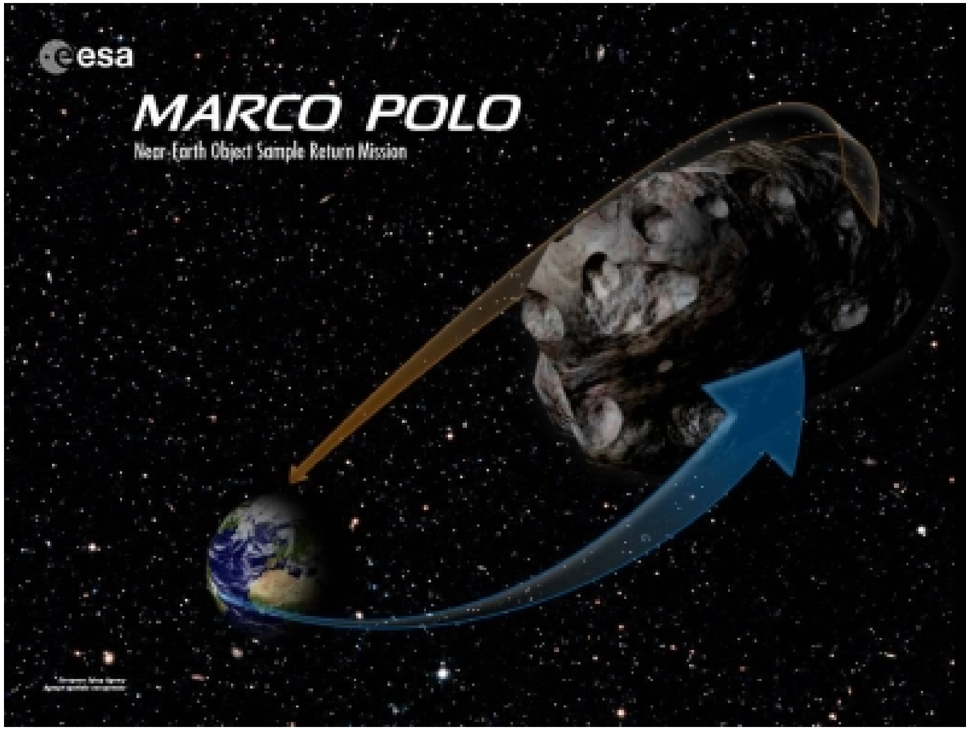
The Model Payload suite of the Marco Polo mission & the new payload assessment and development approach



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Outline

1. The Declaration of Interest (DOI) procedure

   - history, status and the way ahead

2. The Marco Polo model payload

3. Summary of payload budgets vs. S/C performance

The DOI procedure – origin

- **Declaration of Interest (DOI) for payload**
  - procedure inspired by the Science Programme Review Team (SPRT) and approved by Science Programme Committee (SPC)
- **Payload Development**
  - Traditional baseline maintained: provision by ESA member states
  - Early critical payload development
    => clear assessment of tech. readiness at mission implementation decision
  - Phase A/B1 study level must be reached before adoption by SPC (mission *and* payload)

The DOI procedure – Mission Study vs. P/L development

Mission Study Phase	Payload development phase	Year
Assessment Phase Phase 0 (at ESA CDF)	-Definition of model P/L by Study Science Team => Payload Definition Document (PDD)	2008
Assessment Phase Phase A (competitive industry)	- Refinement of model payload - DOI studies *We are here !*	2008/ 2009
Mission SELECTION		End 2009
Definition Phase Phase A/B1 (competitive industry)	AO for P/Ls Development of P/L to TRL ≥ 5	2010/ 2011
Mission SELECTION		End 2011
Implementation Phase Phase B2/C/D	Build instruments	2012

The DOI procedure – evolution

- **DOI call in 2008**
  - 23 proposals
  - model payload fully covered
- **ESA internal review (requested by SPC)**
- **results reported to SPC**
- **start of studies (18 proposals)**
- **DOI study reports before end of August 2009**
  - Auxiliary material to review documentation

