ESA/PB-HME/EUB(2024)30
[ESA/PB-HME(2024)30]
Att.: Annexes
Paris,02 September 2024
(English Only)

EUROPEAN SPACE AGENCY

HUMAN SPACEFLIGHT, MICROGRAVITY AND EXPLORATION PROGRAMME BOARD

Exploration and Utilisation Board (PB-HME-EUB)

Small Missions - Transition and Selection from Pre-Phase A to Phase A/B1

Summary

The document presents the selection process for missions which will enter into a Phase A/B1, as well as the principles guiding the mitigation of schedule impacts regarding the targeted start date. It also presents the case for building a reinforced portfolio of options at Phase A/B1 stage.

Required Action

The Exploration and Utilisation Board is invited to take note of the content of the document and provide comments and guidance on the proposed approach.

Next Steps

Following feedback from Delegations, this document is planned to be presented at the PB-HME meeting in September.

Evolution of the process, notional timeline and outcomes

When first presenting the "Selection Process for Small Mission Studies" to the EUB in May 2023, the Executive was proposing to follow a four-step approach which would start during the first semester 2023 by a six weeks OSIP campaign aimed at receiving mission outline proposals (see Figure 3 Annex 1). The first call of the Small Missions for Exploration initiative would focus on the Moon.

The four-step approach was:

- Step 1: OSIP Campaign,
- Step 2: Restricted Call for Proposals for pre-Phase A,
- Step 3: Phase A/B1 for selected proposals. This step starts with the evaluation of the mission concepts matured through pre-Phase A studies,
- Step 4: Implementation of Pilot for Small Mission decided at CM25.

It was foreseen that a group of 3-5 (TBC) outlines could be selected out of the OSIP Campaign, followed later on by 1 to 3 (TBC) Phase A/B1 studies.

Further discussions took place during the following May PB-HME and the PB-HME Workshop held on 6 July. The initiative was also presented to HESAC on 31 August. The consultation process was concluded and the document "Small Missions Studies for Exploration" (ESA/PB-HME(2023)17, rev.2) was finalised throughout the September EUB and PB-HME.

Aside from the postponement of the process start, major impacts on the notional schedule were induced by the doubling of the OSIP Campaign duration to 12 weeks, as well as by the necessity to carry out a scientific peer review as part of the evaluation process. The latter would then be extended to 4.5 months (see Figure 4, Annex 1).

The OSIP Call was issued as planned on 21 September 2023, with the deadline for submitting mission outlines on 14 December.

This preparation time – from Delegations informing their entities of the coming OSIP Call to the duration of the Call – eventually paid off. The Call was a clear success in terms of number of proposals, number of countries represented, type and diversity of entities involved. The first screening of the mission outlines also showed an overall good quality level. In order to better respond to such so far untapped potential, the activity E3CX-013 "Small Missions for Exploration (Pre-Phase A studies)" was added to the Workplan. Providing additional funding to that of the Basic Activities' Preparation Element, it would allow to place an increased number of Pre-Phase A contracts, hence better reflecting and exploiting the Call's potential.

A total of 62 mission outlines were eligible for evaluation, involving around 220 entities from 23 E3P Participating States (Figure 1). Out of these, nine missions were selected for submitting a proposal for a Pre-Phase A. In addition, the VMMO proposal was selected as a Direct Track candidate. In total, 66 entities from 21 E3P Participating States are still involved in this round.

Step 1 was concluded with the completion of the OSIP Campaign selection process.

