Future Mission Studies at Astrium

Astrium – EOS UK

Presentation for the RoPACS Kick-off Meeting

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29th January 2009

All the space you need

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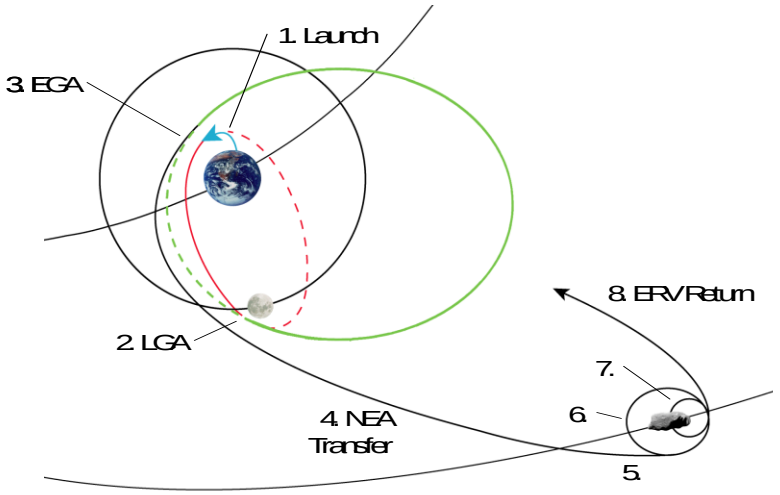

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- What is a Phase A Study?
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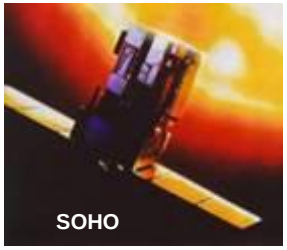
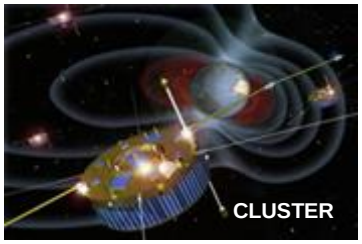
Science Missions at Astrium

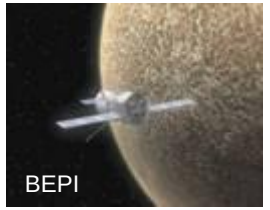
A deep understanding of scientists' expectations sets the foundations for building performing satellites, probes and instruments.

