DOCUMENT

Announcement of Opportunity for the provision of scientific payload including SGS elements for the M3 mission candidates

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1 SUMMARY AND SCOPE

The European Space Agency (ESA) solicits through the present Announcement of Opportunity (AO) proposals for the provision of the scientific payload, including Science Ground Segment (SGS) elements, for the EChO, LOFT, MarcoPolo-R, and STE-QUEST missions that are candidate for the M3 launch opportunity.

These missions were selected in February 2011, as candidates for a "Medium-class Mission" launch opportunity, with a foreseen launch date in either 2022 or 2024 (depending on the evolution of the Science Programme, including the confirmation for launch in 2022 of the L1 mission JUICE).

The AO 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). The AO solicits proposals from scientific Consortia supported by funding agencies in Member States (or from the respective funding agencies in the case of other communities), for carrying out Phase A study activities for the scientific payload onboard each of the four candidate M3 missions until the end of Q3-2013. The M3 mission selection process is planned to be completed by the end of 2013. Consortia have to indicate their readiness (and the readiness from the relevant funding agencies) to carry out the Phase A activities and to subsequently provide the flight and SGS elements and to support the mission, should it be the one selected, throughout its life cycle, including data processing.

The mission's management and responsibilities are organised along an approach similar to other ESA science missions, with the Agency providing the S/C, launch and mission operations, and nationally funded Consortia providing the payload suites. Science operations are typically envisaged to be a shared responsibility, with an ESA Science Operation Centre (SOC) complemented by nationally-funded science operations centres. Section 3 provides information about the general framework for science and project management, while Annex 1 gives details applicable to each of the four missions.

The schedule for the AO cycle and the M3 selection process is given in Table 1. Details on the submission and proposal evaluation criteria are given in Sections 6 and 7.

Date	Event
September 24, 2012	Release of AO for scientific payload, including science ground segment elements, for the M3 mission candidates
October 5, 2012	Deadline for submission of (mandatory) Letters of Intent
October 10, 2012 (TBC)	Briefing meeting
November 30, 2012	Proposals due
December 14, 2012	Letters of Endorsement from Funding Agencies due
November 2012 - January, 2013	Proposals evaluation

January-February, 2013	Recommendations from ESA Advisory Structure
February, 2013	Science Program Committee selection
February, 2013	Preliminary technical KO of payload studies (in parallel with industrial studies extension phase)
September-October 2013	M3 candidate missions Preliminary Requirements Review (PRR)
End 2013	M3 mission selection process completed
May 2014	Kick-off definition phase (Phase B1) of the selected mission Request to Consortium(a) of the selected mission for an updated set of documents
July 2014	Updated set of documents by Consortium(a) due
June-July 2015	M3 selected mission System Requirements Review (SRR)
November 2015	Mission adoption and MLA signature
October 2016	Kick-off selected M3 mission implementation phase (B2/C/D)

Table 1. Planned M3 mission selection cycle

Payloads that address the primary science objectives of the candidate missions, as described in the original mission proposals on the basis of which the missions have been selected for study, and the resulting requirements, as listed in the Science Requirements Documents (Sci-RD), will be given priority in the selection process. However, proposals addressing other science goals are not excluded a priori. The proposals must include all Consortia elements necessary to conduct the on-going study phase and must clearly define tasks, responsibilities and level of commitment to carry out the definition and implementation phases, should the mission be selected.

Only Payload Consortia that will submit a Letter of Intent (LoI) by the deadline indicated in Table 1 will be allowed to submit a proposal.

For the single M3 mission selected in late 2013, ESA will release an updated set of information documents in the early part of Phase B1, which will reflect the maturation of the mission design, interfaces and programmatic aspects. Based on these documents, ESA will require the selected Payload Consortium(a) to submit an updated set of documents to the level expected for the Phase B1, as deemed necessary at that point. The updated documentation will be evaluated by ESA. A final set of documents for the implementation phase will have to be produced by the Payload Consortium(a) before the SRR.

The Proposal Information Package (PIP) with all relevant documentation (including this Announcement of Opportunity) can be downloaded from http://sci.esa.int/M3-payload-AO

2 PROGRAMMATIC FRAMEWORK

2.1 M3 candidate missions and status

The Call for Missions for the M3 mission opportunity was released in July 2010. Four mission candidates were selected in response to this Call, namely EChO, LOFT, MarcoPolo-

R and STE-QUEST. Following their selection in February 2011, Assessment Study activities were started for these mission concepts. Between September and November 2011, the scientific community was solicited, through a "Call for Declaration of Interest", to study possible elements of the payload and the SGS for each of the selected candidate missions. The outcome of the "Call for Declaration of Interest" was non-competitive (allowing the same payload element to be studied in parallel by different teams) and non-binding. As such, it did not imply any commitment, neither from the selected teams nor from ESA, for the following phases, should the mission be selected for either follow-on study activities or for implementation. The activities of the teams selected in response to the "Call for Declaration of Interest" are proceeding and are being carried out in parallel and in coordination with the industrial study activities carried out by ESA.

At the time of the selection of the M1 and M2 opportunities (respectively Solar Orbiter and Euclid) the SPC decided to offer the PLATO mission the possibility to enter the competition for the M3 opportunity, pending the formation of a viable Consortium for the provision of the mission's payload and elements of the science ground segment. A new consortium has been formed and its proposed new structure is currently being assessed. Pending final confirmation of the revised PLATO consortium, the mission will be one of the candidates for the M3 selection. The selection of the M3 mission is thus likely to take place among 5 candidates, i.e. the four missions selected in response to the 2010 Call for Missions, EChO, LOFT, MarcoPolo-R and STE-QUEST, and PLATO. The PLATO Consortium is, however, not solicited to submit a proposal in response to the present AO, given the different programmatic status of the PLATO mission.

2.2 Approach for M3 selection

In June 2012 the Science Program Committee (SPC) endorsed the approach for the selection of the M3 mission, along the following guidelines:

i. The principle of having science-driven Calls for Missions followed by a competitive process for the mission selection is confirmed and reinforced for M3 and for future science missions;

ii. The mission selection should occur before starting Phase B1 for minimising nugatory spending on non-selected missions;

iii. The early phase activities should be strengthened for enabling the selection process at the end of Phase A. In addition to the scientific evaluation of the mission, the selection process requires a clear understanding of the programmatic implications of the mission implementation to both ESA and the Member States, including: definition of respective responsibilities, implementation approach and schedule, development costs and associated risks.

For enabling the mission selection, the following elements should be available at the end of the Phase A:

- Technical definition of the space segment, with a level of maturity enabling to assess: 1) the ability to deliver the targeted science; 2) the space segment feasibility, supported by appropriate mathematical modelling and bread-boarding activities; 3) the space segment technology readiness level (TRL), which must be better than TRL 5 by the end of Phase B1 (SRR);
- Development plan of the space segment, including: implementation approach, verification approach, schedule, risk analysis and cost assessment;
- Definition of the ground segment to a level enabling to reliably assess its development cost and schedule;
- Management scheme for the mission, including the definition of the respective responsibilities of ESA and of the Member States, and the risk management approach.

