COVER LETTER and PROPOSAL TEMPLATE

**[N.B. Use this template to prepare your proposal. Once the proposal is complete and internally validated, please remove all captions in red colour, , add your own logos, headers/footers prior to finalising your proposal for submission to Verhaert. The proposal shall be submitted in a searchable and indexed PDF file for easier viewing.]**

**[COVER LETTER]**

From: **..........** [For the **Applicant** to insert name of the company/institute submitting the application]

Date: **..........** [For the **Applicant** to fill in the date of the proposal]

To: Verhaert New Products and Services

Hogenakkerhoekstraat 21

9150 Kruibeke

BELGIUM

**Contact person: Koen Vriesacker and Dany Robberecht**

Subject: Application for the Belgium Space Solutions Proof of Concept

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dear Sir/Madam,

With reference to the above Call for proposals, we are pleased to present this proposal:

The Applicant [potential Contractor] is:

**....** [full name of company or institute]

**....** [address of its seat]

E-mail: **........**

Telephone: **........**

County of origin [company] : **........**

VAT Number: **…….**

The Subcontractor[s] participating to the activity is [are]:

[Please fill in the tables below]

**TEAM and Price Breakdown Information:**

|  | **Prime Contractor**  **[Applicant]** | **Subcontractor 1** | **Subcontractor 2** |
| --- | --- | --- | --- |
| Economic Operator Complete Name and Legal Nature [[[1]](#footnote-0)] |  |  |  |
| SME [indicate YES or NO] |  |  |  |
| Price type |  |  |  |
| Total Price per Entity |  |  |  |  |  |
| Currency |  |  |  |  |  |
| **TOTAL PRICE** |  | | |

1- The firm-fixed price contract for the activity in accordance with the funding conditions stated in the Call, amounts to: **xx.xxx,xx** Euro[insert the amount of the total price] all included with the sole exception of any import duties and value added taxes. [In case of a proposal including Subcontract[s], an additional price information is to be stated in: a summary price breakdown showing the amount allocated individually to each of the participants, including the own share of the Contractor].

2- The contact person of the Applicant to whom all communications relating to this letter should be addressed is the following: **......** [name of contact person[s], telephone number, e-mail address – it being understood that two [2] contact persons, one technical and one legal/commercial, might be advantageous. Please fill in as needed.

a) for technical matters as follows:

|  | To: | With copy to: |
| --- | --- | --- |
| Name |  |  |
| Telephone No. |  |  |
| e-mail address |  |  |

b) for contractual and administrative matters as follows:

|  | To: | With copy to: |
| --- | --- | --- |
| Name |  |  |
| Telephone No. |  |  |
| e-mail address |  |  |

c) for Personal Data Protection matters to be addressed to the Data Protection contact point as

follows:

|  | To: |
| --- | --- |
| Name |  |
| Telephone No. |  |
| e-mail address |  |
| Mail Address |  |

3- We hereby certify that this application fully complies with the technical and management requirements of the subject Call (*the draft contract and de invitation letter*), including all Appendices and/or Annexes.

In addition, the technical contents of this Proposal are free from any plagiarism. When use is made of material being quotations or citations from existing public literature such use is clearly indicated and due reference indications [source and author] are provided.

4- We hereby state that we have read and understood all the terms and conditions of the Draft Contract included in the subject Call and that we accept the said terms and conditions without any reservations. We also confirm that any sales conditions of our own shall not apply.

[One of the 2 following alternative statements, i.e. a) or b), is to be deleted]

5a- With reference to Article 6.3.2 of the Draft Contract, we have identified relevant Background Intellectual Property Rights belonging to us and/or our Subcontractor(s) and/or Third Party(ies) that we intend to use during the execution of the envisaged Contract and/or to include in the resulting deliverable items; such rights are listed in our Detailed Proposal.

We are prepared to provide evidence of such rights, their origin and ownership if so required by ESA.

