



# Call for a Medium-size and a Fast mission opportunity in ESA's Science Programme

## 1. EXECUTIVE SUMMARY

The Director of Science of the European Space Agency is soliciting the scientific community in ESA's Member States for proposals for both a "Fast" mission opportunity (to be launched in the 2030-2031 timeframe) and for a Medium mission opportunity (to be launched around 2037). The programmatic context for the present Call is described in Section 2 and the boundary conditions are described in Section 3. The proposal submission process is based on a 2-phase approach as described in Section 6 and according to the timeline indicated in Section 7.

## 2. PROGRAMMATIC BACKGROUND

The new long-term scientific plan Voyage 2050, for the Science Programme of the European Space Agency (ESA), has been issued in June 2021, following a broad consultation of the scientific community and a peer review process, with final recommendations issued by an independent scientific Senior Committee (see <https://www.cosmos.esa.int/web/voyage-2050>).

The plan includes three Large (L) missions in selected science themes (Moons of the Giant Planets, From Temperate Exoplanets to the Milky Way, and New Physical Probes of the Early Universe) and a set of Medium (M) and Fast (F) missions.

Through the present Call for Missions the Director of Science solicits from the scientific community proposals for the competitive selection of both a "Fast" mission opportunity (to be launched in the 2030-2031 timeframe) and a Medium mission opportunity (to be launched around 2037).

The definition of the F and M space missions is based on a competitive, peer-reviewed selection process. Even though the Voyage 2050 plan identifies a set of possible themes for the Medium missions, proposals in all fields of space science will be considered, with no prejudice.

## 3. BOUNDARY CONDITIONS

The proposed missions submitted in response to the present Call for mission concepts must be compatible with the boundary conditions spelled out in the present section.

More detailed technical information and boundary conditions are provided in the Technical Annex to the present Call. Further clarification, if and as needed, about some of the requirements listed in the Technical Annex can be provided to successful Phase-1 proposers at the workshop mentioned in Section 6.2.

### **3.1 Payload provision**

For both the F and M missions the CaC includes the cost of the mission's nominal operations and can include a contribution to the payload, including the case of a mission with payload fully funded by ESA (à la Gaia). For the present Call, the management and system activities of large payload elements are foreseen to be under ESA responsibility (see Sect. 7.1 of the Technical Annex). The relevant costs must be included in the ESA CaC.

### **3.2 Cost and schedule: F-class missions**

The present Call solicits proposals for F-class missions with a ceiling to the ESA Cost at Completion (CaC) of 175 M€. Proposals with a cost below this ceiling would be considered with no prejudice. Proposals with a cost to ESA exceeding the ceiling will not be considered.

F-class missions are stand-alone, ESA-led missions. As a consequence proposals for contributions to partner-led missions will not be considered.

F-class missions will be implemented through a design-to-cost approach, and with a total development duration from the early candidate selection to launch of less than 8 years.

### **3.3 Cost and schedule: M-class missions**

The present Call solicits proposals for M-class missions with a ceiling to the ESA Cost at Completion (CaC) of 550 M€. Proposals with a cost below this ceiling would be considered with no prejudice, both for stand-alone missions and for contributions to partner-led missions. Proposals with a cost to ESA exceeding the ceiling will not be considered.

The development schedule and therefore the launch date of M-class missions will be driven by the mission's complexity (and, in case of international partnerships, by the partner's schedule). It is foreseen that a mission of typical complexity making full use of the available CaC allocation (plus nationally provided payload) would require a development schedule of some 8 years from mission adoption to launch. Assuming a mission adoption in 2029, the launch would take place around 2037.

### **3.4 Technology Readiness Level**

Regardless of the implementation timescale and financial envelope, proposed missions must rely on technologies that will reach TRL 5-6 (ISO scale) by the end of the definition phase and before the mission adoption. Considering the limited time available between the selection of mission candidates following this Call and their adoption, the proposed missions must rely on technologies available at the time of the

proposal, although mission-specific technology verifications can be foreseen during the preparation phase as long as feasible within ~3 years. The specific technical requirements for the proposals are described in detail in the Annex.

### **3.5 Mission profiles**

Any mission profile can be proposed in response to the present Call as long as it fits the boundary conditions indicated above. Examples of mission profiles that can fit these boundary conditions for both F and M-class missions are described in the Annex to the present Call. These are in no way prescriptive, and proposals envisaging different mission profiles will be considered with no prejudice, conditional to their being compatible with the boundary conditions of the present Call.

