2010 Call for a Medium-size mission opportunity in ESA's Science Programme for a launch in 2022

1 INTRODUCTION

ESA's Science Programme has for more than two decades been based on long-term planning of scientific goals. The first long-term plan was *Horizon 2000*, started in 1984, followed by *Horizon 2000+*, in 1995, and, more recently, by the *Cosmic Vision 2015-2025* plan, published in 2005. The *Cosmic Vision* plan, established on the basis of a bottom-up process that started with a consultation of the broad scientific community, contains the wide-ranging and ambitious scientific questions that the ESA Science Programme should address in the decade up to approximately 2025. The plan (available as ESA BR-247[1]) describes science themes and topics, and leaves the definition of the actual space missions that will address the science themes in question to a series of competitive "Calls for Missions".

The first Call for Missions for the Cosmic Vision plan was issued in March 2007, and following an initial selection of mission concepts for assessment studies, has resulted in the selection of three candidates for two launch slots for "Medium" (or M) missions and of three candidates for a launch slot for "Large" (or L) missions. The two launch slots for M missions are currently foreseen in 2017 and 2018, and the three missions currently competing are Euclid[2], PLATO[3] and Solar Orbiter[4], addressing respectively dark energy, exo-planetary science, and solar physics. All three candidate M missions are ESA-led with planned participation from international partners.

The three L missions competing for the first L mission slot are IXO[5], Laplace-EJSM[6] and LISA[7]. All three of them are planned to be major international collaborations. While the current ESA programmatic planning allows for the launch of the first L mission to take place in 2020, the actual launch date will also depend on the scientific priorities and financial planning of all involved partners, as well as on the mission's readiness status. A first decision on the down-selection of the candidate L missions is currently planned in June 2011.

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[1] http://sci.esa.int/jump.cfm?oid=38542
[2] http://sci.esa.int/euclid
[3] http://sci.esa.int/plato
[4] http://sci.esa.int/solarorbiter
[5] http://sci.esa.int/ixo
[6] http://sci.esa.int/ejsm
[7] http://sci.esa.int/lisa

Following the first L mission, a further M mission launch slot is planned in late 2022 (approximately two years after the first L mission). Should however the launch date of the first L mission slip significantly (e.g. because of the need to reconcile the planning of the ESA Science Programme with that of the international partners) the M mission launch opportunity planned for 2022 could be brought forward in time to 2020.

A decision on which two missions among Euclid, PLATO and Solar Orbiter to implement for launch in 2017 and 2018 is currently planned to be taken by the Science Programme Committee (SPC) in June 2011.

At the June 2010 SPC meeting it was also decided that the mission not adopted in 2011 for implementation among Euclid, PLATO and Solar Orbiter will be considered as a possible competitor to the initially selected proposals from the present Call until the end of the initial Assessment Phase studies for these proposals. As a consequence, SPC may decide, at the end of the Assessment Phase of the mission concepts selected in response to the present Call, to finally implement the mission not selected in 2011 for implementation among Euclid, PLATO and Solar Orbiter and not pursue Definition Studies for any of the mission concepts proposed in response to the present Call.

2 PURPOSE OF THE PRESENT CALL FOR MISSIONS

Through the present Call for Missions the Director of Science and Robotic Exploration solicits from the broad scientific community proposals for the competitive selection of mission concepts to be candidate for the implementation of one Medium mission for launch in 2022, following the launch of the first L mission (to be selected among the L mission candidates currently being studied). The launch of the M mission selected through the present Call could be brought forward to approximately 2020 should the first L mission slip in time. Depending on the proposals received, and on their scientific quality, a mix of smaller missions approximately equivalent, in terms of overall financial envelope and profile, to one M mission could also result from the present Call.

2.1 Scientific goals of the proposed missions

The missions proposed in response to the present Call should address the science goals and questions described in the *Cosmic Vision* plan. The goals of the proposed mission and their relation with the *Cosmic Vision* plan should be addressed explicitly in the proposal. No limitations to the science goals addressed, other than their relevance to the *Cosmic Vision* plan, are imposed on the proposals.

2.2 Allowed mission categories

Medium missions are defined for the purpose of the present Call as space missions whose total cost to be covered by the ESA Science Programme does not exceed 470 M€ at 2010 economic conditions, and with an implementation schedule compatible with a potential 2020 launch.

Experience shows that the funding ceiling mentioned above allows, in the ESA Science Programme, for the implementation of Soyuz-class missions, of which the current three candidates for the 2017 and 2018 launch slots are good examples.

The costs covered by the ESA Science Programme traditionally include the spacecraft, the launch services and the mission and science operations, with the payload being provided and funded by the ESA Member States. Exceptions to this model are however possible: in the case of Solar Orbiter launch services are provided by an international partner, and in the case of Gaia the payload is fully ESA-funded and provided, due to the need for its development to be intimately linked to the design and development of the spacecraft.

