
Cosmic Vision cycle 1
Presentation to Industry
Science Directorate, ESA/ESTEC
esa
ESTEC, 26 Feb 08

Agenda

9:30- Welcome

9:35- ESA presentation on Cosmic Vision plan

1. Cosmic Vision Cycle 1
2. Selected Missions
3. Assessment Studies
4. National Activities Parallel to Cosmic Vision studies
5. Technology Developments
6. Schedule

11:45- Questions

13:00- End

1- Cosmic Vision Cycle 1

Call for CV planning cycle 1 Mission Proposals

- First CV planning cycle (CV 1) covers 2015–2018 period
  Current Call released March 2007.
- Aims at final selection of
  1 "medium M" mission, ESA cost < 300 ME
  1 "large L" mission, ESA cost < 650 ME
- Launch in mid 2017 & late 2018.
- Total available envelope for first cycle: ~ 950 M€.

Cosmic Vision cycle 1
Overall schedule

5 March 07	Call for Mission Proposals
29 June 07	Proposals due
2007 - 2009	Assessments (competitive)
end 2009	Down selection (2M, 2L)
2010 - 2011	Definition (competitive)
end 2011	Final Selection and Approval
2012 - 2017	Implementation
Mid 2017 & late 2018	M1-L1 Launches

Total budget envelope 950 M€

Proposals Overview

- Total of 50 proposals, often of high quality
- Astrophysics: 19 proposals
  - 4 ‘L’ and 15 ‘M’ class.
- Fundamental Physics:12 proposals
  - 1 ‘L’ and 11 ‘M’ class.
- Solar System: 19 proposals
  - 5 ‘L’ and 14 ‘M’ class.
- About half include potential collaboration with NASA, JAXA, CNSA, Roscomos.

Selection process

- Evaluation carried out by ad-hoc Peer Review Teams (as necessary) under responsibility of ESA advisory bodies.
- Recommendation for selection by discipline Working Groups (i.e. AWG, FPAG & SSWG).
- Final recommendation for selection across disciplines by SSAC.
- PIs of proposals excluded from selection process.
- Agreed rules of conduct for members of advisory bodies involved as Co-Is in proposals

Selection criteria

• Scientific excellence	WG/SSAC
• Scientific return	WG/SSAC
• Compatibility with CV scientific priorities	WG/SSAC
• Timeliness of the mission	WG/SSAC
• Need to go to space	WG/SSAC
• "Science value for money" rating	WG/SSAC-ESA
• Technology maturity and technical feasibility	ESA
• Compatibility with Class M or L envelopes	ESA
• Cost to Member States (payload, etc.)	ESA
• Overall project risk	ESA
• Status of international cooperation	ESA
• Communication potential	WG/SSAC-ESA

CV selection outcome

Seven missions selected for assessment over 2008-2009

- **Five M-class missions (ESA cost < 300 ME)**
  - ✓**Goal: Down-selection end 2009, launch 2017**
- **Two L-class missions (ESA cost < 650 ME)**
  - ✓**Compete with LISA**
  - ✓**Goal: Down-selection end 2009, launch 2018**
- **A number of science mission themes (~ 10) highly ranked, requiring technology developments for enabling readiness for the next Call for Missions**

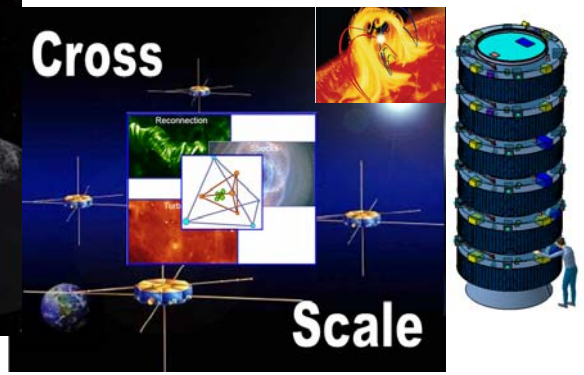
2- Selected missions

SSAC SELECTION

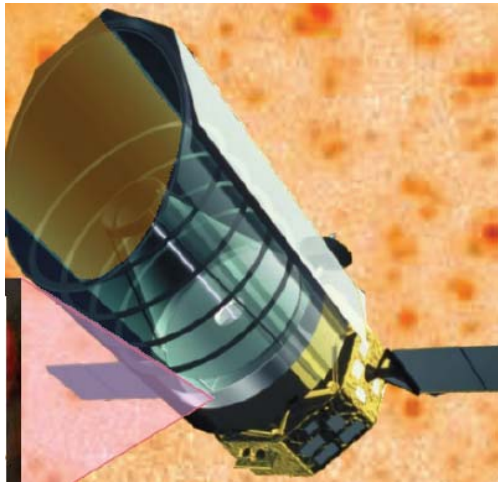
Fields	M Class	L Class	Mission of Opportunity
Solar System	Space Plasmas (CROSS-SCALE)	Giant planets (TANDEM – Saturn)/ LAPLACE – Jupiter)	
	Neo sample return (MARCO POLO)		
Astrophysics	Dark Energy (DUNE/SPACE)	X-ray astronomy (XEUS)	IR astronomy (SPICA)
	Astero-seismology/ Exoplantets (PLATO)		

M class missions

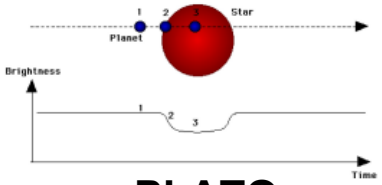
Marco-Polo
NEO sample return
in collaboration with JAXA



