DOCUMENT

Announcement of Opportunity for the JUICE Payload

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1 GENERAL INFORMATION

1.1 Summary and Scope

The European Space Agency (ESA) solicits proposals for the provision of the scientific payload on board the JUICE spacecraft.

JUICE (JUpiter ICy moons Explorer) was selected in May 2012, by the Science Programme Committee (SPC) as the "L1" mission in the Cosmic Vision programme, with a foreseen launch date in 2022.

The JUICE spacecraft will provide a thorough investigation of the Jupiter system in all its complexity with emphasis on the three ocean-bearing Galilean satellites, and their potential habitability. JUICE has been tailored to observe all the main components of the Jupiter system and untangle their complex interactions. Central to this system, the Galilean satellites span a broad range of possible internal structures, from pure silicate/metal bodies to dominantly icy ones. They can be divided into two pairs, two dominantly rocky ones (Io and Europa), and two dominantly icy ones (Ganymede and Callisto). In order to place Ganymede, Europa and Callisto into the right context, and to better understand the Galilean satellites as a system, JUICE will conduct a comparative study of Ganymede, Callisto and Europa, with a special focus on Ganymede, which JUICE will characterise in great detail. The mission will provide a complete spatio-temporal characterisation of the giant, rotating magnetosphere, and of the meteorology, chemistry and structure of Jupiter's gaseous atmosphere. It will study also the coupling processes inside the Jupiter system, with emphasis on the two key coupling processes within that system: gravitational coupling, which ties together Jupiter and its satellite system, and electrodynamic interactions, which couple Jupiter and its satellites to its atmosphere, magnetosphere and magnetodisc.

The spacecraft is planned for launch in 2022 and is foreseen to perform a 7.5 yr cruise toward Jupiter based on Earth-Venus-Earth-Earth gravity assists. The Jupiter orbit insertion will be performed in January 2030, and will be followed by a tour in the Jupiter system, comprising a transfer to Callisto, a phase studying Europa and Callisto with flybys, and a "Jupiter high-latitude phase" that includes Callisto flybys and the transfer to Ganymede. In September 2032 the spacecraft will be inserted into orbit around Ganymede, starting with elliptical and high altitude circular orbits, followed by a phase in a medium altitude circular orbit, and by a final phase in low altitude circular orbit. The end of the nominal mission is foreseen in June 2033.

The JUICE spacecraft constitutes the European element of a coordinated program to Jupiter and its icy moons, which also foresees a Russian Ganymede lander, to be operated by Russia in coordination with JUICE. The joint program would allow a complete characterization of Ganymede, above and beyond what could be achieved with either element alone.

This Announcement of Opportunity (AO) for the provision of the scientific payload on board the JUICE spacecraft is open to scientists from the Member States of ESA and other communities with which reciprocity or specific agreements exist (such as USA, Russia, Japan). An agreement has already been established with NASA as a minor payload contributor. An agreement with Russia concerning payload provision for JUICE spacecraft and the Russian Ganymede lander is under discussion.

Furthermore, discussions with Russia on the possible evolution of the joint program profile are on-going. ESA reserves the right to amend or modify the present AO as needed, based on the outcome of such discussions, at any time.

The mission's management and responsibilities are organised along an approach similar to other ESA planetary missions, with the Agency providing the S/C, launch and mission operations, and nationally funded consortia providing the payload suite. Science operations will be a shared responsibility, with an ESA Science Operation Center (SOC) complemented by nationally-funded PI teams.

The schedule for the AO cycle and the JUICE programme is given in Table 1. Details on the submission and proposal evaluation criteria are given in Section 2.

Date	**Event**
June 25, 2012	Release of AO for scientific instruments onboard the JUICE spacecraft
July 6, 2012	Deadline for submission of (binding) Letters of Intent
July 13, 2012 (TBC)	Briefing meeting
October 15, 2012	Proposals due
October - November, 2012	Proposal evaluation
January, 2013	SSEWG and SSAC recommendations
February, 2013	Preliminary technical KO of instrument Phase A
February, 2013	SPC selection
End 2013	Release of an updated set of ESA documents
Mid 2014	Update of Instrument Consortia documents
November 2014	Mission adoption and MLA signature

Table 1. JUICE scientific payload AO cycle

With this AO it is intended to select the Instrument Consortia for the provision of the scientific payload on board the JUICE spacecraft. Instruments that address the JUICE science goals as described in the Assessment Study Report (Yellow Book) and in the Scientific Requirements Document will be given priority, although proposals addressing other science goals are not excluded a priori. The proposals shall include all Consortia elements necessary for the implementation phase, clearly defining tasks and level of commitment.

