cryogenic instruments).



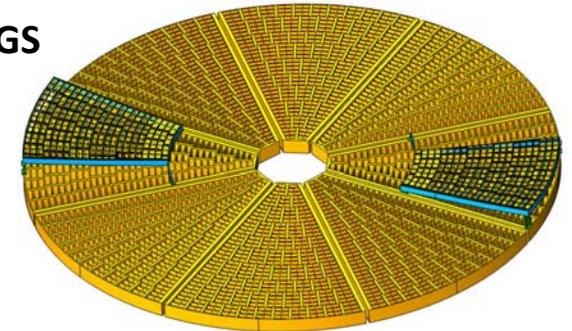
Instruments study activities

Instruments technology workshop	March 2009
Dol's for IXO instrument studies (consortia)	June 2009
Instrument assessment studies start	Sep 2009
Instrument Design Review	Dec 2009
Mid Term Review	Apr 2010
Final Presentations (ESTEC)	14-15 Jul 10
Documentation package	Jul 2010

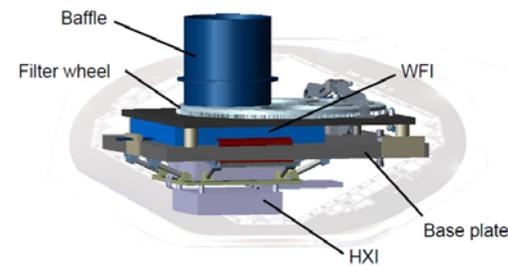
- Total instruments mass 690 kg (including maturity margins and XMS cryo-chain)
- Preliminary Instrument Interface Requirements defined as part of system study



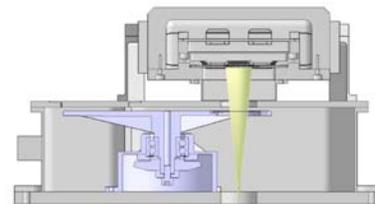
XGS



XMS



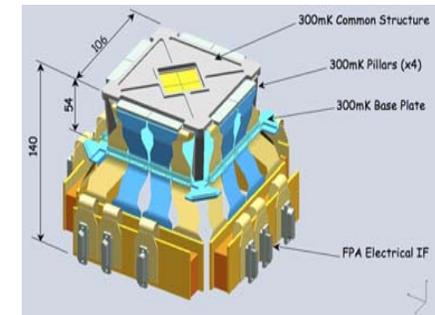
WFI + HXI



HTRS



XPOL



ESA review

System level and Spacecraft:

- Reduce complexity of the Instrument Module, simplifying the mechanism design.

Optics:

- The review board considered that an angular resolution $< 10''$ is achievable with SPO and compatible with TRL=5 by the end of the Def. Ph. ($5''$ angular resolution remains a goal).

Instruments:

- High level of design maturity of the IXO model payload was noticed by the board.
- Reduce complexity of the cryogenic spectrometer (XMS now 60% of total P/L mass).

Programmatic aspects:

- Reference scenario has clear technical I/F, reflecting partnership capabilities and heritage.
- Project schedule: launch by the end of 2022 considered as realistic.
- Production of flight optics (on critical path) requires adequate preparation in the Def. Ph.
- Instruments AO to be moved forward as much as possible (XMS on critical path).
- If compatible with CaC, ESA to consider taking lead on SOC (to be negotiated).

Recent activities

- High priority objective is to continue SPO work in order to:
 - achieve HEW < 10 " at $E < 7$ keV (goal < 5 ").
 - Perform environmental tests to demonstrate TRL 5 by end of 2012.
 - Consolidate the preparation for flight optics production.
 - Development plan to reflect review recommendations.
- Activities in support to SPO technology development:
 - Better formulation of stray-light rejection requirements.
 - Improved definition of MM mechanical environment (quasi-static loads, random vibration, shock-levels).
 - Combined MM design load analysis (relevant to achieving TRL 5).

Conclusions

- IXO assessment activities completed as planned. Large amount of information and excellent basis for next study phases.
- Preliminary S/C design meeting the science requirements, consistent with international cooperation and requiring minimum technology development.
- Review recommendations will be implemented during the next phase activities (e.g. prioritisation of SPO development activities, model payload & instruments AO formulation, simplification of IM design).
- Effort on optics technology development is continuing (see recent activities - next talks). Additional thermo-mechanical analysis (mirror assembly and i/f to MM) will be carried out in parallel with development work (key objective: TRL 5).
- New ESA plan for L class missions: ready to support corresponding study activities (Q2-Q4/11). Recent work provides very valuable input.