TECHNICAL REPORT

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Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 5-6-3:

Systems engineering: Management and engineering guide: Generic profile group: Intermediate profile

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see http://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7 *Software and systems engineering*.

A list of all parts in the ISO 29110 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Very Small Entities (VSEs) around the world are contributing to valuable products and services. For the purpose of ISO/IEC 29110 (all parts), a Very Small Entity (VSE) is an enterprise, an organisation, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system elements and software components used in systems, or sold to be used by others, a recognition of VSEs as suppliers of high-quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2005) 'Small and Medium Enterprises (SMEs) constitute the dominant form of business organisation in all countries world-wide, accounting for over 95 % and up to 99 % of the business population depending on country'. The challenge facing OECD governments is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformance with these standards is difficult, if not impossible. Subsequently VSEs have no, or very limited, ways to be recognized as entities that produce quality systems/system elements including software in their domain. Therefore, VSEs are often cut off from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the application of standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, expertise, budget and time, nor do they see a net benefit in establishing systems or software lifecycle processes. To rectify some of these difficulties, a set of guides has been developed according to a set of VSE characteristics. The guides are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSEs' context; for example, processes, activities, tasks, and outcomes of ISO/IEC/IEEE 12207 for software; and processes, activities, tasks, and outcomes of ISO/IEC/IEEE 15288 for systems; and information products (documentation) of ISO/IEC/IEEE 15289 for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against ISO/IEC 29110 (all parts) specifications.

The ISO/IEC 29110 series of standards and technical reports can be applied at any phase of system or software development within a lifecycle. This series is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 standards to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 are encouraged to use those standards instead of ISO/IEC 29110 (all parts).

ISO/IEC 29110 (all parts) is intended to be used with any lifecycles such as: waterfall, iterative, incremental, evolutionary or agile.

Systems, in the context of the ISO/IEC 29110 series, are typically composed of hardware and software components.

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality, and process performance. See Table 1.

Table 1 — ISO/IEC 29110 (all parts) target audience

The ISO/IEC 29110 series	Title	Target audience
ISO/IEC 29110-1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.

Table 1 *(continued)*

The ISO/IEC 29110 series	Title	Target audience
ISO/IEC 29110-2	Framework for profile preparation	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
ISO/IEC 29110-3	Certification and assessment guidance	VSEs and their customers, assessors, accreditation bodies.
ISO/IEC 29110-4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-5	Management, engineering and service delivery guidelines	VSEs and their customers.
ISO/IEC 29110-6	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-7	Specific profile guidelines	VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4 or ISO/IEC 29110-6 and or ISO/IEC TR 29110-7 ISO/IEC TR 29110-5 can be developed with minimal impact to existing documents.

ISO/IEC TR 29110-1 defines the terms common to the Set of ISO/IEC 29110 Documents. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and needs of a VSE, and clarifies the rationale for specific profiles, documents, standards and guides.

ISO/IEC 29110-2-m introduces the concepts for systems and software engineering profiles for VSEs. It establishes the logic behind the definition and application of profiles. For standardized profiles, it specifies the elements common to all profiles (structure, requirements, conformance, assessment). For domain-specific profiles (profiles that are not standardized and developed outside of the ISO process), it provides general guidance adapted from the definition of standardized profiles.

ISO/IEC 29110-3-m defines certification schemes, assessment guidelines and compliance requirements for process capability assessment, conformity assessments, and self-assessments for process improvements. ISO/IEC 29110-3-m also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC 29110-3-m is addressed to people who have direct involvement with the assessment process, e.g. the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met.

ISO/IEC 29110-4-m provides the specification for all profiles in one profile group that are based on subsets of appropriate standards elements.

ISO/IEC TR 29110-5-m-n provides a management and engineering guide for each profile in one profile group.

ISO/IEC 29110-6-m provides the specification for specific profiles that are based on subsets of appropriate standards elements.

ISO/IEC TR 29110-7-m provides a guide for each profile in the specific profile group.

This document provides a management and engineering guide for the systems engineering Intermediate profile of the generic profile group. This guide is oriented towards the management of more than one project in parallel with more than one work team.

Figure 1 describes the ISO/IEC 29110 International Standards (IS) and Technical Reports (TR) and positions the parts within the framework of reference. Overview, assessment guide, management and engineering guide are available from ISO as Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