Only Instrument Consortia that will submit a Letter of Intent (LoI) by the deadline reported in Table 1 will be allowed to submit a Proposal.

Proposers are made aware that the Agency plans to consolidate interfaces, leading to almost complete interface definitions by the time of the Preliminary Requirements Review, currently planned for September 2013 (see EID-A).

With the maturation of the interface and programmatic documentation for the payload provision and the final agreements on the Instrument Consortia provision, ESA will release an updated set of ESA documents (including, in particular, updated EID-A, SIRD and SOCD – see also Section 2.2.8) before entering the implementation phase.

ESA will iterate with the selected JUICE Instrument Consortia to establish, on the basis of the definition phase activities, a clear understanding of the technical and programmatic status (maturity of the design, remaining identified risks, potential showstoppers, etc.) of the Instrument Consortia contributions to the mission.

The selected Instrument Consortia shall update their proposal documents for the implementation phase in line with the updated AO documentation and shall submit the updated version to ESA for evaluation. In preparation for the adoption of the JUICE mission by SPC in 2014 for implementation, and following the positive evaluation of the final proposals for the implementation phase, a Multi Lateral Agreement (MLA) will be established between ESA and the LFAs of the selected Consortia. This MLA is planned to be submitted for approval to SPC in 2014 (as indicated in the Science Management Plan).

The Proposal Information Package (PIP) and all relevant documentation (including this Announcement of Opportunity) can be downloaded from http://sci.esa.int/juice_ao

1.2 Proposals Information Package

The Proposal Information Package (PIP) contains, in addition to this AO, the following documents:

- Science Requirements Document (Sci-RD), including Science Requirement Matrix (SRM)
- Model Payload Definition Document (MPDD)
- Science Management Plan (SMP)
- JUICE Assessment Study Report (Yellow Book)
- Experiment Interface Document-Part A (EID-A)
- Proposal Template
- Experiment Interface Document-Part B (EID-B) template JUI-EST-XXX-EID-00X
- Environmental Specification document
- Planetary Protection Requirements
- CREMA (Consolidated Report on the Mission Analysis)
- End-to-end trajectory ephemeris files
- Tailoring of ECSS-E-ST-20-06C (Charging) for JUICE

- Technical notes on environment properties and radiation transport simulations
- JUICE project documentation and configuration management procedure
- Science Operations Assumptions Document (SOAD)

A summary of the mission overview, instrument selection procedure and a recapitulation of the investigators' duties and responsibilities can be found in the SMP.

The EID-A defines the technical and programmatic requirements (including management and control procedures), and specifies in detail the interface and planning applicable to the instruments.

Each proposal shall clearly identify a Principal Investigators (PI) and a Lead Funding Agency (LFA) for the proposed Instrument. Proposals will clearly need to spell out the character and level of participation together with the nature of the management structure and financial commitments within each Instrument Consortium.

Each proposal shall address science goals and requirements as described in Sci-RD and comply with the programme definition, resources, operational conditions and constraints. Instrument proposers are expected to have carried out preliminary design and technology studies, which should enable them to include a preliminary design of their instrument in the proposal.

Each instrument proposal shall have to meet the interface requirements contained in the EID-A. However, if a larger scientific return can be achieved with a proven instrument concept by exceeding these constraints, the merits of this option and its technical requirements must be justified. It is expected, however, that basic instrument resources (e.g., mass, power, volume, data rate/volume) be justified, based on preliminary design.

After receipt of the instrument proposals in response to this AO a Payload Review Committee (PRC) will perform a full review of all proposals and recommend the final payload with a view to optimising the overall scientific return within the available resources. Agency staff will assist the PRC in their task with respect to technical, programmatic and financial matters.