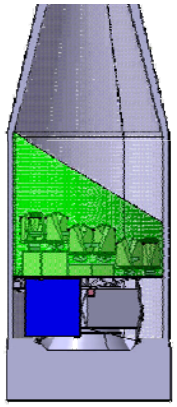
Cross-Scale
Plasma physics

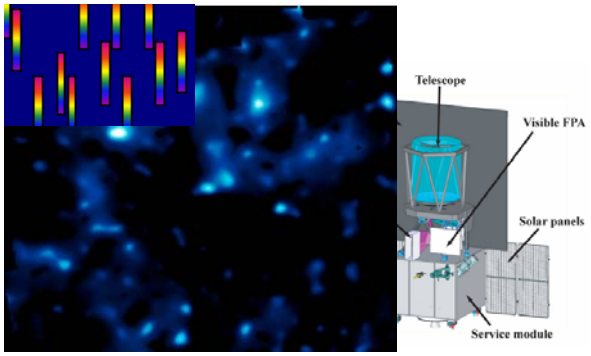


SPICA
3.5 m IR observatory
in collaboration with JAXA



PLATO
Exoplanet detection
& star characterization

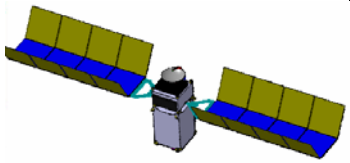


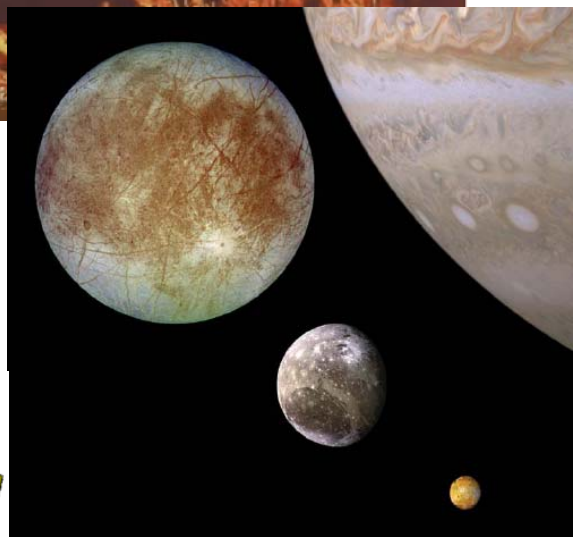


Dark Energy
Deep space survey

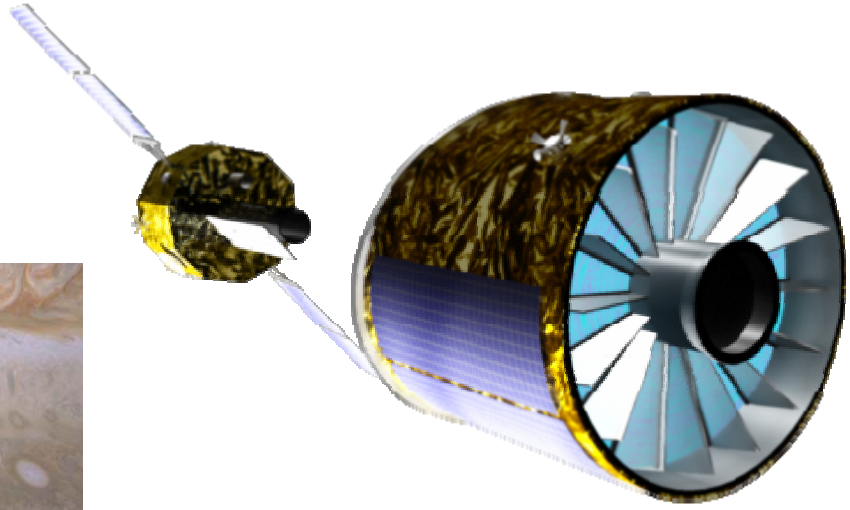
L class missions

Tandem
mission to Saturn/Titan





Laplace
mission to the Jupiter system



Xeus
X rays observatory

Characteristics of L & M missions

- L missions
  - ✓ Ambitious long term missions, down-selection of two L missions end 2009
  - ✓ Mission budget requires international collaboration, to be defined during the assessment phase
  - ✓ Technology developments to be implemented as soon as possible. Coordination between ESA/national agencies for technology development activities (SPC workshop in June)

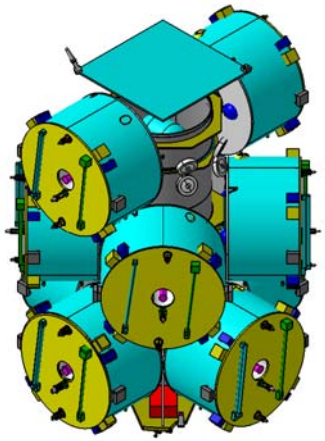
- M missions
  - ✓ High technology readiness level (supposed TRL ≥ 5)
  - ✓ No technology developments before down-selection end 2009
  - ✓ Pre-developments can be envisaged in the development phase, if justified by the mission schedule risk minimisation

Cross Scale – Status of assessment study activities

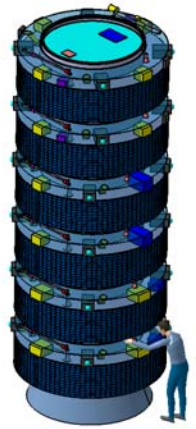
- Study Science Team in place, Sci-RD and PDD are being reviewed (all instrument data sheets are in)
- System level CDF completed in Dec 2007
- Industrial ITT documentation under preparation.
- JAXA and NASA included in Study Science Team

- <u>Two baselines studied:</u>
  - SF2-1b launch to LEO or GTO
  - 1.4 x 25 Re or 10 x 25 Re target orbit (i = 14°)
  - Option 1: 10 S/C on a dispenser, cost and mass critical
  - Option 2: 6 S/C in stacked configuration, cost critical

Convergence on going towards 7 S/C, stacked configuration



Option 1: 10 S/C + dispenser, launch and transfer configuration



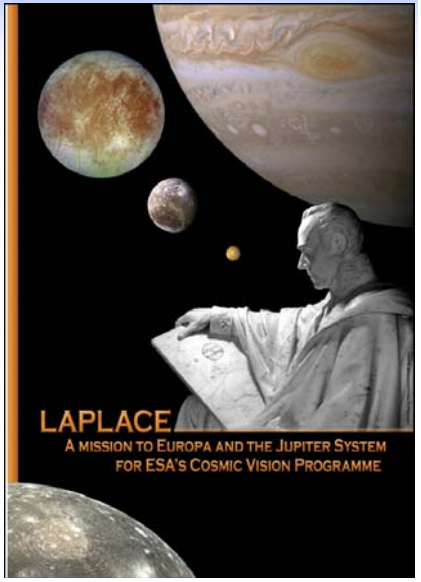
Option 2: 6 stacked S/C, no dispenser, launch and transfer configuration