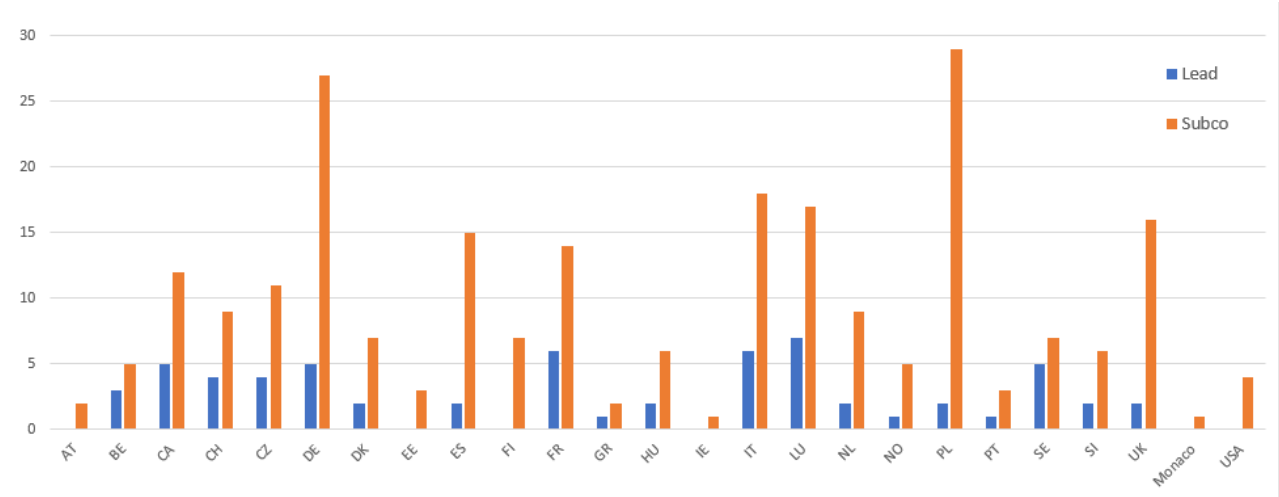


Figure 1.- Distribution of Small Missions proposals by countries
(volume of participation, cumulative numbers, i.e. an entity involved in two proposals is counted twice)

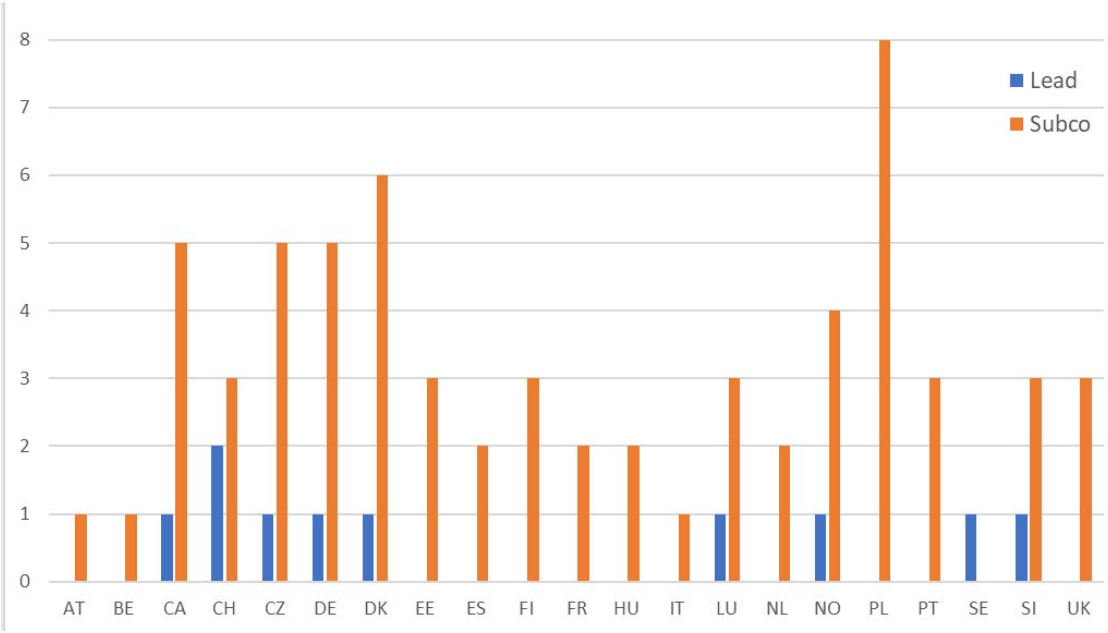


Figure 2.- Distribution by countries of the 10 Small Missions selected
(nine for the Restricted Call for Proposals + one Direct Track)
(volume of participation, cumulative numbers, i.e. an entity involved in two proposals is counted twice)

The outcome of the Call evaluation, which required an additional down selection step between OSIP and placing of Pre-Phase A contracts, would generate an additional schedule shift. Following the issue of the Restricted Call for Proposals, nine proposals for pre-Phase A were submitted by the 22 August deadline (Figure 2). The target is to have the seven selected studies kicked off by October.