(If this concerns rights vesting in a Third Party(ies), the following sentence shall be added here: “Relevant documentation evidencing rights of use of the BIPR owned by Third Party(ies) is attached to our Detailed Proposal Template, as part of Supporting Documentation.”)

or

5b- With reference to Article 7 of the Draft Contract, we hereby declare that we and our Subcontractor(s) shall not / do not intend to use for the activity to be carried out under the envisaged Contract, any Background Intellectual Property Rights, whether belonging to Third Party(ies) or to us and/or to our Subcontractor(s).

[One of the 2 following alternative statements 6a or 6b is to be deleted]

6a- Concerning the feasibility to export the deliverable items of the resulting Contract as that is foreseen in the Draft Contract including its Appendices, we hereby declare that we have examined the case and drawn the conclusion that there are no export restriction issues and thus no need to obtain specific licences or authorisations.

or

6b- Concerning the feasibility to export the deliverable items of the resulting Contract as that is foreseen in the Draft Contract including its Appendices, we hereby declare that we have examined the case and drawn the conclusion that export restrictions and/or need of adequate licences or authorisations exist, and that the status regarding such requirements is at present the following:

- the Applicant or [option]its Subcontractor ?… [name] has obtained the following authorisation[s] in order to submit this application: ?………. [to specify]

and/or [option]

- the Applicant or [option] its Subcontractor ?…. [name] will need to obtain prior to the placing of a Contract, the following authorisation[s]: ? …… [to specify]

7- The legal representative to sign the resulting Contract on behalf of the Contractor will be: **.....** [name and title of the person]

8- The proposal is valid during the following time period, reckoning from the closing date for application submission: 3 months.

We hereby acknowledge the right of Verhaert during the validity period of this Proposal, to require the Applicant to provide evidence of any element of its Proposal and to give additional detailed information, including on the price quotation, whatever the type of price is.

* By submitting the Proposal, I/we the undersigned herewith officially declare that the Proposal fulfils the Key Acceptance Factors listed below, as well as indicated in the subject Call Cover Letter.
* By submitting the Proposal, Verhaert is allowed to include the electronic version of public summary of work covered out in its database with public access.

| Key Acceptance factor | OK / NOK? | Reference paragraph and page in proposal |
| --- | --- | --- |
| 1. The Applicant confirms that the Applicant’s Cover Letter and the Detailed Proposal [appendix I] contain a binding price; | ☐ |  |
| 2. The Applicant confirms that the Cover Letter and the Detailed Proposal contain a price type compliant with the one requested in the Call; | ☐ |  |
| 3. The Applicant confirms that the Applicant is compliant with the budgetary limit applicable to the Call; | ☐ |  |
| 4. The Applicant confirms that the Applicant Cover Letter contains the confirmation of the validity period required in the subject Call; | ☐ |  |
| 5. The Applicant confirms that the Applicant Cover Letter is signed by the authorised representative[s] of the Applicant; | ☐ |  |
| 6. The Applicant confirms that the proposal pertains to the transfer [ie. the use for a new ground application] of a space heritage technology [i.e. the space heritage technology is a piece of hardware, software, know-how, process, methodology or system developed or adapted for space applications]. The proposal does not concern the exploitation of satellite borne data, GNSS signals and satellite communication capacity; | ☐ |  |
| 7. The Applicant confirms that the Technology Description is fully; | ☐ |  |
| 8. The Applicant confirms that a target non-space application has been identified [including identification of industry, end-users, and description of use case scenario]; | ☐ |  |
| 9. The Applicant confirms that the Added Value of the Space heritage for the new application is clearly identified in the proposal [appendix 1]; | ☐ |  |
| 10. The Applicant confirms that the market opportunity has been investigated and validated (see chart of work logic in Section XX of draft contract); | ☐ |  |
| 11. The Applicant confirms that the proposal shows the technical feasibility based on desk research which evidence the feasibility of the considered solution; | ☐ |  |
| 12. The Applicant confirms the participation of a non-space receiver in the activity [appendix 1]; | ☐ |  |
| 13. The Applicant confirms that the donor of the space heritage technology is independent [organisationally and financially] from the end-user organisation involved in the activity; | ☐ |  |

Done and signed for, and on behalf of **.....................** [Name of the company or institute acting as the Applicant ]:

Signature: **..............................**

Name and title of the signatory: ........................ [Full name and function] duly authorised to commit the application entity and its proposed Subcontractor[s] if any, for this purpose.

