Cosmic Vision call for mission proposals
Briefing Meeting

Technical guidelines

ESTEC, 11 April 2007

Advanced Studies and Technology
Preparation Division

Proposal format & content (1)

- Compliant with Annex 3 instructions and page limits.
- Appendixes / annexes not to be added. Pages after page 36 will not be considered for review – See Q&A session later on.
- Use tables to summarise design drivers and key parameters.
- Focus on critical design drivers and requirements.

Proposal is the beginning of the mission design process.

Proposal format & content (2)

- Scientific case must be solid!

- On the technical side, special emphasis is expected on:

  - Clear identification and prioritisation of quantitative science requirements
  - Highlight requirements representing design / cost / risk drivers and calling for specific trade-offs.

Proposal format & content (3)

- On the technical side, special emphasis is expected on:
  - Consistent translation of science requirements into model payload complement (& related technical description).
  - Resources to be provided by the S/C to the payload.
  - Identification of technology development requirements.

Proposal format & content (4) – Specific cases

- Proposals concerning provision of instruments.
- Specific contributions to non-ESA led missions.

- Technical and programmatic emphasis on envisaged ESA (and member states) contribution/s.
- Provide background information on overall mission to allow proper judgement.
- Treated as potential candidate to M -class.

Mission profile (1)

- Detailed orbit/trajectory not expected at this stage.
- Clearly state what is needed to perform the science (e.g. pointing, observations, peri/apo-centre scenarios, lifetime).
- Use *must / should / could do* approach in listing priorities.

Mission profile (2)

- Launcher vehicle selection determines cost class.
- Identify any ‘real-time’ ops demands.
- Indicate clearly and discuss critical areas.
- Quote existing mission heritage / experience if applicable.

Payload instrument complement (1)

- P/L complement = instruments (+ optics).

- ESA putting strong emphasis on early assessment of P/L.
- Payload definition and assessment regarded as highly. critical to sound mission design.
- More detailed description of model P/L is expected.

What does the 'platform' need to provide to accommodate the payload complement?

Payload instrument complement (2)

- Specific effort to define P/L complement and its resource.
- Main parameters:
  - Mass, Volume, Power, OBDH, TM
  - Pointing requirements
  - Thermal control requirements
  - Impact of space environment
  - Cleanliness requirements
  - Technology maturity – model philosophy

• Budget breakdown
• Table format
• ESA PDD as example
• WWW Scitech

- Procurement approach (consortium, ESA contribution?)

Basic S/C key factors

- Key design parameters – necessarily a first iteration.
- Coherent with mission profile and science requirements.
- Support launcher choice and envisaged CaC class.
- Highlight S/C subsystems requiring specific attention.

- Specific emphasis on flight heritage and re-use approach is expected for the M-class mission (refer to Annex 5).

Technology assessment (1)

- Identify & highlight all items requiring development (with specific emphasis on payload elements).
- Assessment based on TRL scale (Annex 4).

- M class missions:

  CaC envelope and timescale precludes significant technology development (i.e. no mission enabling developments expected).

- L class missions:

  dedicated *Technology Assessment Phase* (specific developments expected) – down-selection also based on technology readiness.

Technology assessment (2)

- Possible examples of developments for L-class missions:
  - New generation optics / focal plane detectors
  - Enhanced performance solar arrays / AOCS
  - Technology assessment critical to future mission selection

- Possible examples of developments for M-class missions:
  - Delta-Qualification for specific mission environment
  - Design changes to limited number of units
  - TRL $\geq$ 4 (i.e. component/BB in lab environment)

Preliminary programmatic / cost (1)

- Proposal to provide total mission cost including costs to ESA (CaC) as well as costs to member states (e.g. payload funding / data distribution) and to other partners.
- Spell out any assumptions on ESA contribution to P/L.
- Tables 5a/b of Annex 4 refer to ESA costs only – indications on cost apportionment and envelope available for total industrial S/C cost.
- Additional info (LV cost): footnote of table 1 / Annex 4.

At this stage preliminary CaC estimates, but increased accuracy is expected on P/L cost estimates.

Preliminary programmatic / cost (2)

- Notes on M class missions:

  - Tight CaC and schedule calls for limited development risk
  - Minimise ad-hoc development + leverage existing heritage
  - Optimise mission duration

- Notes on L class missions:

  - ESA mission Vs. internat. cooperation (e.g. Gaia Vs. Bepi).
  - Collaborations are likely to be required for complex missions.