The DOI procedure – output

- ❑ **technical definition of science instruments**
- ❑ **interfaces to spacecraft**
- ❑ **instrument operations**
- ❑ **development plan and schedule**
- ❑ **definition of development activities**
- ❑ **technology readiness analysis**
  - Technology readiness level (TRL) ≥5 can be achieved before implementation phase

The Model Payload

- **The Camera System (Narrow Angel Camera, Wide Angle Camera, Close Up Camera)**
  - context images, shape model, dm resolution for global maps, mm resolution at landing sites, < 100µm resolution sampling site
- **Vis-NIR spectrometer**
  - Global mapping of surface, 0.4-3.3 µm, $\lambda/\Delta\lambda=200$, spatial res. ~m's
- **Mid-IR spectrometer**
  - Surface temperature < 5 K @ 10 m resolution, 8-16 µm, $\lambda/\Delta\lambda=200$
- **Laser Altimeter**
  - Shape model, topography (1 m resolution) and absolute distance
- **Radio Science Experiment (X band)**
  - Mass ±1 %, J2 term accuracy of 10 %
- **Neutral Particle Analyser**
  - Intensity, velocity direction and mass of released particles, <10eV, and 0.01 to 1 keV

The Model Payload (additional)

Measurements in Orbit

- ❑ **Asteroid Charge Experiment**
  - e-field and local conductivity

Measurements in-situ

- ❑ **APXS**
  - Bulk chemistry, main elements
- ❑ **Attenuated Total Reflection (IR)**
  - Mineralogy, organics and ice
- ❑ **Thermal sensors**
  - Surface temperature at landing site