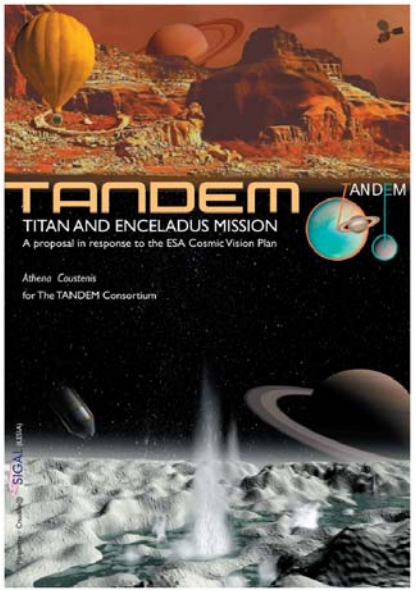
Marco Polo – Status of assessment study activities

- Study science team in place, Sci-RD drafted, PDD work on-going
- Mission in collaboration with JAXA
  - **Collaboration scheme not yet frozen**
  - **JAXA lead**
  - **ESA lead scenario with JAXA as junior partner also considered**
- System level CDF study planned in Mar08
  - **Investigation of simplest possible mission**
- Industrial study scope: whole spacecraft
- Planetary Protection Working Group initiated

Outer planet mission – Status of assessment study activities

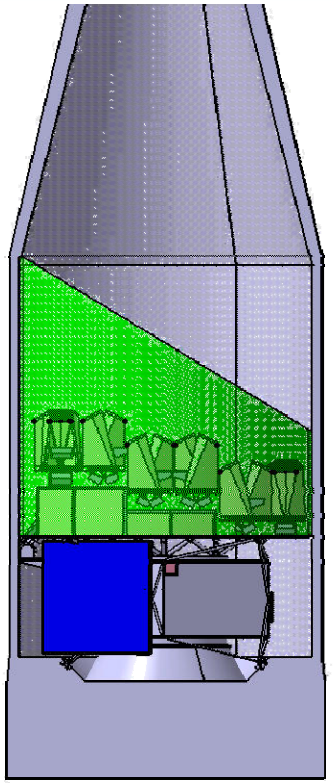
- Cooperation scenario with NASA as baseline – discussions ongoing; JAXA expressed also interest for Laplace/Tandem
- NASA milestone: 3 to 1 down-selection of outer planets Flagship mission in October 2008
  - Organisation and cross-participation for the near future work under discussion
- Work focused on critical mission aspects through dedicated working groups
- Two CDF studies planned for Laplace/Tandem, to be completed by July 08
- ITT planned for end 08





PLATO – Status of assessment study activities

- ❑ SST in place, Sci-RD and PDD are being reviewed
- ❑ Dedicated payload module study made by ESA
  - ✓ Viable staring option elaborated in Dec07,
  - ✓ Adopted as baseline by SST
- ❑ ESA system study (CDF) is completed
- ❑ Industrial ITT documentation in preparation



'*Staring mode*' baseline:

- SF2-1b launch to L2 (direct transfer)
- ~ 30 identical telescopes
- Total collecting area ~0.3 m^2, FOV > 400 deg^2
- 4 CCD's / focal plane (compatible with realistic detector procurement constraints), 3k x 3k, 18 um pixel
- Options to improve science performance: larger CCD/FOV (~ 530 deg^2), modified operations scenario (2^{nd} field + longer lifetime).

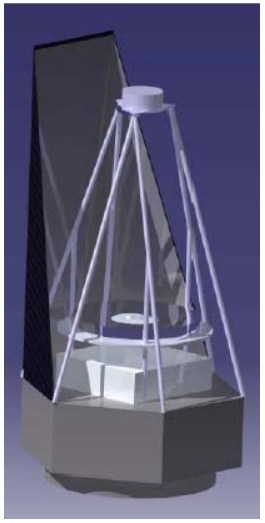
Dark Energy Mission – Status of assessment study activities

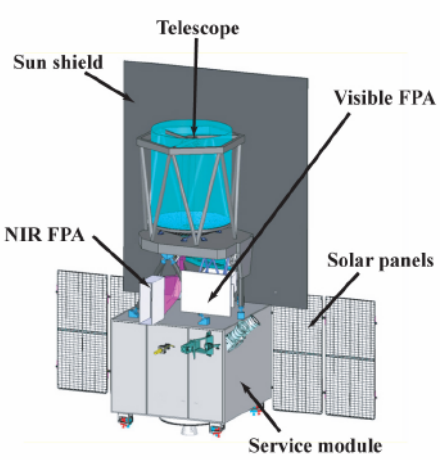
- Concept Advisory Team in place for convergence on Dark Energy Mission payload concept
  - ✓ Achieve a robust dark energy measurement and consolidate technical feasibility

- Convergence concept
  - Telescope aperture diameter of 1.2 m
  - VIS focal plane for weak lensing
  - NIR focal plane shared by photometry and spectroscopy
  - Limit design to 1 spectrometer (+ no DMD back-up)

