ARTES Competitiveness & Growth Full Proposal

Part 3

Technical Proposal

Proposal title

Proposal Reference: reference number

Notes for the use of this template (to be removed from Full Proposal)

This document contains requirements gathered in annex. For convenience, they can be accessed via hyperlinks that are located at the beginning of the section they relate to. These requirements must be taken into account when completing the Proposal.

Material presented in this plain style must not be removed nor modified, unless stated otherwise by an explanatory note.

Parts highlighted in yellow may or may not need to be filled in, depending on the scope of the proposal (please refer to the related explanatory notes to determine if they apply or not). The table below provides a summary of optional sections depending on the different cases.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Space Segment | Ground Segment | Application | System | Confirmed Business case | SME support |
| Definition |  | | | |  | 2.2, Annex 3 |
| Technology |
| Product |
| Demonstration | 9 | 10 ,12 | 11, 12 | 9, 10, 12 |

Text in red font must be modified and/or completed by the Tenderer for the proposed activity (this supplementary information should be presented in plain typeface, i.e. not red, in the final version of the Full Proposal).

This style is used for explanatory notes and guidance to help you to develop the Full Proposal content. They should be removed from the final document before submission.

A single Technical Proposal shall be included covering all Development Phases for which support is being requested under the ARTES C&G Call for Proposals.

The whole development and validation plan of the product, from the current development status up to the completion of the product ready for commercialisation, shall be included in this Technical Proposal.

The Technical Proposal shall be at a level of detail commensurate with the development status of the product.

Use of this Full Proposal Template is **mandatory**. The Tenderer shall not change the structure of this Full Proposal Template (i.e. the table of contents must remain unchanged) and adhere to its guidelines and requirements. However, the format and lay-out can be modified, e.g. to be in-line with the Tenderer’s corporate identity.

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# Introduction

This document describes the final product and its current development status. It presents an overall product development plan for the product and its constituent parts, from the current status up to the point where the product will be ready for commercialisation.

The Product Development Plan includes an overview of the work to be performed in names of Development Phases covered by the proposal, which are the subject of this proposal.

Include the following if appropriate

The following supporting documents related to this Product Development Plan are attached to the proposal.

**Supporting documentation**

|  |  |  |
| --- | --- | --- |
| **Document Title** | **Scope** | **Reference** |
| *e.g. Design, Development and Verification Plan* … | … | … |
| *e.g. Company Margin Philosophy* … | … | … |
| *e.g. Qualification Plan* … | … | … |
| *e.g. Risk Management Plan* … | … | … |

# Description of the Final Product

## Product Overview

|  |  |
| --- | --- |
| **Content Requirements** | **Phase(s)** |
| [3-1](#A1), [3-2](#A2), [3-3](#A3) | All |

## Product Tree and Baseline Architecture

*This section is optional for Proposals claiming SME support (ref. Letter of Invitation, section 2.3)*

The following product tree is a hierarchical breakdown of the product into the hardware and software elements that are required to perform the product functions identified previously:

(insert a product tree block diagram)

For example, refer to ECSS-M-ST-10C-Rev.1, section 4.3.4

The main product or elements are described below.

You may include images to show what the product and its constituent modules will look like and block diagrams to show their implementation details

Name of Module 1

Functions and features: …

Design Concept:…

Critical Technologies:…

Name of Module 2

Functions and features: …

Design Concept:…

Critical Technologies:…

Etc…

## Design Trade-Offs

The following table summarises the main design trade-offs that led to the selection of the baseline implementation, including the rationale for the selection in each case.

**Summary of the main design trade-offs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Trade-Off** | **Affected Performance Parameters** | **Implementation Options** | **Reason for Selecting the Baseline Implementation** |
| … | … | … | … |
| … | … | … | … |
| … | … | … | … |

A more detailed discussion of each trade-off, including its implications and a justification for selecting the baseline solution, is provided in the following paragraphs.

The trade-off between ….

# Third Party Products/Rights

No products or rights of third parties are planned to be used in the development of this product.

or

(delete the inapplicable paragraph)

The following third party products/rights are planned to be used in this product development: ….

The technical reasons for adopting a solution based on these third party products/rights are ….

The impact of this approach on the technical activities and the resulting products and their usage is ….

Financial information relating to the use of third party products/rights is provided in section … of the Financial Proposal (Part 6).

# Product Heritage and Current Development Status

## Description of the Heritage and Starting Point

The product is an evolution of existing product or product line.

