

Update on the ESA studies

N. Rando

Science Project Department, SRE-PA
European Space Agency

Assessment study process at ESA

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 (Q2/09) - IXO instruments assessment studies.	Q3/09 till Q3/10
Two parallel competitive industrial studies at ESA at system level (EADS-Astrium and Thales Alenia Space).	Q3/09 till Q3/10
X-ray optics development activities on Silicon Pore Optics and Slumped Glass Optics. Cryo-chain development activities.	Running in parallel to system level study
Completion of assessment study activities.	September 2010
Internal, technical and programmatic review by ESA.	Q4/2010
Scientific review and down-selection (advisory structure).	Q1-Q2/2011

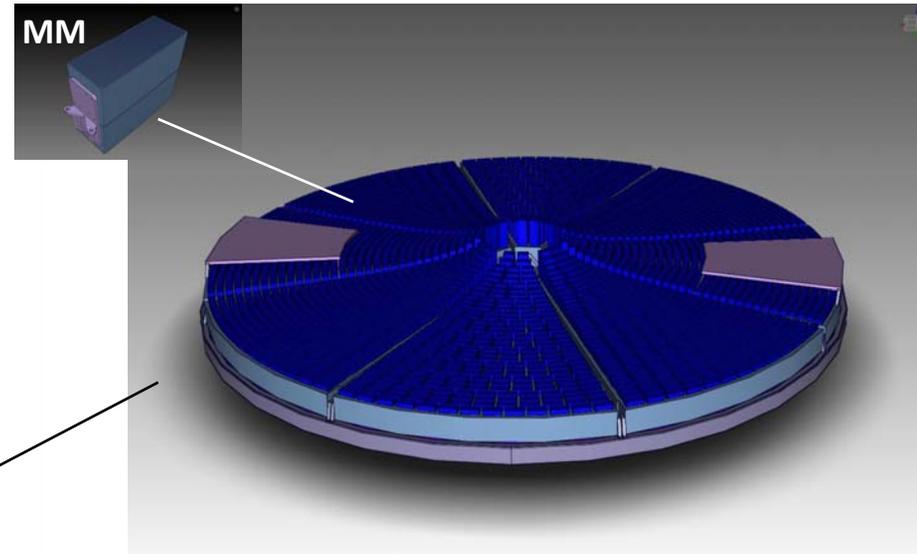
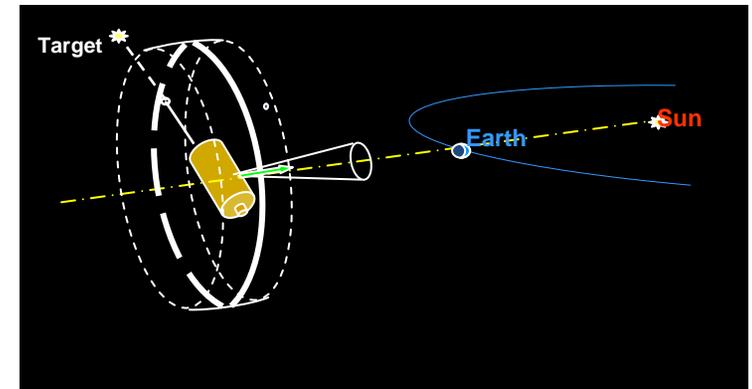
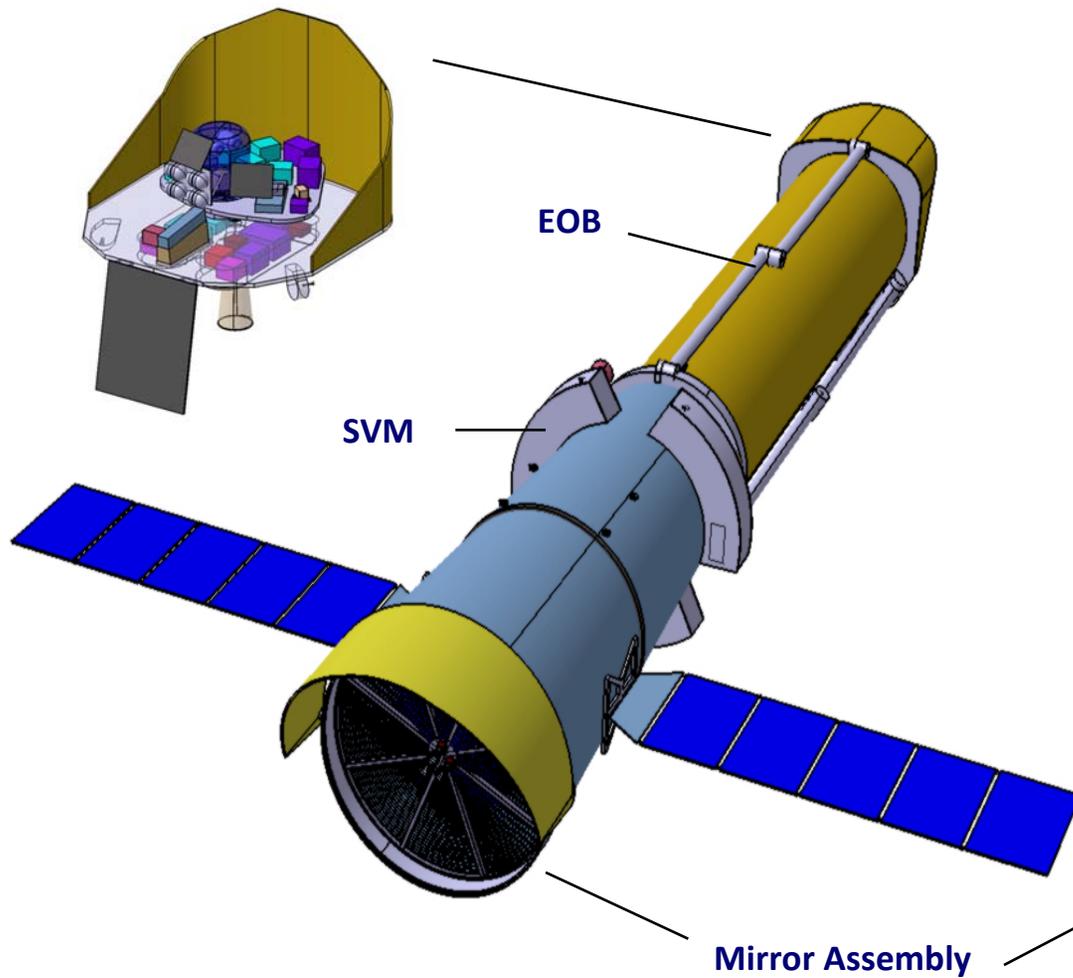
ESA mission concept study