1.3 Instrument Consortia

Each proposing Instrument Consortium shall be headed by a single person, designated as the Principal Investigator (PI). The PI is the single point formal interface to the ESA Project Office.

Co-PIs may be proposed if major development is carried out in country/institution different from the one of the PI. A Co-PI will have similar rights as a PI, but the PI will remain the single interface to the ESA Project Office.

Members of each PI-led Instrument Consortium may be proposed as Co-Investigators. Each Co-I should have a well-defined role either with regard to hardware/software delivery or with regard to scientific support of the investigations within the instrument consortium.

The responsibilities of PIs, Co-PIs and Co-Is are further detailed in the SMP and the EID-A.

The PI shall nominate an Instrument Project Manager with appropriate hardware, software and procurement expertise, and establish with him an efficient management scheme, especially where several institutes provide sub-assemblies or sub-systems.

1.4 Funding Agencies

1.4.1 Lead Funding Agency

The funding agency of the proposing PI is the Lead Funding Agency (LFA) for the instrument and has the overall responsibility to deliver the instrument. All proposals in response to this AO shall be submitted by the proposing PI and shall include a Letter of Endorsement (LOE) from the LFA, committing to the financial support during the Definition Phase and envisaging the full commitment by the time of mission adoption, from the LFA, on behalf of all institutions participating in the proposal. The LFA will generally not change during the development of a given instrument.

1.4.2 Other Funding Agencies

The national funding agency representing a Co-Principal Investigator (Co-PI) or Co-Investigator (Co-I) shall guarantee the funding of the respective Co-PI/Co-I contribution by a formal interagency agreement with the LFA. Indications of the status of interagency agreements shall be submitted to ESA within the proposals. In case there is more than one funding source at national level, the organisation providing the Science Programme Committee (SPC) delegation will be considered as the formal national interface to the ESA Project Office. It will be the task of this organisation to provide ESA (or the LFA, if applicable) with indications about the financial involvement of other organisations.

1.5 Contact with ESA

Requests for further information and clarification should be addressed to:

L. Colangeli
ESA/ESTEC (SRE-SM)
Postbus 299
2200 AG Noordwijk (The Netherlands)
Email: juice@rssd.esa.int

As mentioned in Table 1, a briefing meeting intended to clarify technical and/or programmatic issues will be held at ESTEC, Noordwijk, on July 13, 2012 (TBC). In preparation for this meeting, written questions should be sent by July 6, 2012, addressed to: juice@rssd.esa.int.

2 CONTENT OF THE PROPOSAL

The proposal shall respond to the science, mission and programme requirements described in the PIP, and shall provide all requested information to permit a complete evaluation against the criteria listed in Section 4.1.2 of the SMP. The proposal must be written in English; it consists of the following parts:

- Executive summary
- Part I: Scientific and Technical Plan
- Part II: Experiment Interface Document – Part B (EID-B)
- Part III: Instrument Engineering Plan
- Part VI: Product Assurance Plan
- Part V: Management Plan
- Part VI: Instrument Financial Plan
  With Letter of Endorsement from the Lead Funding Agency

All pages must be numbered. All parts must be produced in separate pdf files.

Cover Page

Each part (including the Executive Summary) has a cover page including:

- The title of the proposal
- The name of Part (Executive Summary, Part I: Scientific and Technical Plan, etc.)
- The names, addresses, telephone (office, alternative and portable) and fax numbers, and e-mail addresses of the PI and Co-PI(s)
- The name of the Lead Funding Agency associated with the proposal together with the associated contact person with name, address, telephone and fax numbers, and e-mail address

2.1 Executive summary

The Executive Summary shall outline all aspects of the proposal, especially the following aspects, within a 3-page limit:

- Objective of the proposal and its compliance with those indicated in the Sci-RD
- Overall performance of the instrument required to fulfil the anticipated goals
- Instrument operations plan
- Scientific analysis plan
- Summary of required spacecraft resources
- Management scheme
- Summary of financial status
- Departure from the model payload described in the MPDD
- Requirements (if any) imposed on other instruments or spacecraft subsystems

- Annex: Instrument data sheet

If the proposal violates any of the constraints described in the PIP, a clear statement about each violation, together with its justification, shall be included in the summary. Each violation shall be further detailed in the appropriate sections. The instrument resources and requirements are to be summarized in tabular forms.