The launch of the selected mission will be consistent with ESA's policy on the use of European launch vehicles, unless an international partner provides the launch vehicle on a no exchange of funds basis.

### **3.6 International collaborations**

M-class missions are a key vehicle for pursuing collaboration opportunities between the ESA Science Programme and other space agencies. As such, any international collaboration scheme can be considered for the implementation of M-class missions: an M-class mission can be entirely European, or it can be European-led with junior participation by international partners, or (part of) the budget allocation of an M mission can be used to implement a junior European contribution to a mission led by a partner agency. All these scenarios have been implemented in the Programme's history.

M-class mission proposals submitted in response to the present Call can be based on all possible international collaboration schemes, i.e., proposals are allowed for both European-only missions as well as for missions in collaboration with international partners. In case an international collaboration is proposed, the proposal must clearly identify whether the mission is proposed as European-led or as a contribution to a partner-led mission, with a clear management scheme proposed in either case.

F-class mission proposals submitted in response to the present Call must be ESA-led, stand-alone missions, possibly with participation by international partners.

Any international partnership scheme will be contingent to the availability of partner agencies willing to pursue the scheme.

## **4. PROPOSAL ENDORSEMENT BY NATIONAL FUNDING AGENCIES**

ESA Science missions are, in general, collaborative undertakings between ESA and its Member States (as well as, in a number of cases, international partners). For the majority of missions, the relative share of responsibilities between ESA and the Member States is based on ESA procuring the spacecraft and the launch vehicle, and being also responsible for the launch services and for the operations.

Payload elements are in most cases procured under the responsibility of scientific consortia funded by Member State agencies, with a varying degree of ESA involvement, with some missions featuring payloads which are funded entirely by the Member States (and in some cases with the contribution of international partners, e.g., JUICE, Euclid, or Ariel) and other missions featuring payload for which the procurement is shared between ESA and the nationally funded consortia. For example, ESA is procuring the telescope assembly and the optical detectors for the Euclid mission, and the complete suite of focal plane detectors, together with the payload management, for the PLATO mission. For some missions (e.g., Gaia) the payload was entirely ESA-procured.

The science ground segment of the missions is in most cases procured under the shared responsibility of ESA and of the Member States, with ESA normally being responsible for the science operations and nationally funded consortia contributing to instrument-specific data processing and calibration activities. In some cases the scientific data processing is almost entirely performed by nationally funded consortia (e.g., Gaia through the Data Processing and Analysis Consortium).

Any of the above schemes can be proposed in response to the present Call. Proposers will have to clearly indicate the proposed share of responsibilities between ESA and the Member States (and eventual international partners), by indicating which mission elements they propose to be procured under their responsibility with funding from the Member States and which elements they propose to be ESA-procured. The proposal must therefore define a Lead Proposer (who shall be the formal point of contact between the Agency and the proposing team during the study phase for selected proposals), include a definition of the payload consortium or consortia (or core consortium) and provide the foreseen distribution of tasks and responsibilities within the consortium (in the “Management” section of the proposal).

Note that it is not planned to issue an “Announcement of Opportunity” for the payload of the missions selected for study. Hence (while susceptible to evolution if necessary) the consortium or consortia defined in the “Management” section of the proposal will be tasked with carrying out the study activities for selected proposals.

ESA intends to implement an enhanced consultation phase with Member State agencies (and if applicable, with international partners) after Proposal submission and prior to their evaluation. Letters of Endorsement from Member State agencies (and international partners, if applicable) will be required after the Proposal submission, according to the deadline indicated in Section 7.

Proposers are of course strongly recommended to interact with their funding agencies already at the beginning of the proposal phase to verify their readiness to support the proposal.

The Letters of Endorsement will have to state the readiness of Member State agencies to undertake the necessary action to secure funding for the study (Phase B1, subject to the mission selection) and implementation (Phases B2/C/D/E/F, subject to the mission adoption) of the nationally provided mission elements falling under their responsibility, contingent on the consolidation of the cost figures for all nationally funded mission elements.

The Letters of Endorsement will have to be addressed to the ESA Director of Science, and sent directly by the Member State agencies by email to the address

[endorsement-2021-call@cosmos.esa.int](mailto:endorsement-2021-call@cosmos.esa.int)

It is understood that commitments by funding agencies of the complete set of mission elements proposed to be nationally funded may not be achievable already at the time of the submission of the Letters of Endorsement. However, proposers must strive to demonstrate the funding and feasibility of the proposed payload complement by showing the presence of at least a “core consortium” (e.g., for astronomical telescopes with an integrated payload complement) or a “core payload complement” (e.g., for solar system missions featuring several individual instruments). It is understood that the funding scheme of the nationally provided mission elements may require consolidation during the study phase prior to the mission selection.