- **IXO terms of reference (SCG, ESA, JAXA & NASA):**
 - Single large X-ray mirror, compatible with both pore optics and slumped glass technology.
 - An extensible optical bench to reach $F=20$ m, plus ways to maximise A_{eff} above 6 keV.
 - Model payload: a wide field imager, a high resolution non-dispersive spectrometer, an X-ray grating spectrometer, a high time resolution spectrometer, an X-ray polarimeter.
 - The IXO concept must be compatible with both Ariane V and Atlas V 551 launchers.
- **Two dedicated runs (Concurrent Design Facility, ESTEC):**
 - Assess overall viability of proposed mission concept.
 - Establish a preliminary S/C architecture with corresponding resource budgets.
 - Identify critical areas to be further analysed.
 - Provide a basis for the industrial studies.
 - Allow better understanding of design drivers and requirements.

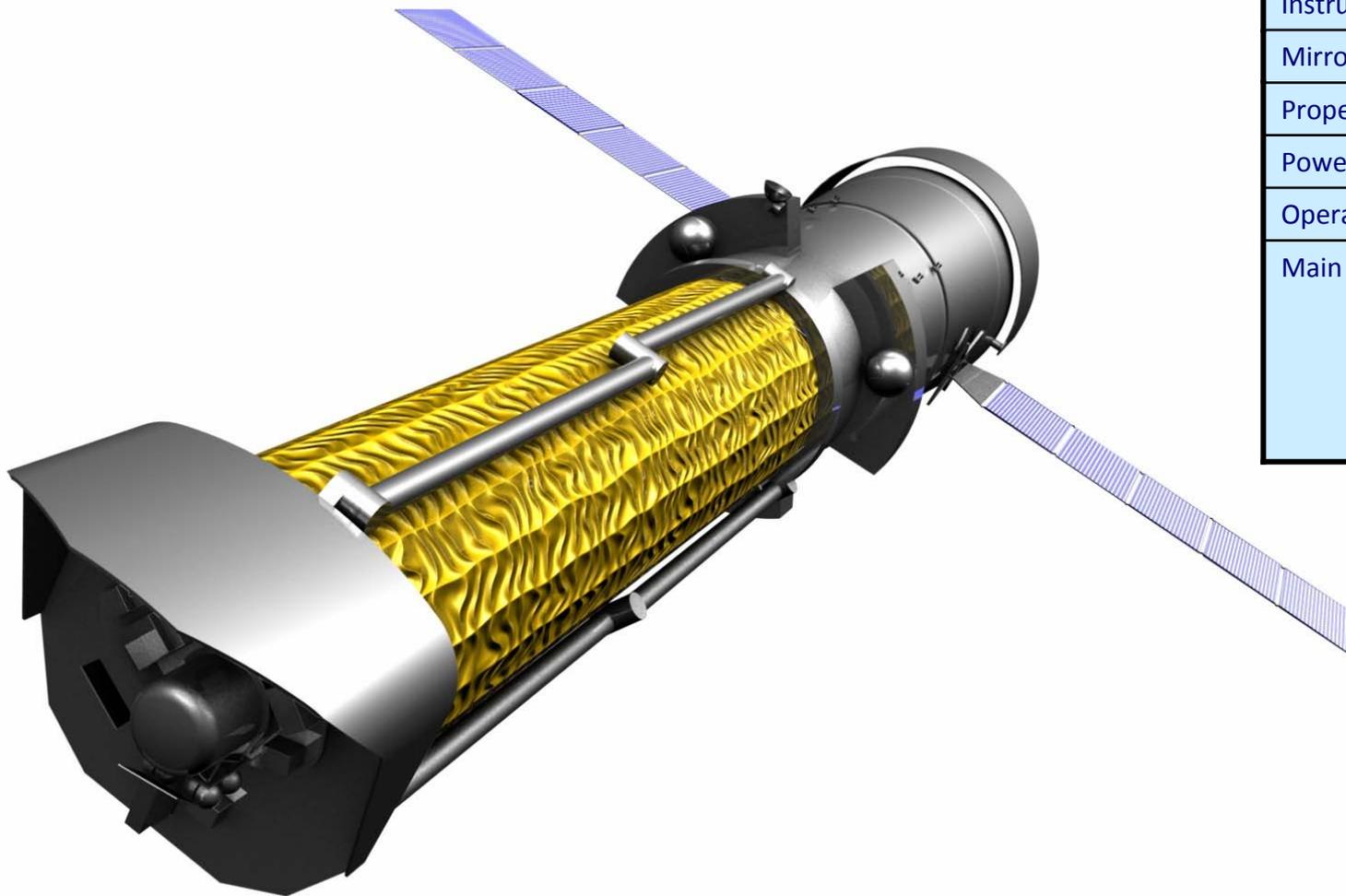
ESA study focused on Ariane 5 and SPO scenario, boundary conditions as for L class candidate.