Should the proposal include contributions from International (i.e., non ESA Member States) partners, the candidate Principal Investigator shall clearly indicate in the Executive summary the agreement that the proposal may be made available – if required – to the relevant International Space Agency(ies) for proper internal assessment.

2.2 Part I: Scientific and Technical Plan

Each JUICE Instrument proposal must be compatible foremost with the scientific and operational objectives of the JUICE mission as summarized in the Sci-RD and be compliant with mission design and operational capabilities specified in the EID-A.

Part I shall not exceed 40 single-spaced A4 pages, with a character size not smaller than 11 points, including illustrations without reduction, but excluding cover page and table of contents. Part I of the response to this AO shall contain the following:

- Scientific Objectives
- Instrument performance
- Technical description and design
- Summary of instrument interfaces
- On-ground and in-flight test and calibration plans
- System level AIV
- Flight operations concept
- Science Ground Segment concept
- Data reduction, scientific analysis and archival plans
- Complete list of names, with affiliation and e-mail addresses of the Co-Is with specification of their expertise and roles in the Consortium

Each item is detailed hereafter.

2.2.1 Scientific Objectives

This section shall clearly describe the scientific investigation and the overall capability of the instrument, in the light of the investigators' objectives and global mission goals, as defined in the Sci-RD. The anticipated overall scientific performance of the instrument under nominal operation conditions shall be stated and compared, if relevant, to that of similar instruments described in the MPDD, flown on other spacecraft or planned for future missions. Possible synergies with laboratory studies and ground- or space-based

observations should be discussed. It is important to list any assumptions required to achieve the science objectives. In particular, details affecting performance and as a result the science objectives, related to the following items need to be clearly indicated:

- Spacecraft performance
- Mission orbit and operations
- Other payload elements
- Ground segment

Expected results should be outlined and discussed, as far as possible, in both qualitative and quantitative terms. If the proposal contains any violation of the technical or programmatic constraints, the scientific justification should be given in this section.

2.2.2 Instrument Performance

A detailed analysis of the proposed instrument performance is required – including sensitivities – and supported by instrument simulations. All assumptions made in this performance analysis (including error budget) shall be provided and shall be justified by a preliminary design (see section 2.2.3). In addition, a critical analysis shall be provided about sensitivity to environmental parameters (e.g., radiation) and degradation in performance if key instrument characteristics turn out to be unachievable during the instrument development programme. Performance simulations must also include evaluations as a function of spacecraft orbital position. Details associated with instrument performance evolution and maturation plans, within the instrument development, should be indicated and the milestones incorporated in the Instrument Engineering Plan (cf. Part III). Instrument performances must be evaluated, not only for the baseline design, but also for options including potentially proposed back-up designs for cases where technology does not meet the expected performance for the baseline.

2.2.3 Technical Description and Design

This section shall include a comprehensive description of the preliminary design of the proposed instrument, including resource budgets and any specific requirements to the spacecraft.

The preliminary baseline solutions of the mechanical, optical and electrical design of the proposed instrument (separately for each component/sensor) shall be described together with the maturity and an evaluation of the technology readiness. The thermal design concept and possible requirements on the spacecraft design shall be given. Specific attention and details are expected on the radiation sensitive parts, shielding and mitigation strategy.

New advanced technologies (if any) should be clearly described and alternative options identified. The impact of these options upon scientific return, interfaces, schedule, etc. should be explained together with an assessment of the associated risks and decision points. The extent to which the design utilizes space qualified and space experienced

hardware shall be stated in terms of instrument heritage and assessment of TRL level of the major instrument components. Again a detailed evaluation of the technology readiness must form part of the Instrument Engineering Plan to be provided as Part III of the response to this AO.

Summary of the resource budgets shall be given and shall be justified by the design. If the proposed instrument consists of more than one unit/sensor, each data sheet shall be given in Annex 1.