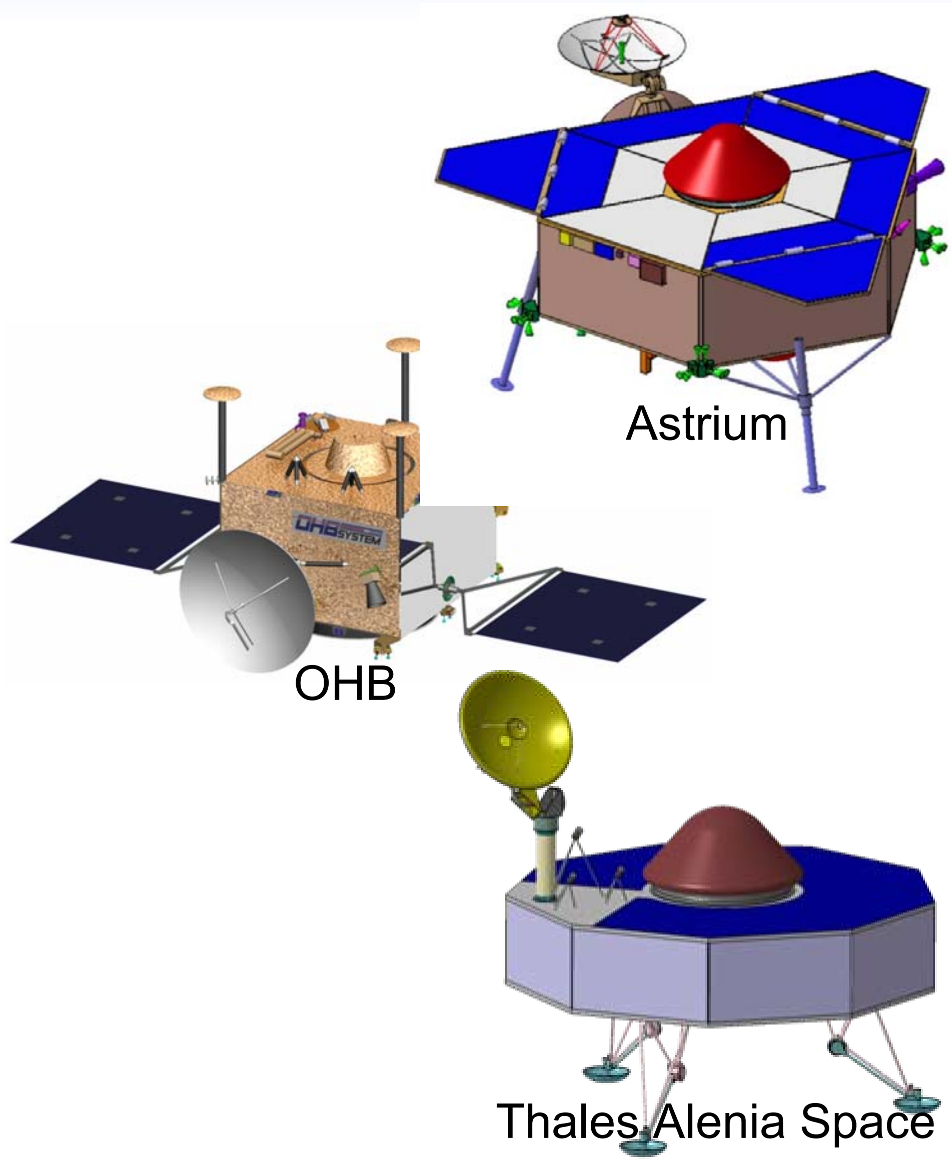
Model P/L – budget summary

	Mass [kg]	Power [W]	Data* [Gbit]
WAC+NAC	6.50	18.5	650.0
CUC	0.65	21.0	7.6
Laser Alt.	4.0	22.0	0.92
VisNIR	4.2	18.0	54.0
MidIR	2.0	2.0	8.7
RSE	com sys	com sys	com sys
NPA	2.2	11.0	1.44
In-situ*	2.5	4.7	0.15
	22.05	97.2	722.81