Solar and Terrestrial Physics

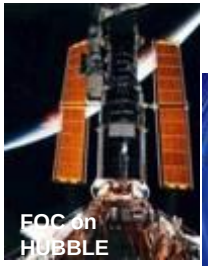


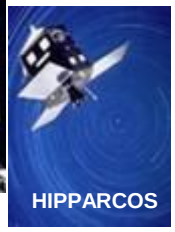


Deep Space Missions



Astronomy, Astrophysics, Fundamental physics





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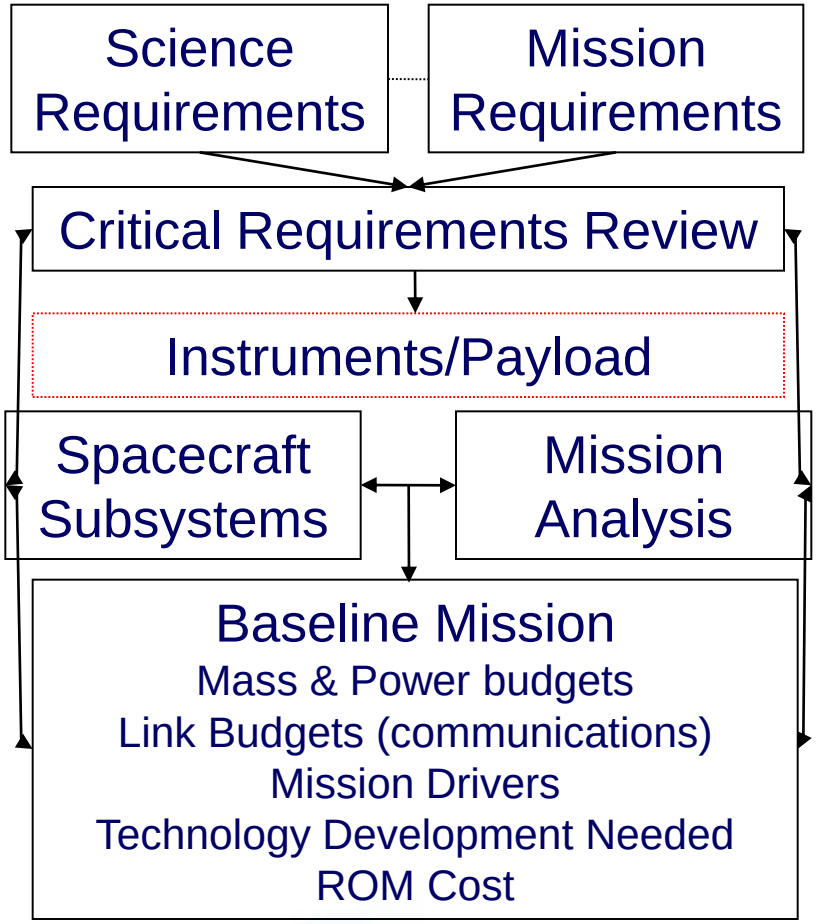
What is a Phase A Study?

- First pen-to-paper part of a mission
- A feasibility study of a mission concept

- How are they done?
- Establish the requirements
- A series of top-level trade-offs
    - establishing an optimum mission solution
        - performance, cost, risk
    - Iterative process!

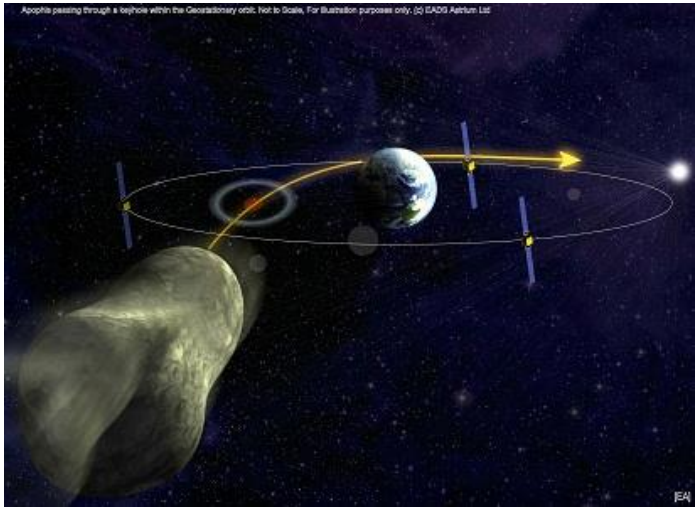
The ultimate aim is to produce a baseline mission design that meets the mission requirements and is as **realistic as possible**.



Recent Studies

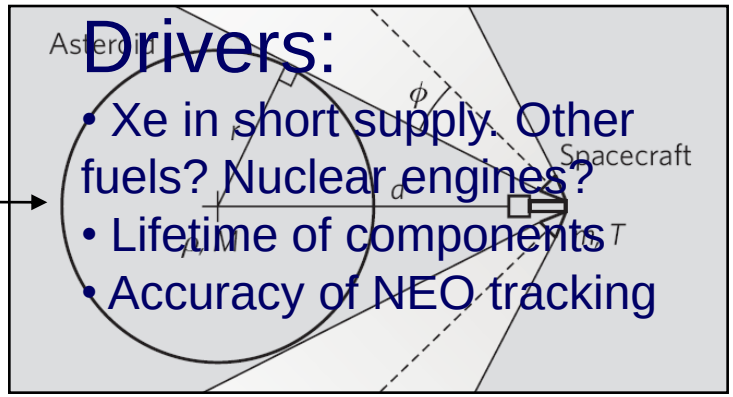
Hazard Mitigation:
APEX – Apophis Explorer