Any specific requirements (mounting, FOV, thermal, purging, EMC, etc.) to the spacecraft system and other instruments shall also be given.

2.2.4 Summary of Instrument Interfaces

The mechanical, optical, thermal, power, data, EMC (Electromagnetic Cleanliness/compatibility) and operational interfaces of the instrument, either to the spacecraft or to other assumed third party provided equipment, shall be summarised here and specified in detail in the EID-B. Assumptions related to this third party equipment with respect to the interfaces shall be clearly indicated. It is expected that these interfaces will need to be matured after selection. Specifically a software model of the instrument shall be provided that could be used for radiation transport simulations.

2.2.5 On-ground and in-flight test and calibration plans

This section shall describe all test and calibration (ground/pre-launch, cruise and in-orbit) plans and procedures deemed necessary to verify the correct functioning of the instrument and achieve the scientific goals.

The requirement and availability of suitable test and calibration facilities (e.g. vacuum, thermal-vacuum, stimulus generator, computer etc.) either in-house or in industry shall be clearly indicated. The ground test and check-out equipment to be supplied by the PI for the instrument shall be described. Assumptions with respect to test facilities or equipment under ESA's responsibility shall be indicated.

Any test requirements needed during the cruise phase must be justified fully in this section. Preliminary description of the specific tests and calibrations required during the science operations phase including procedures and timelines are required. Assumptions and requirements related to instrument cross-calibrations or tests/calibrations requiring data from other instruments must be clearly specified.

2.2.6 System Level AIV

This section shall describe the compliance of the instrument qualification flow with the project provided pre-launch Verification Programme Requirements (Chapter 6 of EID-A) and the Spacecraft system level Assembly-Integration-Verification (AIV) flow, from which the characteristics are derived for the instrument models to be delivered. Instrument

characteristics that do not comply should be identified together with any special requirement. The Mechanical and Electrical Ground Support Equipments (MGSE and EGSE) as well as any additional calibration equipment shall be identified and described in the Annex of the EID-B (see template). Special services required at system level or at launch site shall be identified giving technical justification for them.

2.2.7 Flight Operations Concept

The operational concept of the proposed instrument shall be described. Details (e.g. frequency of calibrations, operational modes and their changes, etc.) should be provided. Different functional operating modes including on-board data reduction concept shall be identified and explained. Modes, which place different requirements on scientific operations and data analysis, shall be described. Detailed information on the instrument software should be given in the EID-B, to be completed and submitted as Part II of the proposal. Any specific requirement for flight operations support should also be identified.

The Instrument Consortium is required to support the Mission and Science Operations Centres (MOC/SOC) through all mission phases. Specifically the following details should be provided:

- The level and nature of the support to the definition of the science operations pre-launch and during the cruise phase;
- The level and nature of the expert support at the MOC and SOC during payload commissioning and critical operations;
- The level and nature of the expert support provided for the preparation of the instrument operation timelines prior to and during the science operations phase;
- The level and nature of the expert support for monitoring and optimisation of instrument performance prior to and during the science operations phase.

2.2.8 Science Ground Segment Concept

Each proposal in response to this AO shall contain an implementation concept for the Science Ground Segment (SGS) related activities, for the implementation, operations and post-operations phases. It shall be based on the tasks required as described in the Science Management Plan (SMP) and the Science Operations Assumptions Document (SOAD).

Items of the Science Ground Segment to be covered are also:

- Planning of payload operations
  This includes the submission of the operations requests, the support given to the payload operations scheduling and the operational review of the timelines generated by the SOC before they are submitted to the MOC.
- On-Board Software Maintenance
  The maintenance of the payload On-Board S/W during the operations, together with the facility needed to generate and test the updates.

The requirements for the Science Ground Segment (SGS) and the operations concept, architecture and interfaces will be defined during the definition phase. During this phase, ESA shall produce the Science Operations Concept Document (SOCD) and the Science Implementation Requirements Document (SIRD). Each Instrument Consortium will be required to prepare a Science Implemental Plan (SIP) in answer to the SIRD.