*no deployment device **main observation campaign, no compression

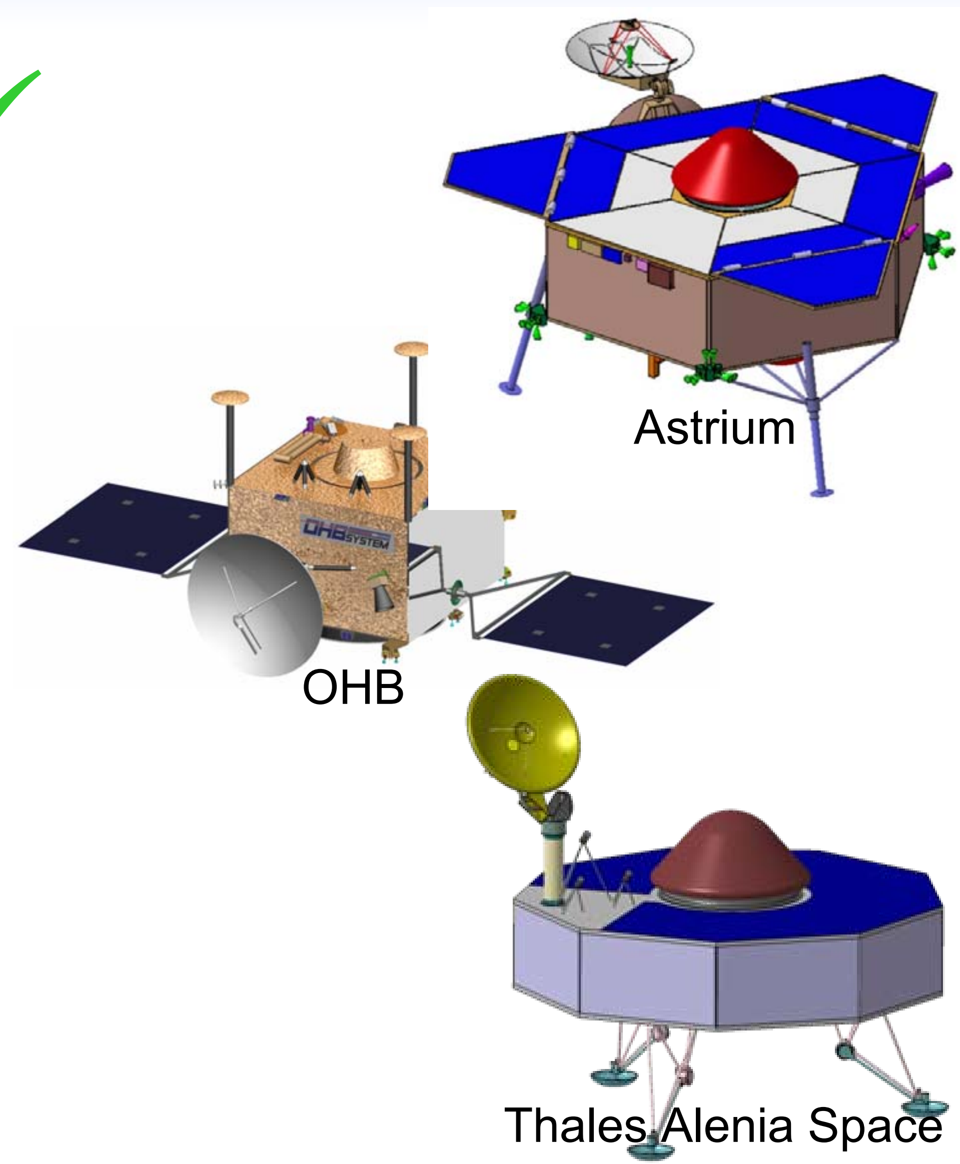
S/C performances vs. P/L

- mass, volume
- power/energy
- data rate
- thermal



S/C performances vs. P/L

- ❑ mass, volume ✓
- ❑ power/energy
- ❑ data rate
- ❑ thermal



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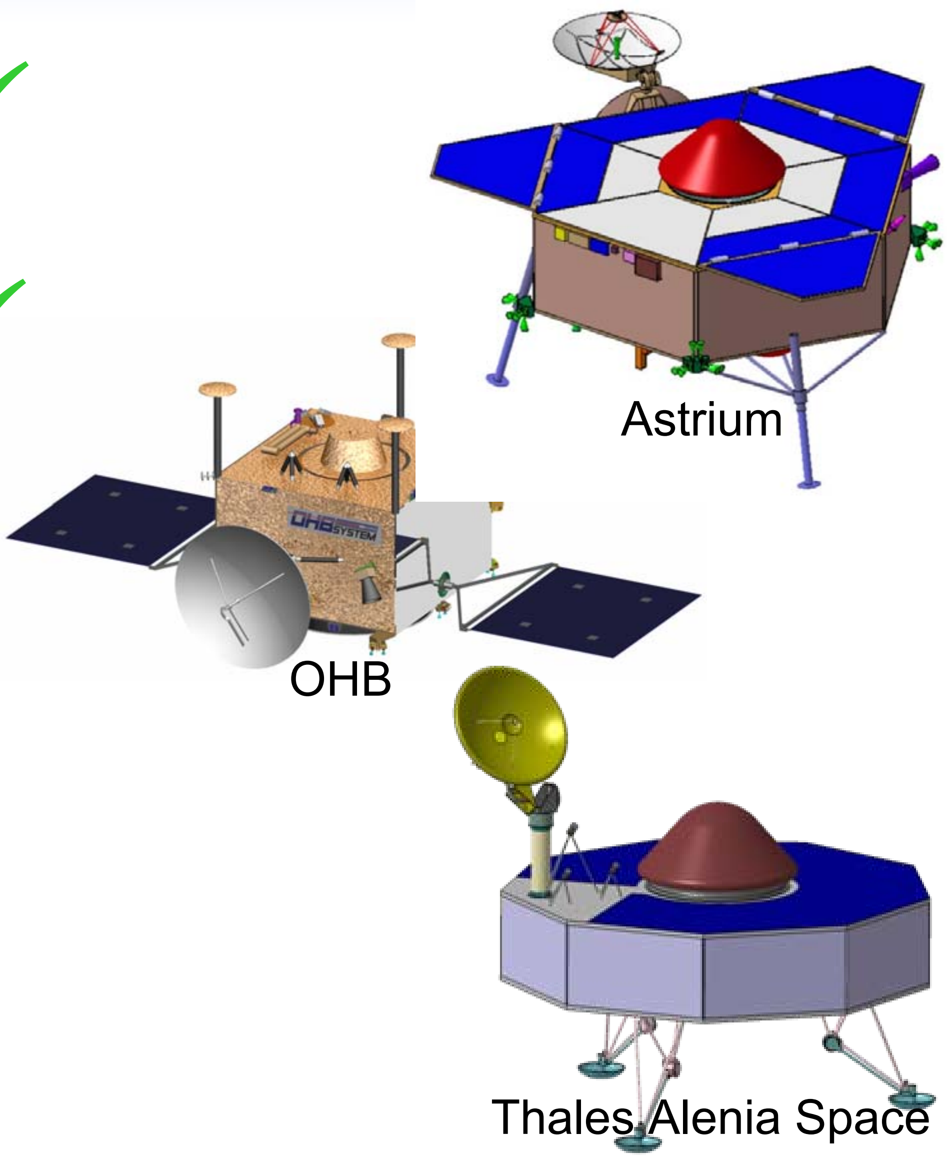

