

The Earth Observation Envelope Programme



Revised Call for Earth Explorer-9 'Fast Track' Mission Proposals

1. Introduction

As part of its Earth Observation Envelope Programme, the European Space Agency (ESA) announces an opportunity for scientists from the Earth Observation communities in ESA Member States and Canada to make proposals for missions to be evaluated as next potential Earth Explorer Mission. These missions are intended to conduct research in the field of Earth Observation.

The Earth Observation Envelope Programme is a rolling programme designed to underpin European efforts in Earth Observation from space. The Earth Explorer element of the programme consists of a series of space missions addressing critical Earth science issues. In the past, eight missions have been selected for implementation under the previous Earth Explorer mission nomenclature, namely four Earth Explorer Core Missions:

- GOCE - Gravity field and steady-state Ocean Circulation Explorer
- ADM-Aeolus - Doppler Wind Lidar
- EarthCARE - Clouds, Aerosols and Radiation Explorer
- Biomass - to take global measurements of forest biomass

and four Earth Explorer Opportunity Missions (now called 'Fast Track' Missions):

- CryoSat - Polar Ice Monitoring
- SMOS - Soil Moisture and Ocean Salinity
- Swarm - Earth's Magnetic Field and Environment Explorer
- FLEX - Fluorescence Explorer

The Agency aims to achieve a clear appreciation of the science community's views on what mission concepts will give the highest scientific return and best response and solution to scientific challenges and issues facing society ([Earth Observation Science Strategy for ESA: A New Era for Scientific Advances and Societal Benefits, ESA SP-1329/1](#) and [ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA, ESA SP-1329/2](#), European Space Agency, Noordwijk, the Netherlands, 2015).

This Call is open to all proposals that fit the criteria indicated in Chapter 6 of this document. The proposers are asked to consider mission concepts that exhibit a certain degree of maturity, or "readiness", and that shall demonstrate the potential of new innovative Earth Observation techniques of relevance to both the scientific and the applications communities. A Scientific Readiness Level (SRL) between 4 and 6 is necessary. Evidence for the SRL shall be provided in the proposal in the form of results of scientific investigations/studies, published material in the peer-reviewed literature (with specific reference to the proposed mission concept) and any analysis software that may be available, in accordance with the [SRL Handbook](#). Similarly, a Technology Readiness Level (TRL) equal to or exceeding 4 (≥ 4) is necessary for all critical technical elements of the space segment. Full evidence for the achieved TRL shall be provided in the proposal in accordance with the '[Guidelines for the use of TRL's in ESA programmes](#)'.

Taking into account the experience from previous Calls, and in line with the spirit of the EOEP programme, the Agency is soliciting proposals for mission concepts for implementation as EE-9 that will not exceed a 260 M€ budget to ESA at 2016 economic conditions (e.c.), covering the whole development of the mission after selection up to the end of the commissioning phase once the satellite is in orbit (phase B1 to E1). This implies, for the proposers, that a strict target of 150 M€, e.c. 2016, has been set for all industrial development costs for the space segment, excluding launch services, operations, ground segment, level 2 processor and ESA internal costs. With respect to the launch, a mission fitting in a Vega-C dual-launch configuration should be the baseline. Any alternative option, e.g. a launch opportunity fully committed through an international collaborative partnership, shall not impact the overall budget. In case of in-kind contributions of the launch service, parts of the space segment such as the instrument or platform or sub-sets of either, the Level 2 processor, or other elements of the ground segment, the industrial development costs can be increased according to these in-kind contributions minus some adaptation costs that occur on the side of ESA to integrate them. The budget ceiling must, however, not be exceeded.

It should also be noted that the EE-9 mission concept does not necessarily have to be a single satellite but could be composed of a constellation of (smaller) satellites, if they allow to address the science challenges outlined in Section 2. The total cost of such a constellation including all cost elements mentioned above (launch services, ground segment, etc.) need to be strictly within the same budget ceiling.