2.3 AO outcome and M3 selection

The primary objective of the present AO is to select, for each candidate mission, Consortium(a) that would be in charge – should the mission be selected – of the provision of the Member State-funded payload elements of the space segment and for the associated contribution to the science ground segment. The baseline scheme for the provision of Member State-funded elements is described in Annex 1.

The industrial Phase As have been initiated early 2012 and are currently running in parallel for the four candidate missions that are addressed through this AO, with the nominal objective of completion by September 2013. The work progress allows the definition, at the present stage, of critical performance and interface requirements for the payload elements, which are provided as input documents to this AO for each mission. Assuming a successful selection of Consortium or Consortia for each mission following this AO (along the lines of responsibility described in Annex 1), all selected Consortium(a) will work up to the M3 mission selection. Following the selection of the M3 mission, all activities will be terminated for the non-selected missions.

All documents relative to the definition of the mission and of the payload may, to some extent, evolve and be matured following the technical activities that will be achieved by the Consortium(a) and the industrial teams during the Phase A. In particular, the interface documents EID-A and EID-B are draft documents at this stage, which will be consolidated by the time of the Preliminary Requirement Review (PRR) at the end of Phase A for all candidate missions, and finalised by the time of the System Requirements Review (SRR) at the end of Phase B1 for the selected mission. No major evolution, i.e. inducing significant science or programmatic impact, should occur from PRR to SRR.

The selection of the M3 mission and the required knowledge at the end of the Phase A (as described in Section 2.2) drive the activities to be achieved during this phase on the payload. When translated to the payload level, the following elements are needed for the mission selection:

Technical elements

- Preliminary design of the proposed payload elements, including design justification, with a definition maturity enabling a preliminary assessment of its feasibility, technology readiness and performance;
- Science performance evaluation for the proposed payload elements;
- Preliminary definition of critical interfaces to the spacecraft;
- Preliminary definition of the contribution to the SGS;
- Preliminary development plan of the payload and SGS elements provision, including: development and verification approach, technology and bread-boarding activities, AIT plan, development schedule, cost assessment and risk analysis;
- In relation with the risk analysis, identification of back-up scenarios (or descoping options) and of their impact on science performance, as relevant.

Managerial elements

- Consortium management plan: definition of the respective responsibilities; background and experience of the Consortium key persons; interfaces within the Consortium and with external actors (ESA, Spacecraft prime contractor, Funding Agencies); development risks management approach;
- Financial plan and support from the Member States.

A first iteration is expected to be produced in the response to the present AO for both technical and managerial elements and will drive the proposal evaluation. Each Consortium is expected to identify critical uncertainties and open points, and provide a detailed work plan for closing the issues during Phase A. Regarding managerial and financial elements, a primary objective is to have the key Consortium contributors and the foreseen task distribution within the Consortium well defined in the proposal, for enabling technical convergence during Phase A and efficient preparation for later phases, should the mission be selected. Further details on the proposal content and selection criteria are provided in Sections from 5 to 7.

3 SCIENCE AND PROJECT MANAGEMENT

This section describes the guidelines about sharing of responsibilities among the different involved entities for what concerns science and project management. The elements envisaged at the present time and common to all involved missions are reported in the following sub-sections; information specific for each mission is reported in Annex 1.

3.1 ESA's responsibilities

During the study phase, an ESA-appointed Study Manager will be responsible for implementing and managing the ESA's study activities. An ESA-appointed Study Scientist will be the interface with the Payload Consortium(a) and the wider scientific community for all matters having scientific relevance.

Starting with the development phase, an ESA-appointed Project Manager will be responsible for implementing and managing ESA's activities. After commissioning, an ESA-appointed Mission Manager will assume responsibility for operations of the S/C, its payload, and the ground segment. During these phases, a Project Scientist will be ESA's interface with the Payload Consortium(a) and the wider scientific community for all matters having scientific relevance.

ESA is responsible for the mission design and for the design, manufacturing, assembly, integration, test, verification and timely delivery of a fully integrated spacecraft capable of accommodating the payload. The provision of the payload is the responsibility of the Consortium(a) that will respond to the present AO, with the possible exceptions spelled out in the payload-specific sections (see Annex 1). System-level integration and test of the payload onto the spacecraft will be the responsibility of ESA.

ESA will be responsible for the following ground segment elements:

- The ESA tracking station network;
- The Mission Operations Centre (MOC);
- The Science Operations Centre (SOC).

ESA is responsible also for the overall design of the Science Ground Segment (SGS), the implementation, operation and maintenance of the mission archive and its interface with the user community.

3.2 Responsibilities of Payload Consortia

The Payload Consortium(a) selected as a result of this AO will be responsible (should the mission be selected for implementation) for the:

- Design, development, implementation, provision, integration, verification, test, calibration and delivery to ESA of the complete integrated and tested payload, including the Ground Support Equipment (optical, mechanical, electrical), according to the agreed model philosophy;
- Provide support to ESA for payload system integration on S/C;
- Provision of the elements of the SGS required for a) the processing of the mission data and the generation of data products, b) the monitoring of the payload operations, and c) the on-ground and in-flight payload calibration.

Each Payload Consortium must identify a single Consortium Lead or Principal Investigator (PI) heading the consortium. The Consortium Lead or PI must be backed by a national funding agency, which should be a Lead Funding Agency (LFA) for the payload (see Section 3.3). In some countries, various organisations or institutions may provide resources. In this case, the one of them providing prevalent financial support must be indicated as LFA.

Co-investigator (Co-I) teams are required via their national funding agencies to seek agreement with the LFAs, which will retain full responsibility for the payload development and timely delivery and will be the sole contact with ESA with respect to the selected investigation.

3.3 Lead Funding Agencies

The LFAs are expected to provide significant support to the proposed activities for the respective payload and to have prime science and industrial responsibility for the provision of the payload and SGS elements. For each mission, the LFAs include the Agency backing the Consortium Lead or PI.

The LFAs will be considered responsible vis-à-vis ESA for all financial matters related to the selected investigation.

Proposers must provide Letters of Endorsement (LOE) from all the LFAs (see Section 5.7.1). The LOE's must commit the financial support necessary up to the end of Phase A, should the proposal be selected. The LOE's must also contain an indication of the intention of the funding agencies to seek funding for the following implementation and operation phases, should the proposal be selected through the present AO and the mission be selected as M3.

The availability of the funding for the following phases will have to be formally confirmed by the time of the M3 mission selection for all following implementation and operation phases, for the selected mission.

A Multi-lateral Agreement (MLA) between ESA and the LFA(s) of the Payload Consortium(a) (or Memorandum of Understanding, MOU, in the case of non-ESA member states) will be established at completion of the Definition Phase for the selected mission to formalise the commitments and deliverables of all parties.