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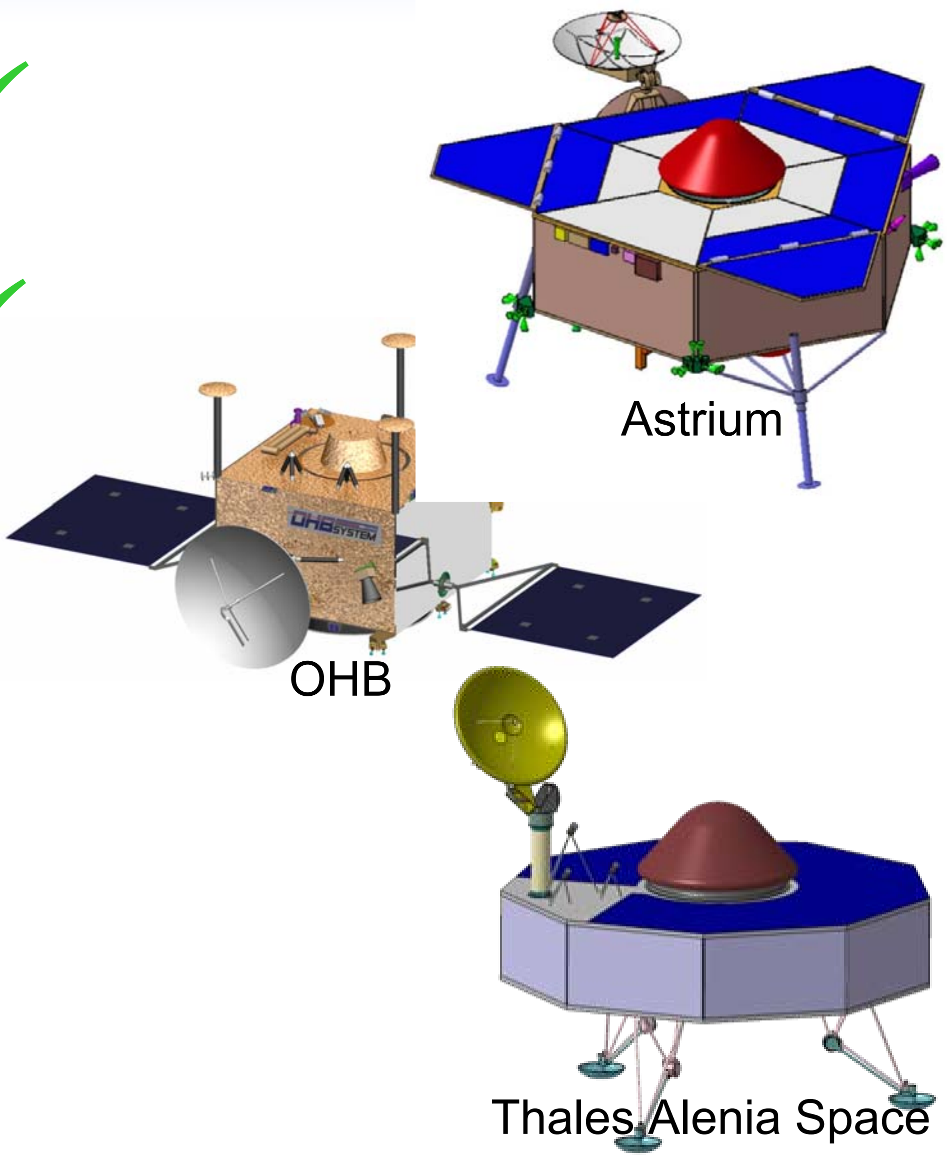

