



# Call for White Papers for the definition of the L2 and L3 missions in the ESA Science Programme

5 March 2013

## EXECUTIVE SUMMARY

The Director of Science and Robotic Exploration intends to define, in the course of 2013, the science themes and questions that will be addressed by the “L2” and “L3” missions. These are the two Large missions in the Cosmic Vision plan currently planned for a launch in 2028 and 2034, following the already selected L1 mission JUICE, to be launched in 2022. This process will start with a consultation of the broad scientific community, in the form of a “Call for White Papers”, solicited through the present document. By means of the White Papers, the scientific community is invited to submit proposals for science themes and associated questions that should be addressed by the L2 and L3 missions.

## INTRODUCTION

The ESA Scientific Programme is today a key player on the world scene. This European success has been made possible by the Programme’s approach to long-term planning, that has fostered a balance between large and smaller projects, between purely European and cooperative projects, between the various research fields, and between missions identified long in advance (providing long-term stability) and missions defined as the result of regular Calls for Missions (providing flexibility). The Large missions are the Programme’s pillars, and a fundamental element of its long-term planning. As a consequence, their definition should rely on a long-term perspective. A long-term planning horizon is needed to ensure the adequate technological and scientific preparation required by missions that should provide a significant, paradigm-changing advance in their respective fields. Such missions have long been the cornerstones of the Science Programme.

A number of L missions or programme pillars (called “Cornerstones” in the course of the previous planning cycles) have been successfully implemented to date in the Science Programme. These are SOHO and Cluster (considered as a single element in the Programme planning), Rosetta, XMM-Newton and Herschel. Two more such missions (Gaia and BepiColombo) are currently under implementation, and a further one (JUICE, as the L1 mission) was selected by the SPC in 2012, and is currently in an advanced study phase. L missions are interspersed, in the Programme, with a regular sequence of Medium (or “M”) missions, selected through individual, ad hoc calls. This approach conjugates the stability and long-term horizon provided by the L missions with the flexibility and the capability, provided by the M missions, to respond to new, unforeseen scientific questions. Missions of opportunity and small mission (such as the recently selected CHEOPS small mission) provide additional flexibility to the Programme.

The Programme’s current broad scientific goals have been defined through a community consultation that took place in 2004, and that resulted in the “Cosmic Vision” plan (or CV plan, available at <http://sci.esa.int/CVplan>). The CV plan provides a broad series of science themes and

questions, together with strawman mission concepts. However the CV plan, given the large number of science themes and mission concepts described in it, was not meant to be a straight blueprint for implementation.

### **WHAT IS AN L MISSION?**

L missions are the pillars of the Science Programme, providing stability and a long-term planning framework to the scientific community and the ESA Member States. As such, they provide the “anchoring points” to the rest of the Programme.

Throughout the history of the Science Programme, “cornerstone” missions have been identified well in advance of their implementation. In the context of the Programme’s first long-term plan, H2000, a far IR mission was first studied in 1983 and selected in the plan in 1985 (with the name “FIRST”). This mission was finally flown in 2009 (when it was finally called Herschel), 24 years later. For the Gaia mission, 20 years have elapsed since its first proposal to the Agency in 1993 until its launch planned in October 2013.

Large missions represent the “flagships” of European science and should therefore be European-led (with Europe being responsible for upward of approximately 80% of the mission’s elements). While limited international participation is possible and welcome, L missions should not rely on international cooperation for mission-enabling elements, as Europe’s capability to implement the mission should be safeguarded. Historically, the cost to ESA of L missions (or cornerstone) has been very close to two times the yearly Science Programme budget, resulting in a cost target of approximately 1 billion € at 2013 economic conditions. Typically the cost to ESA (often referred to as the “ESA Cost at Completion”, or CaC) includes the procurement of the spacecraft and of the launch services, plus the mission’s operations and most of the scientific operations. The current generation of L missions is being launched using an Ariane V launch vehicle. It is customary for ESA science missions for the payload (scientific instruments) to be provided by consortia of scientists funded by their national funding agencies, with eventual contributions by international partners. Nationally funded consortia often also contribute to the mission’s science operations and data processing. The scientific exploitation of the resulting data is funded through and by the Member States.

Under these assumptions the Programme can implement 3 L missions every 20 years (two decades being the Programme’s long-term planning horizon). Indeed, cornerstone missions in the Programme have been implemented at this rate. Within the approximate horizon of the CV plan, and considering that the JUICE mission was recently selected by the SPC for the L1 launch opportunity in 2022, the two other L missions (L2 and L3) can be launched in approximately 2028 and 2034, i.e. within the two decades following the start of the Cosmic Vision plan.