The heritage product is … summary details about the heritage products

The new product will offer the following features over the current products:

* Function/capability 1 (e.g. 20% mass saving, automatic level control or operation in a new frequency band).
* Function/capability 2.

Key details of the heritage product can be found in document reference.

or

(delete the inapplicable paragraph)

The product represents a new product line for the entity. Relevant company capabilities are presented in Part 4 (sections 2, 3 and 4) of this Proposal.

## Current Development Status of the Product

Readiness levels are defined in Annex 1

The table below indicates the current readiness levels (RL) of the product, of each of its key modules/subsystems and of the technologies that are critical to the success of the development. The basis for each RL assessment is indicated in the table.

**Summary of the current development status**

| **Item** | **Current RL** | **Basis of the RL Assessment** |
| --- | --- | --- |
| … | … | … |
| … | … | … |
| … | … | … |

The following paragraphs describe in more detail the development status of the product, its constituent parts and its critical technologies. Etc.

# Overall Product Development Constraints

## Key Requirements

The requirements detailed in the following table are the main driving factors in the design and development.

Key requirements are those considered essential to the success of the proposed development, or those that are likely to significantly affect the course of the development (e.g. design drivers).

The Tenderer should consider which of these key requirements should be included in the risk register (section 6).

**Key product requirements**

| **Product Requirements** | | |
| --- | --- | --- |
| **Requirement ID** | **Requirement** | **Description of criticality** |
| … | … | … |
| … | … | … |
| … | … | … |

*The following is optional for Proposals claiming SME support (ref. Letter of Invitation, section 2.3)*

The product specification is further detailed in Annex 3.

## Other Constraints

No other constraints than those listed in section 5.1 affect the product development plan.

or

(delete the inapplicable paragraph)

The table below summarises other constraints that affect the product development plan.

**Other product development constraints**

| **Type of Constraint** | **Nature of the Constraint** | **Impact/Criticality** |
| --- | --- | --- |
| Implementation (e.g. model/prototype constraints) | … | … |
| Qualification/Certification/ Type Approval | … | … |
| Verification | … | … |
| Business Plan (time to market) | … | … |
| Business Plan (cost) | … | … |
| Other | … | … |

# Risk Analysis and Management

|  |  |
| --- | --- |
| **Content Requirements** | **Phase(s)** |
| [3-4](#A4new), [3-5](#A5new) | Technology |

The table below identifies the technical risks associated with the development of the product based on a preliminary risk analysis. They have been analysed in terms of their severity (potential impact) and probability of occurrence.

**Technical risks**

| **Description of Risk** | **Severity** | **Probability of Occurrence** | **Description of Impact** | **When Mitigated (Dev. Phase)** | **Mitigation Plan** |
| --- | --- | --- | --- | --- | --- |
| … | … | … | … | Technology | … |
| … | … | … | … | Product | … |
| … | … | … | … | … | … |
| … | … | … | … | … | … |

Provide further information below as required to properly explain the risk mitigation strategy and plans

The risk mitigation plan is …

The risk management plan can be found in ….

# Dependencies on Other Activities

## Dependencies on Previous Activities

The proposed activity is/is not a follow-up of a previous activity/previous activities. There are/are no dependencies between the proposed activity and other activities falling outside of the scope of the proposed activity.

Include the text and complete the table below only if the proposed activity is a follow-up of a previous activity or activities or if there are dependencies between the proposed activity and other activities falling outside of the scope of the proposed activity

Further details are provided in the table below.

**Dependencies on previous, ongoing or future activities**

| **Programme** | **Activity Name** | **Brief Description** | **Start Date** | **End Date** | **Main outcomes/Nature of Dependency** |
| --- | --- | --- | --- | --- | --- |
| … | … | … | … | … | … |
| … | … | … | … | … | … |
| … | … | … | … | … | … |

## Overlap

We confirm that the work proposed does not overlap with any previous or currently running activity.

## Management of Interdependencies

Include this section if the proposed development is dependent on any on-going or future activities

Interdependencies between the proposed activity and the related activities identified in the previous section will be managed as follows. …

# Overall Product Development Plan

## Development Phases

The table below is a list of the Development Phases needed to advance the product from its current development status to the point where it is ready for commercial exploitation.