If the initial technical and programmatic assessment of a proposed mission is found to exceed the M mission cost ceiling, the proposal will not be brought forward as a candidate for the following phases.

While the bulk of responses to the present AO may well consist of proposals for Soyuz-class ESA-only or ESA-led missions, there is no requirement for proposals to reach the cost ceiling. The present AO also explicitly solicits proposals for smaller missions and for contribution to missions led by other agencies.

2.2.1 Smaller missions

Proposals for missions at a cost lower than the M-mission cost ceiling indicated above (470 M€, 2010 e.c.) are also explicitly solicited in the present Call for Missions. Such proposals will have to address original and self-standing scientific goals, and not limit themselves e.g. to technology demonstration. They will be assessed in parallel with proposals competing for the full financial allocation of 470 M€, and will have therefore to be competitive in terms of "science for money". No lower limit to the size of smaller missions is imposed in the context of the Call.

The approach taken to the study and eventual implementation of such proposed missions, should they be selected, will depend on the size and nature of the proposed contribution and on the commitment indication of the eventual proposed partners.

2.2.2 Contributions to missions led by international partners

The present Call also solicits proposals for European, ESA-funded contributions to missions led by international partners. Successful past examples of such contributions include the Huygens probe on NASA-led's Cassini mission or the NIRSpec instrument and launch services on NASA-led's James Webb Space Telescope (JWST). Proposals for contributions to missions led by international partners should propose a scientifically and technologically visible role for Europe, and should result in a commensurate scientific return for European scientists. The financial envelope of the proposed ESA contribution will also be capped at 470 M€. Also in this context smaller contributions will be considered, and again evaluated on the basis of their "science for money" return. In case of proposals for participation to missions led by other agencies, the proposed contribution

will also be assessed in terms of its overall content in terms of European technological and scientific expertise and contributions.

2.3 Technological readiness

Regardless of the type of proposal, its implementation timescale and financial envelope, the proposed missions must rely on available technology, and in particular must rely on technology that will be at TRL 5 by the end of the Definition Phase. This TRL level must be reached prior to the mission being adopted for Implementation. The specific technical requirements for the proposals are described in detail in the Annex, section 2.6

2.4 Utilization of the International Space Station (ISS)

Proposals for the utilization of the ISS are not solicited in the present Call. Interested potential users of the ISS are invited to contact ESA's directorate of Human Space Flight for details of ISS utilization opportunities.

2.5 Mars and Lunar science

ESA is running, in parallel with the Science Programme, a Robotic Exploration Programme, that at the moment is working on the implementation of two Mars exploration missions for launch in 2016 and 2018, and on a longer-term plan for Martian exploration, which is directed ultimately to achieve a joint Mars Sample Return mission, and in the immediate term places a high priority on astrobiological goals. Lunar exploration falls under the responsibility of the ESA directorate of Human Space Flight (HSF). The present Call has no restrictions in terms of the science themes that can be addressed. However, proposals addressing Mars or Lunar science should clearly address the potential relationship with the activities currently being carried out in the context of the Robotic Exploration Programme and of the activity of the HSF directorate, and explain if and how they are complementary to, and should be funded independently of, these activities.

3 PAYLOAD FUNDING

Most missions in the ESA Science Programme have to date been implemented with payload provided and funded by the ESA Member States (although with some exceptions, e.g. the Gaia payload or the NIRSpec instrument for NASA's JWST mission, both procured by ESA with industrial contracts). In some cases, payload has been provided by participating international partners. National funding of payload is also expected to be the baseline for the proposals submitted in response to the present Call. However, alternative payload funding schemes can be proposed, and will be considered.

Regardless of the payload-funding scheme considered, proposers must clearly discuss in their proposals the payload development and funding scheme they propose to adopt, together with the rationale for the approach.

4 SCHEDULE FOR THE PRESENT CALL FOR MISSIONS

The deadline for submission of proposals in response to the present Call for missions is December 3, 2010, at 12:00 (noon) Central European Time. Late submissions will not be considered. Submissions are accepted exclusively in electronic form, in PDF format, using the interface available at http://sci.esa.int/2010_M_Call. Proposals will be limited in length to 41 A4 pages (including any title page, appendices, bibliography, etc.), with a minimum font size of 11 pt, and a maximum file size of 50 Mbytes. A description of the expected proposal content is available in the Annex. Any material in excess of the page limit will be removed and will not be submitted to the proposal reviewers. Proposals with file size in excess of the limit indicated above will be rejected by the submission system.