The use of recurrent hardware and software, of formation and constellations (possibly via national and/or international partnerships), and launch opportunities is encouraged. National and/or international partnerships cooperation based on an instrument exchange shall be considered only when the full instrument to be exchanged is already developed at a TRL equal to or exceeding 5, in accordance with the '[Guidelines for the use of TRL's in ESA programmes](#)'. If an international collaborative partnership is proposed, a letter from the prospective partner entity confirming their programmatic and financial commitment shall be included. In addition, the detailed schedule, the potential contributions, and the different programmatic/budgetary approval cycles shall be clearly detailed in the proposal in order to substantiate compliance to the programmatic/budgetary requirements of the Call.

A response to the Call may be made by ESA Member States' or Canadian scientists, or teams of scientists, where proposing teams also may include scientists from non-ESA member states.

Copies of this announcement and of the key reference documents will be found linked from the Agency's Living Planet website <http://www.esa.int/livingplanet> and call website <http://explorercall.esa.int>. All proposals must be submitted via the call website.

2. Scope and Nature of the Call

Previously, Earth Explorer Missions were focussed to conduct research in the field of Earth Observation and/or to demonstrate the potential of new innovative Earth Observation techniques of relevance to both the scientific and the applications communities.

In response to the present Call, proposals should respond to ESA's new Earth Observation Science Strategy, its key elements and strategic science goals ([Earth Observation Science Strategy for ESA: A New Era for Scientific Advances and Societal Benefits, ESA SP-1329/1](#) and [ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA, ESA SP-1329/2](#), European Space Agency, Noordwijk, the Netherlands, 2015). This Science Strategy for ESA aims to cover all areas of science to which Earth Observation (EO) missions from space can make a vital contribution.

The strategic goals identified in the new science strategy for ESA are tailored to ESA's role as a science-enabling organisation. The strategy identifies all the science areas that ESA needs to be responsive to along the value chain from innovative missions through excellent science to societal benefit.

As specificity to this Call, the scope of the EE-9 mission has changed to the extent that the proposed mission concept shall address science questions that have a direct bearing on societal issues such as:

- Food security
- Availability of fresh water
- Management of the Earth's resources and energy
- Health of the planet and humankind
- Disaster risk reduction and improvement of disaster resilience
- Climate change

In that sense not only the feasibility of the concept in terms of realising its scientific objectives and meeting its technical challenges has to be demonstrated, but also the capacity of the mission to address scientific questions in the context of above major societal issues.

As mentioned above, proposals shall relate to the Earth Observation Science Strategy for ESA. Proposals on other topics, including those already being partly addressed by other missions currently flying or under implementation, are not excluded, but must demonstrate novel approaches and new scientific insights, again related to the societal issues as quoted above.

It is important to note that, even though the Agency invites proposals for mission concepts with a certain degree of scientific and technological maturity, they still must demonstrate **scientific excellence and innovative technology**.

Owing to the fact that concepts are invited where scientific as well as technological investigation/validation have progressed, the Agency foresees a more streamlined schedule as compared to previous Earth Explorer Missions, i.e. aiming for a launch by 2025.

This Call is concerned with Earth Explorer 'Fast Track' Mission concepts for EE-9, which will be a mission funded and managed by ESA, or a guest (i.e. contributed) payload provided by ESA to a non-ESA mission. The ESA contribution to EE-9 will be strictly limited financially. Given the demanding development schedule the Agency sees for EE-9, serious consideration should be given to using highly recurrent hardware and software (e.g. existing platforms).

It is important to note that in the evaluation of the proposals a pre-filtering approach will be applied, in the form of an internal assessment by ESA covering compliance to the Call requirements, the scientific and technological maturity, and the programmatic aspects. In terms of scientific maturity, it is a prerequisite for the proposals to contain evidence that the concepts, as proposed, meet the requested SRL. In terms of technical maturity and programmatic, it is a prerequisite that the proposals adhere to the boundary conditions outlined in this Call text and that they meet the requested TRL.