*Indicate, for each Development Phase, its status, how the Development Phase is/was/will be supported (e.g. internal project, ARTES C&G Element, national programme) and whether or not the project is included in the present proposal.*

**Summary of development phases**

| **Development Phase** | **Status** | **Supported By** | **Included in This Proposal** |
| --- | --- | --- | --- |
| Definition*(delete if not applicable)* | intended/running/completed | internal project | yes/no |
| Technology*(delete if not applicable)* | intended/running/completed | national programme | yes/no |
| Product*(delete if not applicable)* | intended/running/completed | ARTES C&G | yes/no |
| Demonstration*(delete if not applicable)* | intended/running/completed | … | yes/no |

## Objectives

|  |  |
| --- | --- |
| **Content Requirements** | **Phase(s)** |
| [3-6](#A11) | All |
| [3-7](#A4) | Definition |
| [3-8](#A5) | Product (Space Segment) |
| [3-9](#A6) | Product (Ground Segment and System) |
| [3-10](#A7) | Product (Application) |
| [3-11](#A8) | Demonstration |

The objectives of the Development Phases included in this proposal are summarised in the table below.

**Objectives of the proposed Phase(s)**

| **Development Phase** | **Objective** |
| --- | --- |
| Definition*(delete if not applicable)* | Generate a complete set of Product Requirements |
| Complete an initial design concept to allow development work to continue |
| Generate the appropriate supporting analyses demonstrating technical and economic feasibility of the product |
| Technology*(delete if not applicable)* | Objective 1 |
| Objective 2 |
| Etc. |
| Product*(delete if not applicable* | Objective 1 |
| Objective 2 |
| Etc. |
| Demonstration *(delete if not applicable)* | Objective 1 |
| Objective 2 |
| Etc. |

Include the text below if this Proposal includes a Technology Phase

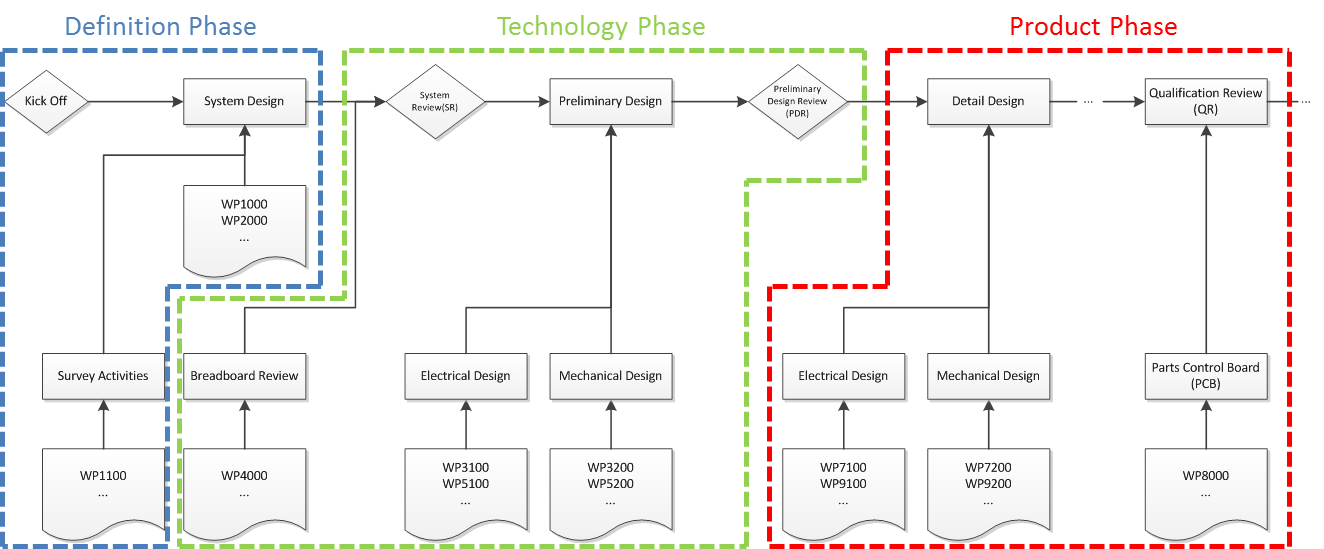
We confirm that the work to be undertaken in the Technology Phase does not include any of the following:

* Materials qualification activities;
* Component qualification activities;
* Process qualification activities;
* Qualification activities on the equipment;
* Industrialisation of the product.

## Development logic

The following figure shows the overall development logic and, for the Development Phase(s) included in this Proposal, provides a visual description of the work packages interrelations as well as the logical flow of activities.