In order to define a coherent and optimised SGS, it is expected that all SGS-related activities in the definition phase shall be carried out in close co-operation between ESA and the Instrument Consortia. It is expected that the SOCD and draft SIRD will be jointly generated during the definition phase. The draft SIRD, after review and any necessary update, will be formally issued by ESA after the definition phase as an input to subsequent phases. Each party will be responsible for their draft SIP which responds to the draft SIRD.

As mentioned in Section 1.1, ESA will release an updated set of documents along with the maturation of the interface and programmatic aspects for the payload provision. SOCD and SIRD will be part of this delivery. Instrument Consortia will have to provide their SIPs as part of their update to proposal documents (see Table 1).

The Science Operations Concept Document (SOCD) will describe the scenario for the operations of the mission. It expands the concepts contained in the SMP to describe how SGS operations (including mission planning and data processing and management) will be performed and establishes the high-level system partitioning. It will be a source for writing the top-level requirements documents.

The draft Science Implementation Requirements Document (SIRD) will contain the requirements applicable to the development and operations of the whole Science Ground Segment. The SIRD will take the concepts documented in the SOCD and will turn them into specific top-level requirements.

Science Implementation Plans (SIP), one covering the ESA-supplied elements and the others the Instrument-Consortia-supplied elements will specify the activities to be undertaken to implement and operate the SGS and also detail the necessary schedules and resources. They are the responses to the SIRD in that they explain how the SGS will be built to fulfil the requirements in the SIRD.

2.2.9 Data Reduction, Scientific Analysis and Archival plans

A data reduction and scientific analysis plan shall be provided. This shall include a description of the proposed infrastructure and hardware configuration, and adequately address the technical, managerial and programmatic issues. The level of resources allocated shall be indicated for each of the following phases of the programme:

- Pre-launch data reduction preparations
- Support to the SOC preparation
- Cruise phase

- Operations phase
- Post-operations phase

It is required that the PI complies with the scientific data policy of the Agency, as defined in the SMP. Any proposed non-compliance shall be identified and substantiated in this section. Specifically, the resources and the approaches necessary to conduct the following activities shall be addressed:

- Deliver the raw, calibrated, and higher level data, including relevant calibration software and/or products for such data production, and associated documentation, to the JUICE ESA archive, within the end of the proprietary period;
- Provide to ESA unlimited access to all processed and analysed data for public relation purposes;
- Provide summaries of the main scientific results;
- Provide inputs for the definition and implementation of data handling and archiving concepts.

The level and nature of the support to the definition and implementation of the JUICE ESA scientific data archive, as part of the pre-launch tasks, shall be addressed.

2.2.10 Complete list of Co-Investigators

A complete list of names, with affiliation and e-mail addresses, of the Co-Investigators shall be provided in Part I, with specification of their expertise and roles in the Consortium.

2.3 Part II: Experiment Interface Document Part B (EID-B)

The purpose of the Experiment Interface Document – Part B (EID-B) is to formalize the Instrument Consortium response to the technical and programmatic requirements. After selection, the EID-B will be maintained and updated at regular intervals, and will become essentially a contractual document between the ESA Project Office and the selected PI-led consortium. This document shall be arranged according to the template provided in JUI-EST-XXX-EID-00X as part of this AO package. It will include information on the following topics:

- Instrument Design Description
- Interface Requirements and resource allocations
    - Budgets
    - Instrument location and pointing
    - Mechanical interfaces
    - Thermal
    - Electrical
    - Data Handling
    - Software

    - Electromagnetic Compatibility
    - Handling
    - Mission environment mitigations
- Ground segment and operations
- Management
- Data deliveries

Complementary inputs not required within the standard EID-A format may be added at the discretion of the PI with a technical justification, which will be assessed in the frame of the proposal evaluation process. The purpose of Part II is mainly to provide factual data on all aspects of the proposed instrument, whereas discussion, justification and risk assessment, etc. are provided in Part I. The quality of the factual input in Part II (EID-B) is essential for a smooth start of the Definition Phase. It is anticipated that these interfaces will need to be matured after selection up to the Preliminary Requirements Review (PRR), such that all interfaces can be frozen by the System Requirements Review (SRR). It is therefore very important that a detailed level of interface documentation be provided at the proposal stage. All interfaces shall be consistent with the preliminary design.