When it comes to the transition from Pre-Phase A to Phase A/B1 studies, this document has a threefold objective:

- Describe the elements of the evaluation and selection process for Phase A/B1 studies (start of Step 3)
- Outline some guiding principles supporting the target goal of starting the Phase A studies around the period currently foreseen
- Present an approach that would create strong additional programmatic options through the portfolio of Phase A/B1 studies

Evaluation and Selection to Phase A/B1

The objectives of the Pre-Phase A studies will be:

1 To establish – or at least identify – the consortia that would be able to carry out a Phase A/B1 and the mission implementation if selected through the following steps of the process,

2 To successfully conclude a Mission Definition Review (MDR) to confirm:

   a. The feasibility and suitability of the mission design, including the correct identification of design drivers and trade-offs
   b. The adequacy and maturity of mission requirements for the Phase A – and the flow-down from the Science Requirements for the Exploration Science type of missions
   c. The adequacy of the cost estimate with the Small Mission for EXploration (SMEX) 50 M€ original target cost

A formal review of the whole portfolio of pre-Phase A studies will be carried out in view of confirming the coherence of the missions from a programmatic point of view (e.g. alignment with Explore2040 strategy), and that the MDR objectives are achieved.

The criteria for selecting the missions which will go to Phase A/B1 were established before the start of the process (see ESA/PB-HME(2023)17, rev.2) and are displayed in Annex 2. During the portfolio review, criteria 1 to 3 will be subject to marking. A re-assessment of the programmatic relevance (already performed as part of step 1) could be performed in the case that the mission objectives were subject to changes during the execution of the Pre-Phase A.

The technology feasibility and programmatic aspects will be evaluated under criteria 2 and 3.

Criterion 4, addressing economic objectives, will be subject to a qualitative assessment.

The results of the selection will be presented to PB-HME, and confirmation of interest from the relevant States will be sought for the proposed Phase A/B1 studies.

Target goal Phase A Start: Process for proposals submission

While various possibilities have been already discussed regarding the process for the submission of Phase A(/B1) proposals, it is deemed premature to complete the process at this stage. Considering indeed the target goal for Phase A starting period, more elements of appreciation and analysis are required to devise the best way to proceed. These elements comprise the schedule of the Pre-Phase A portfolio (once all studies have been kicked off), lessons learned from the Pre-Phase A proposals submission and evaluation, as well as possibly some feedback from the start of the studies.

The guiding principle is that the consortia will be informed of the process duly in advance once the boundary conditions are known for the Phase A/B1. This would be ideally achieved for January 2025, considering that the process would have been presented beforehand to Delegations.

Presenting the outcome of the selection to Phase A/B1 and required Work Plan update during Q1/Q2 2025, would necessitate to provide the required information (e.g. cost estimate, countries' involvement) to the Boards in due time. Adaptation of the usual process might also be expected.

Regarding potential IPC approval, the recommended way forward with a tight schedule would be to directly present proposals for contract placement. This would allow to proceed quickly from requesting the proposals for Phase A/B1 to their evaluation. That approach would nevertheless require that the IPC has been previously informed of the process, for instance with an Information Note on the procurement approach presented to the December 2024 IPC in order to gain adhesion to the approach optimised around the tight timeline.

Building a portfolio of options

In a general manner, since the success of the OSIP Call led to increasing the available funding of pre-Phase As, a similar increase of scope for the following step, the Phase A/B1, would allow to better exploit the potential of the portfolio.

In particular, the specific cases of VMMO and MAGPIE (see below) can create additional programmatic options.

<u>Direct Track: VMMO, ready for Phase B1</u>

In addition to the previously listed missions, the Lunar Volatile and Mineralogy Mapper Orbiter (VMMO) mission was selected as Direct Track. The OSIP Call included indeed the possibility to submit a mission outline as a Direct Track candidate to evaluation for Phase A/B1. Such submission, including all the relevant documentation, was therefore expected to be at the level of a completed Pre-Phase A. Regarding the scientific content, VMMO was among the highest marked missions from the scientific Peer Review carried out during the evaluation phase of the OSIP Call. Besides, the study is actually at the level of a completed Phase A, thanks to its heritage as a GSTP Phase A activity (completed in 2021). In view of its submission as a Small Exploration Mission candidate, VMMO was redefined and adapted, its scope reviewed – leading notably to go from a 12U to a 16U cubesat – technical aspects were revised accordingly, and the cost estimate updated.

Thanks to its high maturity at this stage (Phase A completed), initiating the mission's Phase B1 would also constitute a risk reduction measure regarding the targeted launch date of 2029-2030. To keep the momentum on the consortium side, a Kick-Off should be targeted in early 2025.