- CDF study planned for April 2008

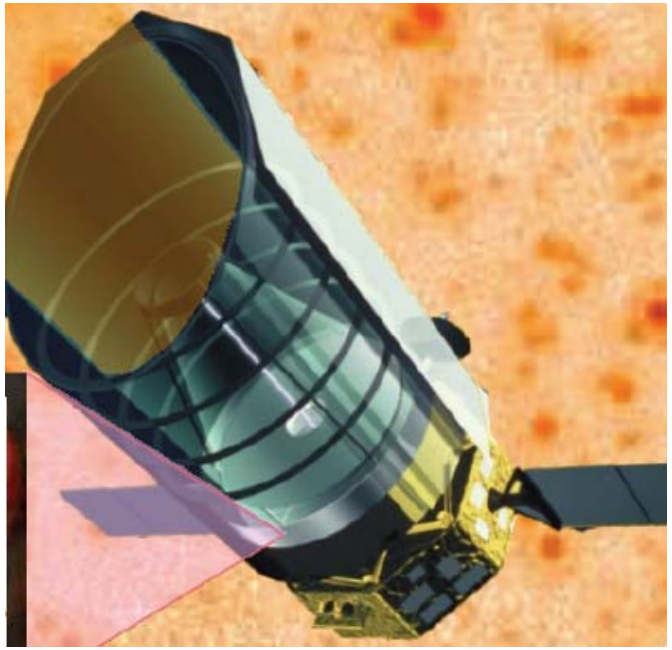
- ITT in May 2008





SPICA – Status of assessment study activities

- JAXA-ESA mission
  - ✓ JAXA led mission
  - ✓ ESA contribution
    - Cryogenic 3.5 m Telescope
    - SAFARI science instrument (through Member States funding, MIRI-like scheme)
  - ✓ ESA-JAXA letter of agreement drafted, for defining respective responsibilities during assessment study

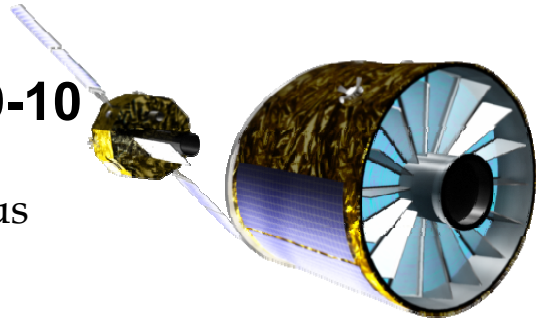


- SAFARI (European instrument) PDD on going

- CDF activities (Telescope Assembly & SAFARI) planned in April/May

XEUS – Status of assessment study activities

- **Internal critical review performed in Dec 07**
  - ✓ take stock of work performed to date,
  - ✓ identify critical areas requiring for attention



- **First meeting of XEUS Study Science Team (9-10 Jan 08):**
  - ✓ presentation on study process and objectives, study status and criticalities, and technology development,
  - ✓ discussion on alternative design solutions.

- **XEUS workshop being organised (ESTEC, 5-6 March 08):**
  - ✓ Science topics and science drivers
  - ✓ Required technology developments
  - ✓ Recent progress on X-ray instrumentation and optics
  - ✓ Evaluation of International collaboration potential

- **System CDF study planned in June 08**

3- Assessment studies

Key elements of Cosmic Vision implementation plan

❑ Spacecraft Assessment Studies

- ✓ ESA internal studies & industrial studies
- ✓ Programmatic inputs for down-selection process

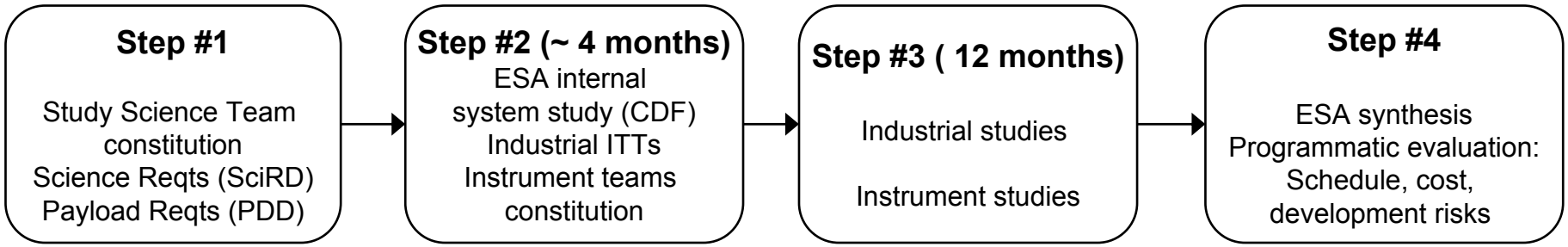
❑ Science Instrument Assessment Studies

- ✓ National activities conducted in parallel to ESA system studies
- ✓ Enable robust spacecraft definition and instrument selection (AO) at the beginning of the Definition Phase

❑ Technology Development Plan

- ✓ For spacecraft and science instruments
- ✓ Harmonisation with Member States requested (June 08 SPC workshop)