**[END COVERLETTER]**

**[DETAILED PROPOSAL TEMPLATE]**

# DETAILED PROPOSAL FOR THE TECHNOLOGY TRANSFER PROOF OF CONCEPT:

**TITLE OF THE PROPOSAL:** [insert title]

**Abstract**

[Key elements on the technology and its new application – Max 5 lines including keywords]

**Technology Domain of the space heritage**

[Tick TD which is applicable in the last column; otherwise describe the applicable technology domain in the last row]

| **TD #** | **Technical Domain description** | **Applicable TD** |
| --- | --- | --- |
| 1 | **On-Board Data Systems** | ☐ |
| 2 | **Space System Software** | ☐ |
| 3 | **Spacecraft Electrical Power** | ☐ |
| 4 | **Space Environments & Effects** | ☐ |
| 5 | **Space System Control** | ☐ |
| 6 | **RF Payload and Systems** | ☐ |
| 7 | **Electromagnetic Technologies & Techniques** | ☐ |
| 8 | **System Design & Verification** | ☐ |
| 9 | **Mission Operation & Ground Data systems** | ☐ |
| 10 | **Flight Dynamics & GNSS** | ☐ |
| 11 | **Space Debris** | ☐ |
| 12 | **Ground Station System & Networks** | ☐ |
| 13 | **Automation, Telepresence & Robotics** | ☐ |
| 14 | **Life & Physical Sciences** | ☐ |
| 15 | **Mechanisms & Tribology** | ☐ |
| 16 | **Optics** | ☐ |
| 17 | **Optoelectronics** | ☐ |
| 18 | **Aerothermodynamics** | ☐ |
| 19 | **Propulsion** | ☐ |
| 20 | **Structures & Pyrotechnics** | ☐ |
| 21 | **Thermal** | ☐ |
| 22 | **Environmental Control Life Support [ECLS] & In Situ Resource Utilisation [ISRU]** | ☐ |
| 23 | **EEE Components and quality** | ☐ |
| 24 | **Materials and Processes** | ☐ |
| 25 | **Quality, Dependability and Safety** | ☐ |
| 26 | **Other: Name TD** | ☐ |

# 1 **TECHNICAL PART** **AND APPLICATION PART**

## 1.1 SPACE HERITAGE AND SPACE TECHNOLOGY READINESS LEVEL [TRL]:

Nota bene: A space heritage technology can be hardware, software, know-how, processes, methodologies or systems developed or adapted for space applications. Satellite borne data, GNSS signals and satellite communication capacity are not considered as space heritage technologies in the context of technology transfer. In case the technology was originally developed for terrestrial purposes [and later spun into space], the space heritage refers to the technical adaptations made on the terrestrial baseline.

Provide the following elements to describe the space heritage technology:

1. Name of the technology:
2. Abstract:

Provide an abstract of the technology in less than 3 lines including keywords – provide at least one illustrative picture.

1. Space origin:

Indicate what problem it does solve in space, and when/what it was developed for, e.g. a space mission, technology development program]. In case the technology was developed under one or more ESA contract[s], please provide the activity name[s] and contract number[s].

1. Description of the technology:

Indicate what functions it performs, its key features and capabilities, and describe how the technology is physically implemented [in case of hardware].

1. Innovation and advantages:

Describe the innovative aspects of the technology, as well as its advantages with respect to alternative technologies which perform equivalent functions.

1. TRL:

Identify with justification the current level of maturity of the technology [TRL] for space applications. Please refer to Annex 2 to this Template for the description of TRLs.

1. IPR:

Provide the IPR situation in case relevant [are background IPRs needed? Has an invention been protected by a patent, etc].