The Call will result in the selection of a maximum of two mission candidates, without any order of priority. These mission candidates will undergo competitive feasibility studies, i.e. Phase-A, after which they will be subject to a peer-review and final selection process. The Earth Science Advisory Committee (ESAC) will be responsible for the scientific review, and, supported by the Agency for technical and programmatic issues, will advise the Agency on which mission candidate to select for entering Phase B1. A decision on the industrial prime contractor for the full implementation of the mission (B2/C/D/E1) will be taken at the end of Phase B1, upon demonstration that the mission selected respects all the necessary conditions (TRL, SRL, and programmatic boundaries).

The selected mission will be implemented in accordance with a tailored approach of the ESA rules and standards for 'Fast Track' Missions, with particular regard to the approaches for project reviews and documentation, applicable standards, industrial organisation with a cost-effective structure. The proposal shall demonstrate sufficient technology readiness, in particular of the payload elements, and that a TRL of at least 4 (≥ 4) is achieved. Proposers are therefore required to liaise with entities, industrial or other, that have the necessary experience in the development of space systems. Furthermore, a SRL between 4 and 6 will have to be demonstrated.

3. Guidelines for Proposal Preparation

Concerning the proposals for EE-9, submission will be performed according to the following steps compulsory for each submitted proposal:

- A Letter of Intent to be submitted by 17 February 2017, noon, introducing the proposing team and briefly outlining the mission objectives and characteristics. The letter should not exceed 3 pages and the core group of proposing scientists

shall be limited to those directly involved in preparing the proposal and appearing later in the proposed science team, see Annex B.

- Proposers workshop on 9 March 2017. The workshop will provide an opportunity to answer questions related to the Call and selection process, and to the various elements that should be addressed in a proposal. Furthermore, scientific matters can be clarified and potential industrial/scientific partners working in the same domain can be identified with whom a joint proposal could be prepared (if applicable). In addition to improving the possibilities of scientific team formation and proposal consolidation, at this workshop the Executive, supported by ESAC, may provide suggestions to the proposers for showing compliance with the scientific, technical and programmatic criteria.
- A 'confirmation to submit a full proposal' by the Lead Investigators to ESA is requested by 24 March 2017, enabling ESA to establish scientific Peer Panels for the review of the proposals and to prepare the imminent evaluation.
- The full proposal to be submitted by 15 June 2017, noon.
- Authors of proposals submitted in the first issue of the EE-9 Call may resubmit proposals as long as they demonstrate a clear compliance with the constraints defined by this new Call. If a revised version of a proposal is submitted, the author shall identify the changes compared with the first version.

The detailed requirements on topics to be addressed in the proposal are given in Annex A.

- Proposals shall provide details for the price of all payload elements as well as any non-conventional element of the system, with justifications. The price breakdown shall highlight any unit/sub-system with substantial cost and include project office, system engineering, Product Assurance, AIT, GSE. Tables are provided in Annex A.1.9 as guidelines for optical and microwave instruments, to be adapted to specific case.
- The key elements for the preparation of a Draft Mission Requirements Document (MRD) shall be included, the purpose of which will be to outline the main mission assumptions and to provide a complete and comprehensive list of all high-level mission requirements necessary to achieve the science goals. The candidate structure of a MRD is provided in Annex A.1.8.
- Proposals must identify a Lead Proposer who is a scientist from one of the Agency's Member States or Canada. The co-investigators and scientific team listed on the proposal should be justified by their respective contribution to the content of the proposal. In addition, proposers shall list the core scientific team involved in their proposal, using the Excel spreadsheet which can be downloaded from the Call web site. For each of the missions selected for Phase-A studies a Mission Advisory Group (MAG) will be established to provide scientific advice on the Phase-A activities. The Lead Proposer must be ready to act as chairman of the MAG for the mission proposed if so requested by the Agency.

Responses should be submitted in English. Page limits (see Annex A) only apply to the Executive Summary (maximum two pages) and Scientific Objectives, Requirements and Justification (maximum twenty pages). Material included in the proposal in order to show that SRL and TRL requirements are met shall not be subject to page limits. Lead Investigators are encouraged to propose qualified independent candidates for the scientific peer review of their proposals to ESA, either in the Letter Of Intent (LOI) or in the confirmation to submit a full proposal.

Any response that misses the deadlines for submissions will not be accepted for evaluation.