3.4 Science Team

During the study phase the mission activities are supported by a Science Study Team (SST) appointed by ESA and chaired by the Study Scientist. The SST has the responsibility for defining in detail the scientific goals of the mission, and in particular for developing the mission's science case in preparation for the competitive down-selection that the mission will undergo at the conclusion of the study phase.

After adoption, the mission activities will be supported by a Science Working Team (SWT) chaired by the Project Scientist. The SWT will support the Project Scientist in monitoring the mission's development in order to ensure the achievement of the scientific objectives of the mission, and will provide advice in order to maximise its scientific return. In general, the SWT will be composed of the Consortium Lead/PIs or representatives of the Payload Consortium(a) and of members of the community at large, who will serve as independent and interdisciplinary scientists. Details will be different depending on the nature of the mission.

3.5 Steering Committee

Following the adoption of the M3 mission, a Multi-Lateral Agreement (MLA) will be established between ESA and the LFAs of the Payload Consortium(a) to formalise the commitments and deliverables of all parties. A Steering Committee with representatives from the LFAs and ESA will then be set up to oversee the activities of the Payload Consortium(a) and the timely fulfilment of the obligations of all parties to the MLA.

3.6 Operations and Data

The ground segment will consist of the MOC, the SOC and the Payload Consortium(a) Teams.

The MOC will in general be responsible for the operations of the spacecraft, monitoring of the spacecraft health and safety, overall mission planning and upload of the platform and payload telecommands and reception of the downloaded telemetry data. The MOC will also be responsible for provision of the raw payload data, spacecraft housekeeping and auxiliary data.

The Science Ground Segment (SGS) will in general consist of the ESA SOC and of contributions from the Payload Consortium(a).

The SOC will be the unique point of contact to the MOC during routine operations for providing detailed payload operational requests. The SOC will plan the payload operation activities.

The SOC will in general develop, operate and maintain the mission archive containing all the mission data products, together with all the information necessary (including any software pipeline) to enable the scientific community to access, exploit and re-process them as needed.

In general, software, calibration and technical data for the generation of payload specific products are provided by the Payload Consortium(a).

The distribution of responsibilities outlined above for the SGS activities is the one currently assumed for the implementation of the M3 mission candidates. Proposals submitted in response to this AO may include deviations from this scenario. Such proposed alternatives must be duly justified and explained.

3.7 Data Rights

All data from ESA science missions become public after the end of the proprietary period. The detailed definition of the data policy for the selected mission will be part of the Science Management Plan (SMP) that will be submitted to the SPC for approval shortly after the time of the mission's selection.

For the purpose of the present AO, a baseline data rights scenario is described for each candidate mission in the mission-specific sections (see Annex 1). Proposals submitted in answer to the present AO may present and must duly justify alternative schemes and/or alternative durations for the proprietary time. While these elements will form part of the material used to evaluate the proposals scientifically, acceptance of the proposals does not bind either ESA or the proposers to the proposed scheme. The SPC retains the authority to approve an SMP for the mission that may differ from the proposed scheme.

3.8 Public relations and outreach

ESA is responsible for planning and coordinating education and outreach activities related to each mission, with the support of the Payload Consortium(a). An outreach and education plan will be required for the mission selected for the M3 flight opportunity. This plan will be developed and executed jointly by ESA and the Payload Consortium(a) under supervision of the mission SWT. The following guidelines will be applicable:

- ESA has the lead on the execution of all education and outreach activities within the data rights framework of the mission;
- For the purpose of public relation activities, Payload Consortium(a) will provide to ESA unlimited access to all processed and analysed data, even during their proprietary period (if applicable); this material will anyway follow the data rights policy for matters concerning scientific publication purposes;
- Members of the SWT and the Payload Consortium(a) have a duty to support ESA with regards to education and outreach;
- ESA gives credit to members of the SWT and the Payload Consortium(a) regarding scientific and technical results when applicable.

4 PROPOSAL INFORMATION PACKAGE

The Proposal Information Package (PIP) contains, together with this AO, the following documents for each candidate mission:

- Science Requirements Document (Sci-RD)
- Mission Requirements Document (MRD)
- Experiment Interface Document-Part A (EID-A)
- Experiment Interface Document-Part B (EID-B) template
- Payload cost spreadsheet template

Additional documents for EChO:

- Environmental Specifications (ES)
- Payload Definition Document (PDD)
- Radiometric Model Document (RMD)
- Baseline Telescope Description (BTD)
- Format for the prescription of optics (FPO)
- Mission Analysis Guidelines (MAG)

Additional documents for LOFT:

- Payload Definition Document (PDD)
- Environment Specification (ES)
- Mission Analysis Guidelines (MAG)

Additional documents for MarcoPolo-R:

- Payload Resources and Requirements Document (PRRD)
- Environment Specification (ES)
- Planetary Protection Requirements (PP)
- Mission Analysis Guidelines (MAG)

Additional documents for STE-QUEST:

- Environmental Specification (ES)
- Payload Definition Document (PDD)
- Mission Analysis Guidelines (MAG)

The EID-A documents included in the PIP are a preliminary collection of requirements, which reflect the current maturity of each mission design. For the mission selected at the end of 2013 for the M3 flight opportunity, the EID-A will at that point be updated, to reflect the mission design evolution, up to the Preliminary Requirements Review (end of Phase A).

The Payload Definition Document (PDD/PRRD) is a Reference Document defining the model payload.

5 CONTENT OF THE PROPOSAL

5.1 Overall structure

The proposal must address all the science, mission and programme requirements described in the PIP, and must provide sufficient information to allow a complete evaluation.

Each proposal must address the science goals and requirements as described in the Sci-RD and must be compliant with the mission definition, resources, operational conditions and constraints as specified in the MRD.

Each proposal must include an EID-B to respond to the interface requirements contained in the EID-A, to the maximum extent possible at the present time.

If the mission scientific return can be achieved with a proven payload concept departing from the model payload the merits of this option and its technical requirements must be justified in the proposal and must still be compatible with the overall mission resources.

The proposal must consist of the following parts:

- Executive summary
- Part I: Scientific Objectives
- Part II: Payload Design and Development
- Part III: Science Ground Segment contribution
- Part IV: Management Plan
- Part V: Financial Plan
- Experiment Interface Document – Part B (EID-B)
- Letters of Endorsement from the Lead Funding Agency (to be submitted separately, see Table 1 for the deadline).

For Parts I, II and III, the proposal must clearly identify major open issues and uncertainties (if any) that could affect the mission selection, and detail the work plan for closing them by the end of Phase A.

Furthermore, a preliminary risk analysis is required in the proposal and the proposers are invited to identify back-up or descoping options as risk mitigation measures, e.g. for coping with potential issues related to technology readiness, compatibility with readiness for launch in 2022, and/or cost issues. The impact of descoping options should be assessed.