*Replace the example diagram below with that of the work logic and associated work packages.*



The above development logic is further described in the table below:

|  |  |  |
| --- | --- | --- |
| **Item** | **Development Phase(s)[[1]](#footnote-2)** | **Development Activities[[2]](#footnote-3)** |
| Module xxx | ……… | ……… |
| sub-system yyy | ……… | ……… |
| Component, material or process zzz | ……… | ……… |

*An item could be, for example, a module, sub-system, component, key technology, manufacturing process, or industrialisation. Provide supplementary text as necessary to fully explain the development approach.*

*The work to be performed on all modules that form the final product shall be described, even if not part of this activity. If a module development is not included in the proposed activity, its development approach shall in described in the column “when developed”*

*Please provide a concise product roadmap, if relevant.*

## Verification Approach

The table below identifies the verification activities to be undertaken through dedicated tests or analyses during the development of the product, indicating the Development Phase in which they will be carried out and on which model they will be performed.

Column 1: Development Phase during which the verification activity will be performed.

Column 2: The aspect(s) of the product to be confirmed by the verification activity (e.g. product functions, technical performance, market potential, certification, etc.).

Column 3: The verification method (test, analysis, simulation, inspection, etc.).

Column 4: The analytical, simulation, hardware or software model that will be used as a vehicle to perform the verification.

Column 5: The main standard(s) (e.g. ECSS, MIL, ESCC, ISO) applicable to the activity, if any.

**Summary of the verification approach**

| **Development Phase** | **Functionalities/ Requirements Verified** | **Verification Method** | **Model** | **Standard(s)** |
| --- | --- | --- | --- | --- |
| … | … | … | … | … |
| … | … | … | … | … |
| … | … | … | … | … |
| … | … | … | … | … |

Provide below any additional details to complement the information given in the table.

The verification approach in the development of the product from its current state to the point where it is ready for commercial exploitation is as follows. …

The product test sequence is the following:…

The product test matrix is the following:…

The elements test sequence is:…

# Flight Opportunity

Include this section if this Full Proposal includes a Space Segment (Atlas) or System Demonstration Phase

## Flight Configuration

Support is requested for an embedded/passenger/Pilot case.

Include the following sub-sections as appropriate

See the Cover letter for a definition of the different Atlas cases

## Overall Mission Objective

The purpose of the demonstration mission is to……

*Please provide a top level set of objectives for the demonstration mission, and the success criteria for the mission.*

The flight items will be installed and launched on [Number of] spacecraft.

Include the following paragraph if more than one spacecraft is proposed.

The reason [Number of] spacecraft are required is that….

*Please provide a detailed justification for the reason that more than one spacecraft is proposed, and the relative orbits/mission of each spacecraft.*

## Host Mission(s)/Platform(s)

Details of the mission(s) in which the flight items will be embarked are provided in the table below.

**Details of the Host Mission(s)/Platform(s)**

| **Item** | **Value** | **Comments** |
| --- | --- | --- |
| Operator | … | … |
| Mission Name | … | … |
| Mission Objective | … | … |
| Prime S/C Manufacturer | … | … |
| S/C Model/details | … | … |
| S/C Mass (dry/wet) | … | … |
| S/C DC Power | … | … |
| Launch Vehicle (if known) | … | … |
| Intended Orbit | … | … |
| Duration of Operational Phase | … | … |
| Duration of Supported Test Phase. | … | … |

Summary details of the spacecraft platform for this mission are provided below:

*Please provide a top level description of the spacecraft platform to be used on this mission and the reasons for selecting this platform for this activity.*

The following modifications to the standard platform are required to support this mission:

*If any modifications/customisation is required to the standard version of the proposed platform to support the proposed flight equipment, then please provide a top level description of these modifications/customisation.*

## Flight Items

The following products are proposed to be developed and flown as part of the Demonstration Phase.

**Items to be developed and flown**

| **Product** | **Total Number of Units in Spacecraft** | **Number of Units Supported by ATLAS** | **Function/Usage Within the Mission***\** | **Fully Representative of Recurrent Flight Product** |
| --- | --- | --- | --- | --- |
| Product 1 | … | … | … | Yes/No |
| Product 2 | … | … | … | Yes/No |
| Product 3 | … | … | … | Yes/No |
| … | … | … | … | Yes/No |

\* Explain how the proposed architecture will support the mission objectives, including how the supported units will be utilised in the mission and how they will be used in the context of the payload or platform architecture. For example, for an embedded case, a redundant unit within a redundancy ring, with the rest of the hardware being standard hardware.

