

ARTES ScyLight Full Proposal

Requirements for the Content of the Technical Proposal

Part 3C

Design, Development and Verification Plan (DDVP)

Statement of Applicability and Proposal Submission Requirements

Applicable Segment(s)	
Space	Ground
Yes ⁵	Yes

Applicable Development Phase(s)			
Definition	Technology	ScyLight Demonstration	Product
Yes ¹	Yes ²	Yes ^{3,5}	Yes ^{4,5}

1. Requirements specific to the Definition Phase are stated in section 8.
2. Requirements specific to the Technology Phase are stated in section 9.
3. Requirements specific to the ScyLight Demonstration Phase are stated in section 10.
4. Requirements specific to the Product Phase are stated in section 11.
5. Requirements specific to Space Segment elements of the ScyLight Demonstration and Product Phases are stated in section 12.

Proposal Submission Requirements
A separate and self-contained Part 3C of the Technical Proposal shall be included for each Development Phase for which support is being requested under the ARTES ScyLight Call for Proposals.

Notes on the Content of this Document

- i* This style is used for explanatory notes and guidance to help you to develop the Full Proposal content.
- 1** This numbered style in bold font identifies the main sections to be completed in this Part of the Proposal.
- 1.2 This numbered style identifies requirements for the Full Proposal content for each of the main sections of this Part of the Proposal.

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Requirements for the Content of the Technical Proposal: Design, Development and Verification Plan	
1	General Requirements
ⓘ	<i>This Part of the Proposal zooms in from the top-level Product Development Plan presented in Part 3B of the Proposal, providing a more detailed Design, Development and Verification Plan (DDVP) for a specific Development Phase.</i>
ⓘ	<i>The DDVP is a detailed plan to develop the product from its state of development (Readiness Level) at the start of a planned Development Phase to its target state of development at end of that Phase. It shall result in achieving the required outputs of the Development Phase.</i>
ⓘ	<i>Each Part 3 of the Proposal shall only answer the set of requirements applicable to its associated Development Phase (excluding requirements for other Development Phases).</i>
ⓘ	<i>The ECSS DRDs may be used as a reference for the content and layout of the elements of the DDVP (e.g. ECSS-E-ST-10-02C Annex A).</i>
ⓘ	<i>The use of stand-alone documents is encouraged. These documents should be referenced in the Development Plan and attached (not copied) to the Proposal.</i>
1.1	The Tenderer shall provide an independent and detailed Design, Development and Verification Plan (DDVP) for each of the proposed Development Phases.
1.2	The Tenderer shall identify the specific Development Phase to which the detailed development logic applies.
1.3	Stand-alone documents referenced as supporting information in the DDVP element of the Proposal shall be delivered to the Agency as part of the Proposal documentation package.
2	Objectives of the Proposed Development Phase
ⓘ	<i>This section establishes the top-level objectives of the work to be performed. The details of how these objectives shall be achieved are then detailed in the subsequent sections.</i>
ⓘ	<i>Specific requirements relating to the objectives also apply for each Development Phase:</i> <ul style="list-style-type: none"> - <i>Definition Phase: see requirement 8.1.</i> - <i>Technology Phase: see requirements 9.1, 9.2 and 9.3.</i> - <i>ScyLight Demonstration Phase: see requirements 10.1, 10.2, 10.3, 10.4, 10.5, 10.6.</i> - <i>Product Phase: see requirement 11.1, 11.2, 11.3, 11.4, 11.5.</i>
2.1	The Tenderer shall establish the objectives of the proposed Development Phase including the key outputs and achievements.
2.2	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.
ⓘ	<i>Readiness Levels for the Space and Ground Segments are defined in Appendix 1 to the Requirements for Part 3B of the Proposal.</i>
2.3	The Tenderer shall confirm that an output of the planned Development Phase shall be an updated Business Potential assessment (Part 2 of the Proposal) reflecting the maturity of the development achieved at that time.
ⓘ	<i>For example, at the end of the Definition Phase the business potential assessment should have become sufficiently mature to justify the initiation of the next proposed Development Phase (e.g. Technology Phase).</i>
ⓘ	<i>Mandatory content for the updated Business Potential assessment is set out in the Requirements for Part 2 of the Proposal, assuming that the next proposed Development Phase is the starting Phase.</i>