Assessment of the adequacy of the proposed consortium as demonstrated by its preliminary definition, including a distribution of tasks and responsibilities within the consortium supported by the submitted Letters of Endorsement will form an important part of the proposal’s technical and programmatic evaluation.

## **5. SCIENCE MANAGEMENT**

Proposers must clearly explain their science management concepts, including their proposed approach to data ownership, broad community involvement, and division of mission responsibilities between ESA, the Member States and the international partners (if applicable). Acceptance of a proposal does not constrain ESA to adhere to the proposed scheme, which will however constitute a starting point for the selected mission. For the selected mission a Science Management Plan will be prepared by ESA in coordination with a Science Study Team; this plan will undergo revision by the Science Advisory Structure of the ESA Science Programme and approval by the Science Programme Committee (SPC).

## **6. PROPOSAL SUBMISSION PHASES**

The selection will be based on a 2-phase proposal process. Following reception of the “Phase-1 proposals” (see Section 6.1 for details) a first technical and scientific screening of the proposed mission concepts will be performed by ESA (for the mission profile and implementation aspects) and by a peer review committee under the responsibility of the ESA Science Advisory Structure (for the scientific goals).

An on-line briefing to prospective proposers will take place on 13 January 2022. The goal of the briefing is to provide any necessary clarification relative to scope of the Phase-1 proposal, the expected information, possible international cooperation schemes, possible payload provision schemes, etc.

Prospective proposers should register for the on-line briefing in advance (with a deadline of 11 January 2022 at 12:00(noon) CET) at the on-line interface available at

<https://www.cosmos.esa.int/web/call-for-missions-2021>

Proposers whose Phase-1 proposals will have been considered likely to meet the technical feasibility and whose science case will be considered sufficiently competitive by the scientific peer review will be invited to a dedicated workshop (see Section 6.2 for details). At this workshop the feasibility of the individual ideas will be discussed in detail, following which the proposers will be invited to submit a detailed “Phase-2 proposal” (see Section 6.3 for details).

The Phase-2 proposals will be subject to a detailed technical and programmatic screening by ESA for assessing their feasibility and consulting the potential partners to the mission during the evaluation phase. Following this technical and programmatic screening, the selection process will be based on the scientific merit of the proposals, assessed through peer review under the responsibility of the ESA Science Advisory Structure.

ESA will share the proposals with Member State agencies and with SPC delegations, e.g., for the purpose of discussing their commitment, as well as, when applicable, with the proposed international partners. Therefore, ESA cannot ensure the confidentiality of the submitted material.

Details of the personal data protection measures that apply to this Call can be found in the privacy notice on the submission website.

## **6.1 Phase-1 Proposals**

### **6.1.1 Content and submission of Phase-1 proposals**

The deadline for submission of Phase-1 proposals in response to the present Call is stated in Section 7. Late submissions will not be considered; proposers are thus invited to submit their Phase-1 proposals well in advance of the deadline.

Proposals will be accepted exclusively in electronic PDF format, submitted via the interface available at

<https://www.cosmos.esa.int/web/call-for-missions-2021>

Phase-1 proposals will be limited in length to 10 A4 pages, with a minimum font size of 11 pt, and a maximum file size of 50 Mbytes. Proposals with file size in excess of this limit will be rejected by the submission system.

Phase-1 proposals must contain all the information indicated below. Proposals missing one or more of the indicated elements may fail the initial technical, programmatic and scientific screening. The suggested number of pages for each topic is indicative. Proposers are thus free to give more emphasis to one topic with respect to others. However, the total number of pages in the proposal is a hard limit; proposals exceeding the total page limit will not be considered for evaluation.

Phase-1 proposals must be structured to contain the following information:

- Cover page: including which mission classification the proposal is intended for (M-class or F-class), the proposal title, and name and full contact information of Lead Proposer;
- Back cover page: List of core team members (names and institutions) insofar as known/available;
- Section on scientific goals of the mission (3 pages);
- Mission configuration, including mission profile, payload/instrument configuration, technology, etc., with specific reference to the boundary conditions indicated in Section 3 (3 pages);
- Potential management structure, payload consortium/consortia composition and expected main funding agencies involved in the payload provision, including eventual (if applicable) proposed international collaboration elements (2 pages).