ESA CDF – Spacecraft architecture

Instrument Module



The IXO spacecraft



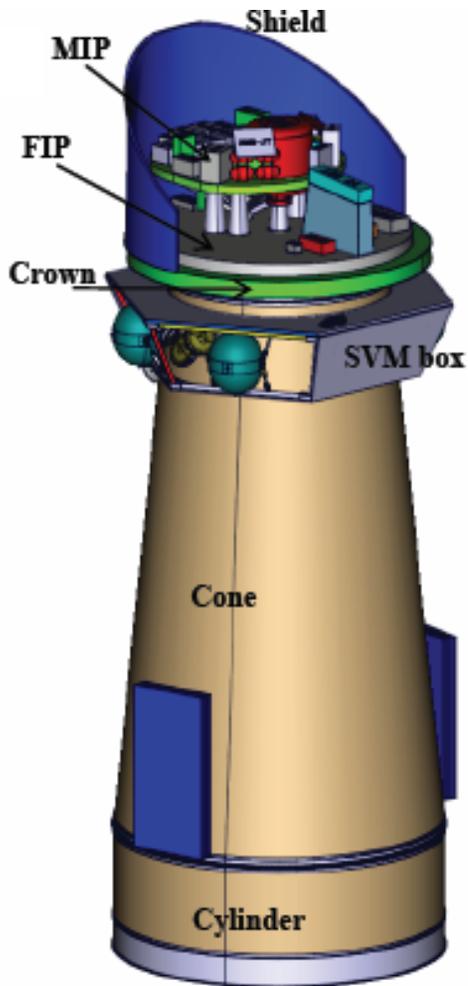
Launch mass:	6500 kg
Instruments mass:	~ 700 kg (w/ cryo-chain)
Mirror Assembly:	~ 2000 kg
Propellant:	~ 300 kg
Power:	~ 4.5 kW
Operational orbit:	Halo orbit, L2
Main challenges:	<ul style="list-style-type: none"> - X-ray optics - EOB, mechanisms - Instrument Platform - XMS cryo-chain - System AIV

ESA industrial studies

- Two parallel, competitive industrial studies (Phase 0/A level).
- Contracts awarded to EADS-Astrium Space and to Thales Alenia Space, 1 yr duration.
- System level assessment (incl. instruments accommodation and mirror assembly design).
- Study activities divided in 3 phases:
 - **Phase 1:** identification of baseline for spacecraft design (MDR – Dec 2009).
 - **Phase 2:** consolidation of the design baseline and technical analyses (PRR – Jun 2010).
 - **Phase 3:** programmatic analysis (by Jul 2010).
- Top level objectives (in line with Phase 0/A level):
 - Identify and consolidate mission design.
 - Consolidate the system level requirements and establish main sub-system requirements.
 - Assess the technical feasibility of the proposed mission design via dedicated analysis.
 - Analyse payload (optics + instruments) accommodation.
 - Identify optimal verification approach and technology readiness.
 - Provide preliminary costing and risk assessment.

Thales Alenia design

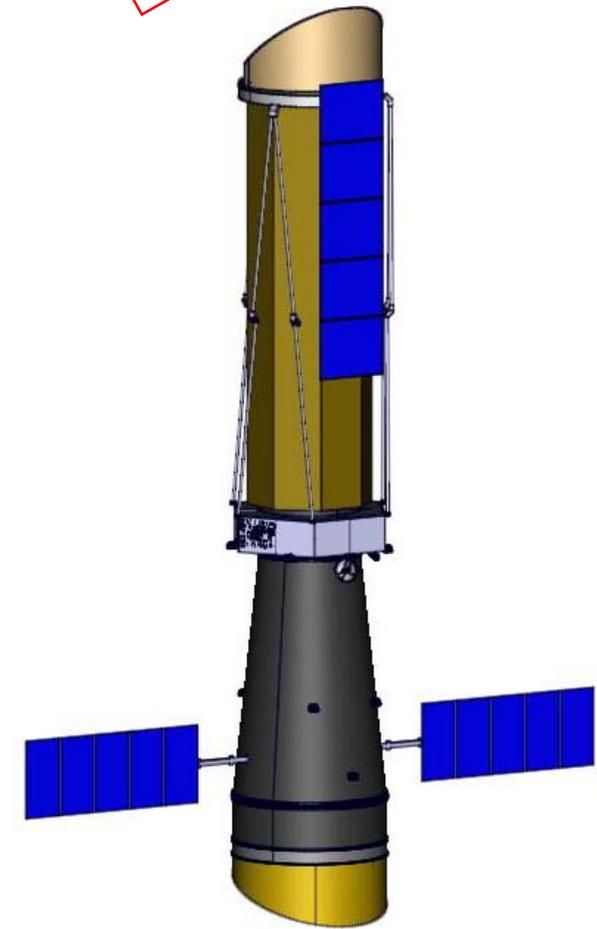
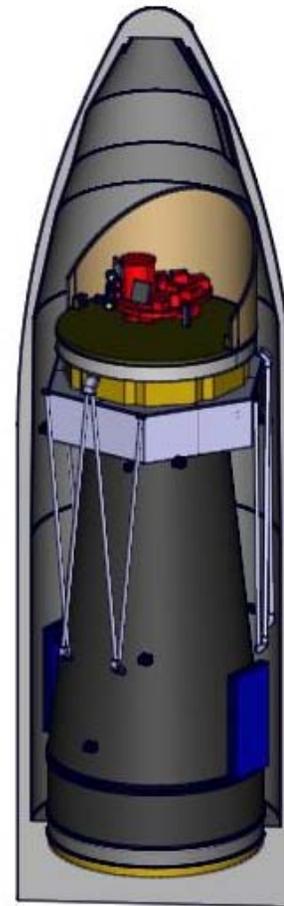
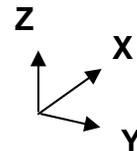
Work in progress



