

Esa Mandatory Programme

Opportunities

as seen by Astrium Satellites

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All the space you need



Overview

- Esa member states are contributing to Esa by
 - mandatory contributions, calculated along GNP Gross National Product
 - optional programmes (with contributions of single member states from zero up to > 40%)
- ¼ of the yearly 3 B€ Esa budget is the “mandatory programme”, consisting of:

▪ Esa basic infrastructure, operations and staffing	293M€	}	~450M€
▪ The space science missions incl. technology	386M€		
▪ The basic technology research programmes (TRP)	42M€		
▪ The general studies programme (GSP)	23M€		
- 50% (75% planned for 2013) earmarked for industrial activities
- Periodical decisions by the member states on the level of resources (LoR)/inflation compensation

Expenditures in the Esa Mandatory Programmes

- **Cost elements for space science missions**
 - Satellite development
 - Launch
 - Operations at ESOC ESA Space Operations Center, Darmstadt, Germany
 - while instruments' and scientists' cost are borne by member states!
- **Study contracts in preparation of future missions**
- **Technology contracts**
 - in preparation of specific missions:
CTP Core Technology Programme
 - in preparation of general basic long-term technology needs and of low TRL technology readiness level: TRP Technology Research Programme

Esa Space Science Missions under Preparation:

Mission	Launch	Astrium
Herschel/Planck Infrared astronomy	2009	Prime of Payload Module
Lisa Pathfinder; technology for gravitational waves measurements	2010	Prime
Gaia, galactic survey	2011	Prime
Instruments* for Nasa James Webb Telescope (infrared astronomy)	2013	NIR Spec Prime MIRI Proj.Managm.
Bepi Colombo; Mercury probe	2013	Prime
Solar Orbiter (SolO)	2015	Prime
Cosmic Vision Candidates	2015-25	see next page

Too late for involvement

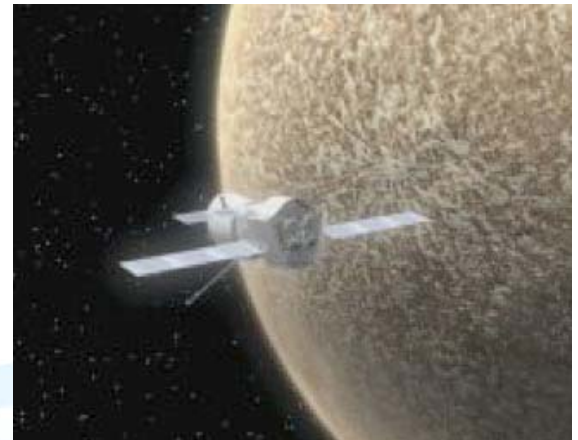
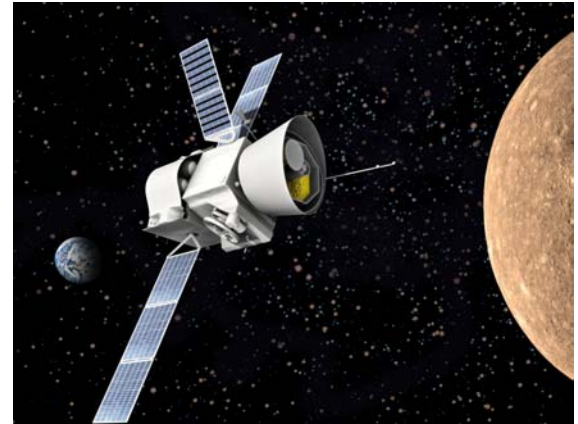
Short term opportunities

Opportunities in BepiColombo and SoLO

- **Mercury Orbiter “Bepi Colombo”**
 - 2/3 of the procurement is contracted
 - 1/3 still open
 - ITTs Invitations to Tender will come end of 2008 via Esa webpage: <http://emits.esa.int> (no www!)
 - Topics (not exhaustive): structural parts, various brackets, mech./thermal test dummies, harness, software, independent software validation, radiation monitor

- **Solar Orbiter (SoLO)**
 - Definition phase has just started
 - Procurements expected not earlier than 2010
 - Rover software would be a very noble task, but competition is high

The Czech Industry can apply for contracts by submitting proposals to Astrium.