Assessment Phase Logic: Four major steps



Science Reqts & definition of Payload needs

ESA internal study & Instrument teams constitution

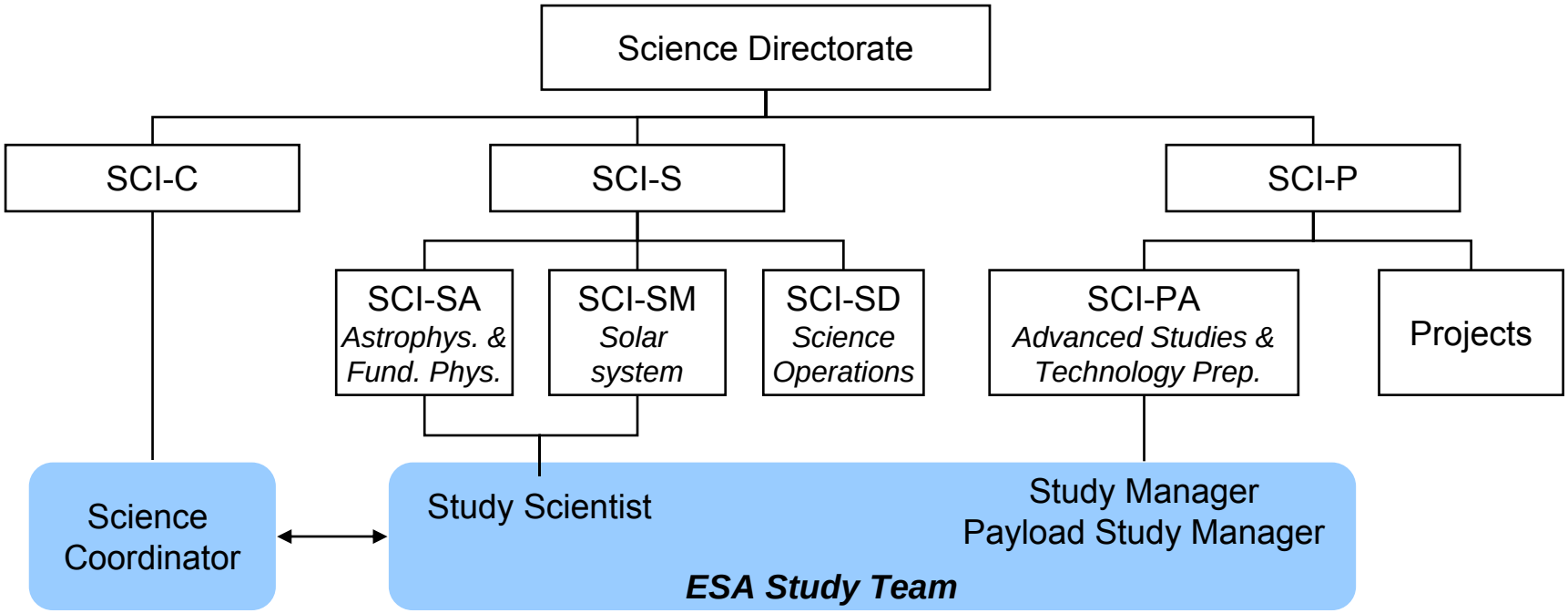
Industrial & Instrument studies

ESA synthesis

Assessment study actors

- Study Science Team
  - ✓ Represents the science community for the study field
- ESA study team
  - ✓ **Study scientist:** Responsible for all Science aspects related to the study needs. Chairs the Study science team
  - ✓ **Study manager:** Overall study management, including technical management and programmatic aspects
  - ✓ **Payload study manager:** Responsible for payload aspects, in support to the study manager
  - ✓ **ESA technical experts**
- Industrial study teams
  - ✓ Selected through open competition
- Instrument teams
  - ✓ Phase A level study of non recurring science instruments
  - ✓ Funded by Member States

CV Implementation in ESA



The Science Coordinators are in charge of the overall implementation and coordination of the Cosmic Vision Plan

Industrial studies: ITTs

Competitive Invitation To Tenders

- ✓ Parallel contracts envisaged for each study, provided good offers are received
- ✓ Documentation inputs: SOW, Science Requirements, Payload Definition Document
- ✓ ESA internal studies outcome will be made available the latest at the study kick-off
- ✓ 6-7 weeks for offer preparation

Industrial studies: Objectives

- **Space segment definition**
  - Spacecraft concept and definition, meeting science objectives and programmatic requirements
  - Payload definition (ESA part)
  - Consolidation of technical requirements

- **Mission Technology Readiness Evaluation**
  - Requirement: TRL ≥ 5 at the beginning of Implementation Phase. Applicable to the whole spacecraft, including science payload

- **Spacecraft programmatic evaluation**
  - Spacecraft development plan
  - Technology development plan, if relevant
  - Risk assessment and cost estimate

Industrial studies: Structure

❑ Three major phases

- Concept review and trade-offs ~ 4-5 months
- Detailed design ~ 6-7 months
- Programmatic evaluation ~ 1 month

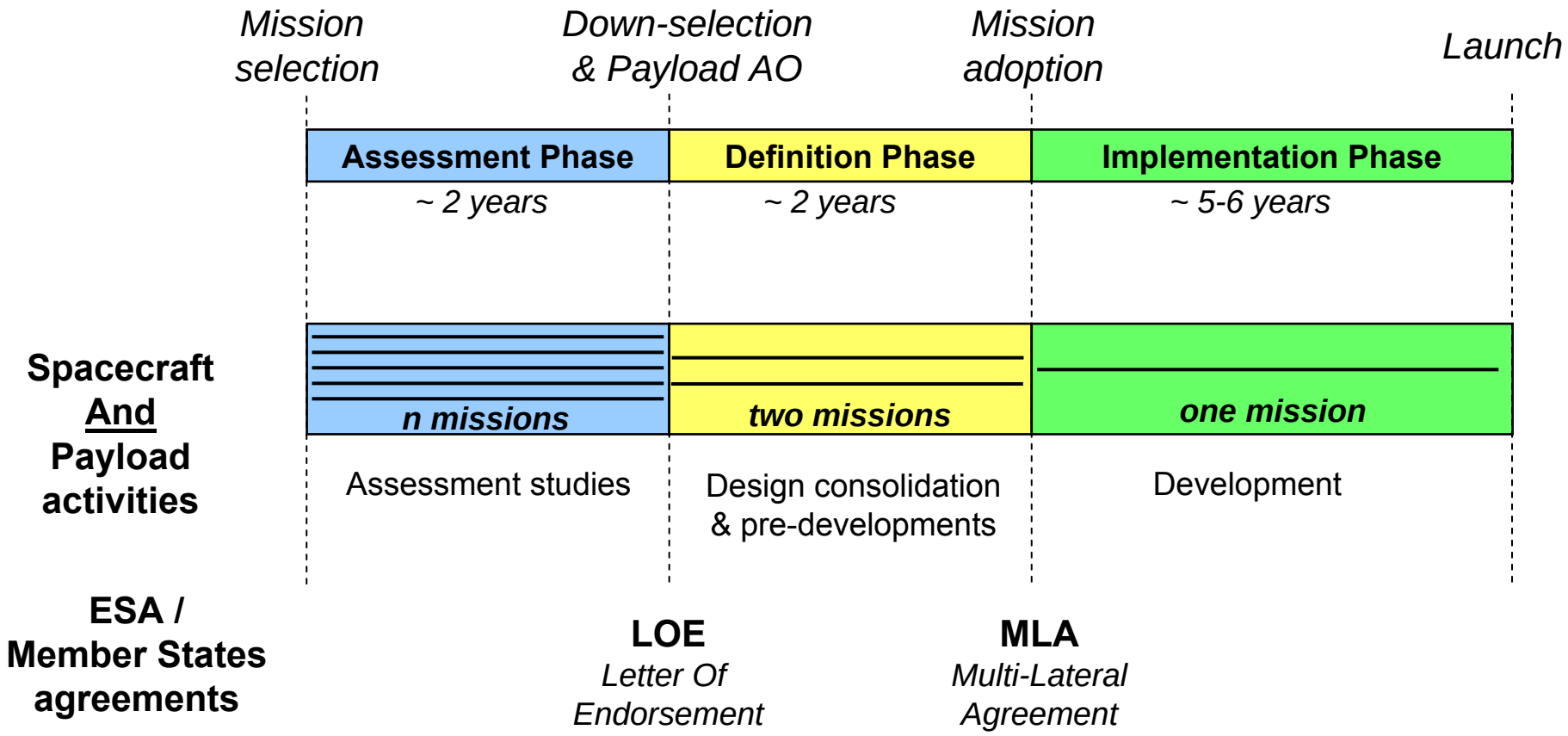
❑ Overall study duration: ≤ 1 year (must)