It is therefore proposed to add VMMO Phase B1 as an additional study to the already envisaged 2 Phase A/B1 studies. The corresponding Work Plan activity would be presented at the November PB-HME.

Title	Type of Mission	Mission Category	Lead Country	Consortium
Lunar Volatile and Mineralogy Mapper Orbiter (VMMO) Low-cost CubeSat	Exploration Science	Orbiter (Cubesat)	CA	MPBC Communications Inc. (CA), Deimos Engenharia S.A (PT/ES), Critical Software (PT), Honeywell Aerospace, Ontario (CA), NGC Aerospace, Sherbrooke, Quebec (CA), Surrey Space Centre (UK), Univ. of Winnipeg (CA), Kings College University, London (UK), University of the Basque Country, UPV/EHU, Bilbao (ES), University of Valladolid (ES)

MAGPIE – Target landing in 2028

This proposed surface mission would be led by Ispace Europe, targeting a Moon landing currently planned in 2028 (one year earlier than the notional timeline, cf Figure 4 Annex 1) by using the lander developed by Ispace (Japan). It is therefore a special case as it involves upfront a non-European entity to land it with a time-critical schedule which requires accelerated implementation.

In order to seize this opportunity, some technological pre-developments, as well as other activities, would need to be initiated in 2025, in parallel to the Pre-phase A study. The corresponding WorkPlan activity could be presented to the November PB-HME. However, initiating such activity(ies) already now implies that there would be a Phase A/B1 after the Pre-Phase A. This implies that a potential MAGPIE Phase A would mean in turn that one of the two Phases A/B1 foreseen is de facto selected.

It is therefore proposed that MAGPIE Phase A(/B1) study comes in addition to the two ones planned.

Title	Type of Mission	Mission Category	Lead Country	Consortium
MAGPIE - Mission for Advanced Geophysics and Polar Ice Exploration	Exploration Science	Surface mission, rover	LU	ISPACE Europe (LU), University of Oslo (NO), Czech Technical University (CZ), KP Labs (PL), Open University (UK), TUM - Technical University of Munich (DE)

In summary, the portfolio of Phase A/B1 studies could be:

- Two proposals following the selection from the completed Pre-Phase A
- VMMO Phase B1
- MAGPIE Phase A(/B1)

For Information: Other Small Moon Missions in the broader ESA context

The High-Resolution Lunar Mineralogy Mapper (HRLMM) is a pre-Phase A study introduced in the DPTD Work and Procurement Plan in 2021, whose ITT was issued in 2023 and was kicked off in early January 2024. Two parallel contracts were placed with GMV (ES) and Creotech (PL). Potential longer-term prospects (after Pre-Phase A completion) can be discussed with the Delegations involved.