Technical parts of the selected proposals, including the EID-B, will be provided to the Prime Contractors responsible for the industrial system assessment studies right after the payload selection in February 2013. If required Non Disclosure Agreements (NDA) with the industrial teams will be put in place.

5.2 Executive summary

The Executive Summary must outline all aspects of the proposal, with special emphasis on:

- Objectives of the proposal and compliance with the scientific objectives listed in the Sci-RD
- Overall performance of the proposed payload required to fulfil the anticipated objectives
- Payload description and operations plan
- Summary of required spacecraft resources
- Science Ground Segment contribution
- Science data analysis plan and data rights policy
- Management scheme
- Funding scheme
- Requirements (if any) imposed on other payload units or spacecraft subsystems

If the proposal violates any of the constraints described in the PIP, a clear statement about each deviation, together with its justification, must be included in the summary. Each deviation must be further detailed in the appropriate sections. The payload resources and requirements are to be summarized in tabular forms as part of EID-B.

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

5.3 Part I: Scientific Objectives

This section must clearly describe the scientific investigation and the overall capability of the payload, in the light of the investigators' and global mission objectives, as defined in the Sci-RD. The anticipated overall scientific performance of the payload under nominal operation conditions must be stated and compared, if relevant, to that of similar payloads described in the PDD/PRRD, flown on other spacecraft or planned for future missions. Possible synergies with laboratory studies and ground- or space-based observations should be discussed. Assumptions required to achieve the science objectives must be clearly indicated. 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 scientific results must be outlined and discussed, as far as possible, in both qualitative and quantitative terms. If the proposal contains any deviation from the technical and/or programmatic constraints, the scientific justification will be given in this section.

The implications of payload descoping options, if presented in Part II, on scientific objectives achievement should be clearly identified and described.

This section must include a statement about the acceptance of the guidelines about public relations and outreach indicated in Section 3.8 and/or any foreseen possible deviation from them.

5.4 Part II: Payload Design and Development

The Part II on Payload design and development must be organised in sections covering the payload design and expected performance, the technology readiness assessment and the development approach.

5.4.1 Part II.1: Payload Design

The Payload Design section must address the following topics:

- Payload Requirements Specification

  This section will list and justify main requirements in the following areas:

  - Scientific requirements
  - Functional requirements
  - Observational requirements
  - Environmental requirements
  - Operational requirements
  - Verification and validation requirements
  - Cleanliness requirements
  - Calibration requirements

- Baseline Payload Technical Description and Design

  This section will include a description of the preliminary design of the proposed payload:

- Functional description and block-diagram
- Concept of operations
- Accommodation on the spacecraft
- Mechanical and thermal architecture, baseline solutions
- Optical design and performance
- Electrical architecture
- Processing and control units

A payload design justification must be provided. The status of the payload mathematical models will be presented (drawings, mechanical Finite Element Model, thermal model, optical model as relevant, radiation model, performance assessment models, etc.), by highlighting critical open points and the timeline/activities needed for closing the issues.

The proposed design must be reflected in the EID-B, in terms of resource budgets, preliminary configuration drawings (e.g., CAD - Computer Aided Design) and any specific requirements to the mission.

- Payload Performance

An analysis of the proposed payload performance, based on the preliminary design and supported by payload simulations, must be provided. All assumptions made in this performance analysis (including error budget) will be included. The performance analysis must include any alternative design, including back-up and/or descoping options proposed in case the technology does not meet the expected performance for the baseline.

In addition, a critical analysis of the payload performance must be provided concerning sensitivity to environmental parameters (e.g., radiation, temperature ranges, EM fields, charging), and to degradation in performance if key payload elements turn out to be unachievable during the payload technology development programme. Details associated with payload performance evolution and maturation plans, within the payload development, must be indicated.

5.4.2 Part II.2 Technology Readiness

The technology and qualification readiness status of payload units and of the overall proposed payload must be provided. The payload technology readiness level is required to be better than TRL 5 at the SRR. This level does not generally require the development of the complete payload, but rather focused technology developments and bread-boarding, limited to components with low flight heritage, for demonstrating that all payload components meet the expected performance in the relevant environment.

Considering that technology readiness is an important input for the mission selection decision process, and that SRR will occur within two years from the PRR, TRL5 should preferably already be achieved at PRR (i.e., at the time of the mission selection). Otherwise, clear evidence that TRL 5 will be reached by SRR should be provided, or back-up solutions identified.

The technology readiness analysis will in particular include the following:

- Critical review of the payload components, TRL evaluation and identification of low heritage elements (TRL < 5) requiring technology developments;
- Identification of all required technology developments, including indication of expected development duration;
- Current technology development status of all payload elements: description of running activities and timeline;
- Timeline for future bread-boarding activities, if any.

5.4.3 Part II.3 Payload Development Plan

A preliminary development plan will be provided, including the following topics:

- Product Tree;
- Overall engineering approach;
- Procurement scheme of payload parts: off-the-shelf or commercial components, new developments and industrial involvement foreseen if any, identification of Long Lead Items (LLI);
- Payload verification approach: verification matrix, model philosophy;
- Assembly, Integration and Test approach: integration flow, test plan, identification and availability of test facilities, cleanliness and contamination control needs;
- Development schedule for phases A/B/C/D, providing details at subsystem or component levels;
- Payload calibration approach: identification of specific needs and facilities on-ground, during cruise phase and in-orbit, as relevant.

5.5 Part III: Science Ground Segment contribution

Proposals must contain the description of the contribution for the Science Ground Segment (SGS), covering the implementation, operations and post-operations phases. It should be based on the distribution of responsibilities given in Section 3 and Annex 1 and respond to the SGS requirements as defined in the EID-A. It must contain a description of the tasks to be performed by the Payload Consortium and the interfaces between the various elements of the SGS (including the ESA ones). A description of the proposed infrastructure should be also included.

The requirements for the SGS and the operations concept, architecture and interfaces will be defined during the rest of the mission's study phase. In particular, during Phase A, ESA will produce the Science Operations Assumptions Document (SOAD). This will be refined during the Definition Phase with the release by ESA of the Science Operations Concept Document (SOCD) and the Science Implementation Requirements Document (SIRD) to be answered by each Instrument Consortium by a Science Implementation Plan (SIP).

In order to define a coherent and optimised SGS, it is expected that all SGS-related study activities in Phase A and in the definition phase will be carried out in close co-operation between ESA and the selected Payload Consortia.

5.5.1 Scientific Data Analysis plan

A scientific data analysis plan must be provided. This will contain an outline of the relevant technical, managerial and programmatic aspects within the framework described in Section 3.6 for each mission.

The plan will define the proposed assignment of proprietary data access within the Payload Consortium, at mission level and to the wider scientific community, responding to the guidelines given in Section 3.7, and identifying the teams with proprietary rights and the relevant data products.