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2.4	The Tenderer shall confirm that the outputs of the planned Development Phase shall include updated plans to organise, direct and conduct the remaining development work to be carried out in the subsequent Development Phase, defining: <ul style="list-style-type: none"> i) schedule, ii) cost, iii) reviews, iv) deliverables.
3 Models/Prototypes to be Developed within the Proposed Development Phase	
3.1	The Tenderer shall identify the model(s) to be developed in the proposed Development Phase. <i>‡ The models to be developed should include any iterations of a given model that the Tenderer proposes to undertake within the Development Phase.</i>
3.2	The Tenderer shall identify the characteristics/functionality of product to be verified by the each of the models in the proposed Development Phase.
4 Risk Mitigation Activities within the Proposed Development Phase	
4.1	The Tenderer shall identify any risk mitigation activities to be undertaken within the proposed Development Phase.
5 Qualification, Certification and Type Approval Activities within the Proposed Development Phase	
‡	<i>Qualification refers to demonstrating that the product is capable of operating in the specified environment.</i>
‡	<i>For the Ground Segment, the term validation is often used in place of qualification.</i>
‡	<i>Certification refers to meeting the safety or regulatory requirements (e.g. CE marking).</i>
‡	<i>Type approval refers to a demonstration, by test to the extent practicable, that a product meets the technical requirements for its use within a given satellite system, with a certification that all units of the same product type will meet the requirements in a similar manner.</i>
‡	<i>Specific requirements also apply for Space Segment elements of the ScyLight Demonstration and Product Phases – see requirements 12.1, 12.2 and 12.3.</i>
5.1	The Tenderer shall identify and describe the qualification, certification or type approval activities that shall be carried out within the proposed Development Phase (as applicable).
5.2	The Tenderer shall identify the model(s) to be used to achieve each of the identified qualifications/certifications/type approvals to be carried out within the proposed Development Phase.
5.3	The Tenderer shall identify the standard(s)/procedure(s) to be applied to achieve qualification, certification or type approval on each model during the proposed Development Phase.
6 Verification Activities within the Proposed Development Phase	
‡	<i>Reference may be made to a separate test plan document (or set of documents), a copy of which should be attached to this part of the Proposal.</i>
6.1	The Tenderer shall identify and describe the verification activities to be performed in the proposed Development Phase.

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6.2	<p>The Tenderer shall give an overview of:</p> <ul style="list-style-type: none"> i) The tests to be performed; ii) The model on which the test will be performed; iii) The test environment. <p><i>ⓘ This information may be presented in the form of a test matrix.</i></p>
6.3	<p>The Tenderer shall identify and define the various analyses and simulations foreseen within the proposed Development Phase (if relevant).</p>
6.4	<p>The Tenderer shall identify any simulation tools to be utilised (if relevant).</p>
7	<p>Work to be Performed in the Proposed Development Phase</p> <p><i>ⓘ This section provides an overview of the work to be performed, which should be defined in more detail in the work package descriptions.</i></p> <p><i>ⓘ Specific requirements also apply for the Product Phase – see requirements 11.6 and 11.7.</i></p>
7.1	<p>The Tenderer shall define the development approach to be followed within the proposed Development Phase.</p>
7.2	<p>The proposed development logic shall achieve the specific objectives of the proposed Development Phase.</p>
7.3	<p>The Tenderer shall identify the key enabling technologies that will be developed during the proposed Development Phase.</p>
7.4	<p>The work description shall identify the item(s) (e.g. technology, technique, system, performance, environment etc.) to be assessed or developed within the proposed Development Phase.</p>
7.5	<p>The Tenderer shall identify the adopted manufacturing approach and the associated resources required (if relevant).</p>
8	<p>Specific Requirements for the Definition Phase</p> <p><i>ⓘ The requirements stated in this section only apply for a Definition Phase.</i></p>
8.1	<p>The Tenderer shall confirm that objectives of the Definition Phase shall be to:</p> <ul style="list-style-type: none"> i) Perform system/market studies. ii) Generate a complete set of requirements, including verification plans for the prototype and/or product. iii) Establish a technical baseline of an overall system, or part thereof, of which the product to be developed is an element. iv) Establish the overall performance of the system, or part thereof, of which the product to be developed is an element. v) Establish a technical baseline for the prototype and/or product. vi) Generate the appropriate supporting analyses demonstrating the technical feasibility of the product.