- Aims to track Apophis to 3σ accuracy of 14km
- Map physical properties and motion of the Asteroid
- Payload – Radio science, NIR/thermal spectrometer, altimeter and accelerometer



The Gravity Tractor

- Spacecraft 'hovers' above the surface of NEO
- Gravitational attraction used to apply a force
- Over ~15 – 20 years NEO is accelerated
- Δv ~0.5 $cm.s^{-1}$ – enough to deflect some NEO
- Uses 24 (!) ion drives and ~8 tonnes of Xenon



Drivers:

- Xe in short supply. Other fuels? Nuclear engines?
- Lifetime of components
- Accuracy of NEO tracking

Ref: Lu & Love Nature, Vol. 438, 10 November 2005

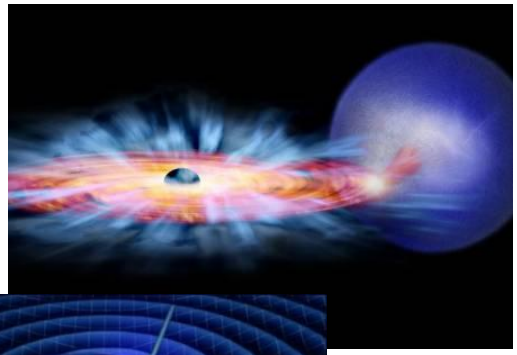
Recent Studies

Marco Polo – Asteroid Sample Return

- Aim to bring back a 100g sample from a primitive asteroid
- ESA assessment study currently being conducted
- Technology focussed on sample return in zero-g
- Precursor mission to Mars sample return

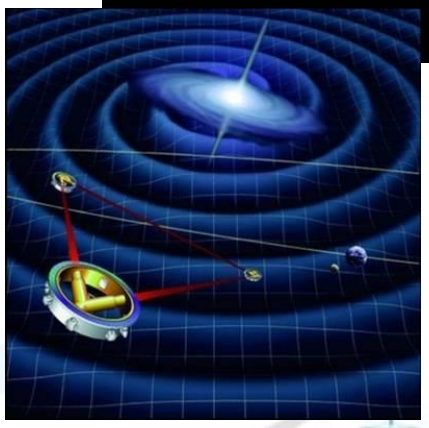
International X-Ray Observatory (IXO)

- High angular resolution X-ray optics and detectors
- Optics and focal plane separated by long boom
- Novel X-ray optics



Some other studies...

- Plato – Planet Transits
- BepiColombo – Mission to Mercury
- Euclid – Dark energy mapping by spectroscopy
- MoonLITE – UK-led lunar penetrator mission
- LISA – Gravity wave telescope



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RoPACS and Astrium

Astrium is the RoPACS industrial partner

We will:

- Co-supervise a PhD student with University of Hertfordshire
- Topic: Bridging science requirements and mission design
- Focus on a post-SEE COAST mission
- Provide: supervision and training in mission systems disciplines
- Host seminars/site visits with other network members

The RoPACS Mission Study

Based on a more adventurous version of SEE-COAST
(Super Earth Explorer - Coronagraphic Off-Axis Space Telescope)

THIS MISSION 'REQUIRES'

- Start with the science requirements: from EPRV white paper by Schneider the following qualitative science requirements are derived

EVERYTHING

(as do all missions at this stage!)

- High resolution Imaging
- High resolution spectrometry
- Polarimetry
- Interferometry
- Large field of view
- High sensitivity
- Broadband sensitivity
- "CHEAP"

IR and Visible

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The RoPACS Mission Study

Trade-off Studies Needed!

- Need to establish which are ESSENTIAL 'requirements'
- Which requirements are actually just VERY DESIRABLE
- Which requirements are just plain DESIRABLE

- Which requirements affect the science most when changed?
  - e.g. Does a small reduction in spectral resolution, which may result in a massive cost/risk reduction result in just a small loss of science return?