☐ The Applicant confirms and agrees to allow Verhaert and ESA to keep and publicise its technology description for further opportunities at Verhaert in the framework of Space Solutions [ i.e. post it on the ESA’s and Verhaert’s websites, bring it to the attention of non-space organisation looking for a solution, put you in contact with such organisations.

## 1.2 NEW APPLICATION OF THE SPACE HERITAGE [Defining the Current situation and challenge]

1. New application domain:

Describe the new domain of application.

1. Current use case scenario and End-users:

* Describe the current operational situation without making use of the new solution.
  + Identify the intended customers of your solution, and describe their role in the value chain. Customers shall be understood as the stakeholders who are candidates to procure directly your solution.
  + Identify end-users and describe their operational role. End-users shall be understood as stakeholders who are candidates to operationally use the solution [possibly embedded into a larger system]. NB: end-users and direct customers may be the same, in case your solution can be used as a standalone product.

## 1.3 MARKET OPPORTUNITY

1. Problem and Problem validation:

Describe the operational limitations or problems faced in this use case scenario [which you think the space technology can help to solve], and explain the impact[s] of those problems [e.g. large costs, safety issues, lack of performance, issues of maintenance, disposability, environmental footprint, etc…].

Provide evidence of validation of the problem[s] by receivers and possibly other relevant stakeholder[s]. Typically, evidence comes in the form of words from the receiver[s], e.g. quote[s] from a trade journal, excerpt from an interview, etc.

1. Other stakeholder[s]:

Identify all stakeholders [other than the end-users and direct customers] and describe their stake[s] with regards to the problem being solved and the solution being brought [e.g. implementation, procurement, operation, maintenance, health & safety, end of life, etc.].

1. Stakeholder requirements:

Provide the requirements from receivers and all other stakeholder[s], as previously identified. Be as specific as possible, with quantitative requirements when applicable. NB: Cover aspects related to performance, interfacing, costs, maintenance, operational availability & down time, end of life, health & safety, etc.…. as applicable.

1. Suitability of space heritage technology:

Justify your assumption that the space heritage may be relevant to solve the problem[s] currently faced in the target application.

1. Value proposition and market fit validation:

* Describe the value proposition [i.e. the value that is intended to be delivered to the customer] for the primary target market, i.e. the pains which your product aims to relieve, and/or the gain[s] it intends to provide;
* Present the product features which enable this value proposition;
* Explain how this value proposition addresses and solves [or alleviates] the problems faced by the customers;
* Provide elements of validation of the value proposition by [a] end-user representative[s].

1. Competition analysis:

* Identify competitive offers.
* Describe the unique selling points of your value proposition
* Compare the competitive offers with yours, in relation to salient stakeholder requirements; explain how your offer is positioned relative to your competitors’s offer.

Summarise your findings in the following table. The commercial situation in the last column refers to the level of presence of the competitive product on the market, e.g. is the product being developed? Has newly entered the market, or is it an established offering? How dominant is it on the market?

| Competitor | Country of Origin  [ISO Code] | Salient Product Characteristics | Strengths | Weaknesses | Key differentiators | Tec. maturity  [current TRL] | Commercial situation? |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Competitor A | **……** | **……** | **……** | **……** | **……** | **……** | **……** |
| Competitor B | **……** | **……** | **……** | **……** | **……** | **……** | **……** |
| Competitor X | **……** | **……** | **……** | **……** | **……** | **……** | **……** |
| Your solution | **……** | **……** | **……** | **……** | **……** | **……** | **……** |

1. Market:

* Identify and characterise the possible market segments
* Provide an estimate of the total market and the serviceable obtainable market, and provide evidence to justify your estimates.
* Explain how your business is likely to be profitable (i.e. at least reach the break even point) based on realistic assumptions on market capture.

## 1.4 TECHNICAL SOLUTION

1. System requirements:

Provide the system requirements, both functional and non-functional, at system level.

1. Conceptual design:

Describe the conceptual design for the new product; illustrative schematics or diagrams are encouraged. Justify the technical choices you have made.