Requirements for the Content of the Technical Proposal: Design, Development and Verification Plan	
9	Specific Requirements for the Technology Phase
<i>ı</i>	<i>The requirements stated in this section only apply for a Technology Phase.</i>
9.1	<p>The Tenderer shall confirm that the work to be undertaken in the Technology Phase does not include any of the following:</p> <ul style="list-style-type: none"> - Materials qualification activities; - Component qualification activities; - Process qualification activities; - Qualification activities on the equipment; - Industrialisation of the product; - In-orbit demonstration of the hardware. <p><i>ı All qualification or industrialisation activities should be carried out as part of a Product Phase.</i></p> <p><i>ı All in-orbit demonstration activities should be carried out in either the ARTES ScyLight Demonstration Phase, or in the ARTES C&G Demonstration Phase (Atlas). The ARTES C&G Call for Proposals reference is AO 1-8793.</i></p>
9.2	<p>The Tenderer shall confirm that the output of the Technology Phase shall include a Breadboard(s), Prototype(s) or EM(s) of the product.</p> <p><i>ı The hardware/software developed under the Technology Phase shall be identified in the definition of the model to be developed within the current Development Phase (see requirement 3.1).</i></p>
9.3	<p>The Tenderer shall confirm that, at the completion of the Technology Phase, all the hardware or software developed during the Technology Phase (Breadboard(s), Prototype(s) or EM(s)) shall have been subjected to appropriate test campaigns to demonstrate the functionality and/or performance of the product.</p>
10	Specific Requirements for the ScyLight Demonstration Phase
<i>ı</i>	<i>The requirements stated in this section only apply for a ScyLight Demonstration Phase.</i>
10.1	<p>The Tenderer shall confirm that the objective of the ScyLight Demonstration Phase shall be to support the launch of in-orbit flight hardware to demonstrate the functioning and capabilities of the technology in a system context.</p>
10.2	<p>The Tenderer shall identify the functions and capabilities of the product to be demonstrated in orbit during the ScyLight Demonstration Phase.</p>
10.3	<p>The Tenderer shall identify the data to be collected to demonstrate the capabilities of the product functions in orbit during the ScyLight Demonstration Phase.</p>
10.4	<p>Outputs of the ScyLight Demonstration Phase shall include:</p> <ul style="list-style-type: none"> i) Measurement of the performance of the demonstrator during ground testing. This shall include: <ul style="list-style-type: none"> - Acceptance Testing; - Performance of the demonstrator during Spacecraft Acceptance Testing. ii) Measurement of the in-orbit commissioning performance of the demonstrator and comparison to the data collected during ground testing. iii) Measurement of the in-orbit performance during the demonstration period after the completion of in-orbit testing, and comparison to the data collected during ground testing and that taken during in-orbit commissioning.

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10.5	<p>The Tenderer shall confirm that, at the Demonstrator Acceptance Review, the Tenderer shall have completed (as applicable and/or included in the activity):</p> <ul style="list-style-type: none"> i) All qualification testing of the product for flight on the specified spacecraft and launch vehicles. ii) All materials qualifications required for the flight opportunity. iii) All parts qualifications required for the flight opportunity. iv) All process qualifications required for the flight opportunity.
	<p><i>Requirements 10.7 to 10.21 inclusive relate to the flight configuration of a ScyLight Demonstration Phase. Please address these requirements in a separate “Flight Configuration” section of Part 3C of the Proposal for the ScyLight Demonstration Phase.</i></p>
10.6	<p>The Tenderer shall identify by name all products that are proposed to be developed and flown as part of the ScyLight Demonstration Phase.</p>
10.7	<p>The Tenderer shall describe the differences between the proposed flight item(s) and the corresponding (planned) recurrent product(s).</p>
10.8	<p>The Tenderer shall identify the build standard(s) to be used for the flight item(s).</p> <p><i>The build standard(s) should be consistent with the duration of the demonstration mission. For example, for a relatively short demonstration mission the Tenderer might propose to fly an EM version of the unit using commercial rather than space-grade parts.</i></p>
10.9	<p>For each element of the demonstrator, the Tenderer shall provide a description of the flight configuration, including:</p> <ul style="list-style-type: none"> - The total number of units of the product to be flown, including additional units of the same type for which the Agency is not providing support; - The number of units that are proposed to be developed and flown with Agency support; - How these units are to interface with the main mission/spacecraft.
10.10	<p>In all cases where Agency support is requested to include more than one unit of the same type in the in-orbit demonstrator, the Tenderer shall explain why it is necessary to fly more than one unit:</p> <ul style="list-style-type: none"> - what function(s) would not be adequately demonstrated by flying only one unit, and - how would these function(s) be adequately demonstrated by flying the proposed number of units?
10.11	<p>The development plan shall specifically identify any study activities associated with the accommodation of the in-orbit demonstrator on board the satellite (if applicable).</p>
10.12	<p>The development plan shall specifically identify any activities associated with the accommodation of the flight hardware on the satellite, including assembly, integration and test at spacecraft level (if applicable).</p>
10.13	<p>The nature of any work foreseen to be carried out by the spacecraft manufacturer shall be identified by the Tenderer.</p> <p><i>For example, accommodation studies, design modifications performed to accommodate the innovative item, hardware specifically required for accommodation purposes and satellite level assembly, integration and test (AIT), specific activities related to the innovative product during the AIT and launch campaigns.</i></p>
10.14	<p>The Tenderer shall state the operator of the main mission.</p>