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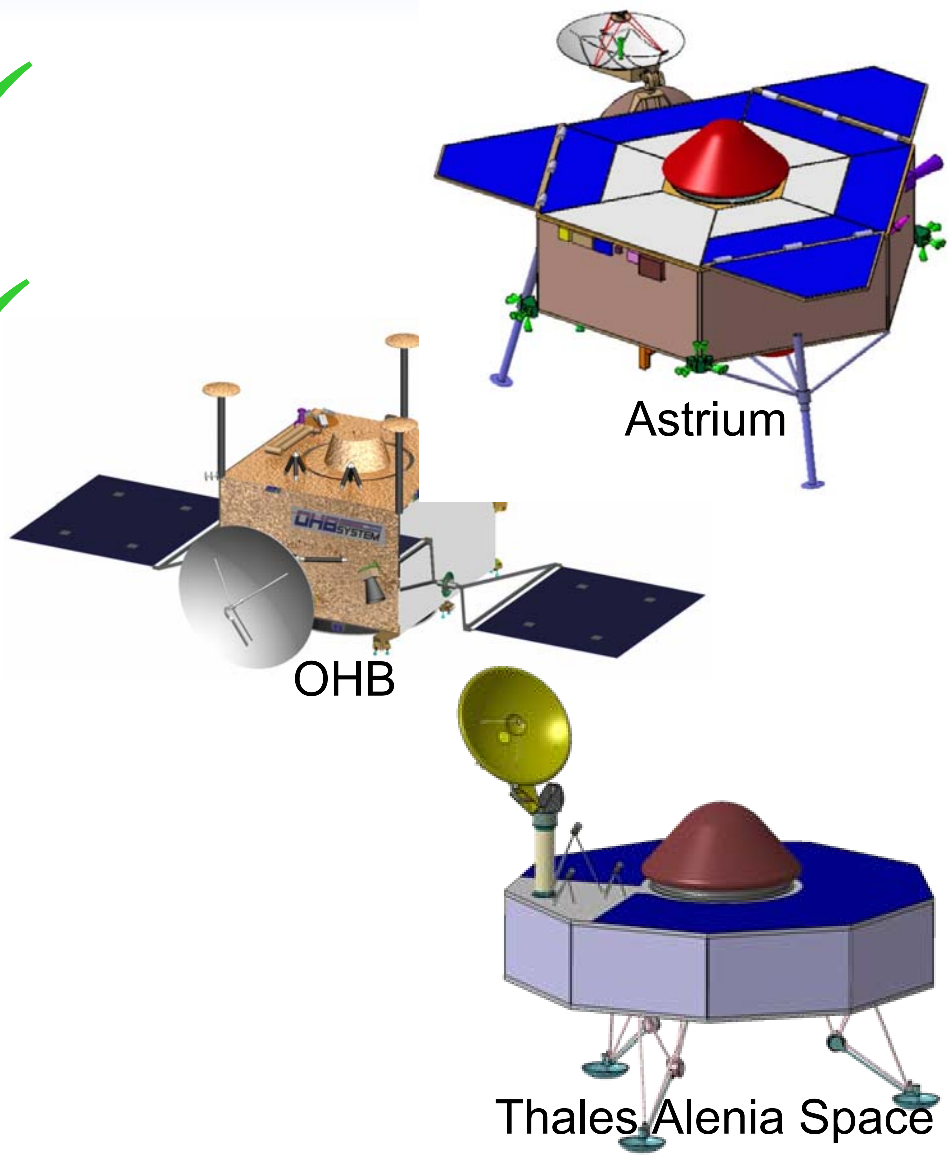

Outlook

- A substantial amount of asteroidal material will be returned to Earth
- The spacecraft contains a sound payload compliment fully supporting the sampling operations and collecting context information
- Scientific goals can be 100% fulfilled
- Feasible accommodation on S/C compatibility to mission design with respect to all resource requirements

Large support by the scientific community and a feasible mission and spacecraft design should carry Marco Polo through the next selection phase.