4. Boundary Conditions

It is intended to implement the EE-9 mission as quickly as possible. This means that all proposed missions must be ready to be launched within a period of maximum eight years after the selection of the mission to be implemented following Phase-A. The launch is scheduled to take place by 2025.

The feasibility of the selected mission candidates will be established during Phase-A. Implementation includes detailed design, development and manufacturing of the satellite and its ground segment (including FOS, on-ground data collection, pre-processing and distribution to the scientific processing centre) capable of delivering in a timely fashion the geophysical data products required to realise the mission objectives. Implementation also includes the development of algorithms, as well as specific scientific studies and support activities required for the realisation of the mission.

The Agency is soliciting proposals for mission concepts for implementation as EE-9 that will not exceed a 260 M€ budget to ESA at 2016 economic conditions (e.c.) as outlined in Section 1.

In the case of a proposed in-kind contribution e.g. guest (contributed) payload, the proposal shall provide evidence of the credibility of the in-kind contribution including a letter from the prospective partner entity confirming the estimated cost of the commitment and signed at the appropriate level of budgetary authority.

Any mission not respecting above boundary conditions will be excluded during the selection.

Proposals must comply with the format indicated in Annex A, and should be submitted in English. LOIs must comply with the format indicated in Annex B.

Procurement procedures for any element of a mission funded by ESA shall comply with the rules of the Agency. Tailoring of the rules related to project reviews, documentation and applicable standards in line with fast-track mission experience is possible and shall be detailed in the proposal. The same applies to intellectual property rights, which in no circumstances will be accepted as a reason not to involve the wider scientific community.

All data deriving from the mission selected for implementation will have to be made available to the worldwide Earth Observation research community (after commissioning) in accordance with the established ESA Earth Explorer data policy.

5. General Procedures

5.1 Overall Approach

The Earth Science Advisory Committee supported by scientific Peer Review Panels will evaluate all eligible proposals received by the closing date for submission. ESA staff will support the evaluation as regards technical and programmatic aspects. The ESAC will then undertake an overall evaluation and recommend a maximum of two candidate missions for study at Phase-A level, without any order of priority.

During the Phase-A studies the technical feasibility and programmatic aspects of the candidate missions will be evaluated. After this phase the status of the candidate missions will be presented to the scientific community, soliciting opinions and comments from the community at large. Extensive presentation material will be made available and an overview of consolidated mission requirements, together with Reports for Mission Selection based on the studies of the concepts. Following this meeting, the ESAC will evaluate the mission candidates, again supported by the Executive for technical and programmatic matters, and make a recommendation to D/EOP on which mission to propose to PB-EO for implementation. The selected mission will subsequently enter full implementation, with launch by 2025.

5.2 Implementation Steps

It is planned to implement the EE9 mission in three steps, namely:

- Selection of up to a maximum of two mission concept proposals for competitive Phase A studies
- Down-selection of a single candidate mission at the end of Phase-A through an evaluation process including a User Consultation Meeting and start of Phase B1
- Mission implementation (Phase B2/C/D/E) after confirmation that the necessary conditions (TRL, SRL, cost, schedule) are met at the end of Phase B1.

For the selection of missions for Phase-A study (see above), the Executive will make a proposal for the study of up to a maximum of two mission concepts at Phase-A level. The Chair of the ESAC will present the recommendations of the ESAC to the Programme Board for Earth Observation (PB-EO), which will make a decision on the Executive's proposal. The PB-EO is the Delegate Body mandated by the ESA Council to oversee the execution of the Agency's Earth Observation Programme.

After completion of the evaluation process and the final endorsement of the missions for Phase-A studies by the PB-EO, preparations for further work will be initiated immediately. All proposers will be notified of the results of the evaluation and PB-EO decision before the end of November 2017. Within these time scales, all successful proposers will be required to confirm their capability to proceed with the project.

After the consultation meeting with the scientific community following Phase-A, the Executive will, based on the ESAC recommendations, formulate a proposal to the PB-EO on which mission to move forward to Phase B1 level. Following the PB-EO decision the selected mission will enter Phase B1. At the end of Phase B1 and upon confirmation that the mission fulfils all the necessary conditions (TRL, SRL, cost, schedule), PB-EO will decide upon the implementation of the mission.