END

Annex 4 – table 1

Table 1: Mission Overall Summary

Mission	Launcher	Launch wet Mass (kg)	Orbit (km)	Launch date	Cost (e.c. 2006)	TM (kb/s)
		Observatory	Type	Missions		
XMM	A5	3800	114000x7000	1999	919	66
Integral**	Proton	3954	153000x9000	2002	397	113
GAIA	Soyuz Fregat-2B	2030	L2	2011	550	5000
		Planetary	Type	Missions		
MEX	Soyuz Fregat	1223	11560x258	2000	204	38-230
Rosetta	A5 G+	2900	N/A	2004	825	22
VEX	Soyuz Fregat	1241	66000x250	2005	203	28-262

** *Launcher provided by RSA (Russian Space Agency) as part of an international collaboration*

Current ESA launcher policy restricts ESA-only missions to 3 launcher types: Ariane-5 ECA (125 ME), SF-2B (40 ME) and Vega (22 ME) [c.f. Table 3]. However, Rockot KM is being accepted as a back-up to Vega.

Annex 4 – table 2

Table 2: Past Mission Summary

Mission	S/C dry Mass (kg)	P/L Mass (kg)	Mass Ratio	S/C Pwr. (W)	P/L Pwr. (W)	Pwr. Ratio
Observatory Type Missions						
XMM	3234	2147	0.62	1000	675	0.68
Integral	3414	2013	0.59	2377	719 (max)	0.30
Planetary Type Missions						
MEX	510 (71)	116	0.26	1500 [650]	140	0.21
Rosetta*	1322 (~110)	170 (27)	0.11	850@ 5 AU	190	0.22
VEX	633	93	0.15	1100(Venus)	150	0.13

(*) The additional Lander mass is included in the total dry spacecraft mass.

[ ] Power at maximum distance from Sun. Power available varies depending on Mars position.

Annex 4 – table 3

Table 3: Launcher Data

Launcher	Diameter[1]	Mass HEO	Mass GTO[2]	Mass LEO[3]	SSO	Mass L1/L2[4]	Mass Escape[5]
A5 ECA	4570	7000 to 9000 kg depending on orbit	9600 kg	> 10 000 kg in 800 km	>10 000 kg, 800 km	6600 kg	4300 kg (V_{inf}=3.5 km/s)
Soyuz Fregat 2B	3800 (ST)	1400 kg to 2600 kg depending on orbit	3060 kg	5300 kg	4 900 kg, 660 km	2000 kg	1600 kg (V_{inf}=0)
Vega	2380	No information yet available		2300 kg (5.2°)	1 500 kg, 700 km	*(500 Kg)*	N/A
Rockot-KM	2100 / 2380	N/A	N/A	1850 kg (63°)	1 000 kg 800 km	*(500 Kg)*	N/A

1 *Here the Diameter refers to the inner useable diameter of the fairing expressed in mm*

2 **GTO = 250 x 35950 km – shared launch as potential alternative**

3 *LEO refers to the mass (kg) into 300 km altitude Low earth Orbit with a typical orbital period of 90 minutes. Unless specified otherwise, an equatorial orbit is assumed*

4 *L1/2 refers to mass (kg) to L1 or L2*

5 *Escape refers mass (kg) for an interplanetary escape trajectory.*

Annex 4 – table 4

Table 4: The ESA Ground Station Network

[dB/deg K]

Ground station	Size	Receive Band	Transmit band	G/T ratio[1]		
				S	X	Ka
New Norcia	35 m	S & X (& Ka[2])	S & X		49.5	(54.9)
Cebreros	35 m	X & Ka	X & Ka[3]		50.8	55.7
Kourou	15 m	S & X	S & X	29.9	41.4	
Maspalomas	15 m	S & X	S	29.2	37.5	
Perth	15 m	S & X	S & X	26.6	42.5	

[1] The G/T ratio is calculated for 10 degree elevation (Link figure of merit, gain/system noise).
[2] Upgrade to Ka band reception is currently planned.
[3] Upgrade to Ka band transmission is planned for BepiColombo

Annex 4 – table 5a/b

Table 5a: Main Cost Elemnts for Class M Missions

Activity	% of Total ESA CaC	MEUR
Pre-Implementation Phase	2	6
Total spacecraft industrial activities	38	114
Launch services from CSG (Soyuz Fregat-2B launcher) *	13	39
Ground segment (MOC and SOC)	18	54
ESA internal costs	11	33
Contingency	18	54

* use of Vega Launch services would reduce the cots from 13% to 8 % of the overall CaC.