Provide supplementary information as necessary to fully describe the intended operational use of each product in the proposed flight opportunity.

The operational use of Product 1 will be …(E.g. Primary element, redundant element, …).

The operational use of Product 2 will be …(E.g. Primary element, redundant element, …).

The table below contains further information on the innovative nature of the proposed flight items and, in cases where more than one unit of the same product is proposed to be flown, why it is necessary to fly more than one unit.

**Flight item details**

| **Product** | **Innovative Nature of the Flight Item***1* | **Rationale for More than One ATLAS-Supported Flight Item of the Same Type***2* |
| --- | --- | --- |
| Product … | … | … / not applicable |
| Product … | … | … |
| Product .. | … | … |
| … | … | … |

1 Nature of the innovation that justifies the need for Atlas support for this particular product (first flight heritage of a new product or product variant).

2 What function(s) would not be adequately demonstrated by flying only one item of the same type and how would these function(s) be adequately demonstrated by flying the proposed number of units?

Include the following statement and table if any of the above flight items are not fully representative of the recurrent flight product

Some of the flight items identified above are not fully representative of the recurrent flight product. The following table explains the differences in each case and provides a justification for why a fully recurrent product is not proposed to be flown.

**Rationale for flying items not fully representative of the recurrent flight product**

| **Product** | **Differences with Respect to the Recurrent Flight Product** | **Rationale for not Flying a Representative Example of the Recurrent Flight Product** |
| --- | --- | --- |
| Product … | … | … |
| Product … | … | … |
| Product .. | … | … |
| … | … | … |

## Accommodation of the Flight Items

No activities associated with the accommodation of the supported flight items on board the spacecraft are included in this development phase.

or

(delete the inapplicable paragraph)

The following table indicates the activities associated with the accommodation of the supported flight items on board the spacecraft, to be carried out by the spacecraft manufacturer.

**Activities associated with accommodating the flight items on board the spacecraft**

| **Activity** | **Description** | **Performed By** | **Included in the Proposal** |
| --- | --- | --- | --- |
| Accommodation Studies | … | contractor/spacecraft manufacturer | Yes/No |
| Accommodation in the Spacecraft | … | … | … |
| ... | … | … | … |
| … | … | … | … |

The nature of any work foreseen to be carried out by the spacecraft manufacturer shall be identified. For example, accommodation studies, design modifications performed to accommodate the innovative item, hardware specifically required for accommodation purposes, satellite level assembly, integration and test (AIT) and specific activities related to the innovative product during the AIT and launch campaigns.

## Launch Activities and In-Orbit Test

Include this section if this Full Proposal includes a Passenger or Pilot Case

No activities associated with the launch campaign and in orbit testing of the supported flight items are included in this development phase.

or

(delete the inapplicable paragraph)

The following table describes the activities associated with the launch campaign, in orbit test and verification of the performance and function of the supported flight items.

**Activities associated with the launch campaign and in orbit testing**

| **Activity Type** | **Activity** | **Performed By** | **Included in the Proposal** |
| --- | --- | --- | --- |
| Launch campaign | … | … | Yes/No |
| … | … | … | … |
| In-Orbit Test | … | … | … |
| … | … | … | … |

Launch campaign activities could include the part of the testing and early operation phase specific to the item, for verification of function and performance or monitoring.

The flight items will only be used to support in-orbit demonstration and validation activities during and after the completion of the proposed activity.

# Pilot Configuration

Include this section if this Full Proposal includes a Ground Segment or System Demonstration Phase

The following products are proposed to be developed and tested as part of the Ground Segment/System Demonstration Phase. We confirm that the pilot configuration is of a scale sufficient to demonstrate the commercial attractiveness of the product.

**Items to be developed and tested in the Demonstration Phase**

| **Product** | **Total Number of Units** | **Number of Units Supported by ARTES C&G** | **Function/Usage Within the Ground Segment /System Architecture** *\** | **Fully Representative of Recurrent Product** |
| --- | --- | --- | --- | --- |
| Product 1 | … | … | … | Yes/No |
| Product 2 | … | … | … | Yes/No |
| Product 3 | … | … | … | Yes/No |
| … | … | … | … | Yes/No |

\* Explain how the units supported by ARTES C&G will be embedded within the Ground Segment/System architecture.