### **SELECTION PROCESS FOR THE L2 AND L3 MISSIONS**

The L2 and L3 missions will be defined through a two-step process, first selecting the science areas and relevant questions that should be addressed by each of the two missions, and then selecting, in due time, the actual mission and payload consortia. Both steps will be “bottom up”, and will be achieved through open community consultations. Science themes and questions will be selected through the present “Call for White Papers”, while the selection of the actual mission to be flown for each of the two launch opportunities will take place through dedicated Calls for Missions, issued

at a later time and restricted to the science areas previously identified through the present Call for White Papers.

### **DEFINITION OF THE SCIENCE THEMES FOR THE L2 AND L3 MISSIONS**

The Director of Science and Robotic Exploration has appointed a Senior Survey Committee, composed of internationally recognized scientists whose expertise spans a broad domain, to advise him on the definition of the science themes and questions to be addressed by the L2 and L3 missions.

The process is starting with the present, open call to the broad scientific community, soliciting White Papers advocating science themes and questions for the L2 and L3 flight opportunities. The White Papers should focus on two key points, namely the science questions that are proposed to be addressed by an L-type flight opportunity, and one (or more) strawman mission concept(s), or possible approaches to obtaining the necessary measurements, that could provide the answers to the science questions proposed. Each White Paper must identify a “spokesperson”, who will have to be available to present and advocate the White Paper’s content on request from the Senior Survey Committee.

White Papers can also explicitly advocate observatory-type missions and survey-type missions. Observatories and survey-type missions have figured in the Science Programme’s line-up of large missions, and the scientific community is also invited to advocate if and which such missions should be considered for the L2 and L3 opportunities.

White Papers received by the deadline will be subject to a screening by the Senior Survey Committee with the assistance of ESA technical staff, to eliminate responses that are not of interest either technically (e.g. because any credible implementation of the proposed mission concepts would fall out the boundaries of affordability, or because they violate the programmatic constraints of the Programme) or scientifically (e.g. because the Senior Survey Committee considers that the proposed scientific questions and fields do not merit further review).

The Agency intends to publish (likely in electronic form) all the White Papers that will pass the initial screening. Prior to submitting a White Paper authors are required to accept that the submitted material will be made public by the Agency. Therefore White Papers should not contain confidential material, or information that authors consider should not be made public. Proper acknowledgement of the authorship will be ensured in the publication of the White Papers

The Senior Survey Committee will invited a selection of spokespersons from the White Papers that have passed the initial screening phase to present the relative case in an open workshop, planned to be held in early September (venue and date are to be confirmed). Should more White Papers address the same science theme, the Senior Survey Committee may decide if and which of the spokespersons to invite to the workshop to advocate the science theme in question. Should it decide to do so, the Senior Survey Committee may also decide to appoint a spokesperson not among the ones identified in the White Papers.

The Senior Survey Committee will attend the workshop, and the relative presentations will form part of the input to the selection process. The Advisory Structure to the Science Programme (the discipline-specific Working Groups and the Space Science Advisory Committee, SSAC) will also be invited to the workshop, as will SPC Delegations. The workshop will further be open to all interested parties, subject to capacity limitations of the workshop venue.

Following the workshop the Senior Survey Committee will be invited by the Director to recommend the two science themes that should be addressed by the L2 and by the L3 launch opportunities. A recommendation will be expected in October 2013. Between the workshop and the issuing of its recommendation, the Senior Survey Committee will be invited to meet with the SSAC for a “mid-term interaction”, giving the opportunity for an exchange of views and of feedback with the Advisory Structure prior to the Senior Survey Committee reaching its conclusions. In addition, the Senior Survey Committee will be welcome to consult with the Advisory Structure at other times, should they wish to do so. Through this process the Senior Survey Committee will be assisted by ESA staff to further screen and assess the ideas received from the technical and programmatic point of view, and may also request further clarifications directly to the spokespersons of the White Papers. The Senior Survey Committee will also be free to seek additional views on the science questions proposed in response to the Call for White Papers by consulting with additional members of the scientific community if and how they see fit.

At the end of the process the Senior Survey Committee will advise the Director of Science and Robotic Exploration by proposing two science themes and related scientific questions to be addressed by the L2 and the L3 mission opportunities. Based on the recommendation by the Senior Survey Committee the Director of Science and Robotic Exploration will make a proposal to the Science Programme Committee, who will be invited to decide on them.