Instrument Module

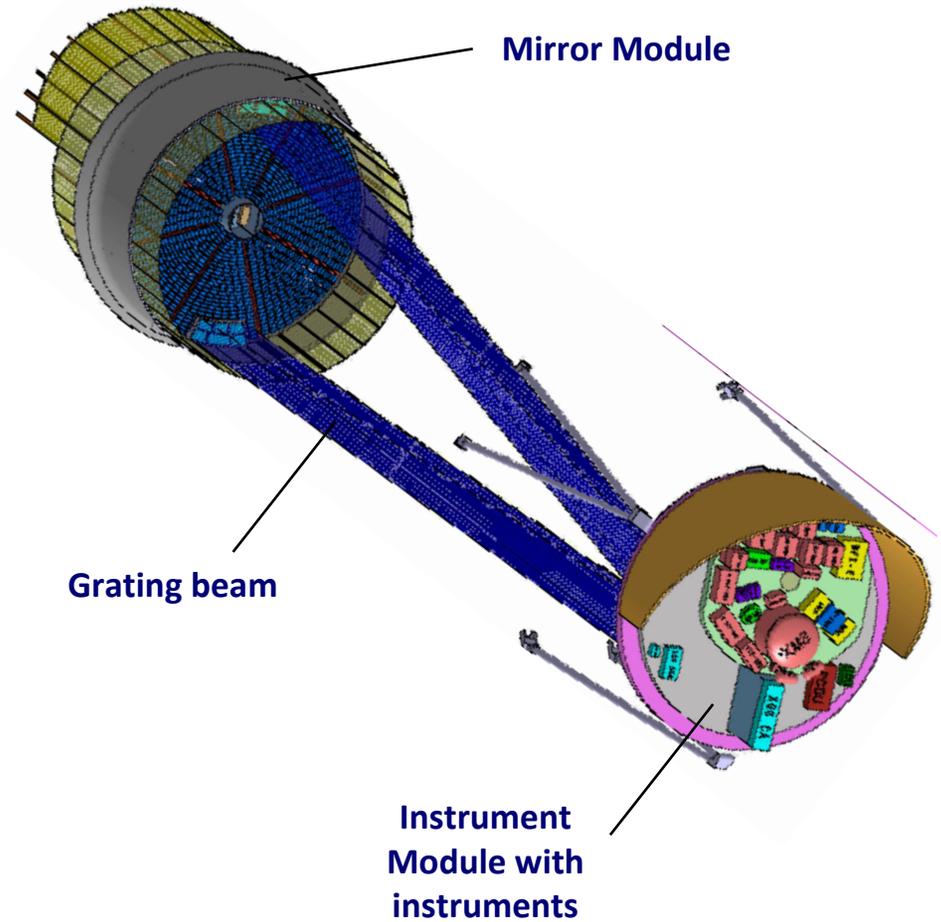
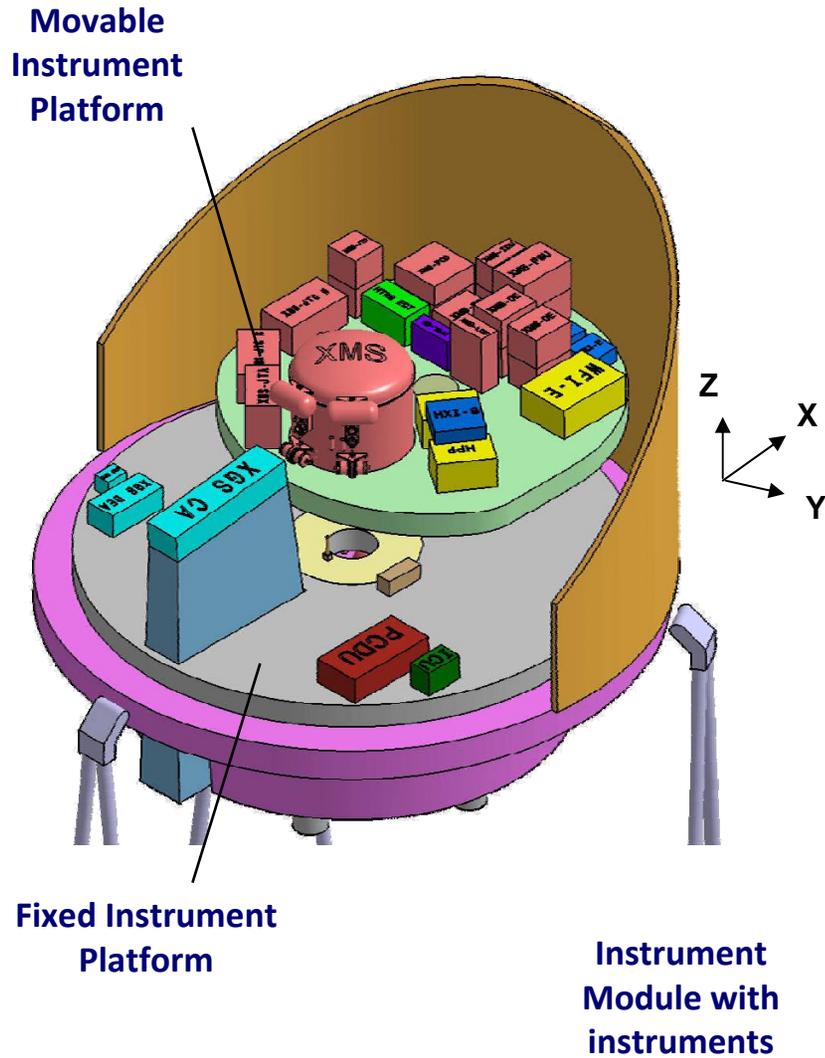
Service Module