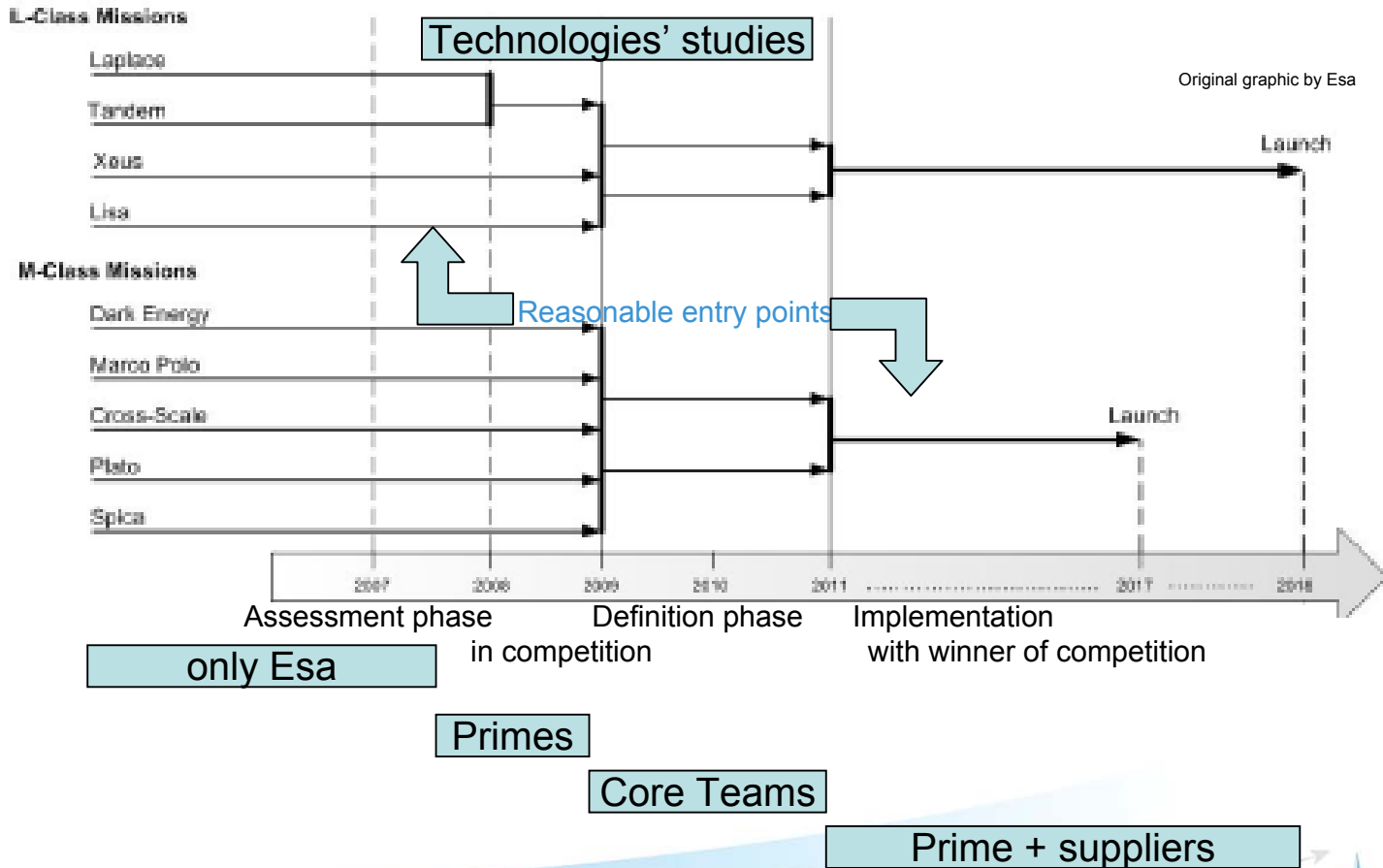
Cosmic Vision 2015-2025

- Programme for Esa's next decades' scientific missions
- First candidates to be launched until 2017/18 identified in 2007 after a call for proposals
- Medium class missions (< 300M€ total cost)
- Large missions (< 650M€)
- one year industrial assessment studies initiated



Illustrations from Esa webpage

Downselection of CV mission candidates



Original graphic by Esa

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Cosmic Vision-related Technologies