4.1 Letters of Intent

Prospective proposers are required to submit, by September 15, 2010, at 12:00 (noon) Central European Time, a Letter of Intent stating their intention to submit a proposal in response to the present Call. Submission of a Letter of Intent is mandatory; proposals not preceded by a corresponding Letter of Intent will not be considered. The Letter of Intent should have a maximum length of 1 A4 page, minimum font size 11 pt, and a copy should be sent to the national funding agencies expected to play a major role in the funding of any mission element (in particular of the proposed payload). They should only contain the name of a contact point for the proposal, the proposal title and a brief description of the science goals to be addressed. No scientific justification will be needed in the Letter of Intent. The purpose of the Letter of Intent will be to allow ESA to make the necessary preparation for the proposal evaluation process.

Letters of Intent may have as an attachment a list of questions the proposer would like to see addressed at the briefing meeting. This list is limited in length to 1 A4 page. No support or endorsement letters should be attached to the Letters of Intent.

4.2 Briefing meeting

Following the submission of a Letter of Intent, proposers will be invited to a briefing meeting, currently planned for September 29, to be held at ESTEC (The Netherlands). Confirmation of the date and of the logistical details for the briefing meeting will be communicated to the contact points indicated in the Letters of Intent.

4.3 International collaborations

Proposals for projects to be carried out in cooperation with international partners (e.g. space agencies of other, non-ESA countries) are welcome. These may be projects to be led by ESA with minor contributions from other agencies, as well as ESA contributions to projects led by other agencies. Proposals involving international cooperation should state

clearly the elements of the proposed cooperation scheme, such as the proposed roles and responsibilities for all partners and the funding scheme for the non-ESA funded elements.

In all cases letters of acknowledgement from the proposed partner agencies, stating their awareness concerning the cooperation scheme, are highly encouraged. The letters in question should be appended to the proposal, and will not count against the page limit for the length of the proposals.

For all proposals ESA reserves the right to contact the proposed international partners during the proposal evaluation phase, to verify the programmatic status of the proposed cooperation and the partners' availability to support the Assessment Phase of the mission under the proposed scheme, should the proposal be selected.

5 PROJECT IMPLEMENTATION APPROACH

The currently foreseen implementation scheme of the selected proposals will follow the current practice of the ESA Science Programme. This foresees a two-stage competitive down-selection. Under this scheme, a number of proposals will be selected for a competitive Assessment Phase, consisting of both ESA-internal and industrial study activities, to be carried out in parallel with nationally-funded payload study activities, for an approximate duration of 18 to 24 months. At the end of this phase, a smaller number of mission concepts will be proposed for selection by the SPC, on the basis of the outcome of the Assessment Phase, for a competitive Definition Phase.

It is expected that an Announcement of Opportunity for the nationally funded payload elements will be issued by ESA at the start of the Definition Phase for the selected missions; this will lead to selection of the payload and of the consortia providing the payload.

During the Definition Phase, mission concepts will be studied to the end of Phase B1, both through ESA-funded industrial studies and through nationally-funded studies of the payload components. This phase is also projected to last for approximately 18 to 24 months. At the end of the Definition Phase the SPC will adopt one mission for implementation, with an Implementation Phase foreseen to last approximately 6 years, depending on the project's complexity. SPC might eventually decide to adopt more than one mission, depending on the mission cost and nature, e.g. the presence of international cooperation schemes that might result in lower costs to ESA.

The foreseen implementation approach described here is indicative only, and may be modified depending on the evolution of the ESA Science Programme. The approach may also be tuned as needed in the case of smaller missions and of participations to missions led by international partners.

6 PROPOSAL EVALUATION

All proposals received in response to the present Call will be subject to a technical and programmatic evaluation by ESA, covering issues such as technology readiness, proposed international collaboration scheme (if applicable), etc. One specific aspect addressed during the initial technical and programmatic evaluation will be a "Rough Order of Magnitude" assessment of the mission cost. The proposals will be ranked scientifically by the Advisory Structure to the ESA Science Programme, composed of discipline-specific Working Groups and of the Space Science Advisory Committee (SSAC), who will consider the advice of the Working Groups and will issue the final advice to ESA.

The SSAC will be asked to rank the missions scientifically, keeping into account the technical and programmatic evaluation performed by ESA, and explicitly addressing the science return to the European scientific community in relation to the cost to ESA ("science for money"). The SSAC will recommend a number of proposals to be selected for an Assessment Phase study. The number of proposals that will enter the Assessment phase will depend on a number of factors, including the balance between ESA-led and international cooperation projects among the scientifically top-ranking proposals, and the technological challenges presented by the proposals. The Advisory Structure may decide, at their discretion, to interview a limited number of proposers prior to issuing a recommendation.

A decision by the Director on the basis of the SSAC recommendation is expected to take place in March 2011. All proposers will be notified of the outcome of their proposals.

7 DEADLINES AND SCHEDULES

Activity	Date
Letter of Intent submission deadline	September 15, 2010 (12:00 CET)
Briefing meeting	September 29, 2010 (TBC)
Proposal submission deadline	December 3, 2010 (12:00 CET)
Proposal evaluation	December 2010-February 2011