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10.15	The Tenderer shall identify the name of and objective of the main mission of the spacecraft. <i>⚠ Please note that the main mission does not have to be a telecommunications mission.</i>
10.16	The Tenderer shall identify the launch vehicle if it is known.
10.17	The Tenderer shall identify the entity which will be the legal owner of the flight items upon successful completion of the Demonstrator Acceptance Review.
10.18	The Tenderer shall identify the entity which will be the beneficial owner of the flight item after launch of the flight item.
10.19	The development plan shall specifically identify any activities associated with the launch campaign (testing and early operation phase specific to the item, for verification of function and performance or monitoring).
10.20	The development plan shall specifically identify any activities associated with the in-orbit test (IOT) and verification of the performance and function of the product.
10.21	The development plan shall include a list of data to be collected and analysed during IOT.
10.22	The development plan shall specifically identify any activities associated with the demonstration of the product during the demonstration period.
10.23	The development plan shall include a list of data to be collected and analysed during the demonstration period.
11	Specific Requirements for the Product Phase
<i>⚠</i>	<i>The requirements stated in this section only apply for a Product Phase.</i>
<i>⚠</i>	<i>The objective of the Product Phase is to have completed the development of the product ready for commercial exploitation. The Product Phase activities shall conform to the following principles:</i> <ul style="list-style-type: none"> - <i>For the development of a product to be used on a spacecraft, the Product Phase shall be related to the qualification and to non-recurring development activities preparing for its commercial production.</i> - <i>For the development of a product to be used in the Ground Segment, the Product Phase shall be related to verification and industrialisation (i.e. readiness for commercial production).</i> - <i>The Product Phase shall include a test program suitable for validating the final product.</i>
11.1	The Tenderer shall confirm that the objective is to have a product ready for commercial exploitation at the end of the Product Phase.
11.2	For Space Segment products, the Tenderer shall confirm that, at the end of the Product Phase, the Tenderer shall have completed (as applicable and/or included in the activity): <ul style="list-style-type: none"> i) All qualification testing of the product for flight on the specified spacecraft and launch vehicles, i.e. TRL 7 shall have been reached. ii) All non-recurring development activities to prepare for the commercial production of the product. iii) All materials qualifications required for the product. iv) All parts qualifications required for the product. v) All process qualifications required for the product. vi) The industrialisation of the product. vii) The development of the product test system.

Requirements for the Content of the Technical Proposal: Design, Development and Verification Plan	
11.3	For Space Segment products, the Tenderer shall indicate which of the objectives listed in requirement 11.2 are applicable to the proposed activity.
11.4	For Ground Segment products, the Tenderer shall confirm that, at the end of the Product Phase, the Tenderer shall have completed (as applicable and/or included in the activity): <ul style="list-style-type: none"> i) Verification of the product in a non-operational environment. ii) The product design and industrialisation, ready for commercial exploitation. iii) Verification of the product performance, via a suitable test program. This verification shall confirm that the performance of the product is suitable for the target market. iv) Industrialisation of the product or product test system (if applicable).
11.5	For Ground Segment products, the Tenderer shall indicate which of the objectives listed in requirement 11.4 are applicable to the proposed activity.
11.6	The Tenderer shall detail any development activities required to prepare the product for commercial production (if applicable). <ul style="list-style-type: none"> ⓘ <i>For example development of automated test software.</i>
11.7	The Tenderer shall detail any product industrialisation activities to be undertaken in the Product Phase (if applicable).
12	Specific Requirements for Space Segment elements of the ScyLight Demonstration and Product Phases <ul style="list-style-type: none"> ⓘ <i>The following requirements relate to the qualification of Space Segment items.</i> ⓘ <i>Qualification is the demonstration that an item is capable of operating in its specified operational environment with adequate margins. The decision to use a developed product for an operational mission or flight demonstration rests with its customer and is dependent on the outcome of a separate qualification and suitability review. Thus completion of any qualification activity in the contract does not ensure that the item will be accepted for use in a specific operational programme.</i> ⓘ <i>Specific requirements for reviews to be held for each Development Phase are given in Part 5C of the Requirements for the Content of the Management Proposal.</i>
12.1	The Tenderer shall define any component qualifications that will be performed in the proposed Development Phase.
12.2	The Tenderer shall define any material qualifications that will be performed in the proposed Development Phase.
12.3	The Tenderer shall define any process qualifications that will be performed in the proposed Development Phase.