TABLE #1: L CLASS MISSIONS			
Mission	Technology area	Future Technology development activities	
XEUUS	X-Ray Optics	Back up X-Ray optics technology	
		Tandem ruggedizing and environmental testing	
		Baffling system, tandem level	
		Petal breadboard	
		X-Ray Optics Production Issues	
		X-ray test facilities upgrading	
	Detection systems/ Instruments	Back-up cryo detector (NEI)	
		NEI: TES read out and follow on	
		WTE: prototype and package	
		Auxiliary Instruments	
		Delta-development on FE metrology for L2 requirements	
GNC (Guidance Navigation & Control)	Optical Metrology		
	Last stage cooler		
Cryogenics	Cryocooler chain for TES		
	Readout electronics for cryogenic sensors		
Laplace/Tandem	Components	Radiation hard characterization: <ul style="list-style-type: none"> - Digital components - Memories - Mixed analogue and digital - Analog components 	
		Power	LILT solar power systems
			RTGs and heat management system
		Payloads/Instruments	Development of compact, tightly integrated instrument and subsystem suites
	Micro-penetrators for Titan and Enceladus: ground demonstration of impact survival of key systems		
	LISA	LASER	Opto-mechanical stability characterization
Metrology system			
High-power laser system			
Propulsion		Macro-propulsion Life Time Characterisation	
Instrument	Charge Management		

TABLE #2: M CLASS MISSIONS		
Mission	Technology area	Future Technology development activities
Marco-Polo	Re-entry technologies	Development of lightweight ablative material
		Development of a CMC/hot structure-based heat shield
		Hypersonic aerothermodynamics/ aerodynamic stability
	Payload/Instruments	Navigation instrumentation elements
Dark Energy	Optics	Surface and sub-surface sampling, Sample transfer / capture
		Landing Technologies
	OBDH	Digital Mirror Device
		High Processing Power DPU
	Detection systems	Rad-Hard CCD Development
		NEI detectors development & readout
GNC (Guidance Navigation Control)	High dynamic range fast readout CCDs	X-band transponder (low-mass < 0.83kg and data rates up to 3.5Mbit/s)
		X-band ranging with low-mass
		1-5 N high Isp=308s, mass= 0.28 kg thrusters hybrid Mon-3 hydrazine, low-power valve
Cross-Scale	Detection system/Instruments	star mapper for IJREM, low mass spinning S/C
		Combined ion/electron electrostatic analyser
SPICA	Components	Radiation-tolerant memory
		Telescope assembly verification and testing
	Optics	Cryogenic refocusing mechanism
		SAFARI: Fourier Transform Spectrometer BB
	Detection systems	SAFARI: Detector development
		SAFARI: Focalplane read-out
Cryogenics	SAFARI: 50 mK ADR	
	SAFARI: Cryogenic mechanisms	

Technology Research Programme

- Previous page is just a list of activities related to Cosmic Vision (typically 100-1000K€ each)
- It is part of the Core Technology Programme CTP
- There is also the basic technology research programme TRP, with an even higher number of subjects, covering all aspects of spaceflight on the same amount of budget available per project
- Contract award is always according to heritage and quality of proposed work and bid decision will depend on subjects of specific expertise
- Astrium as prime is often participating as a space partner for the specialised company/institution
- Other technology programmes on optional basis

Optional Programme: Exploration (Aurora)

- Long-term goal: human spaceflight beyond low Earth orbit
- Medium term goal: participation in international mission
MSR Mars Sample Return, tentatively scheduled for 2022
- Studies and technologies are part of the Aurora Core programme
- Real project: ExoMars
 - Robotic mission to Mars for in-situ analyses and search for life to be launched in 2013
 - Italy strongest contributor (>40%): TAS-Italy prime
 - Started as a 600 M€ programme, but the Ministerial conference end 2008 has to decide now for a 1000-1200 M€ programme before going into implementation
 - Rover for surface mobility is a major system under Astrium-lead
 - Procurement of subsystems and components, Software with opportunities for Czech industry will start earliest in 2010
 - But first:
Czech government had to decide on a contribution to ExoMars



Image: Esa

Summary

- **Short term opportunities from 2008 onwards**
 - Contributions to Bepi Colombo, Mercury Orbiter development with ITTs
 - Contributions to technology programmes
 - Related to Cosmic Vision, to be realised as a project long-term (CTP)
 - Related to more long-term needs (TRP)
- **Mid term opportunities from 2010 onwards**
 - Contributions to Solar Orbiter
 - Contributions to ExoMars Rover
 - but Czech Republic had to subscribe a share of the Aurora programme on the Ministerial Conference
 - would need a more thorough investigation, what could be done for what amount of money in order to allow a proper allocation of money
- **Long term opportunities from >2011**
 - Participation in industrial Cosmic Vision mission implementations