Mirror Module



Thales Alenia design

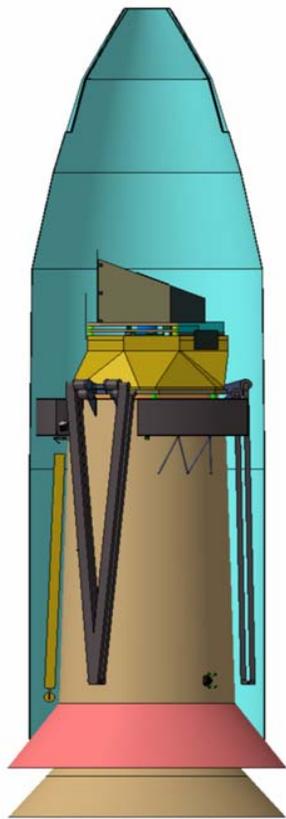
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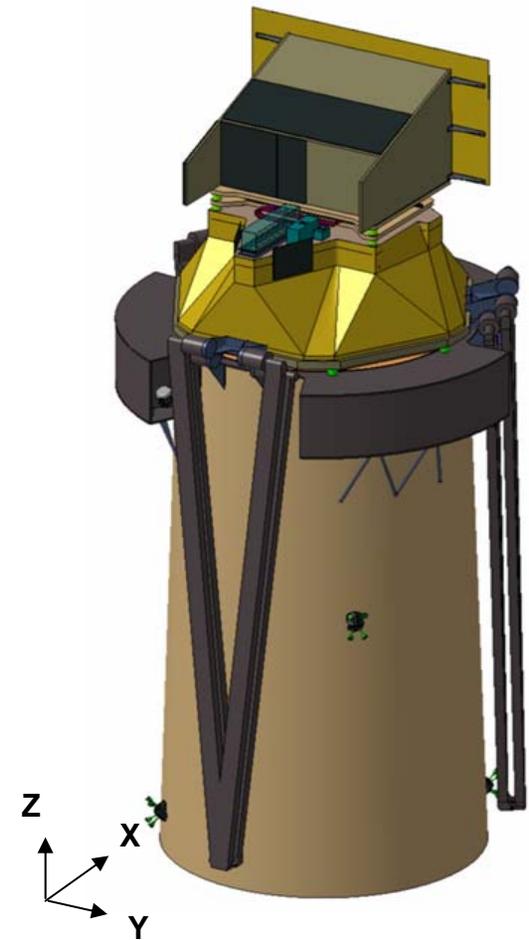
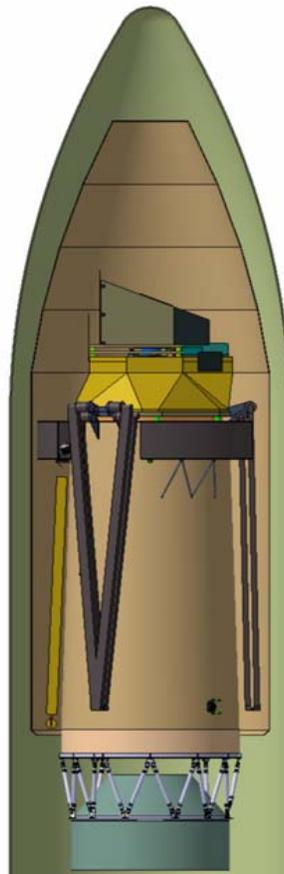
EADS-Astrium design