Provide supplementary information as necessary to fully describe how each product is embedded in the Ground Segment/System architecture and its intended operational use in the context of both the proposed pilot phase and the end-to-end system.

The operational use of Product 1 will be …

The operational use of Product 2 will be …

Include the following statement and table if any of the above items are not fully representative of the recurrent product

Some of the items identified above are not fully representative of the recurrent product. The following table explains the differences in each case and provides a justification for why a fully recurrent product is not proposed for the Demonstration Phase.

**Rationale for items not being fully representative of the recurrent product**

| **Product** | **Differences with Respect to the Recurrent Product** | **Rationale for Not Employing a Representative Example of the Recurrent Product in the Demonstration Phase** |
| --- | --- | --- |
| Product … | … | … |
| Product … | … | … |
| Product .. | … | … |
| … | … | … |

# System and Service Architecture (SAA)

Include this section if this Full Proposal addresses the Application Domain

An initial version of the System and Service Architecture (SAA) is provided in the following reference document(s), which is/are attached to this part of the proposal.

*The content of the document recalled hereafter.*

*The System and Service Architecture documentation shall define and specify the overall pilot system, starting from the high level architecture down to its building blocks. The SSA shall include the following sections:*

*1 – Overall System Architecture:*

*This section shall provide a preliminary high level description of the overall system architecture, and it shall clearly point out the strategic role of the satellite communications component in the proposed system compared to potential terrestrial alternatives. It shall also provide a clear partitioning of the overall system architecture, identifying:*

* *which elements are pre-existing, like facilities or items developed/procured in previous activities, specifying the required adaptations or modifications whenever applicable;*
* *which elements have to be developed in the frame of the proposed project;*
* *which elements have to be procured as Commercial Off The Shelf (COTS) items, indicating the proposed procedure for the procurement.*

*2 – Design and Development Plan:*

*If the Demonstration Phase includes the development of hardware and/or software this shall comprise a preliminary design and development plan to illustrate, in a concise and conceptual manner, the logical execution of the developed activities from contract award to final review. It shall define and include decision points on which the course of the development will depend.*

*3 – Risk and mitigation plan of the implementation:*

*A table of risks with an estimation of their respective impacts (e.g. cost, delays...), likelihood, and corresponding mitigating actions.*

# Pilot Utilisation Plan (PilUP)

Include this section if this Full Proposal includes a Ground Segment, Application or System Demonstration Phase

An initial version of the Pilot Utilisation Plan (PilUP) is provided in the following reference document(s), which is/are attached to this part of the proposal.

*The content of the document is set out in section 2.17 of the Draft Contract and recalled hereafter.*

*The Pilot Utilisation Plan shall describe the activities to be carried out during the pilot utilisation of the system and define the related evaluation framework. It shall consist of the following sections:*

* *Users: identifying the actors in terms of organisations and user groups that will be involved in the pilot operations and describing their roles.*
* *Pilot utilisation baseline: describing the utilisation of the pilot system (e.g. number of utilisation sessions, volume of data exchanged, duration of interactive sessions) and the associated planning (e.g. duration of pilot stage, starting date of pilot sites).*
* *Pilot assessment: intended approach to evaluate the pilot including success goals, performance criteria (e.g. quality of the product/service, evolution of the number of users, utilisation time etc.).*
* *Pilot preparation: describing the content elements that have to be developed or procured in the course of the project as a prerequisite to start the pilot stage (e.g. products, training of people, statement of commitment from user/stakeholders involved in the pilot, planned approach to promote the commercial uptake of the system/services).*
* *Pilot risks: a risk assessment associated with the pilot service and your mitigation plan.*

*Assessment of the Satcom Applications: describing the envisaged approach to evaluate the added value brought to the target user groups by the Satcom Applications developed in the project. The assessment shall be based on a combination of quantitative and qualitative data gathered via forms and/or questionnaires from the user groups directly involved in the pilot stage.*

# Overall Product Development Schedule

The table below summarises the overall product development schedule from the current development status up to the point where the product is ready for commercial exploitation.