1. Justification and feasibility:

Justify the technical choices made; discuss and assess the feasibility of the solution, in relation to the most significant / critical system requirements. Provide some results of analysis previously carried out.

1. Suitability and Importance of space heritage:

Explain how the space heritage may provide advantage(s) and added value to solve the problem of the new application (as captured by the requirements) with regard to prior art and competing solutions.

Explain the significance of the space heritage technology for achieving the value proposition intended for the particular application which you target [NB: refer to section 1.1 for a definition of space heritage]; explain how the space heritage may provide advantage[s] and added value to solve the problem of the new application [as captured by the requirements] with regard to prior art and competing solutions.

1. Technical maturity:

Identify with justification the current level of maturity of the technology under development in the context of the new application.

## 1.5 TECHNICAL RISKS & MITIGATION PLAN

1. Technical risks:

Identify the [critical] requirements, i.e. those requirements which may be difficult to meet. Discuss and assess the associated risks.

1. Mitigation plan:

Define a mitigation plan for those technical risks.

## 1.6 PROGRAMME OF WORK

1.6.1 Work logic:

The baseline work logic of the activity is presented in the draft contract (see chart in section XXX). Include here a compliance matrix against the baseline work logic. In case of deviation from the baseline, provide a flow chart showing the proposed work logic (including work packages, dependencies, and review meetings), and justify the proposed deviations.

### 1.6.2 Work package description:

Provide a description of the work [in the form of work packages] which will be implemented to achieve the objectives of the activity [as outlined in the AO CoverLetter and again below]. For each work package describe:

* Title
* Objective
* Work package leader [Name of responsible company/institute, Name of the WP Manager]
* Approach
* Relevant resources [incl. labour volume]
* Inputs
* Outputs

1.6.3 Provisional Breadboard (BB) test objectives and approach:

The breadboard is to be understood as a piece of hardware or software to be designed with the objective to test against specific requirements):

* Identify the major technical risks (Critical / challenging requirements, against which the technology needs to be verified.
* Define the objectives of the breadboard verification tests.
* Describe the intended approach / methodology for implementing the breadboard verification tests.
* Provide assessment of resources (facilities, equipment, etc.) required to build the breadboard / simulation software and to implement the verification tests.

1. Involvement of customer:

[to be filled in only in case the receiver(s) is/are not (a) subcontractor(s)]

* Summarise how customer(s) will be involved (i.e. their role for each of the work packages which they are involved in), as well as other forms of contributions (e.g. in-kind labour, financial contribution, access to facilities, etc.)
* Explain the status of your discussions on cooperating over this activity. Provide evidence of their interest in the envisaged solution, and of their willingness to take the role described, in the form of support letters;
* You can summarise the receiver related information in the following table:

| **Name** | **Contributions in the activity (Phase 1 and 2)**  (in-kind labour, financial contribution, access to facilities, etc.) | Involvement evidence in **support letter?** | **Indicate the status of the cooperation agreement**  (e.g. in place / expected for the negotiation meeting, etc.**)** |
| --- | --- | --- | --- |
| ……… | ……… | Yes / No | ……… |
| ……… | ……… | Yes / No | ……… |
| ……… | ……… | Yes / No | ……… |

## 1.7 FEASIBILITY OF THE ACTIVITY

1. Suitability of key personnel:

Introduce key personnel [incl. short CVs with information directly relevant to this activity] and explain how key personnel have the appropriate experience, expertise and skills to satisfactorily fulfil their assignment in this activity.

Nota bene: a “key person” is a person who substantially contributes, in terms of effort and knowledge, to the work carried out under a Contract, and who is explicitly nominated to perform such duties. Key persons are individuals with a certain degree of seniority and whose knowledge, reputation and/or skills in the relevant areas or disciplines are critical to achieving the objectives of the Contract.

1. Suitability of organisations facilities:

Present an overview of the involved organisations, and explain how the facilities & equipment required to implement the programme of work will be at the disposal of the activity.