Work in progress

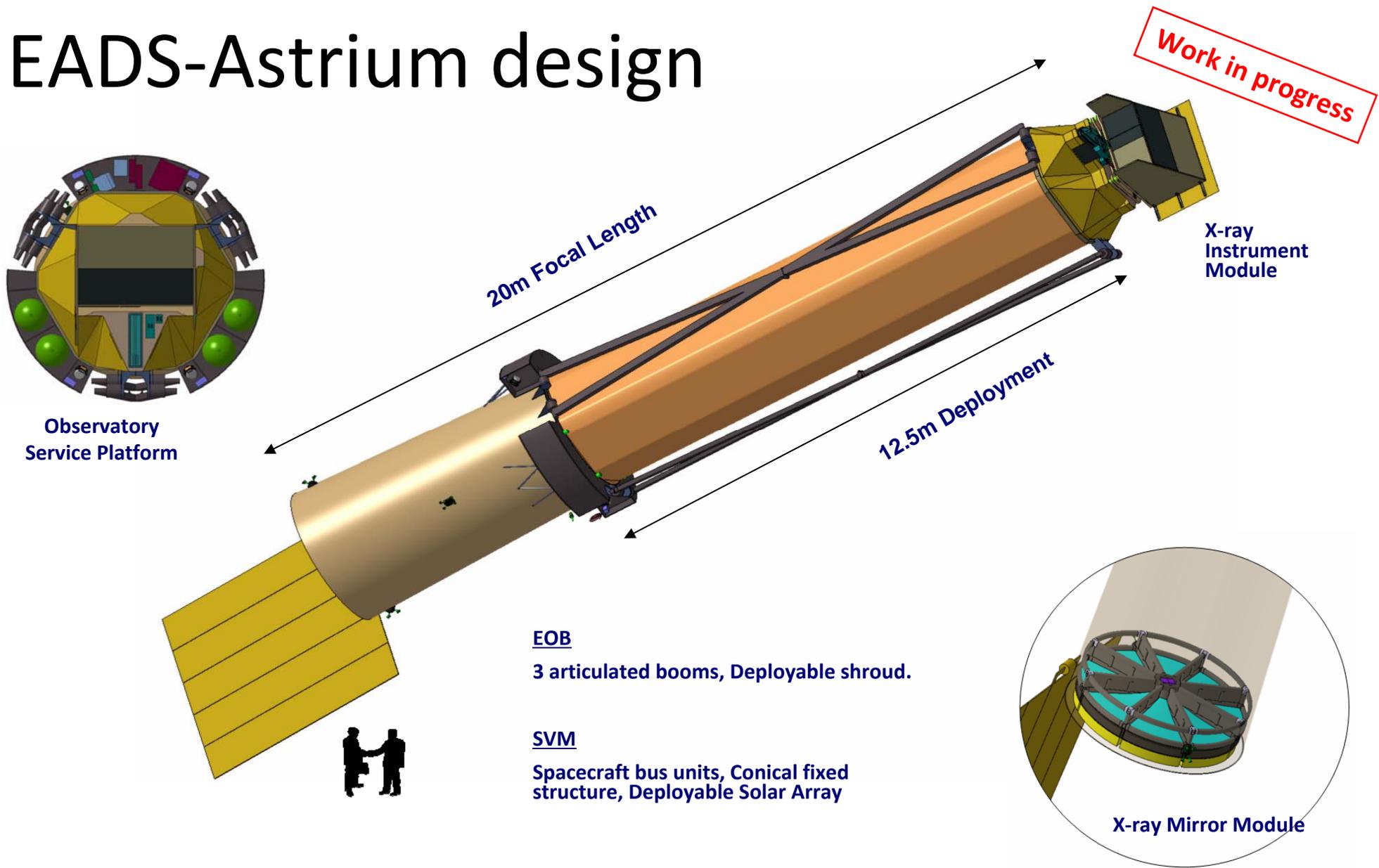
Ariane 5 ECA



Atlas V 551
Medium Fairing



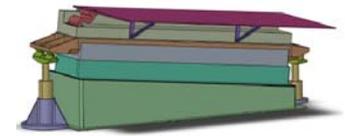
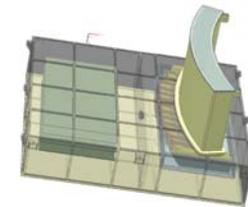
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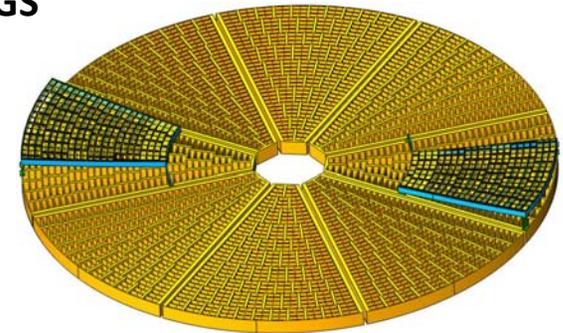
Instruments study activities

Work in progress

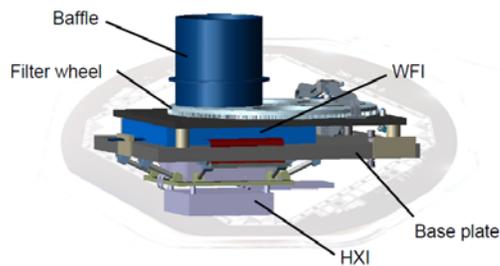
Instruments technology workshop	March 2009
DoI's for IXO instrument studies	June 2009
Instrument assessment studies start	Sep 2009
Instrument Design Review	Dec 2009
Mid Term Review	Apr 2010
Final Presentations (ESTEC)	14-15 Jul 10
Documentation package	Jul 2010