4- National Activities
Parallel to Cosmic Vision Studies

ESA approach on Payloads, resulting from SPRT/SPC recommendations

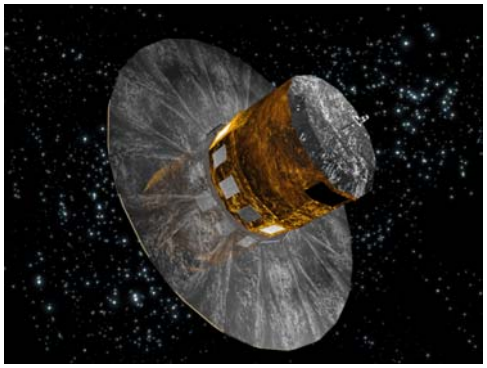
- Science Payload Phase A/B1 to be completed before entering the implementation phase
- Payload AO is moved at the beginning of the Definition Phase
- Perform Instrument assessment studies before entering the Definition Phase

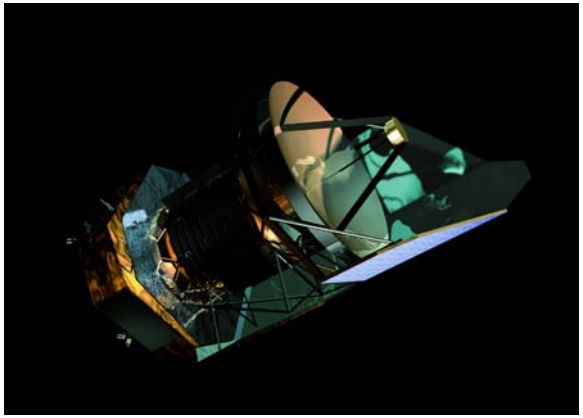
Consequences of SPRT/SPC: Illustration for M missions



Payload categories

Payload = Instrument or instrument suite.
Hardware from useful signal collection/detection device to digital output signal





Category A
“ESA only” Payload
(Gaia)

Category B
Payload = Instrument suite from science institutes
(Bepi Colombo)

Category C
Shared payload
ESA + Institutes
(Herschel)

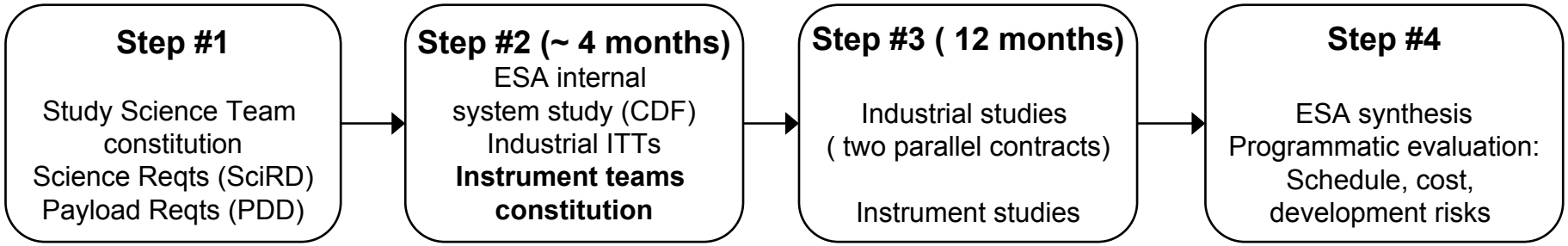
Instrumentation activities during the assessment phase

- **Instrument teams expected to be in place at the start of the industrial assessment studies**
- ✓ Phase A type study required during the assessment phase.
- ✓ Work funded by National Agencies, requested for non recurring instruments
- ✓ Work input: Payload Definition Document, elaborated by ESA payload study manager with inputs from the study science team.

Mission	Payload category	Member state provision
Marco-Polo	B	Instrument suite
Cross-scale	B	Instrument suite
Laplace/Tandem	B	Instrument suite
Plato	C	Focal planes, and potentially the whole instruments. The payload will be treated as category A in the industrial studies.
Dark Energy mission	C	Focal planes (IR and VIS). The payload will be treated as category A in the industrial studies.
SPICA	C	Telescope provided by ESA. ESI cryo instrument provided by science institutes under ESA management.
XEUS	C	Optics under ESA responsibility, cryogenic elements TBD, focal plane instruments provided by institutes

Instrument teams constitution: Procedure

- Instrumentation requirements are defined in the PDD
  - ✓ Needs established by the Study Science Team,
  - ✓ PDD book captain is the Payload Study Manager
- Call for "Declaration of Interest", includes instrumentation requirements (PDD)
- Instrument teams are requested to respond to the Call within 3 months
  - ✓ Instrument team response: organisation, technical background, study logic, expected funding scheme
  - ✓ Copy is sent to the relevant Member States
  - ✓ ESA will close the loop with the relevant Member States: confirmation of the support, instrument study follow-up, meeting plan details



Instrument study follow-up

- **The overall process preserves the future competition for both the spacecraft and instrument developments**
  - ✓ Instrument and industrial teams are independent. Formal interface goes through the ESA Study Team.
  - ✓ Several instrument teams may work on the same instrument
  - ✓ Synthesis of spacecraft and instrument studies to be made by ESA at the end of the assessment phase, with the SST support.