5.6 Part IV: Management Plan

The Management Plan will cover all aspects of the proposed investigation for the entire duration of the mission. It should be based on the distribution of responsibilities between ESA and the Consortium(a) given in Section 3 and Annex 1 for each mission and the corresponding management requirements as defined in the EID-A.

As already stated in Section 3.2, each proposal will clearly identify a PI or Consortium Lead and LFAs. The PI/Consortium Lead must show how he/she will establish an efficient and effective management scheme.

The following items must be included:

- Work Breakdown Structure
- Consortium organisation and team composition
  Organisation charts must contain the names and affiliations of all key personnel, including their respective fraction of time available for the project. The PI/Consortium Lead will show, in particular, how he/she will manage and participate in the overall activities.

The Management Plan must consist of two main sections:

i) A consolidated binding plan that will cover the Payload Consortium activities up to the end of Phase A, to be concluded with the M3 mission selection by SPC, planned at the end of 2013. All management aspects during that period must be described in detail.

ii) A draft plan covering Phase B1, the implementation and operation phases (Phases B2, C, D, E) and the post-operations phase, until the delivery of all the agreed products to ESA, for all the elements contained in the proposal. This draft plan will be regarded as indicative of the capabilities and readiness of the Payload Consortium to carry out the mission activities in the next phases, which must enable the achievement of the mission objectives. It must address the following topics:

- Payload
    - Critical technology developments, including funding for back-up development plans
    - Development
    - External test and ground calibration campaigns (where facility costs are incurred)
    - Payload operations (from preparation to in-flight activities)
    - On-board software maintenance

- SGS
    - Scientific planning of payload operations
    - Scientific operations (including in-flight calibration)
    - Payload operations monitoring
    - Data reduction and science analysis

A complete list of names, with affiliation and e-mail addresses, of the Co-Investigators will be provided as an Annex, with specification of expertise and roles of key members in the Consortium. This list will not count against the page limit of the proposal (see Section 6).

5.7 Part V: Financial Inputs

The Financial Inputs map the two main sections reported in the Management Plan, according to the following indications:

i) A consolidated financial plan for the Payload Consortium activities in the period up to the M3 mission selection.

ii) Draft cost estimates covering Phase B1, the implementation and operation phases (Phases B2, C, D, E) and the post-operations phase, for all the elements contained in the proposal.

The estimated payload development cost will be summarised in tabular form. An Excel cost template is provided for convenience in the PIP of this AO, and can be used for identification of the financial costs according to the requirements above. The specific labels and numbers in the template are examples only.

The cost breakdown must follow the Work Breakdown Structure specified in the Management Plan. For each key partner in the Consortium the Financial Inputs must include separate sections for their own resource provision with the detail of estimated resources for each activity. The assumptions made in the calculation of the resources must be given explicitly (e.g., as comments in the Tables). For estimating the necessary resources the following items must be accounted for:

- Manpower resources (FTEs) and associated costs
- Other internal institute resources
- External contracts
- Capital equipment costs required in the development of the payload
- Risk margin, with appropriate justification
- Total funding requirements

The proposal must explicitly identify the margins contained in the cost estimate. ESA considers a 20% contingency margin necessary in order to manage the payload development risk.

5.7.1 Letter of Endorsement

Proposal must include Letters of Endorsement (LOE's) from the funding agencies that will provide significant support to the proposed activities (see Section 3.3). The LOE's must commit the financial support necessary up to the end of Phase A, should the proposal be selected. The LOE's must also contain an indication of the availability of the funding agencies to seek funding for the following phases, should the proposal be selected through the present AO and the mission be selected as M3 (see also Section 3.3).

5.8 Experiment Interface Document – Part B (EID-B)

The purpose of the Experiment Interface Document – Part B (EID-B) is to formalise the Payload Consortium response to the technical and programmatic requirements given in the EID-A. In response to this AO, a preliminary EID-B is expected. It is anticipated that the interfaces will be matured in the period between the Payload Consortium selection and the Preliminary Requirements Review (PRR), such that all interfaces can be frozen by the time of the System Requirements Review (SRR), should the mission be selected. Critical interfaces must be justified in the preliminary design reported in the Part II of the proposal (see Section 5.4) and must be identified and spelled out in the EID-B.

Should the mission be selected for the M3 flight opportunity, the EID-B will be maintained and updated at regular intervals during the different mission phases, and will become a contractual document between ESA and the selected Payload Consortium. This document must be arranged according to the template provided in the PIP of this AO package. It will include information on the following topics:

- Payload Design Description
- Interface Requirements and resource allocations
  - Budgets
  - Payload location and pointing
  - Mechanical interfaces
  - Thermal
  - Electrical
  - Data Handling
  - Software
  - Electromagnetic Compatibility
  - Handling
  - Mission environment compatibility
- Ground segment and operations
- Management
- Data deliveries

Complementary inputs not required within the standard EID-B format may be added at the discretion of the proposing team with a technical justification, which will be assessed in the frame of the proposal evaluation process. The purpose of the EID-B document is to provide factual data on all aspects of the proposed payload, whereas discussion, justification and risk assessment, etc. are provided in Part II of the proposal (see Section 5.4).

6 SUBMISSION OF THE PROPOSAL AND CONTACT WITH ESA

Letters of Intent and Proposals must be submitted electronically using the interface available at:

http://sci.esa.int/M3-payload-AO

Consortia interested in submitting a Proposal are requested to submit a Letters of Intent (LoI) no later than:

5 October 2012, 12:00 CEST (noon)

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

Only Consortia that have submitted a Letters of Intent (LoI) within the deadline reported above will be allowed to submit a Proposal. Submission of Proposals must be completed no later than:

30 November 2012, 12:00 CET (noon)

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

Letters of Endorsement may be submitted to the relevant e-mail addresses listed below after this date, but no later than:

14 December 2012, 12:00 CET (noon).

Proposals must be written in English and must be edited on single-space A4 pages, with a character size not smaller than 11 points.

The maximum number of pages allocated to each proposal Part is as follows:

- Executive summary, 3 pages
- Part I: Scientific objectives, 20 pages
- Part II: Payload Design and Development, 70 pages
- Part III: Science Ground Segment contribution, 10 pages
- Part IV: Management Plan, 20 pages
  The list of Co-Investigators can be provided as an Annex to part IV, not counted against its page limits
- Part V: Financial Plan, submitted as spreadsheets
- Experiment Interface Document – Part B (EID-B) (no page limitation)

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

- The title of the proposal
- The Part title (Executive Summary, Part I: Scientific Objectives, etc.)
- The name, address, telephone (office, alternative and portable) and fax numbers, and e-mail address of the PI or Consortium Lead

All pages must be numbered. Parts must be produced in separate PDF files, except for the Financial Plan that must be submitted as a spreadsheet following the template.

Page allocations include illustrations, but exclude cover page and table of contents.