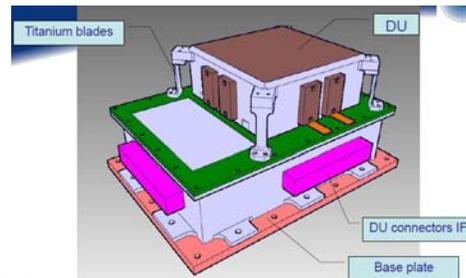
XGS



XMS



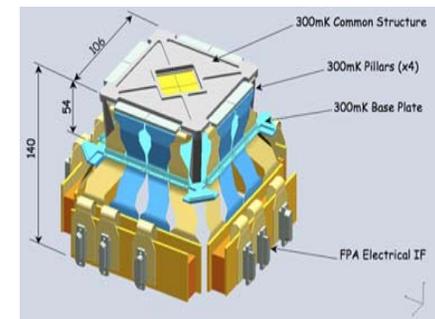
WFI + HXI



HTRS



XPOL



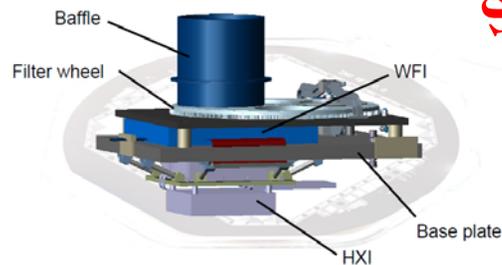
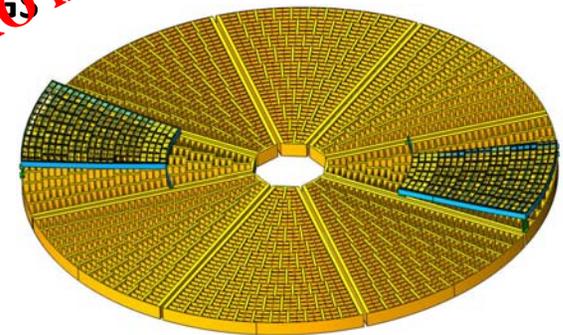
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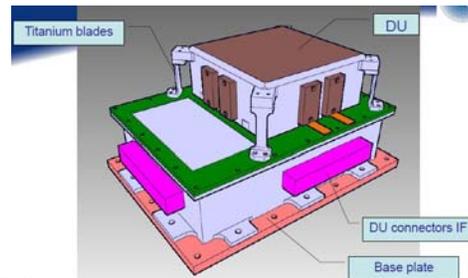
Work in progress



See talk by Didier Martin tomorrow on IXO instruments



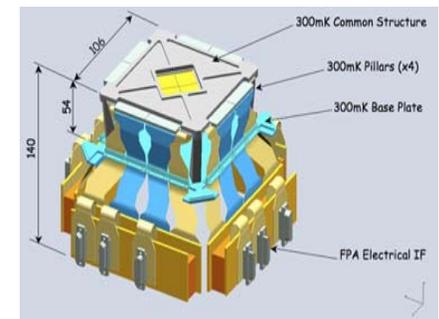
WFI + HXI



HTRS



XPOL



XMS

Technology development activities

Mirror technology:

- IXO Mirror Module pre-qualification activities (SPO).
- IXO Mirror Module pre-industrialisation activities (SPO).
- IXO back-up optics (slumped glass).

Cryogenics and instrument related technology:

- SQUID readout electronics.
- Maxi compressor (advanced linear compressor for e.g. 10K cooler).
- 10K Stirling cooler (linked to previous contract).
- 50mK cooler: development of sorption/ADR, parallel development of double ADR.
- Advanced 2K Joule-Thompson Cooler.
- Large area X-ray window development.

SPO Plate stacking facility

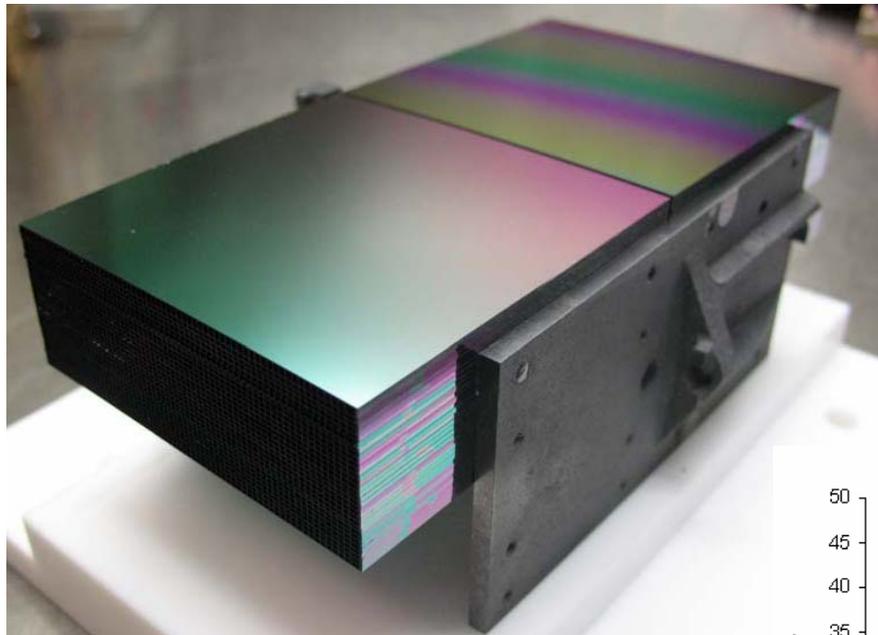


Technology development plan to be updated on the basis of system level study and to take into account international cooperation.

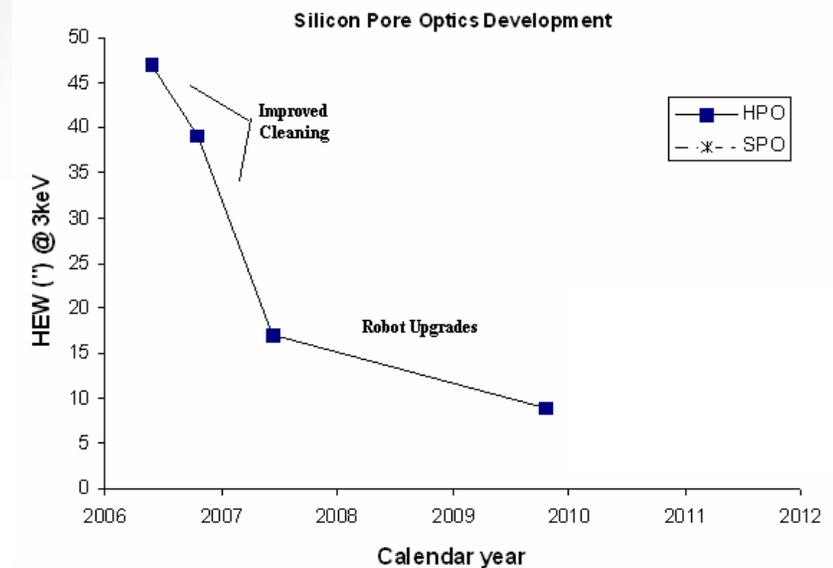
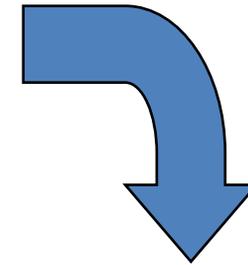
Technology development activities