Table 5b: Main Cost Elements for Class L Mission Concepts

Activity	% of Total ESA CaC	MEUR
Pre-Implementation Phase	1	6.5
Total spacecraft industrial activities	45	293
Launch services from CSG (Soyuz Fregat-2B launcher)	6	39
Ground segment (MOC and SOC)	16	104
ESA internal costs	11	71.5
Contingency	21	136

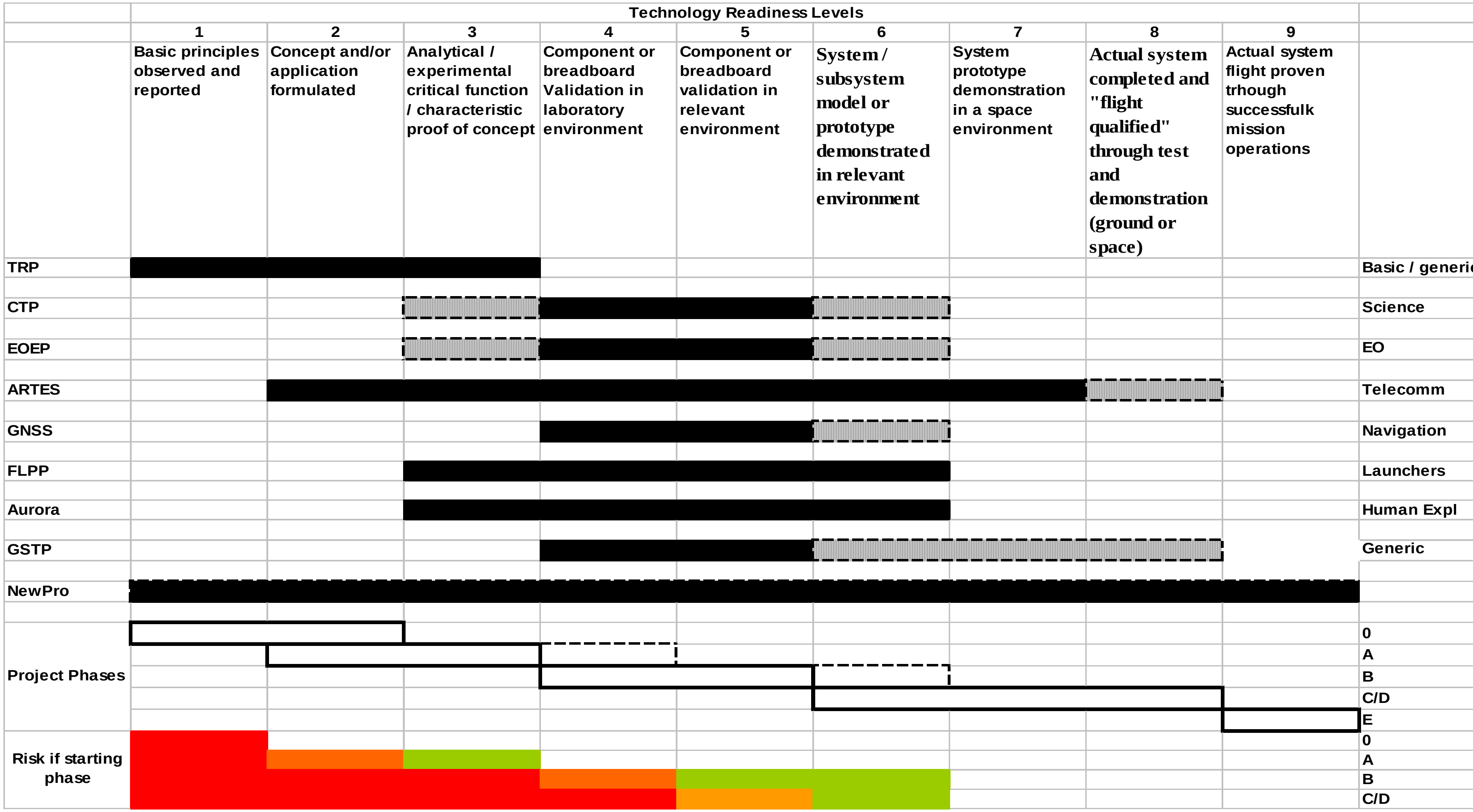
A5-ECA ~ 125 MEUR

Annex 4 – table 6

Table 6: Technology Readiness Levels (TRL)

Level	Description
1	Basic principles observed and reported
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof-of concept
4	Component and/or breadboard validation in laboratory environment
5	Component and/or breadboard validation in relevant environment
6	System/subsystem model or prototype demonstration in a relevant environment (ground or space)
7	System prototype demonstration in a space environment
8	Actual system completed and "flight qualified" through test and demonstration (ground or space)
9	Actual system "flight proven" through successful mission operations

Technology development: programmes, project phases and risks



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