Requests for further information and clarification should be addressed to the following e-mail addresses relevant for each mission:

EChO EChO@rssd.esa.int

LOFT	LOFT@rssd.esa.int
MarcoPolo-R	MaPoR@rssd.esa.int
STE-QUEST	STEQUEST@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.

Questions about the AO documentation and process can be sent to the different e-mail addresses above, as appropriate, by the same deadline as for the LoIs.

7 EVALUATION OF PROPOSALS

A review process of the proposals received in response to this AO will be put in place for each of the candidate missions.

The general approach to be adopted for the selection, funding and development of the Payload Consortia aims at preserving an efficient procurement of a highly optimised payload, to ensure the required science return from the mission with minimum resources. The payload evaluation criteria are detailed in Section 7.2.

For each of the four missions ESA will appoint a Payload Review Committee (PRC) consisting of external experts, with competences covering the main scientific areas of the mission, with the main role of reviewers of the payload's scientific capability. The PRC will evaluate the merits of each instrument proposal according to the terms of reference indicated in Section 7.1 and in line with the criteria listed in Section 7.2(1).

In parallel with the work of the PRC, ESA will appoint for each mission an Instrument Review Panel (IRP), consisting of selected personnel of the Agency, as well as invited specialists if needed. The IRP will undertake a technical, operational, managerial and financial review of each payload proposal to establish the overall proposal integrity and compliance with the mission requirements and risk. The instrument concept, feasibility, management scheme and funding will be assessed in line with the criteria listed in Section 7.2(2,3).

Each PRC will work in close collaboration with the relevant internal ESA IRP. ESA will provide for each payload proposal a technical and programmatic assessment to the relevant PRC. For each payload proposal, in financial and programmatic areas, ESA will consult the funding agencies and provide the PRCs with input on the implementation feasibility and risk assessment.

Based on the technical and scientific assessments, each PRC will evaluate and recommend to D/SRE the configuration of the payload complement that satisfies the mission scientific objectives and meets as closely as possible the objectives of the mission model payload.

The Advisory Structure to the Science Programme will be requested to provide an evaluation of the proposals and to recommend to D/SRE a payload complement for each of the missions. The deliberations of both the PRC and ESA IRP will be submitted to the ESA Advisory Structure as an element on which to base their recommendation. The results of this process will be reported to D/SRE. Based on this, D/SRE will submit to SPC a proposal for the selection of the P/L for each of the four missions.

7.1 Payload Review Committee

An independent international Payload Review Committee (PRC) for each mission will assess instrument proposals in close cooperation with the internal ESA IRP.

The PRC of each mission will review all instrument proposals received in response to the AO for that mission according to the following terms of reference:

- Ensure that all science objectives are satisfied within the overall AO response;
- Evaluate whether each payload proposal satisfies the science requirements in terms of sensitivity and performance, as specified in the relevant documents, to achieve the specific science objectives;
- Evaluate compatibility of each payload against the objectives of the model payload as defined in the PDD/PRRD;
- Recommend which proposal should be selected, in the case that competing payload proposals are submitted;
- Recommend alternative solutions in the case of too high development risk and/or incompatibility with available spacecraft resources or interfaces.

The PRC will also recommend about the composition of the overall payload carried by the mission taking into account the following elements:

- Evaluation of individual payload proposals (see above);
- Potential scientific achievement within the global mission objectives;
- Compatibility with the model payload;
- Compatibility with system resources, mission and programme constraints, and financial envelope imposed by national agencies.

7.2 Evaluation criteria

The individual instrument proposals will be evaluated on the basis of the requirements specified in the AO and using the following criteria:

(1) Scientific

- Relevance of the scientific objectives and their compatibility with the global objectives of the mission;
- Adequacy of the proposed measurements to fulfil the stated objectives and capability of the proposed payload to perform the required measurements as indicated in the relevant Sci-RD;

(2) Technical and Operational

- Design maturity and justification of the proposed technical solutions;
- Technology readiness assessment: technology developments status and compatibility with M3 timeline;
- Identification of critical open issues and uncertainties. Quality and completeness of the proposed work plan in the Phase A for enabling the mission selection;
- Overall development status and compatibility with M3 timeline: payload definition and modelling, performance analyses, technology developments;
- Compliance with the interfaces specified through the EID-A;
- Realism of the payload development plan;
- Operational complexity and associated operational risks;
- Coherence and robustness of the SGS contribution for its implementation, operations and post-operations;
- Risk analysis and back-up options.

(3) Managerial

- Competence and experience of the team in all relevant areas (science, technology, software, development, management and outreach/science communications);
- Consortium structure and management plan, during the Phase A and later phases: responsibilities, work distribution, definition of interfaces between the Consortium members, decision process, interface with ESA;
- Compliance with ESA applicable management, engineering, reporting and product assurance requirements and standards;
- Risk management scheme;
- Financial support from the Member States.

ANNEX 1 MISSION-SPECIFIC ELEMENTS

The present section describes the mission-specific elements in terms of the currently assumed breakdown between ESA-provided and Consortium-provided items, for both the payload and the SGS. It also indicates the baseline assumptions about data rights. Proposers are free to propose alternative schemes for any of these elements, bearing in mind that selection of the relative proposal binds neither ESA nor the Consortium at this stage in terms of the proposed scheme. Any assumption will be refined during the study phase and the binding scheme will be the one spelled out in the SMP that will be approved by the SPC, according to current planning shortly after the mission's selection.

A1.1 EChO

The baseline EChO payload consists of a single instrument, a spectrometer. This will be provided by a single Payload Consortium. It is currently planned that ESA will be responsible for the design, provision, verification and integration of the following elements:

- the fine guidance sensor (as required by the S/C attitude control system);
- the telescope assembly;
- the associated passive cooling system.

Should the mission be selected for implementation for the M3 launch opportunity, the Payload Consortium selected for EChO as a result of this AO will:

- design, develop, integrate, verify, test, calibrate and deliver to ESA the complete integrated and tested spectrometer and necessary subsystems that are the subject of their proposal, including any required active cryogenic stage, on-board calibration sources, instrument optical bench, and GSE (optical, mechanical, electrical), according to the agreed model philosophy;
- provide the elements of the SGS required for the processing of the mission data and the generation of data products;
- provide support to ESA for payload system integration on S/C, maintenance, operations and calibration.

A preliminary definition of the data products is:

- Level 0: Unpackaged/decompressed raw spacecraft data (to include payload, spacecraft/ground segment data) for each observation/target visit;
- Level 1: Individual calibrated light curves for each target visit. Data will be in the form of cubes containing spectral timelines that record the observed flux as a function of time (binned per cadence interval), per spectral bin of the EChO spectrometer;

- Level 2: Individual transit and/or occultation spectra for each exoplanet observed, stacked to include all transits/occultations observed over the course of the mission. Where orbital phase measurements have been made, spectra will be provided at multiple epochs. In all cases, spectra for individual visits will be included in the product.

The definition of Level 2 product for observations of targets other than exoplanets will be on a case-by-case basis, and will be at the discretion of those proposing the observations.