- **Instrument requirements and interfaces visible to all parties**
  - ✓ Instrument teams, industrial study teams, study science team
  - ✓ Instrument science requirements monitored by SST, expressed in PDD
  - ✓ Technical interface requirements monitored by the ESA Payload Study Manager

- **Technical meetings on instrument definition**
  - ✓ Meeting location: ESTEC. Participants: Instrument team, ESA, Member States representatives

5- CV Technology Developments

Technology Developments

- **Medium Class Missions (M)**
  - Proposals based on existing technology, due to launch 2017
  - Need TRL 4-5 for down-selection in 2009, and TRL ≥ 5 for Implementation in 2011
  - Identification of pre-implementation technology activities, but no technology developments foreseen before down-selection in 2009

- **Large Class Mission Themes (L)**
  - Include technologies requiring maturing, target launch date 2018
  - Need TRL 4-5 for down-selection in 2009, and TRL ≥ 5 for Implementation in 2011
  - Determination of required technology developments, to be implemented ASAP
  - Coordination with national Agencies required on payload developments

- **Future Science Programme Themes (F)**
  - Important future themes identified by AWG, SSWG, FPAG in Oct 2007
  - Need TRL4 by next CV call in 2010/11
  - Potential activities identified, need prioritisation by Advisory Structure, and harmonisation with National Agencies' developments

- **Generic Technologies for Future Science Missions (G)**
  - Multiple-use technologies required for future Science Programme
  - Technologies related to European Non-dependence

Technology Programmes

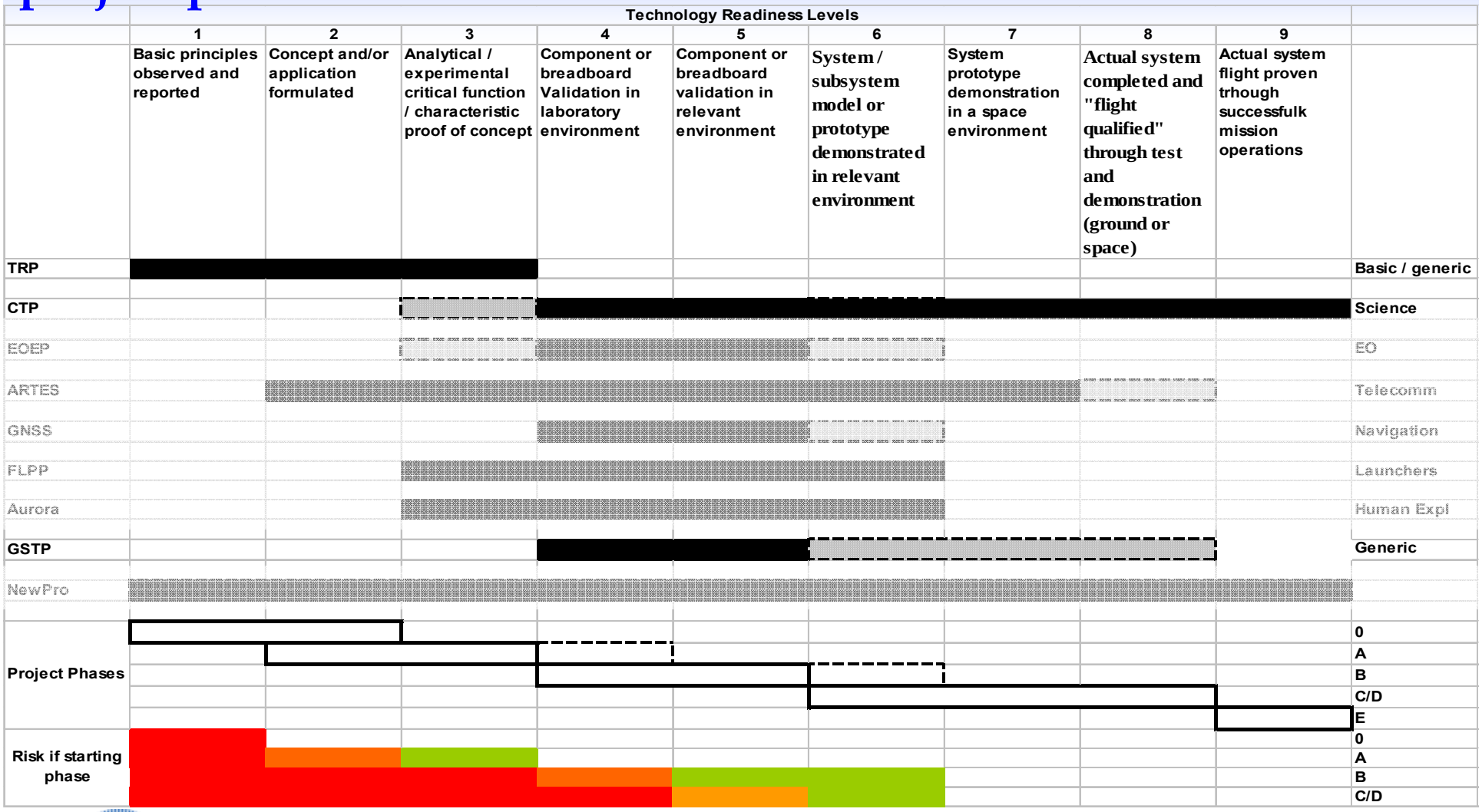
- **Technology Research Programme (TRP)**
  - ESA wide technology developments (all ESA programmes)
  - Science is Service Domain 2 (SD2)
  - TRL not beyond 3