6. Selection Criteria

Following PB-EO's acknowledgement of the new Earth Observation Science Strategy for ESA – A new Era for Scientific Advances and Societal Benefits (ESA-SP-1329/1) and ESA's Living Planet Programme: Scientific Achievements and Future Challenges – Scientific Context of the Earth Observation Science Strategy for ESA (ESA-SP-1329/2) and discussion at PB-EO level, the applicable Earth Explorer selection criteria are as follows:

- 1. Relevance to the ESA research objectives for Earth Observation** – for this criterion reference must be made to the general and specific objectives and scientific challenges set forth in the document Earth Observation Science Strategy for ESA – A New Era for Scientific Advances and Societal Benefits and 'ESA's Living Planet Programme: Scientific Achievements and Future Challenges' – Scientific Context of the Earth Observation Science Strategy for ESA (ESA SP-1329/1+2, 2015). Here account shall be taken of how scientific advances anticipated from the mission contribute to addressing major societal issues.
- 2. Need, usefulness and excellence** – this must take account not only of scientific requirements and/or the importance of a mission viewed as a precursor but also the extent to which the requirements, including those of space/time sampling, can be met by the proposed mission.
- 3. Uniqueness and complementarity** – this must take account of other (i.e. not space) means of addressing the mission requirements as well as the activities and plans of other national and international bodies for space missions.
- 4. Degree of innovation and contribution to the advancement of European Earth Observation capabilities** – this relates to technical/industrial aspects as well as to user interests.

5. **Feasibility and level of maturity** – this encompasses the technical constraints with a particular emphasis on the technology readiness and the scientific readiness, as well as the status of the associated user community within ESA member states and the maturity of its requirements.
6. **Timeliness** – this must take account not only of the timeliness of a mission from the point of view of user needs but also with regard to implementation constraints.
7. **Programmatics** – in addition to the considerations of development schedule, cost, risk, etc., (set within the overall Earth Explorer Programme) this addresses the implications of possible cooperation with other bodies, including synergies with other national and international developments, and taking account of the planned availability of relevant data from other observing systems.

7. Overall Schedule

The major milestones are as follows:

Release of the Call	13 December 2016
Deadline for receipt of <i>Letters of Intent</i>	17 February 2017, 12:00 CET
Proposers Workshop	9 March 2017
Confirmation to submit a full proposal	24 March 2017
Deadline for the receipt of full <i>Proposals</i>	15 June 2017, 12:00 CEST
Announcement of results of evaluation of <i>Proposals</i>	End November 2017

All proposals must conform to the format specified in Annex A, and must be submitted via the web site (<http://explorercall.esa.int>) by the deadlines indicated above. **No proposal that misses the above deadlines or fails to comply with the content requirements in Annex A will be accepted.**

Annex A to the Call for Proposals for Earth Explorer Mission EE-9

Guidelines for proposal preparation

Recalling the programmatic objectives of the Earth Explorer Missions, and specifically the budgetary constraints and short development schedule, and considering also that the selected candidates will move directly to feasibility studies at Phase A level (i.e. this is not a Call for Ideas followed by an assessment at Phase 0 level), it is of paramount importance for the proposal to include, in addition to the scientific objectives and requirements, the technical and programmatic elements detailed to a level sufficient to confirm that the mission has the potential for implementation as an Earth Explorer Fast-Track Mission within the given constraints. To this end, the proposal shall be prepared by scientists (individually or in cooperation with other individuals and/or scientific institutes) supported by technical experts, in industry or other expert entities.

A.1 Content of the Proposal

The proposal will be structured as follows:

A.1.1 Cover Page

A.1.2 Executive Summary

A.1.3 Science and Mission Objectives, Requirements and Justification

A.1.4 Mission Concept Assumptions and Technical Requirements

A.1.5 Proposed Mission Architecture

A.1.6 Programmatic Elements

A.1.7 Annex: Mission Performance

A.1.8 Annex: Elements for a Draft Mission Requirements Document (MRD)

The guidelines relevant to the preparation of the specific parts of the proposals are provided in the following sections.