**Overall product development schedule**

| **Development Phase** | **Start Date** | **End Date** | **Comments** |
| --- | --- | --- | --- |
| … | mm/yyyy | mm/yyyy | … |
| … | … | … | … |
| … | … | … | … |
| … | … | … | … |

1. Readiness Levels

| Level | TRL  Technology Readiness Level  (Space and Ground Segments) | | | | SRL  Service Readiness Level (System and Application) |
| --- | --- | --- | --- | --- | --- |
| Capabilities | Space Segment model | Ground Segment model | Software model |
| 1 | Basic principles observed and reported |  | Idea or concept | Research results or preliminary algorithm | not applicable |
| 2 | Technology concept/ application formulated |  | Concept supported by paper | Individual algorithms for main functions | Application/service concept formulated, market opportunities not yet addressed |
| 3 | Analytical and experimental critical function or characteristic proof-of-concept | Mathematical models, supported e.g. by sample tests | Demonstrate feasibility | Prototype of the main functions | Concept analysis performed and target market identified |
| 4 | Functional verification of component / breadboard in laboratory environment | Breadboard | Partial prototype | Alpha version covering the main functions | Application/service verification in laboratory environment, market segment(s) and customers/users identified |
| 5 | Critical function of component / breadboard verified in a relevant environment | Scaled EM for the critical functions | Reduced scale prototype (for large pieces) | Beta version covering all functions | Application/service verified using operational elements, customers/users not involved |
| 6 | Demonstration of element critical functions in a relevant environment | Full scale EM representative for critical functions | Full prototype to demonstrate functionality | Product | Demonstration of prototype in relevant environment, price policy identified |
| 7 | Demonstration of element performance in the operational environment | QM/EQM/PFM\* | Verified Product with final BOM, layouts, released software, full GUI | Integrated product validated in a pilot case | Trials with customers/users to validate utilisation and business models |
| 8 | Actual system completed and accepted for flight | PFM/FM | Validated Product in operation and commercial offer ready | Integrated product validated for full operation | Application/service completed and validated, commercial offer ready |
| 9 | “Flight proven” system through successful mission operations | PFM/FM | Product operationally deployed and used by paying customer | Live product validated in a mission | Application/service operationally deployed and used by paying customers |

\* a PFM may be used to achieve qualification provided that the commercial customer accepts the risk and it is demonstrated that the use of an alternative qualification model (e.g. EQM) is not viable. In this case the cost of the flight hardware is not supported by ESA.

See also “Guidelines for the use of TRLs in ESA programmes”, ESSB-HB-E-002, Issue 1, Rev 0, 21 August 2013 (available on the ARTES web site at the following URL: <https://artes.esa.int/documents>) and “Technology readiness level (TRL) guidelines”, ESA handbook ECSS-E-HB-11A, issue 1, 1 March 2017.