It is understood that the proposal's structure and content may evolve between submission of the Phase-1 proposal and submission of the Phase-2 proposal, e.g., in terms of detailed technical configuration, payload consortia composition, or presence of possible international partners. The Lead Proposer and the proposal's title identified in the Phase-1 proposal, however, must remain the same throughout the process.

Any further communication between ESA and the proposing team will only take place through the Lead Proposer.

Failure to submit a Phase-1 proposal by the deadline stated in Section 7 will prevent teams/proposers from the possibility of submitting a Phase-2 proposal.

### **6.1.2 Evaluation of Phase-1 proposals and following steps**

Phase-1 proposals will be subject to a technical and programmatic screening by ESA to evaluate their compatibility with the boundary conditions indicated in Section 2. Phase-1 proposals that will have been considered likely to meet the technical feasibility will be subject to a scientific screening performed under the responsibility of the ESA Science Advisory Structure.

The results of the Phase-1 selection will be communicated to the competing teams and only proposers whose Phase-1 proposals will have been considered likely to meet the technical feasibility and whose science case will be considered sufficiently competitive by the ESA Science Advisory Structure will be invited for the next steps of the process.

## **6.2 Workshop in preparation for Phase-2 proposals**

Proposers whose Phase-1 proposals will have passed the Phase-1 selection will be invited to dedicated workshops (separately for the F-class and the M-class mission proposals) in preparation for Phase-2 proposals.

The purpose of the workshops will be to discuss in detail, collegially but also with individual sessions for each team, the feasibility of candidate missions with the ESA engineering team, in advance of the submission of the "Phase-2 proposal" (see Section 6.3 for details).

The date and location of the workshops will be communicated to the Lead Proposers.

### **6.3 Phase-2 proposals: Structure, content, page limits and submission**

The deadline for submission of Phase-2 proposals in response to the present Call is stated in Section 7. Late submissions will not be considered. Proposals will be accepted exclusively in electronic PDF format, submitted via the interface available at

<https://www.cosmos.esa.int/web/call-for-missions-2021>

Proposals will be limited in length to 50 A4 pages (not including annexes), with a minimum font size of 11 pt, and a maximum file size of 100 Mbytes (including annexes). Proposals with file size in excess of this limit will be rejected by the submission system.

Phase-2 proposals not preceded by a corresponding Phase-1 proposal that has passed the Phase-1 screening will not be considered.

Proposals must contain all the information indicated in Section 6.3.1. Proposals missing one or more of the indicated elements may fail the technical and programmatic screening. The suggested number of pages for each topic is indicative, unless otherwise stated. Proposers are thus free to give more emphasis to one topic with respect to others. However, the total number of pages in the proposal is a hard limit; proposals exceeding the total page limit will not be considered for evaluation.

#### **6.3.1 Topics to be covered in the proposal and page limits**

- Cover page (1 page, mandatory limit): must clearly indicate which mission classification the proposal is intended for (M-class or F-class), the proposal name and the name of the Lead Proposer. Any other information is optional;
- Contact information page (1 page, mandatory limit): must clearly indicate the contact information for the Lead Proposer. The proposal must explicitly state the availability of the Lead Proposer to support the study activities by making available at least 20% of his/her time throughout the study period. Note that the Lead Proposer will be the formal point of contact between the Agency and the proposing team throughout the study phase;
- Executive summary (2 pages, mandatory limit): should contain a summary of the proposal, allowing the reader to gain a preliminary understanding of the proposal's content upon reading;
- Science case (10 pages, suggested length): should clearly address the scientific rationale for the proposed mission, explaining the broad context, the progress in the relevant field that the proposed mission will achieve, the need to perform the relevant measurements from space, the eventual synergy with other facilities (ground- and space-based), etc. It is suggested to assume that the relevant readers will be scientists from other fields of space science, hence not necessarily experts in the field;
- Scientific requirements (5 pages, suggested length): should explain how mission science objectives flow into scientific requirements, what are the required measurements, and how these translate into instrument requirements. For the



selected mission the information provided in this section will constitute the starting point for producing the Science Requirements Document, the Mission Requirements Document and the Payload Definition Document. Content of this section should be understandable by both scientists and engineers;