Notional timeline for the implementation of Small Missions

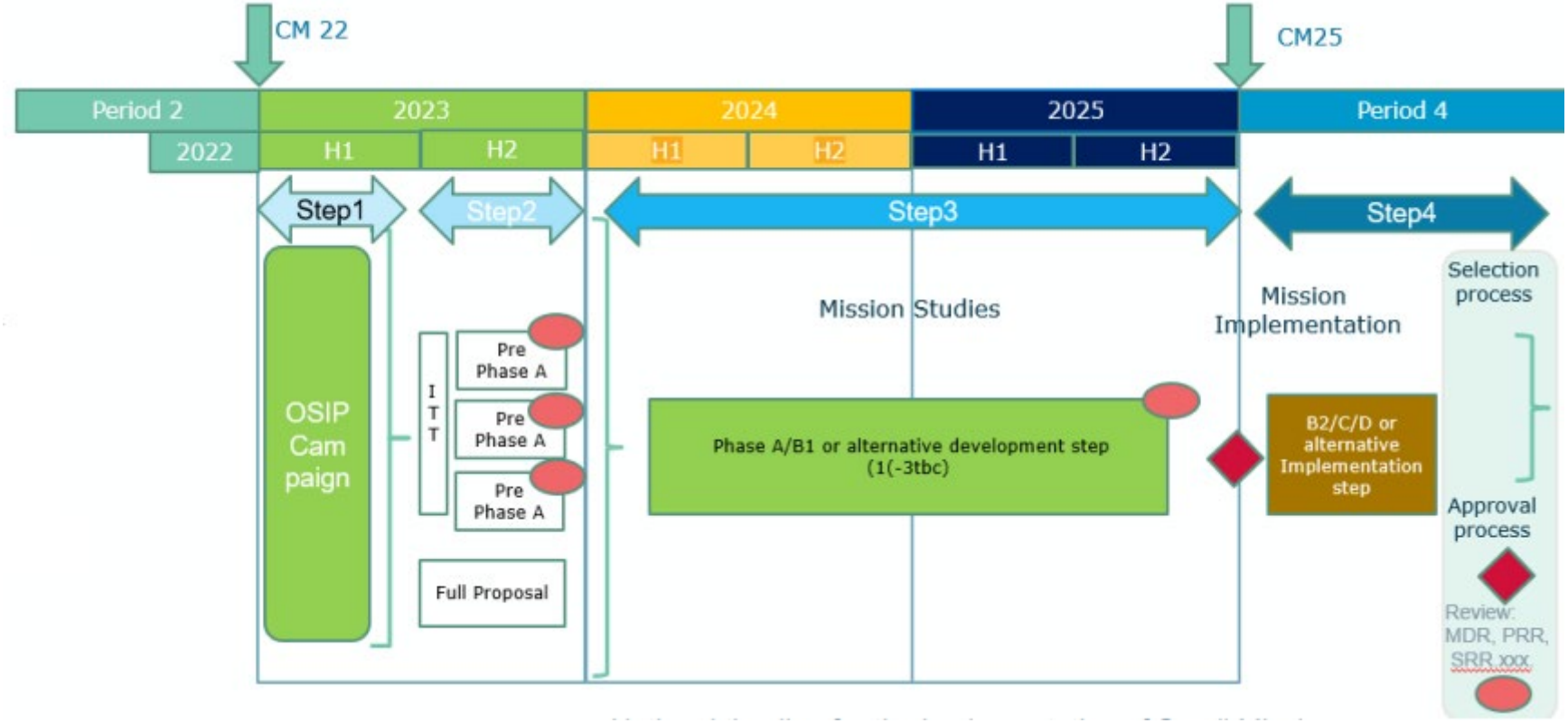
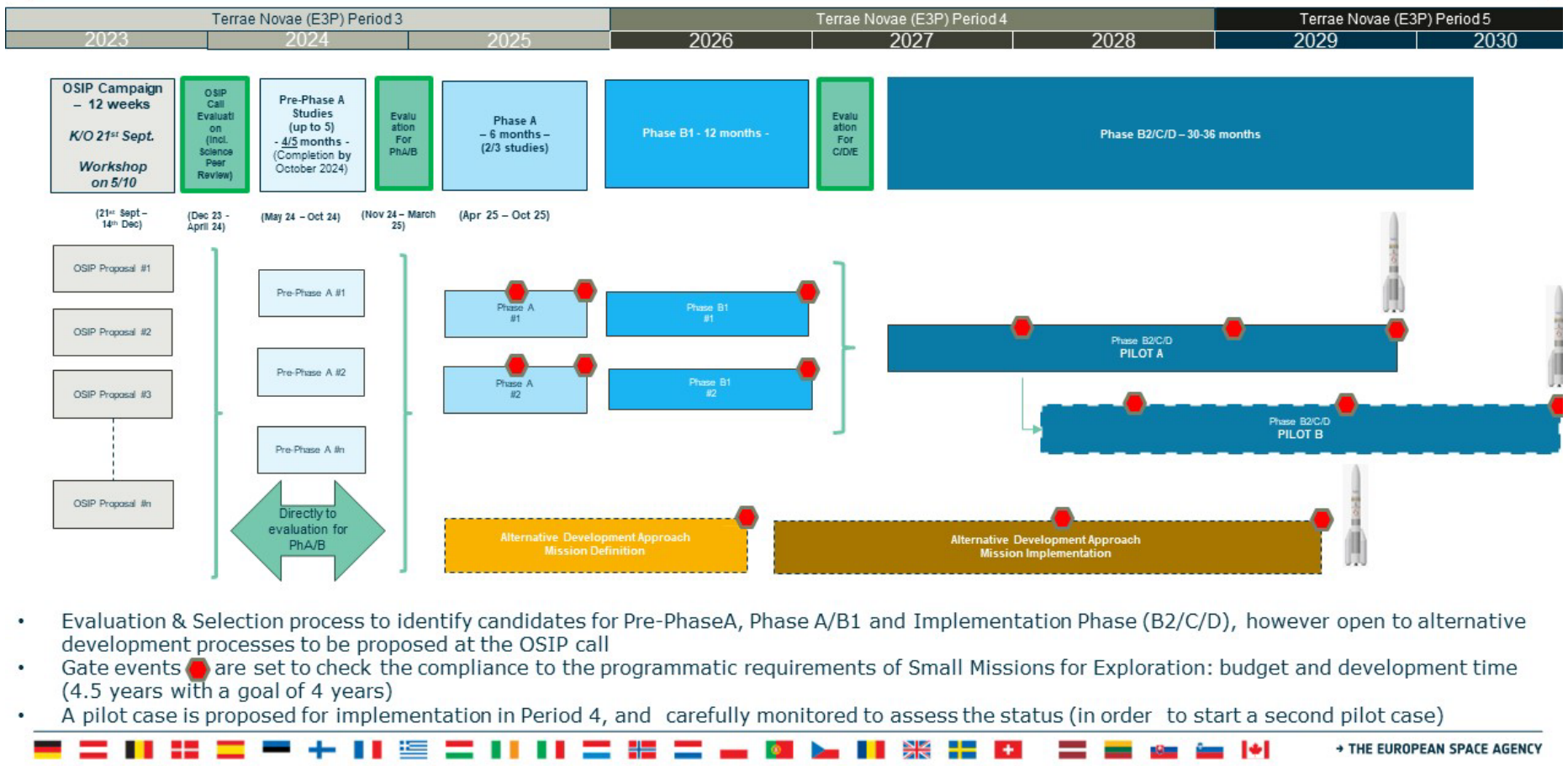