1. Risks and mitigation plan for activity implementation:

Identify potential risks pertaining to the implementation of the activity. Propose a mitigation plan [and reflect it in the work logic, work package description & management plan]. The technical risks requested in the proposal template **shall not** be considered here. This could be for instance risk related to COVID-19.

# 2 MANAGEMENT PART

## 2.1 MANAGEMENT PLAN

[Explain how the activity will be managed to ensure compliance with the proposed schedule [2.2].

## 2.2 PLANNING

### 2.2.1 Proposed Schedule

[Provide a starting date and a synthetic summary of the schedule in relation to the workflow including duration, planning assumptions [e.g. envisaged start date, holidays etc.] and identifying and explaining key planning drivers and dependencies].

### 2.2.2 Meeting and Travel Plan

Indicate if any Travel is planned to accomplish the work [e.g. for suppliers or subcontractor].

## 2.3 DELIVERABLE ITEMS

### 2.3.1 Documentation

[For each of the deliverable documents proposed by the Applicant , a description, in the form of a bullet list of the main contents shall be added. This shall be sufficient to understand the contents, scope and depth of the envisaged document or report].

A full description of the documents is offered in the deliverables section of the draft contract.

| **Doc ID** | **Title** | **Milestone** |
| --- | --- | --- |
| TD | Space Technology Description | Final Review |
| ESR | Executive Summary Report and achievement summar | Final Review |
| RD | Requirements document | Design Review |
| SAD | System Architecture Document | Design Review |
| BCM | Business Canvas Model | Design Review |
| BDTR | Breadboard Design and Test Report | Element 1 @Design review  Element 2 @Final Review |
| RMIP | Risk Mitigation & Implementation Plan | Final Review |
| ES&AS | Executive Summary & Achievement Summary | Final Review |
| SS | 2 summarising slides | Final Review |
| TDP | Technical Data Package | Final Review |
| FR | Final Report | Final Review |
| CCD | Contract Closure Documentation | Contract Closure |

# 3 FINANCIAL PART

## 3.1 PRICE QUOTATION FOR THE CONTEMPLATED CONTRACT:

[Enter here the total amount quoted as a firm-fixed Price [CRP], in Euro, delivery duty paid, exclusive of import duties and value added taxes in BELGIUM]

## 3;2 DETAILED PRICE BREAKDOWN

### 3.2.1 Breakdown of the total price per work package

### 3.2.2 Milestone Payment Plan

[Provide a Milestone Payment Plan using the table here below, taking into account Article 4 of the Draft Contract.

All claims for payment shall be linked to the achievement of defined schedule milestones with tangible deliverables including as the case may be, achieved performance of service. Examples of such milestones are the satisfactory completion of WPs and delivery of the related output.]

[You are requested to indicate below for only information purposes, the Milestone Payment Plan that is envisaged for Subcontractor[s]]

| **Milestone and month** |  | **Work package Description** | **Payment** |
| --- | --- | --- | --- |
| M+1 | Kick-off |  | 0,00 |
| M+3 | Design Review | WPx- WPX | Max. 50% |
| M+6 | Final review | WP | Remaining part up to 100% max |

# 4 CONTRACTUAL PART :

## 4.1 INTELLECTUAL PROPERTY RIGHTS

### 4.1.1 Right to use/modify Intellectual Property

[The Applicant confirms that they have the right to use /modify the intellectual property rights [IPR] which is subject to the technology transfer. The specific types of rights shall be identified [e.g. ownership, licence, etc.]

## 4.2 IMPORT AND EXPORT LICENCES

[This section is only to be completed in case of items or services that are subject to envisaged or probable inclusion of import/export restrictions, other than those from the Applicant ’s own country, in either the body of the work performed under this activity or in a resulting product or service. For the purpose of this section, ‘items’ shall be taken to include EEE parts and materials, ‘services’ shall be taken to include testing and coating and such restrictions include, as example, US ITAR, Israeli Export Control etc. ]

### 4.2.1 Import and Export Licences applicable to this Activity

[OPTION1]

The Applicant declares that no items subject to import or export control will be used in the execution of this activity.