A.1.1 Cover Page

A.1.2 Executive Summary

A concise resumé of not more than two pages, describing: the scientific objectives, the mission requirements in terms of the geophysical parameters to be retrieved, the target accuracy and the relevant spatial and temporal scales, as well as a broad justification for the mission requirements.

An outline of the mission implementation concept addressing:

- The required observation techniques and the associated main requirements.
The candidate instrument concepts.

- The main architectural and functional elements of the mission (space segment, ground segment, mission operations and utilization, approach to data exploitation).
- What steps have been taken to assess the end-to-end mission and system performance, and identify the critical requirements governing feasibility.

The Agency shall be allowed to use the Executive Summary for public distribution. The rest of the proposal will be treated confidentially.

A.1.3 Scientific Objectives, Requirements and Justification

This part of the proposal shall provide (maximum twenty pages):

- A detailed description of the mission objectives and their rationale, including the status of the scientific knowledge and the identification of the gaps and open issues that the mission intends to respond to.
- The required mission duration and the relation to other planned or existing missions.
- The identification of the geophysical variables and data products, both level 1 and level 2, required to fulfil the objectives of the mission and the relevant observation requirements (accuracy, spatial and temporal scales).
- The development status of the required geophysical retrieval algorithms, and the approach to the data processing. In this respect, the Scientific Readiness Level for all the relevant elements shall be analysed and explained, with evidence provided that the mission concept is validated to a **Scientific Readiness Level (SRL) between 4 and 6**. Supporting peer-reviewed references (validating the feasibility of the retrieval) shall specifically refer to the details of the proposed retrieval concept, and include the methods for achieving the required geophysical product given the measurement uncertainties (in relation to the specific instrumentation and observation technique proposed).
- The relevance of the mission set forth in the documents “Earth Observation Science Strategy For ESA” (2015), Vol. I and II.
- The relevance to other programmes (national and/or international).

A.1.4 Mission Assumption and Technical Requirements

This section of the proposal presents the general mission characteristics and the associated technical requirements, including a justification of how the proposed technical requirements allow the fulfilment of the scientific objectives of the mission. This section shall include:

- The observation techniques relevant to the mission.
- The relevant observation requirements (e.g., as relevant, observation geometry, required observing conditions, temporal, spatial, spectral and radiometric requirements, spatial and temporal co-registration requirements, measurement accuracy requirements).

- Other general requirements (e.g. synergy with other missions and relevant co-registration requirements)

A.1.5 Proposed Mission Architecture

This section describes the proposed implementation concept addressing all the elements of the mission architecture and provides a detailed justification of the capability of the proposed concept to meet the technical requirements. The mission architecture shall address:

- The Space Segment: payload and platform, with the payload down to its elements, and launcher.
- The Ground Segment (Flight Operation Segment, Payload Data Ground Segment, external interfaces for e.g. auxiliary data and approach to data exploitation), identifying possible adaptations of existing ESA infrastructure or specific cost-effective solutions.
- Mission Analysis and Operations concept.

Given the tight programmatic constraints (budget and development schedule) applicable to the Earth Explorer Mission, the technical description of the architectural elements will include a detailed assessment of the maturity of the proposed solution (e.g. heritage, re-use of existing hardware/software) and of the relevant key technologies, for which the Technology Readiness Level (TRL) will be analysed according to the established classification ranging from TRL 1 (Basic principles observed and reported) to 9 (Actual system 'flight proven' through successful mission operations). The proposal shall demonstrate sufficient technology readiness with **TRL equal to 4 for all technologies of the payload and any critical platform technologies**, and that **a minimum TRL of 5 is achievable by the end of Phase-B1**.

A.1.6 Programmatic Elements

This section of the proposal shall provide:

- An outline Design, Development and Verification (DD&V) plan addressing the complete system and the development schedule from the start of Phase B up to the launch.
- A reliable cost estimate of the complete Mission from Phase B up to the end of Phase E1, covering all development costs, excluding launch, ESA internal costs and contingencies. A description of the cost estimation methodology and all underlying assumptions must also be provided.