1. Requirements for Proposal Content

| **Requirement** | **Template Section** |
| --- | --- |
| * 1. The Tenderer shall provide a top-level description of the overall product and its main sub-systems. | [Section 2.1](#_Product_Overview) Product Overview |
| * 1. TheTenderer shall describe the role of the product in the context of the overall system of its target users.   *For example: the thruster is intended for small satellites providing DeltaV for station keeping and is mounted externally to the spacecraft; the high power amplifier will provide RF amplification within a small transportable VSAT terminal; the interactive virtual presence application will be used between two medical centres in the satellite based telemedicine service.* | [Section 2.1](#_Product_Overview) Product Overview |
| * 1. The Tenderer shall describe the external interfaces of the product. | [Section 2.1](#_Product_Overview) Product Overview |
| * 1. The Tenderer shall identify the specific technology risks to be retired during the Technology Phase. | [Section 6](#_Risk_Analysis_and_2) Risk Analysis and Management |
| * 1. The Tenderer shall identify the test/verification method(s) to be used during the Technology Phase to demonstrate that each technology risk has been retired. | [Section 6](#_Risk_Analysis_and_2) Risk Analysis and Management |
| * 1. The Tenderer shall indicate the target (ending) readiness level (RL) of the product and of its major subsystems and key enabling technologies at the end of the proposed Development Phase. | [Section 8.2](#_Objectives) Objectives |
| * 1. The Tenderer shall confirm that the objectives of the **Definition Phase** shall at least be to: * generate a complete set of Product Requirements; * complete an initial design concept to allow development work to continue; * generate the appropriate supporting analyses demonstrating technical and economic feasibility of the product. | [Section 8.2](#_Objectives) Objectives |
| * 1. The Tenderer shall confirm that the objectives of the **Space Segment Product Phase** shall at least be to complete: * all qualification testing of the product for flight on the specified spacecraft and launch vehicles, i.e. TRL 7 shall have been reached; * all materials qualifications required for the product; * all parts qualifications required for the product; * all process qualifications required for the product. | [Section 8.2](#_Objectives) Objectives |
| * 1. The Tenderer shall confirm that the objectives of the **Ground Segment and System** **Product Phase** shall at least be to: * be a product verified in a non-operational environment; * complete the product design and industrialisation, ready for commercial exploitation; * complete the verification of the product performance, via a suitable test program. This verification shall confirm the performance of the product is suitable for the target market | [Section 8.2](#_Objectives) Objectives |
| * 1. The Tenderer shall confirm that the objective of the **Application** **Product Phase** shall at least be to complete the verification of the product performance via a suitable test program. This verification shall confirm that the application/service is ready for entering in a validation stage with operational users. | [Section 8.2](#_Objectives) Objectives |
| * 1. The Tenderer shall confirm that the objective of any **Demonstration Phase** shall at least be to validate the product, application or service in its operational environment (i.e. involving users and/or customers). | [Section 8.2](#_Objectives) Objectives |
| * 1. For the **Space Segment, Ground Segment and System Domains,** the Product Specification shall define the technical requirements at a level of detail commensurate with the development status of the product. The technical requirements shall cover the following: * functional requirements; * performance requirements; * interface requirements; * environmental requirements; * design requirements; * quality requirements; * implementation requirements; * operational scenarios requirements, user needs and use cases (if applicable); * verification requirements, in particular those established for the product by any third party. * quality   For example, third-party verification requirements could be received from the customer(s), or from a certification authority such as the FCC. Verification methods include test, analysis, similarity, review of design, inspection, or some combination of these.  Requirements needing further elaboration should be highlighted (e.g. TBC/TBD). | [ANNEX 3](#Spec) Technical Requirements |
| * 1. For the **Space Segment, Ground Segment and System Domains,** the Tenderer shall provide a copy of the technical requirements for any major subsystem of the product at a level of detail commensurate with the development status of the product. | [ANNEX 3](#Spec) Technical Requirements |
| * 1. The requirements shall be specified using unique identifiers. | [ANNEX 3](#Spec) Technical Requirements |
| * 1. For the **Space Segment and System Domains**, the Product Specification shall define the requirements for quality control, including as applicable:      + - quality assurance        - dependability        - safety        - electrical, electronic, electromechanical (EEE) components        - materials, mechanical parts and processes        - software product assurance | [ANNEX 3](#Spec) Technical Requirements |
| * 1. For the **Application Domain**, the Product Specification shall provide a complete set of requirements applicable to the project, together with the relevant justifications. It shall contain the user needs, the user requirements and the system requirements of the proposed proof of concept demonstrator. To allow formal traceability of the different requirements, each requirement shall be assigned a unique identifier using a suitable methodology that distinguishes between the different types of requirement. | [ANNEX 3](#Spec) Technical Requirements |

1. Product Specification

*This Annex is optional for Proposals claiming SME support (ref. Letter of Invitation, section 2.3)*

**Technical Requirements**

|  |  |
| --- | --- |
| **Content Requirements** | **Phase(s)** |
| [3-12](#A12), [3-13](#A13) | All (Space Segment, Ground Segment, System) |
| [3-14](#A14) | All |
| [3-15](#A15) | All (Space Segment and System) |
| [3-16](#A16) | All (Application) |

Include the requirements of the product to be developed and the main technical requirements of its constituent parts (in particular for the new assemblies to be developed such as sub-assemblies, modules, components, etc.)

Include the following statement if the product specification is provided as a separate document

The requirements for the product and its constituent parts are presented in document reference(s), a copy/copies of which is/are attached to this proposal.

**Statement of Compliance to the Requirements**

Include this section only if some or all requirements have been provided by a third party/external entity (for example, a satellite prime, an operator, or an ESA mission), or if the proposal addresses a Space/Ground Segment or System Demonstration Phase, and there are differences between the proposed product configuration and the generic/fully operational one.

A statement of compliance to the requirements for the product and its constituent parts is presented in document reference(s), a copy/copies of which is/are attached to this proposal.

**Requirements Traceability**

Include this section if the product complexity is such that multi-level specifications are used and the development maturity of the product enables the traceability to be defined

A requirements traceability matrix is presented in document reference, a copy of which is attached to this proposal.

1. The development phase(s) in which the proposed development will take place. [↑](#footnote-ref-2)
2. Brief description of the proposed main development activities for this item. [↑](#footnote-ref-3)