- Proposed scientific instruments (14 pages, suggested length): should explain, following on the definition of scientific requirements, what instrument(s) will be needed to achieve the required measurements. While the proposal is not intended to contain engineering blueprints, the information provided should allow readers to assess feasibility and maturity level of the proposed instruments. Relevant information about, e.g., TRL, heritage, etc. needs to be provided. To allow a proper technical evaluation of the proposal the following information needs to be provided:
  - Measurement principle/detection concept;
  - Block diagram: main building-blocks and subsystems, including software;
  - Design description (down to major subsystems) and operating principle;
  - Performance budgets;
  - Required resources: volume, mass, power, data transmission;
  - Specific/critical interface requirements to the spacecraft and environment constraints, e.g. accommodation, integration, cooling, pointing, contamination and cleanliness, radiations, magnetic cleanliness, etc.;
  - Specific calibration needs (on ground and in orbit); and
  - TRL assessment per unit and relevant heritage.
- Proposed mission configuration and profile (10 pages, suggested length): it should contain a description of the proposed mission needs, including the orbit, launch, etc., together with the system level requirements imposed by the mission concept (e.g., pointing requirements, sun aspect angle constraints, specific observing modes, etc.). Relevant options and trade-offs should be identified. A concept for the operations should be provided, describing the mission phases from launch to end of life (e.g., as relevant: observing strategy, measurement sequence, specific modes for science or calibration aspects, spacecraft disposal at end of life, etc.). Details of the spacecraft should be provided as far as available, including possible spacecraft design, requirements/description of major subsystems and estimation of spacecraft key budgets (possibly by benchmarking with previous missions). Proposers may make reference to the mission profiles described in the Annex to the present Call or deviate from them, by providing necessary elements for enabling the proposal assessment;
- Management scheme (5 pages, suggested length): proposers should spell out the proposed procurement scheme for all mission elements, indicating which elements are proposed to be ESA-procured and which procured by nationally funded consortia or international partners (if applicable). The consortia organisation and the distribution of tasks and responsibilities (work breakdown structure for the core team with key persons) should be detailed, for both the Phase A/B and subsequent phases. The proposers are also invited to detail where relevant any specific task they believe should be achieved during the Phase A/B, in addition to the regular study activities, for the purpose of the mission selection. Should the mission be proposed as an international collaboration, the proposed collaboration scheme should be described in this section. Proposers should

describe the proposed science management plan (data policy, community involvement, etc.) – see Section 5;

- Costing (2 pages, suggested length): while proposers are not expected to provide detailed costing information about the proposed mission, they should argue convincingly that it can be implemented within the relevant CaC ceiling (see Section 3), in particular if the proposed mission is deviating from the guidelines provided in the Annex to the present Call;
- Bibliography: not required but encouraged. The list of references can be included as an Annex; it will not count against the page limits.

Details on Letters of Endorsement from Member State agencies are given in Section 4. They are not required at the time of the submission of the proposal, but they are mandatory by the deadline stated in Section 7.

## **6.4 Phase-2 proposal evaluation**

Valid Phase-2 proposals (i.e., received by the deadline indicated in Section 7 and supported by Letters of Endorsement from Member State agencies as indicated in Section 4) will be subject to a strict technical and programmatic screening by ESA, aiming at ascertaining the compatibility of the proposed mission with the Call's boundary conditions.

Phase-2 proposals which will be found to be incompatible with the Call's programmatic boundaries, or which do not provide the required endorsement for the mission elements proposed to be nationally provided (or provided by international partners) will be marked as “unfeasible” and will not be subject to the scientific peer review.

Phase-2 proposals that are considered feasible will be submitted to a scientific peer review process conducted under the responsibility of the ESA Science Advisory Structure. Based on this evaluation, the ESA Director of Science plans to select up to three M-mission proposals and one F-mission proposal for a study phase.

A written debriefing will be provided to all proposers, comprising in all cases a short technical and programmatic assessment of the proposal, as well as, for the proposals which were submitted to the scientific peer review, a scientific evaluation. No face-to-face debriefing meetings are planned.

Further details on the plans for the studies of the selected mission proposals and the further activities will be provided to proposers that have been invited to submit Phase-2 proposals, at latest at the time of the workshops.

## 7. DEADLINES AND SCHEDULE

All dates are subject to confirmation.

<b>Activity</b>	<b>Date</b>
Release of Call for an M and an F mission	13 December 2021
Briefing for proposers	13 January 2022
Phase-1 proposal submission deadline	14 February 2022 – 12:00 (noon) CET
Phase-1 proposal assessment	February-April 2022
Phase-1 proposer notification	Mid-April 2022 (exact date TBD)
Workshops for Phase-2 proposers	End-April 2022 (exact date TBD)
Phase-2 proposal submission deadline	15 July 2022 – 12:00 (noon) CEST
Letters of Endorsement deadline	15 September 2022, 12:00 (noon) CEST
Proposal evaluation and scientific ranking	July – October 2022
Selection of missions for study	November 2022