The proposal shall include details about the proposed tailoring of the project development cycle and approach in order to comply with the constraints of a Fast-Track Earth Explorer Mission, which is expected to be a medium to small-class mission. It shall cover in particular the approaches to project reviews (e.g. any combination of reviews), to documentation, to the applicable standards and the criteria for cost-effective project organisation. Any derived constraint, e.g. strict use of an off-the-shelf platform (or other

reduction in procurement options) and subsequent constraint on its possible supplier(s), shall be clearly identified.

A.1.7 Annex: Mission Performance

This additional section of the proposal provides evidence of the end-to-end simulation and performance modelling tools that have been used to demonstrate feasibility of the mission between SRL 4 and 6, and ability to meet the objectives, and shall include:

- Outline of methodology and logic used in tracing from scientific goals to Level 2 geophysical product needs, to Level 1b observation requirements to be fulfilled by the mission and system design
- Outline of simulation/performance modelling tools used in assessing feasibility of the proposed concept
- Outline of algorithms to be used for geophysical retrievals, and background citations
- Quantitative examples of output of simulator demonstrating maturity of tools
- Quantitative results providing evidence from simulated output of means to achieve required performance for critical requirements

A.1.8 Annex: Elements for a Draft Mission Requirements Document (MRD)

The key elements for preparation of a Draft MRD shall be included, with the following structure:

- Introduction
- Mission Background and Justification
- Mission Objectives
- Mission Requirements
- Observation Techniques and Requirements
- Data Products and Usage
- Synergies and International Context

A.1.9 Annex Templates for Price Estimate for Optical and Microwave Payloads

Optical Passive

Equipment	Cost (k€)
Telescope	
Spectrometer	
Focal Plane Assembly (incl. detectors)	
Mechanism	
On-board calibration Unit	
Proximity electronics	
Video Electronics	
Instrument Control Unit (incl. S/W)	
Structure assembly	
Thermal Control (radiators, Cryo-cooler, ...)	
Harness	

Optical Active

Equipment	Cost (k€)
Transmitter optics	
Laser System	
Receiver optics	
Focal Plane Assembly (incl. detectors)	
Mechanism	
On-board calibration Unit	
Proximity electronics	
Video Electronics	
Instrument Control Unit (incl. S/W)	
Structure assembly	
Thermal Control (radiators, ...)	
Harness	

Radar

Equipment	Cost (k€)
Antenna	
Deployment mechanism	
RF feed / beamforming network	
Power Amplifier/ T/R modules	
Power conditioning unit	
RF Radar Electronics	
Digital Radar Electronics (incl. timing and signal generator, data compression)	
Instrument Control Unit (incl. S/W)	
Structure assembly	
Instrument thermal subsystem	
Harness	

Microwave radiometer

Equipment	Cost (k€)
Antenna	
Deployment / scanning mechanism	
Calibration unit	
Radiometer receiver	
RFI filter processor	
Instrument Control Unit (incl. S/W)	
Structure assembly	
Thermal Control	
Harness	

Annex B to the Call for Proposals for Earth Explorer Mission EE-9

Guidelines for Letter of Intent (LOI)

The Letter of Intent shall introduce the concept for the mission to be proposed and should not exceed 3 pages. It shall provide a brief assessment containing evidence that the concept of the proposed mission has been scientifically validated, with a **SRL between 4 and 6**, and that from a technological viewpoint the concept is at **TRL equal to 4**, and that **a minimum TRL of 5 is achievable by the end of Phase-B1**. It shall identify the Lead Investigator and the supporting scientific and technical team (which should normally not change between LOI and proposal submission).

The following structure for the Letter of Intent will be expected:

- Proposing Team, introducing the members of the Team directly involved in preparing the proposal together with their affiliation.
- Executive Summary, summarising the mission concept, its objectives and expected deliverables.
- Mission Objectives, describing the research objectives of the mission together with its relevance to ESA's EO Science Strategy.
- Mission Characteristics, giving the main specifications for the concept, together with an indication of its scientific and technical maturity and its expected resource demands.
- References