Slumped glass



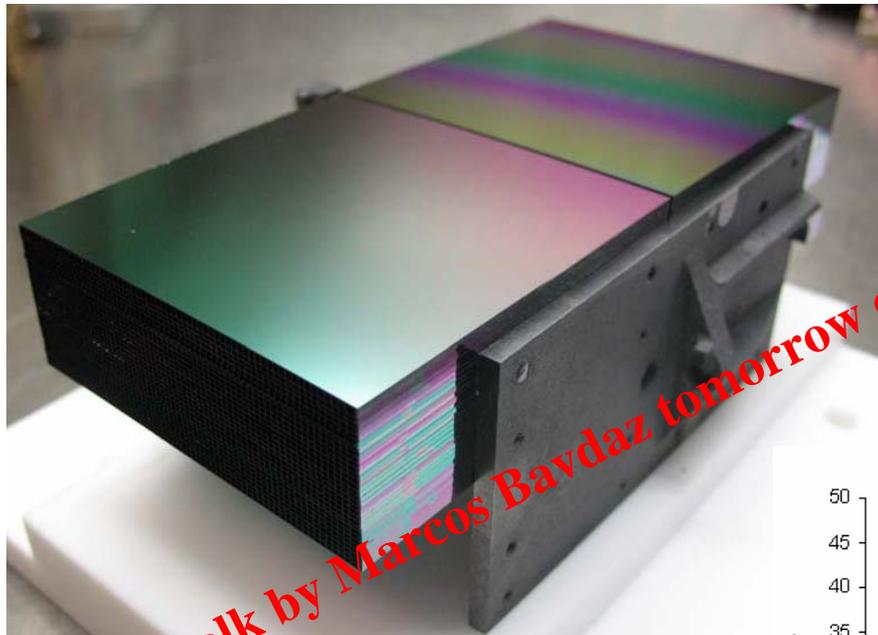
SPO Mirror Module prototype



Technology development activities

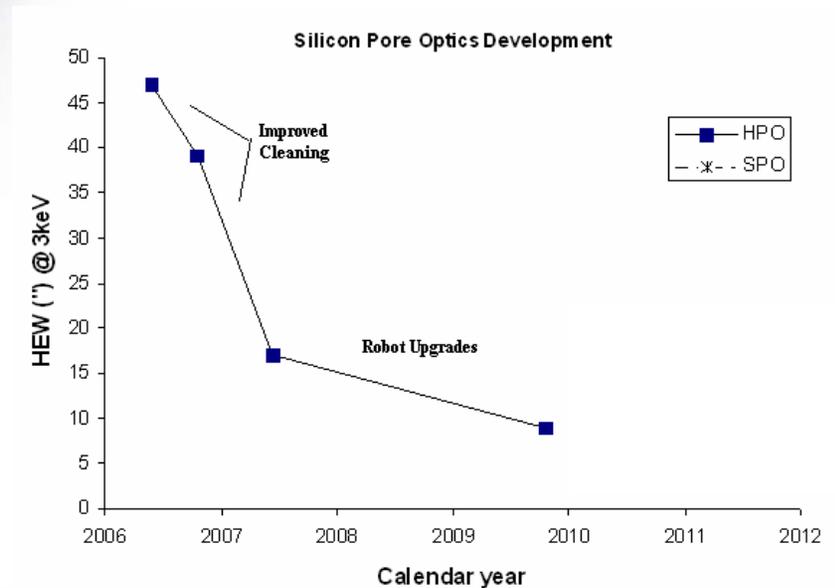


Slumped glass



SPO Mirror Module prototype

See talk by Marcos Baydaz tomorrow on IXO optics



The next steps

- Completion of industrial and instrument studies.
- Consolidation of key interface requirements documents.
- Assessment study report ('Yellow Book', summary of study activities).
- Preparation of documentation package for the ESA review :
 - Industrial study, Instrument assessment, ESA activities.
 - Technology development activities.
 - Contributions from partner Agencies.
- Internal ESA review.

} July 2010

} Aug/Sep
2010

— Oct 2010

Reference L class
timeline
(CV15-25)

L-class down-selection (Defin. Ph.)	Q1-Q2/2011
Definition Phase	Q2/11 – Q4/12
Instruments AO	Q2/2011
Final down-selection (Implem. Ph.)	Q1/13
Implementation Phase	Q3/13 – Q3/20
Launch	By 2020

Conclusions

- IXO assessment activities have progressed as planned and are now approaching the completion.
- Industrial studies have consolidated further the system design. No '*show stoppers*' identified to date.
- Baseline design meets the science objectives, while remaining compatible with available S/C resources.
- Main technical challenges are being tackled via dedicated technology development activities.
- Additional developments in Definition Phase are possible, in view of achieving TRL => 5 before entering the Implementation Phase.
- Further mitigation of development risk will be enabled by an optimised international cooperation scenario.
- Preparation for down-selection process started, in line with CV15-25 plan.

END