[END OPTION1]

[OPTION2]

The Applicant declares that the following items, subject to import or export control will be used in the execution of this activity:

| Item | Control Type and Country of Origin | Deliverable affected | Comment |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ATTACHMENTS**:

- ANNEX 1: TECHNOLOGY READINESS LEVEL [TRL]

# ANNEX 1: TECHNOLOGY READINESS LEVEL [TRL]

ESA has adopted the Technology Readiness Level [TRL] scale as a way to measure the maturity of a technology. It has now become a well-established standard. For additional information on definitions, please refer to ECSS-E-AS-11C.

|  | **Technology Readiness Levels[[2]](#footnote-1)** | |
| --- | --- | --- |
|  | **9** | Actual system “flight proven” through successful mission operations |
| **8** | Actual system completed and accepted for flight “flight qualified” |
| **7** | Model demonstrating the element performance for the operational environment |
| **6** | Model demonstrating the critical functions of the element in a relevant environment |
| **5** | Component and/or breadboard critical function verification in a relevant environment |
| **4** | Component and/or breadboard validation in laboratory environment |
| **3** | Analytical and experimental critical function and/or characteristic proof-of-concept |
| **2** | Technology concept and/or application formulated |
| **1** | Basic principles observed and reported |

Figure 1 – Technology Readiness Levels adopted in ESA since 2005

Regarding the maturity status of software the same number of TRL are indicatively used. A short description using software engineering terms is shown in Figure 2.

| **TRL** | **Software Maturity** |
| --- | --- |
| **9** | Live Product |
| **8** | General Product |
| **7** | Early Adopter Version |
| **6** | Product Release |
| **5** | BETA Version |
| **4** | ALPHA Version |
| **3** | Prototype |
| **2** | Algorithm |
| **1** | Mathematical Formulation |

Figure 2 – Technology Readiness Levels using software engineering terms

Figure 3 gives an indicative correspondence between commonly used engineering terms and TRL levels:

| **TRL** | **Commonly Used Engineering Terms** |
| --- | --- |
| **9** | Mission Operations. Flight Qualified Hardware/Software |
| **8** | Theoretical First Unit. Flight Unit. Flight Spare. |
| **7** | System Demonstration. |
| **6** | High-Fidelity Laboratory Prototype. Engineering Qualification Model. Subsystem model. Development Model. System Model. |
| **5** | High-Fidelity Breadboard. Brassboard. Engineering Breadboard. Function-Oriented Model. |
| **4** | Component. Breadboard. |
| **3** | Laboratory Experiments. |
| **2** | Systems Analysis. Pre-Phase-A Studies. |
| **1** | Scientific Research. |

Figure 3 – Technology Readiness Levels and associated Common Engineering Terms.

Figure 4 gives an indicative list of readiness levels for applications and service developments

| **TRL** | **Applications and Services** |
| --- | --- |
| **9** | Application/service operationally deployed and used by paying customers |
| **8** | Application/service completed and validated, commercial offer ready |
| **7** | Trials with customers/users to validate utilisation and business models |
| **6** | Demonstration of prototype in relevant environment, price policy identified |
| **5** | Application/service verified using operational elements, customers/users not involved |
| **4** | Application/service verification in laboratory environment, market segment[s] and customers/users identified |
| **3** | Concept analysis performed and target market identified |
| **2** | Application/service concept formulated, market opportunities not yet addressed |
| **1** | Scientific research |

Figure 4 –Readiness Levels for Applications and Services

**[END DETAILED PROPOSAL TEMPLATE]**

1. Specify here the type of business entity to which the company belongs (e.g Limited Company, Société Anonyme, AG etc). [↑](#footnote-ref-0)
2. ref. Technology Readiness Levels - A White Paper April 6, 1995, John C. Mankins, Advanced Concepts Office, Office of Space Access and Technology, NASA) [↑](#footnote-ref-1)