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# Introduction

The following requirements document template shall be written from the perspective of contractors involved in InCubed projects (mostly applicable for all InCubed Domains except Space Segments, for which only chapter 2 of this document shall be used, while ECSS, or simplified ECSS are supposed to be used for mission and system requirements)

The initial purpose of the Requirements Document (RD) is to make sure that all the users/customers needs are listed and agreed. These needs are turned into measurable requirements which can be later tested by the consortium in the System Verification Document.

This template structures the minimum requirements of content expected in the Requirements Document deliverable to be reviewed by the ESA during the project execution.

Concerning the use of this template, please note the following:

* Material presented in this plain style is either suggested content for the Requirements Document, or describes the content to be inserted in the corresponding paragraph, as relevant. This is intended to be an example of a response to the related Agency requirements, which the Contractor needs to properly complement. The suggested material may be adopted as is, or modified at the Contractors’ discretion. It remains the responsibility of the Contractor to ensure that all of the Agency’s requirements are properly addressed.
* This style is used to identify information that must be modified and/or completed by the Contractor for the proposed activity. This supplementary information should be presented in plain typeface (i.e. not red) in the final version
* This style is used for explanatory notes and guidance to help you to develop the Requirements Document content (e.g. to indicate a selection between mutually-exclusive options). This information should be removed from the final version of the Requirements Document.

PLEASE, REMOVE THIS TEXT BOX AFTER YOU HAVE STARTED USING THIS TEMPLATE

*In the introduction, the contractor shall describe the requirements engineering approach that intends to follow. In case a waterfall approach to the requirements engineering is retained, the Requirements Document (RD) will be discussed at the Requirement Review (RR). The set of Requirements herewith described will be the baseline for the following design and development activities and associated verification. In case an agile method is retained, the contractor shall describe the iteration process and identify the milestones in which the RD shall be discussed with the Agency.*

## Reference Documents

| Ref. | Document ID. | Title | Rev. |
| --- | --- | --- | --- |
|  |  |  |  |

## Applicable Documents

| Ref. | Document ID. | Title | Rev. |
| --- | --- | --- | --- |
|  |  |  |  |

## Acronyms

| **Tag** | **Description** |
| --- | --- |
| RD | Requirements Document |
|  |  |

# User/customer Needs and Requirements

*To allow formal traceability of the different requirements, each requirement shall be associated with a unique identifier using a suitable methodology. Such methodology shall use a suitable set of acronyms (e.g. UN/CN for User/customer Needs, UR/CR for User/customer Requirements, SR for System Requirements) to facilitate traceability.*

*The approach could be different depending on the type of user/customers involved in the project. It could be necessary to identify before User/customer Needs, translate them in measurable User/customers Requirements and map them into System Requirements; it could also happen User/customers Needs could be directly mapped into System Requirements or even that a skilled user/customer already has a set of User/customers Requirements that can be used by the designer for the System Requirements. The approach to be followed is left to the designer; justification shall be anyhow provided.*

## User/customer Needs

*The scope of this section is presenting the improvements as desired and expressed by the user/customer and expected to be answered by the proposed system, together with a concise presentation of the high level interaction between the intended system and the different actors involved (e.g. use case). This can be done providing a description of the current situation (before introduction of the product/service, with the problems to solve) and how this will change after the introduction of the proposed product/service.*

**User/customer Needs Description**

*Any user/customer needs shall be defined on the basis of the following rules. In particular, it will be listed in a row of table as presented in Table 1.*

| **ID** | **User/customer Need** | **Source** |
| --- | --- | --- |
| UN-0100 | User/customers needs to identify crop types in Region A | User/customer group A |
| ……. | ……. | ……. |

Table 1 – User/customer Needs

Where:

* **ID**: is a unique identification composed of a prefix, for instance “**UN” or “CN”**, followed by a serial number, which could be composed of four digits (e.g., **UN-0100, CN-0200** etc.). In the initial phase the serial number could start from 0100 and will proceed in steps of 100 per requirement, in order to allow the possibility of adding new or more detailed needs during the course of the requirements definition.
* **User/customer Need**: Describes the need in qualitative terms.
* **Source**: From where this need has been expressed (e.g. a specific user/customer that expressed this need).

## User/customer Requirements

*This paragraph is describing in a structured form the set of statements originated by the user/customers describing the functions, performance and capabilities that the system will bring to them during its utilisation. A mapping between User/customer Requirements and User/customer Needs is part of this section.*

**User/customer Requirements Description**

*Any User/customer requirement shall be defined on the basis of the following rules. In particular, it will be listed in a row of table as presented in Table 2.*

| **Req. ID** | **User/customer Requirement Name** | **Description** | **Justification and/or comment** | **User/customer Need Ref.** |
| --- | --- | --- | --- | --- |
| UR-PERF-0100 | Crop Type Identification performance  | The service shall provide a response to the customer within 10 seconds. | Update timing expressed by Customer X…. | UN-0100 |
| CR-PERF-0200 | …….  | …….  | …….  | CN-0100 |
| ……. | ……. | ……. | ……. | ……. |

Table 2 – User/customer Requirements

Where:

* **ID**: unique identification composed of the **UR or CR** prefix, followed by a serial number composed of four digits (e.g., **UR-0100, CR-0200** etc.). It is suggested to use for the numbering scheme the same criteria used for the User/customer Needs (e.g. start from 0100 and proceed in steps of 100 per requirement).
* **User/customer Requirement**: Define the requirement through a concise name
* **Description**: Describes the requirement in more details and with regard to the impact on the system definition
* **Justification**: Provides the rationale for the requirement and what are the benefits
* **User/customer Need Ref.**: Define the cross reference with respect to the satisfied need