The following responsibilities are assumed for the generation of data products:

- levels 0, 1 and 2 data are generated by the SOC and made available to the Payload Consortium;
- the SOC is responsible for the provision of the data processing infrastructure needed for Level 0, 1 and 2 data product generation;
- the Payload Consortium provides to the SOC the payload-specific software modules and processing blocks that will be used for the generation of Level 0 products;
- the Payload Consortium provides to the SOC the software modules and processing blocks that will be used for the generation of Level 1 products, and for generation of Level 2 products that are specific to observations of exoplanets.

EChO is considered to be a survey-type mission and will characterise the atmospheres of a core sample of transiting exoplanets to be defined prior to launch. A fraction of the total observing time will be made available to the astronomical community through open calls. All mission data products associated with the core EChO exoplanet survey will be available to the community after the expiration of the proprietary period. At the start of the mission the duration of the proprietary period for data from an individual target will be 12 months, starting from the time of the last visit to the target needed to achieve the required signal-to-noise. It is envisaged that the proprietary period will reduce significantly as the mission progresses. The same definition and duration of proprietary period will apply for open time observations.

The definition of data rights given above should be regarded as an initial framework. Proposals submitted in response to this AO may include alternative approaches and deviations from the scenario given above: any framework proposed for the distribution of data rights, however, must prioritize observation of the EChO survey targets and the realisation of a library of high-quality, homogenously processed exoplanet spectra that can be used to address the science objectives of the EChO mission. The framework should ensure fair return to the member states delivering the EChO payload, as well as providing access to the capabilities of the EChO payload to the astronomical community through open call(s).

A1.2 LOFT

The baseline LOFT payload consists of two core instruments, the Large Area Detector (LAD) and the Wide Field Monitor (WFM) that will be provided by a single Payload Consortium. It is currently assumed that ESA will be responsible for the design, development, verification and integration, and test of the following payload elements:

- the supporting structure for both LAD and WFM, composed of:
    - payload bench (including primary and WFM supporting structure);
    - LAD supporting structure (detector panel);
    - LAD hold-down, release and deployment sub-systems;
    - LAD harness according to specification provided by the P/L consortium.
- the VHF transmitter required for the burst alert system.

Should the mission be selected for implementation for the M3 launch opportunity, the Payload Consortium selected for LOFT as a result of this AO will assume the responsibility to:

- Design, develop, integrate, verify, test, calibrate and deliver to ESA the LAD and WFM, including Ground Support Equipment (optical, mechanical, electrical), according to the agreed model philosophy;
- Provide the elements of the SGS required for the processing of the mission data and the generation of data products, including the ground infrastructure and operational capability for a VHF-based Loft Burst Alert System;
- Provide support to ESA for payload system integration on S/C, maintenance, operations and calibration.

ESA will be responsible for the system-level integration of the LAD and of the WFM.

The Institutes participating to the LOFT mission will take responsibility for providing a set of ground stations to receive the burst alerts from the satellite as well as the ground system to process them and to disseminate the data/alerts to the scientific community.

A preliminary definition of the data products for LOFT is:

- Level 0: Raw spacecraft telemetry is de-commutated and split into functionally independent parallel streams formatted as binary FITS files;
- Level 1: Aspect correction is applied to assign photons to sky coordinates and payload-specific calibration such as detector gain and good timing information are applied to produce calibrated photon event lists;
- Level 2: Data from multiple observation intervals that constitute an observation are combined to create merged event files, images, and other observation-level data products. Images are generated for WFM, temporal/spectral data cubes are generated for LAD observations, photon lists for sources from both instruments will be generated. Standard pipeline data analysis tools are applied to extract per-observation source and

spectral properties, PSD and light curves, source spectra, background data sets, and other (TBD) products to facilitate interactive data analysis.

- Level 3: Level 2 properties are combined to produce catalogues and mosaics.

For the generation of data products the following responsibilities are assumed:

- Level 0 and Level 1 data are generated by the SOC and made available to the Payload Consortium. The Payload Consortium(a) provides the algorithms to the SOC for the generation of the Level 1 payload specific products;
- The Payload Consortium generates and delivers the Level 2 and 3 products to the SOC for their archival.

LOFT is assumed to be a Guest Observer mission with a significant Key Project element designed to ensure adequate execution of all key science goals. All mission data products will be available to the general scientific community after the expiration of the proprietary period. The duration of the proprietary period for each data set will be one year, starting from completion of data acquisition of an extended observation campaign, i.e., once all the observation data requested for an individual target over a number of separate observations are declared as complete, then all target data will be publicly accessible one year later. For the WFM no proprietary data rights will apply, as this data should be made available to the community on a much shorter time scale.

Considering the importance of the key projects, proposals submitted in response to this Announcement of Opportunity should describe a framework for the distribution of data rights which ensures a proper execution of the core program, a fair return for the member states providing the payloads and a guarantee that the science return is optimized through call(s) for observations open to the community.

A1.3 MarcoPolo-R

The main objective of MarcoPolo-R is to return samples from an asteroid to Earth. To put the samples in context, the spacecraft will host a number of payload units provided by Payload Consortia answering to the present AO. The envisaged model payload is described in the mission specific PRRD.

Should the mission be selected for implementation for the M3 launch opportunity, the Payload Consortia selected for MarcoPolo-R as a result of this AO will assume the responsibilities mentioned in Section 3.2 for the proposed payload. In addition, considering the objectives of the MarcoPolo-R mission, a sample Curation Facility is needed and assumed to be part of the Member States provision.

A preliminary definition of the data products for MarcoPolo-R, that follows the CODMAC (Committee for Data Management, Archiving, and Computing) format and is commonly used in the Planetary Science Archive, is:

- Level 1: Raw data: telemetry data with data embedded;
- Level 2: Edited data: data corrected for telemetry errors and split or de-commutated into a data set for a given payload. They are also called Experimental Data Record. Data are also tagged with time and location of acquisition;
- Level 3: Calibrated data: edited data that are still in units produced by payload, but have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No re-sampling applied, so edited data can be reconstructed;
- Level 4: Re-sampled data: data that have been re-sampled in the time or space domains in such a way that the original edited data cannot be reconstructed. These data could be calibration in addition to being re-sampled;
- Level 5: Derived data: derived results, as maps, reports, graphs, etc.
- Level 6: Ancillary data: non-science data needed to generate calibrated or re-sampled data sets. They consist of payload gains, offsets, pointing information for scan platforms, etc.

For the generation of data products the following responsibilities are assumed:

- Level 1 data will be distributed by the MOC;
- Level 2 data are generated by the SOC and made available to the Payload Consortia teams;
- Level 3 data will alternatively be generated by the SOC pipeline with the payload teams providing the necessary software routines or they will be generated directly by the payload teams. This will have to be proposed and negotiated with each team individually;
- Level 5 data will be produced by the payload teams as part of their scientific work;
- Level 6 data (ancillary data) will be produced by the MOC and the SOC. The SOC will provide Level 6 data in the SPICE format (http://naif.jpl.nasa.gov).