#### **CALLS FOR MISSIONS FOR THE L2 AND L3 MISSIONS**

The outcome of the process above (i.e. the science themes and questions to be addressed by the L2 and L3 missions) will be used as the basis for the Calls for Missions that will be issued in due time, to select first the actual mission and later the scientific consortia in charge of the payload provision. The current planning foresees the issue of the Call for the L2 mission in the course of 2014. The Call will only solicit proposals for L missions addressing the science themes and questions defined through the process described above. Thus, while open to the whole community, the Call will be restricted to the science goals identified through the present Call for White Papers. Authorship, or involvement in the White Paper that eventually led to the selection of the science theme for which missions will be solicited in the Call for Mission, does not imply any form of pre-selection for any team or person for what concerns the mission proposals, nor does it grant any right in terms of participation to the mission that will be selected.

The Call for Missions for the L3 opportunity will be issued at a later time, likely around the end of the present decade, and is planned to follow a similar approach as the Call for the L2 opportunity. The Agency will consider if and what broad technology activities may be useful in preparation for the Call for the L3 mission.

#### **TIMELINE AND DEADLINES**

Proposals in response the present Call for White Papers are due by 12:00 noon CEST on May 24, 2013. Submission can take place exclusively by using the web interface available at <http://sci.esa.int/Call-WP-L2L3>. More information about the submission process can be found at the same address.

The invitations to selected spokespersons to make a presentation at the workshop will be issued by July 8, and the workshop will likely be held on September 3 and 4 (dates and venue of the workshop will be confirmed at a later stage).

The Senior Survey Committee will issue its report to the Director of Science and Robotic Exploration in the course of October, and the Director will make its proposal to the SPC at the end of October 2013. The SPC will be invited to take a decision at their meeting planned for November 13 and 14, 2013.

A summary of the relevant dates is shown in the table below.

Activity	Date
Release of Call for White Papers	March 5, 2013
Deadline for Call for White Papers	May 24, 2013
Invitation to spokespersons to the workshop	July 8, 2013
Open workshop	September 2-3, 2013 (TBC)
Director's proposal to the SPC concerning the science themes for L2 and L3	Late October 2013
Selection of the science themes for L2 and L3 by the SPC	November 13-14, 2013

### **CONTENT AND FORMAT OF THE WHITE PAPERS**

White Papers are subject to a page limit of 16 A4-size pages of text, tables and figures, plus two pages for a cover and a list of supporters and two further pages for references, for a total of 20 pages. All text must be single spaced with a minimum font size of 11 points.

White Papers not respecting the format specifications or exceeding the page limit will be discarded and will not be considered for further evaluation.

#### **Cover page**

White Papers must have a cover page (page 1), clearly listing a title (which will be used to refer to them) and a spokesperson (who will be the only point of contact with the Agency for all matters relative to the White Paper). Contact details (address, email and telephone numbers) for the spokesperson must also be provided on page 1. Authors can include on the cover page logos, graphics, etc. in a free format, as long as the required information is also present.

#### **List of authors and supporters**

The second page should be used to list the authors and contributors to the White Paper, as well as any "supporters" who endorse the White Paper's content. Should the list of supporters exceed one page, the author will have to truncate it (eventually referring to a longer list available on line).

#### **Science case and strawman mission concepts**

The 16 pages (from page 3 to page 18 inclusive) advocating the science theme and the relative strawman mission concept are in free format (respecting the font size constraints above). The authors should emphasize the proposed science theme and related questions, advocating the reasons for which the proposed science theme (or observatory, or survey) is of such high scientific relevance and importance as to merit priority over all competing science themes. The authors should also

identify the specific scientific questions that will be addressed through the strawman space mission concepts (or measurement concepts). The role of the proposed theme in the broad context of science should be given proper emphasis. The foreseen development of the relevant scientific field in the timeframe relevant for the L2 and L3 opportunities should be addressed, in particular concerning (where relevant) the scientific advances foreseen to take place through ground-based instrumentation.

While the majority of the available pages should be used to advocate the science theme, a fraction (as an indication, 4 pages or less is expected to be adequate) should be used to describe one or more strawman's mission concepts, or measurement concepts. The purpose of this part is not to propose an actual mission (this would be happening later) but rather to demonstrate that the proposed science theme and relative questions can be effectively addressed, with technology that is expected to be (or to become) available within the relevant time frame and within the programmatic framework (cost, development time, etc.) applicable to ESA's L2 and L3 missions.

### **References**

The final two pages (pages 19 and 20) can be used for references.