# System Requirements

*A system requirement is a statement typically originated by the designer about what the system shall do and/or shall be to fulfil the User/customer Requirements (e.g. associated to constraints, environment, operational and performance features).*

*This section is identifying, allocating and specifying the System Requirements defined by the designer. A mapping between System Requirements and User/customer Requirements (if applicable) or User/customer needs is part of this section.*

## System Requirements

*Any requirement shall be defined on the basis of the following rules. In particular, it will be listed in a row of table as presented in Table 3.*

| **ID** | **System Requirement** | **Priority** | **Description** | **Verification Method** | **User/customer Req.** |
| --- | --- | --- | --- | --- | --- |
| SR-PRF-0100 | Data retrieval | M | The service shall be able to retrieve raw data from providers within 10 seconds. | T | UR-PERF-0100, UR-PERF-0200 |
| SR-PRF-0200 | Crop Type Algorithm  | M | The AI-model to derive the “Crop Type” shall have at least 96% of accuracy. | I | UR-PERF-0300, UR-PERF-0200 |

Table 3 – Requirement description

Where:

* **ID**: unique identification composed of a prefix, followed by a serial number composed of four digits (eg. **SR-0100**, **SR-0200** etc.).
* **Priority**: define whether the requirement is:
	+ Must have (**M**) – must be implemented in the system.
	+ Should have (**S**) – must be implemented but may wait until a second increment.
	+ Could have (**C**) – could be implemented but it is not central to the project objectives.
	+ Wish to have (**W**) – will not be implemented but it will be considered for a future phase.
* **Description**: describes the requirement.
* **Verification Method**:
* **Inspection (I)** – Verification by inspection shall consist of visual determination of

physical characteristics.  Visual inspection of either graphical interface, textual results, user/customer manual, or equipment manufacturer specifications. It will require an analysis of the documentation and/or visual inspection, providing evidence of the correct implementation that satisfy the requirement by means of screenshot, extraction of sections from operational manuals, etc. Therefore no specific test procedure with detailed operations is envisaged.

* **Analysis (A)** – Verification by analysis is done when other methods are not appropriate or too cumbersome to perform a verification by test. It is usually done by collecting data like test results related to some part of the system, and then, knowing the system design, an engieneering based judgement is perfomed to infer whether the verification was successful or not.
* **Demonstration (D)** – Verification by demonstration is done verifying the behaviour of the system, either once or more than once, without special test equipment or intrumentation. Demonstration can be documented in different ways, such as with pictures or screen captures.
* **Test (T)** - Verification tests consist of measuring system performance and functions under representative environments.

# Appendix 1

This appendix is intended to serve as Guideline in order to develop Requirements.

The following diagram shows the logical flow linking User/customer Needs, User/customer Requirements with System Requirements



Logical separation of the requirements depending on the involvement of the different agents:

* User/customer Requirements – the “WHAT”

Proposed definition: *Statement originated by the user/customers describing the functions and capabilities that the system shall bring to them during its utilization*

* Related to a process that the user/customer must be able to accomplish using the system / service
* Derived from the analysis of user/customer expectations, problems, needs, constraints and scenarios.
* Originated by: user/customers, based on an in-depth interaction with the designer. This dialogue helps to translate the user/customer needs into verifiable user/customer requirements.
* Should not propose solutions or technologies.
* System Requirements – the “HOW”

Proposed definition: *Statement typically originated by the designer about what the system shall do and/or shall be to fulfil the User/customer Needs or Requirements (e.g. associated to constraints, environment, operational and performance features)*

* Derived from the user/customer needs or requirements, need to be verifiable and traceable to the user/customer needs or requirements.
* Originated by: designer/system engineer.

Ground rules applicable to SR

* They need to be agreed and meaningful for both user/customers and designer (i.e. need of constant dialogue)
* They should be limited to a single thought, concise, simple and stated in a positive way
* SR shall be needed (i.e. responding to at least one UR/CR and or need)
* They need to be verifiable and attainable
* Presented in formal documents
* Each requirement shall be accompanied by:
	+ Description: helps to understand and interpret the requirement, and to transform knowledge in project asset. Needs to be documented and linked to the requirement, likely in a design document (e.g. Design Justification File).
	+ Test Verification method: needs to be considered and documented while writing the requirements

Hint: words such as “adequate, easy, high speed, maximise, minimise, quickly, robust, sufficient, use’-friendly” are likely to indicate unverifiable requirements and should not be used.

* + Traceability: needed to identify a requirement source, helps correct omissions, redundant or unnecessary requirements. Requirements can be traceable by assigning unique identifiers to each requirement. Traceability matrices can be used to quickly check the SR dependences.

# Appendix 2

This Appendix provides some ground rules for Project Management towards Requirements process:

Inclusion of a Requirements Review in the projects, as part of the RR. It is Characterized by the following:

* Includes the User/customers and Designers
* Gives the opportunity to the designer to explain the System Requirements and the associated rationale
* Collect User/customer feedback on System Requirements

The following diagram shows the different stages characterizing an InCubed Data Segment/Ground Segment Project. Iterations of the Requirements may be needed in an agile approach and this should be explained by the contractor.