This distribution of responsibilities reported above is the currently assumed baseline. Proposals submitted in response to this AO may include and must justify deviations from the scenario given above.

Data products will be available to the general scientific community after the expiration of the proprietary period. The duration of the proprietary period for each data set will be 6 months, starting at the time of calibration and validation of the data, i.e., data calibrated at a given date will be publicly accessible 6 months later.

The following scientists have proprietary access to the MarcoPolo-R data:

- Scientists in the payload teams;
- Members of the SWT, under the conditions to be described in the Science Management Plan.

Proposals submitted in response to this AO should describe other or alternative strategies for the assignment of proprietary access within and outside the payload teams.

Considering the nature and objectives of the MarcoPolo-R mission, access to data provided by on-board scientific payload in properly processed form should be granted at any requested time to ESA and other involved personnel for the purpose of planning and developing activities relevant to target characterisation and sample acquisition.

Proposals for the preliminary definition of a Curation Facility for the returned samples will be acceptable in answer to the present AO. With respect to this element, the general requirements reported in the present AO are the same as for a "payload and/or Science Ground Segment element". In this particular case, however, no EID-B is required. The ground-based instruments supporting the sample ground analysis are not part of this AO. These proposals will include a rationale for access and distribution of returned samples to the wide interested community. As a baseline, the proprietary period is assumed to be 6 months after receipt of the sample in the Facility. External scientists should have the possibility to request part of the samples via a proposal process.

A1.4 STE-QUEST

The baseline STE-QUEST payload consists of two separate core instruments, the Atomic Clock and the Atom Interferometer that will be provided by Payload Consortium(a). ESA will be responsible for the design, provision, verification and integration of the additional payload elements:

- Optical and microwave science links;
- Precise Orbit Determination equipment.

Should the mission be selected for implementation for the M3 launch opportunity, the Payload Consortium selected for STE-QUEST as a result of this AO will:

- integrate, verify, calibrate and deliver to ESA the Atomic Clock and the Atom Interferometer;
- provide the elements of the SGS required for the processing of the mission data and the generation of data products;
- provide support to ESA for payload system integration on S/C, maintenance, operations and calibration.

Although the baseline scenario is the provision by ESA of the required science link(s), potential involvement of the Atomic Clock Consortium in the provision of the science link(s) can be included in the proposal. Actual tasks and interfaces will be discussed following the proposal review.

As part of the agreements with ESA, the Consortium(a) participating to the STE-QUEST mission will take responsibility for providing the ground clocks, verifying and operating them, providing the necessary infrastructure and operational capability required by the optical and microwave science links, providing ground clock data and supporting their analysis during the STE-QUEST mission lifecycle.

A preliminary definition of the data products for STE-QUEST is:

- Level 0: Spacecraft and payload raw data, ground segment raw data as well as the required ancillary data;
- Level 1: Level 0 data converted into physical and engineering values and dated according to the same time scale and reference frames;
- Level 2: Level 1 data processed in near real-time. They are mainly used for quick look to evaluate the status of the on board payloads, of the science links as well as of the clocks on the ground;
- Level 3: Full performance results of the comparison between space and ground clocks;
- Level 4: Highly processed data products. They include clock red-shift measurements, measurements of the Eötvös parameter for Weak Equivalence Principle tests, comparisons of clocks on the ground, geo-potential measurements, optical and microwave ranging and measurements of atmospheric propagation delays, contribution to atomic time scales, and cold atom physics experiments in weightlessness conditions. They also include regular reports on the continuous comparison between the primary clock providing the reference signal to the STE-QUEST optical and microwave terminals on the ground and the secondary clocks eventually available at the ground station.

For the generation of data products the following responsibilities are assumed:

- Level 0 and Level 1 data are generated by the SOC and made available to the Payload Consortium(a).
- Level 2 quick-look data products for orbit determination and clock comparison are provided by the SOC, while payload-specific Level 2 data are generated by the Payload Consortium(a) and provided to the SOC.
- For Level 3 data (full performance clock comparisons), the existence of at least two independent analysis centres is required to allow the necessary cross-checks. Data from all centres will be archived at the SOC, tagged with information on its provenance. These centres are assumed to be provided by the Payload Consortium(a), although one centre might be provided at the SOC, supported by Payload Consortium(a).
- Level 4, data products are generated by the Payload Consortium(a) and delivered to the SOC.

STE-QUEST is assumed to be an experiment mission. All mission data products will be available to the general scientific community after the expiration of the proprietary period. The duration of the proprietary period for each data set will be one year, starting at the time of quality check and validation by the data analysis centres, i.e., data validated at a given date will be publicly accessible one year later.

The following parties are envisaged to have proprietary access to the STE-QUEST data:

- Scientists in the Payload Consortium(a).
- Members of the SWT, under the conditions that will be described in the Science Management Plan.

Proposals submitted in response to this AO should describe the proposed assignment of proprietary access in the Payload Consortium(a); e.g., which groups have proprietary access to which products, if applicable.

ACRONYMS

AIT	Assembly-Integration-Test
AO	Announcement of Opportunity
BTD	Baseline Telescope Description
Co-I	Co-Investigator
CODMAC	Committee for Data Management, Archiving, and Computing
D/SRE	Director of the Science and Robotic Exploration Directorate
EID	Experiment Interface Document
EID-A	Experiment Interface Document - Part A
EID-B	Experiment Interface Document - Part B
ES	Environment Specification
ESA	European Space Agency
FPO	Format for the prescription of optics
FTE	Full Time Equivalent (man years)
IRP	Instrument Review Panel
LAD	Large Area Detector
LFA	Lead Funding Agency
LLI	Long Lead Item
LOE	Letter Of Endorsement by funding agency
MAG	Mission Analysis Guidelines
MLA	Multi-Lateral Agreement
MOC	Mission Operations Centre
MOU	Memorandum of Understanding
MRD	Mission Requirements Document
NDA	Non Disclosure Agreement
PI	Principal Investigator
P/L	Payload
PDD	Payload Definition Document
PIP	Proposal Information Package
PP	Planetary Protection Requirements
PRC	Payload Review Committee
PRR	Preliminary Requirements Review
PRRD	Model Payload Resources and Requirements Document
RMD	Radiometric Model Document
S/C	Spacecraft
Sci-RD	Science Requirements Document
SGS	Science Ground Segment
SIRD	Science Implementation Requirements Document
SIP	Science Implementation Plan
SMP	Science Management Plan
SOAD	Science Operations Assumptions Document
SOC	Science Operations Centre
SOCD	Science Operations Concept Document

SPC	Science Programme Committee
SRR	System Requirements Review
SST	Science Study Team
SWT	Science Working Team
TRL	Technology Readiness Level
WFM	Wide Field Monitor