- **Core Technology Programme (CTP)**
  - Funded by Science Programme
  - Covers all mission stages, from assessment to implementation
  - All TRL levels are supported

- **General Support Technology Programme (GSTP)**
  - Co-funded by ESA and National Funding Agencies
  - Wide range: from basic technologies to in-orbit demonstrations (eg Proba 2)
  - All TRL levels are supported, with emphasis on higher TRL levels

- **National Funding Programmes (National)**
  - Direct national funding
  - Funding of activities managed by ESA

Technology development: programmes, project phases and risks



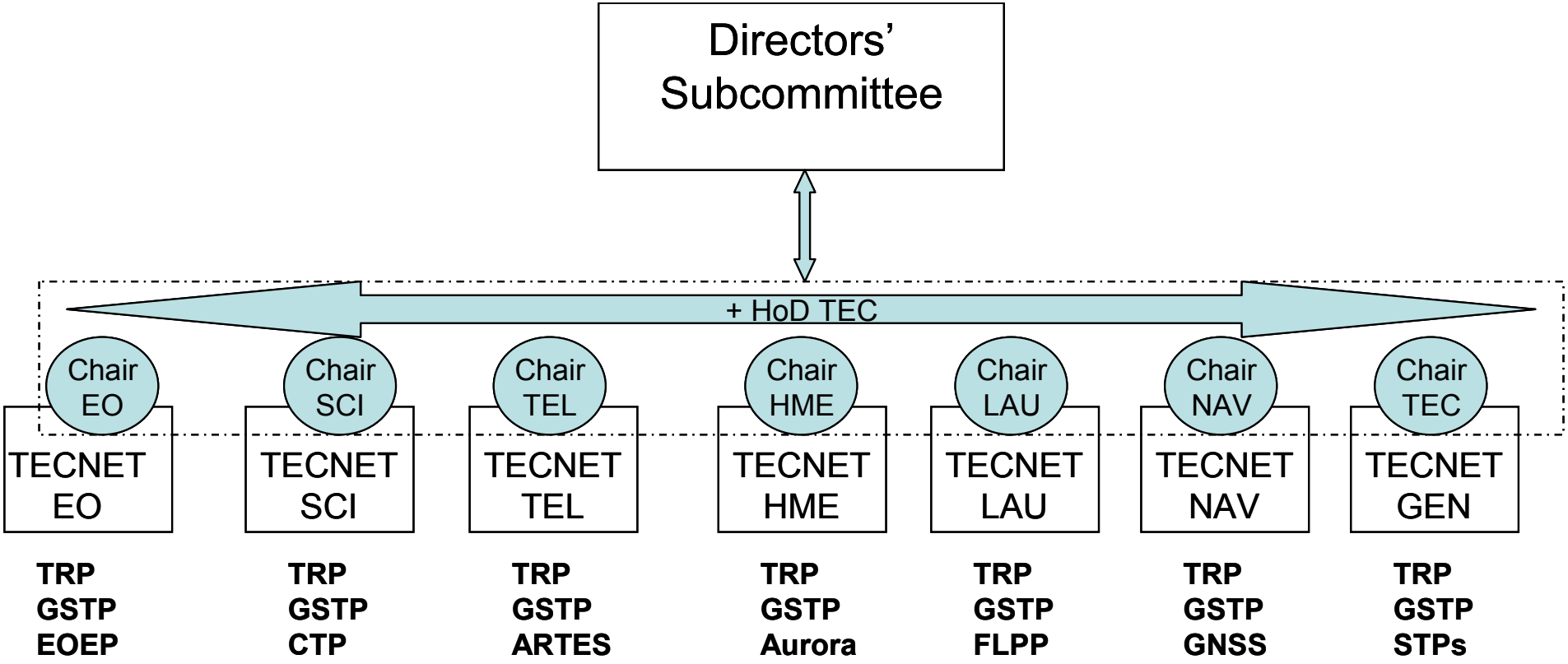
Preparation of ESA Technology Work plan

- **ESA Technology End-to-End process (E2E)**
  - Is organized in service domains (SD)
  - facilitating the coordination between corporate multi-domain programmes and specific domain programmes developments (all ESA programmes)

- **There are six programme driven SDs**
  - Earth Observation
  - Space Science
  - Telecommunications
  - Automatic Exploration and Human Space Flight
  - Navigation
  - Launchers
  - Generic SD that covers multi-use technologies and technology push.

- **TECNET**
  - There is a working group (called TECNET) for each SD
  - Each TECNET is composed of members of the Programme Directorate as required and including the chairperson, and of D/TEC.
  - The Generic SD is chaired by TEC and includes representatives of TEC, OPS and of Programme Directorates as Directorates find appropriate.
  - A Directors' Subcommittee for Technology oversees the process

TECNET and Directors' Subcommittee



T.D.P. Elaboration

- **Technology Development Plans will be elaborated in the course of 2008**
  - Starting position: proposals for Missions as submitted
  - System level work (ESA internal) just started, considered only as far as available
  - Planning horizon: 3-4 years

- **ESA TECNET has started Q1/2008**
  - Will provide expert involvement and harmonisation with other service domains
  - Objective is to issue plan as complete as possible for June 2008 SPC workshop, for submission to SPC/IPC for discussion and approval
  - Work will be harmonised with SPC Task Group 2, for June SPC workshop

- **Some activities are not yet defined and require further studies/decisions**
  - GSP activities will complement (partly preceding) technology items
  - Some science mission decisions still open (eg Laplace or Tandem? Exoplanet search approach)

6- Schedule

Milestones

ITTs for industrial studies

- Cross-scale Apr 08
- Plato Apr 08
- Marco-Polo May 08
- Dark energy May 08
- SPICA May 08
- XEUS TBD (before end 08)
- Laplace /Tandem TBD (before end 08)

All industrial studies are expected to be completed by 2009

Technology developments

Prioritisation for future missions from Advisory Bodies: Mar 08

SPC workshop for Technology development plan: Jun 08

End