Our aim is always to find the optimum mission solution

PERFORMANCE, RISK & COST

Thank you

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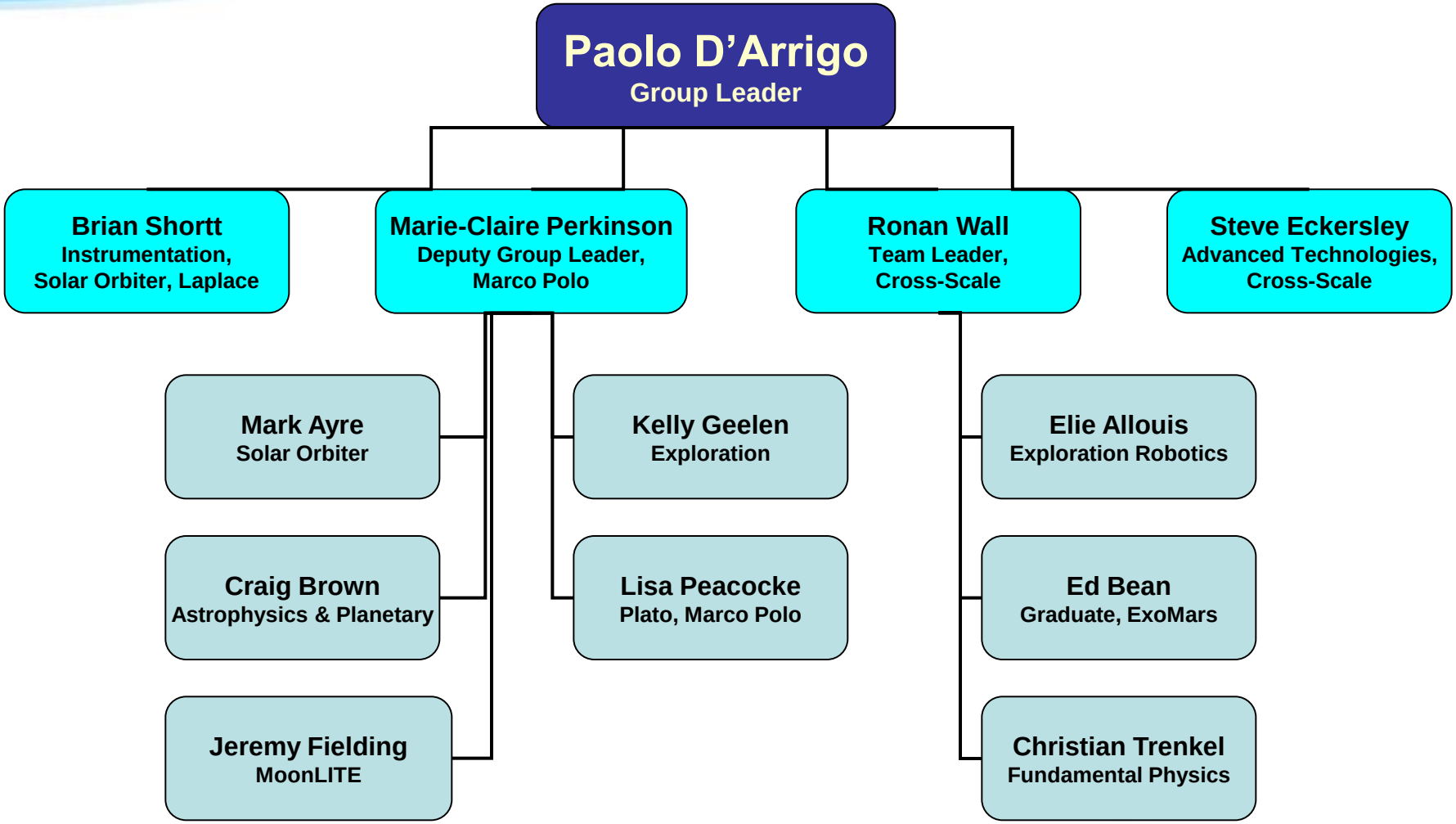
Space Science Group – Future Missions



Supported by all Astrium subsystem engineers