2.4 Part III: Instrument Engineering Plan

Part III describes in detail the instrument engineering plan. It must define the approach, methods, procedures, resources and organization to co-ordinate and manage all technical activities necessary to specify, design, verify, operate and maintain the JUICE instrument in conformance with the JUICE Science Requirement Document and JUICE Experiment Interface Document – Part A. Please refer to ECSS-E-ST-10C for detailed information.

Part III must contain the following details:

- Instrument overview
- System engineering approach
    - Overall design, engineering and verification plan
    - Technology readiness assessment
    - Identification of potential improvement options by using technology development, including the specification of decision points
    - Instrument Model Philosophy
- Implementation plans
- Procurement Plan
    - Identification of ITAR controlled items
    - Assembly, Integration, Verification and Calibration Plan
    - Technology Development Plan
    - Software Development Plan
    - Risk management plan

2.5 Part IV: Product Assurance Plan

Part IV describes in detail the Instrument Product Assurance (PA) plan and must contain the details as described in the EID-A and the template of the PA Plan:

- Product Assurance
- Quality Assurance
- Safety Assurance
- Dependability Assurance
- Parts and Materials
- Radiation tolerance of EEE components
- Software Product Assurance
- Cleanliness and contamination control
- Planetary Protection

It is highlighted that the baseline is that the Planetary Protection requirements will be met by the S/C reliability. Therefore, individual instruments are not expected, for the time being, to embark/prepare for active bio-burden reduction measures.

2.6 Part V: Management Plan

The Management Plan should cover all aspects of the proposed investigation for the entire duration of the mission. The PI must show how he/she will establish an efficient and effective management scheme that must include an Instrument Manager. The contribution of each institution must be clearly indicated and the responsibilities of each participant described in detail. It is essential to provide a clear management plan, which is adequate with respect to the instrument complexity and the interfaces within the instrument consortium. Emphasis should be placed on a simple management scheme with as few interfaces as necessary.

Organization charts must contain the names of all partners: PI, Co-PIs (if any), Co-Is, Instrument Project Manager, and all key personnel. The PI will show, in particular, how he/she will participate in the overall activities. The fraction of time available for the project shall be given for each individual throughout the instrument development cycle and the following mission phases:

- Instrument development phase, including in-orbit commissioning
- Cruise phase
- Science operations phase
- Data reduction and scientific analysis
- Post-operation phase

For all personnel the qualifications and experience of the team must be clearly indicated along with the fraction of time to be spent on the project.

Furthermore the Management Plan shall contain all information related to the compliance of management requirements as laid down in EID-A Chapter 9. These requirements address the following subjects:

- Project phasing and planning control including reporting to ESA
- Reviews
- Configuration management
- Deliverable items
- Instrument costs and schedules
- Risks

The PI is expected to describe his/her compliance to these requirements and their expected implementation.

2.7 Part VI: Instrument Financial Plan

The PI, Co-PIs (if any) and Co-Is shall include separate sections for their own resource provision with the detail of estimated resources for each activity subdivided into the following topics:

- Instrument
    - Development
    - External test and ground calibration campaigns (where facility costs are incurred)
    - Instrument operations (from preparation to in-flight activities)
    - Critical technology developments, including funding for back-up development plans
- Science Ground Segment
    - Science operations (including in-flight calibration)
    - Planning of payload operations
    - Instrument operations monitoring
    - Data reduction and science analysis
    - On-board Software maintenance

For estimating the necessary resources the following details are required:

- Internal manpower resources (FTEs) and associated costs
- Additional manpower resources (FTEs) provided to support the development but not budgeted within the project
- Other internal institute resources budgeted against the proposal
- External contracts
- Capital equipment costs required in the development of the instrument

- Risk margin, with appropriate justification
- Total funding requirements

These details must be provided as a function of the complete instrument development and operation timeline for each contributing party (PI, Co-PI and Co-I), as well as for the total development overall. In addition for the single instrument as proposed in response to this AO the total provisions required from national sources for funds and manpower shall be provided and justified. The Co-I-supported authorities for these resources shall be identified and the current status of their applications indicated, as well as the level of agreement between them and the LFA. The estimated instrument development cost shall be summarised in tabular form.