Figure 3: Document W55-06, EUB#55, May 2023

Notional timeline for the implementation of Small Missions



- Evaluation & Selection process to identify candidates for Pre-PhaseA, Phase A/B1 and Implementation Phase (B2/C/D), however open to alternative development processes to be proposed at the OSIP call
- Gate events are set to check the compliance to the programmatic requirements of Small Missions for Exploration: budget and development time (4.5 years with a goal of 4 years)
- A pilot case is proposed for implementation in Period 4, and carefully monitored to assess the status (in order to start a second pilot case)

→ THE EUROPEAN SPACE AGENCY

Figure 4: in the OSIP Call (corresponding to the notional timeline in doc. ESA/PB-HME(2023)17, rev.2; September 2023)

Selection Criteria

#	Criterion	#	Criterion encompasses	Selection at OSIP	Selection for A/B1 Studies
1	Exploration Scientific / Exploration Content	1.1	Does the mission concept address an important problem or challenge within the priority areas?	✓	☑
		1.2	Is there a clear scientific justification and motivation provided for the proposed mission objectives?	✓	☑
		1.3	What are the mission data products and what extent will they result in outcomes, which are incremental or radical/disruptive?	✓	☑
		1.4	Will the outcomes of the mission provide benefits to Earth or space exploration?	✓	☑
		1.5	Are the mission concept and the methods applied adequately developed, and traceable to the identified objectives and hypotheses?	✓	☑
		1.6	Does the applicant acknowledge scientific risks and suggest mitigation?	✓	☑
		1.7	Does the applicant have appropriate background and expertise for this proposed mission?	✓	☑
2	Technology Feasibility / Technology Readiness	2.1	Are all critical technologies (including those of the payload) and their corresponding and projected TRL identified?	[✓]	☑
		2.2	Are necessary activities for raising (by the end of Phase B2) TRL, their duration and responsible entities shall be identified?		☑
		2.3	Is the mission free from non-European mission-enabling or critical technologies? / All non-European technologies, if any, shall be identified.		☑
		2.4	Does the applicant acknowledge technical risks and suggest mitigation?	[✓]	☑
3	General Programmatics	3.1	Is the proposed mission compatible with the Terrae Novae Period 4 budget corridor ?	[✓]	☑
		3.2	Is the background, capabilities and facilities of the consortium elaborated and deemed adequate?	[✓]	☑
		3.3	Are there measurable benefits for the purpose of the specific mission.		☑
		3.4	Has a risk analysis of the programmatic (not technical) aspect been performed?	[✓]	☑
4	Economic Objectives	4.1	Does the mission enhances Startups, universities and/or schools participations within the programme?	[✓]	☑
		4.2	Does this mission create new businesses or help existing businesses to grow?		☑
		4.3	Does the proposal show that the project would develop skilled workforce?		☑

✓ Selection for Pre-Ph.A

[✓] At level required (e.g. ROM Cost) for selection for Pre-Ph.A

☑ Selection for Ph.A/B1 (inc. outcome of / update from Pre-Ph.A)