The Funding Agency shall explicitly identify the margins contained in the cost estimate. The Agency considers a 20% contingency margin necessary in order to manage the instrument development risk.

An Excel cost template as Annex to this AO is provided for convenience and can be used for identification of the financial cost according to above requirements. The specific labels and numbers in the template are examples only.

2.8 Letter of Endorsement

This Announcement of Opportunity calls for the identification of both a Principal Investigator (PI) and a Lead Funding Agency (LFA). The proposal must include a Letter of Endorsement (LOE) from the Lead Funding Agency. The response to the AO will have to establish not only the technical character and level of the Instrument, but also the level of involvement together with the nature of the management structure and financial commitment. Therefore, the LOE shall commit to the financial support in the Definition Phase, should the proposal be selected, and shall contain a time-line showing milestones leading to full commitment by the time of mission adoption, from the relevant national funding agency, on behalf of all institutions participating in the proposal. The LOE will constitute a preliminary agreement between ESA and LFA until formalization of the Multi-lateral Agreement (MLA) between all participating agencies (or Memorandum of Understanding (MOU) in the case of non-ESA member states) at completion of the Definition Phase.

The LFA will be considered responsible vis-à-vis ESA for all what concerns financial matters related to the selected investigations. Co-PI/Co-I teams are required via their national funding agencies to seek agreement with the LFA, which retains full responsibility for the instrument development and timely delivery and is the sole contact with ESA with respect to the LOE. The LFA is expected to provide the majority element of the funding for the respective Instrument and have prime science and industrial responsibility through the PI and Instrument Manager. The national funding agency representing a Co-PI/Co-I shall guarantee the funding of the respective Co-PI/Co-I contribution by a formal interagency

agreement with the LFA. Indications of the status of interagency agreements shall be submitted to ESA. See Section 1.4 for description of responsibilities of Funding Agencies.

3 SUBMISSION OF THE PROPOSAL

The proposal shall be submitted by the candidate Principal Investigator in electronic form to the address listed below.

Each proposal must consist of the following elements:

- Cover Letter and Executive summary
- Part I: Scientific and Technical Plan
- Part II: Experiment Interface Document (EID-B)
- Part III: Instrument Engineering Plan
- Part IV: PA Plan
- Part V: Management Plan
- Part VI: Instrument Financial Plan
  with Letters of Endorsement from Lead Funding Agency

All pages must be numbered.
The different Parts of the proposal must be in different pdf files.

The electronic submission at http://sci.esa.int/juice_ao must be completed no later than:

15 October 2012, 12:00 CEST (noon)

ESA will confirm by e-mail the reception of the proposal.

ACRONYMS

AIV	Assembly-Integration-Verification
AO	Announcement of Opportunity
Co-I	Co-Investigator
Co-PI	Co-Principal Investigator
CREMA	Consolidated Report on Mission Analysis
ECSS	European Co-operation for Space Standardization
EID	Experiment Interface Document
EID-A	Experiment Interface Document - Part A
EID-B	Experiment Interface Document - Part B
EGSE	Electrical Ground Support Equipment
EMC	Electromagnetic Cleanliness/compatibility
ESA	European Space Agency
FM	Flight Model
FTE	Full Time Equivalent (man years)
ICD	Interface Control Document
JUICE	JUpiter ICy moons Explorer
LFA	Lead Funding Agency
LOE	Letter Of Endorsement by funding agency
MGSE	Mechanical Ground Support Equipment
MOC	Mission Operations Centre
MOU	Memorandum of Understanding
PI	Principal Investigator
P/L	Payload
MPDD	Model Payload Definition Document
PIP	Proposal Information Package
PRC	Payload Review Committee
PRR	Preliminary Requirements Review
S/C	Spacecraft
Sci-RD	Science Requirements Document
SGS	Science Ground Segment
SMP	Science Management Plan
SOAD	Science Operations Assumptions Document
SOC	Science Operations Centre
SPC	Science Programme Committee
SRM	Science Requirement Matrix
SRR	System Requirements Review
TRL	Technology Readiness Level