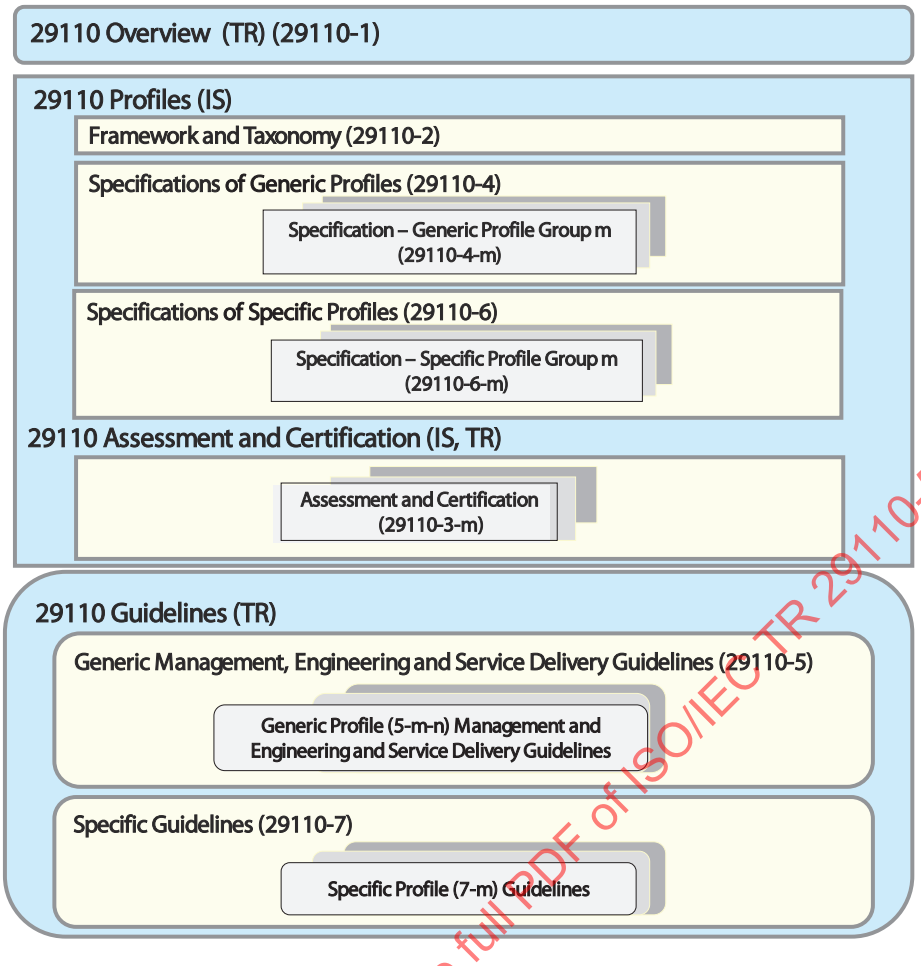


Figure 1 — The ISO/IEC 29110 Series

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 5-6-3:
Systems engineering: Management and engineering guide: Generic profile group: Intermediate profile

1 Scope

1.1 Fields of application

This document provides management and engineering guidance within the Intermediate profile for the Business Management, Project Management, System Definition and Realisation and Acquisition Management processes.

This document is applicable to Very Small Entities (VSEs). VSEs are enterprises, organisations, departments or projects having up to 25 people. The lifecycle processes described in the ISO/IEC 29110 series are not intended to preclude or discourage their use by organisations bigger than VSEs.

This document has been developed using the management and engineering guide from the systems engineering Basic profile. Elements were added or modified (e.g. process, task, work product, role) to support VSEs involved in the development of more than one project in parallel with more than one work team.

This guide is oriented towards the management of more than one project in parallel with more than one work team.

This document applies for the development of non-critical systems.

Using this document, a VSE can obtain benefits in the following aspects:

— An agreed set of project requirements (technical part of contract) and expected work products are agreed by the Acquirer.

— A disciplined management process, that provides project visibility and corrective actions of project problems and deviations, is performed.

— A systematic System Definition and Realisation process, that satisfies Acquirer needs and helps ensure quality work products, is followed.

Once the system, developed by a VSE, has been accepted by their customers, the VSE that wants to provide after delivery services can refer to ISO/IEC TR 29110-5-3.

In the context of systems engineering, that is the System Definition and Realisation (SR) process, the group that is part of the VSE responsible for developing software elements that are part of the system are encouraged to use the management and engineering guide of the software engineering Intermediate profile (ISO/IEC TR 29110-5-1-3).

1.2 Target audience

This document is targeted at VSEs that do not develop critical systems and have little or no experience with systems engineering (SE) process planning and implementation using ISO/IEC/IEEE 15288.

This document is also targeted to VSEs which are familiar with management and engineering guide of the systems engineering Basic profile (ISO/IEC TR 29110 5-6-2) for their system development projects and are involved in the development of more than one project in parallel with more than one work team.

This document is intended to be used with any processes, techniques and methods that enhance the VSE's Stakeholder satisfaction and productivity.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 29110-2-1, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 2-1: Framework and taxonomy*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29110-2-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
agreement
mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.4]

3.2
acquirer
stakeholder that acquires or procures a product or service from a supplier

Note 1 to entry: Other terms commonly used for an acquirer are buyer, customer, owner, purchaser or internal/organizational sponsor.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.1]

3.3
critical system
items (e.g. functions, parts, software, characteristics, processes) having significant effect on the product realization and use of the product, including safety, performance, form, fit, function, producibility, service life, etc., that require specific actions to help ensure they are adequately managed

Note 1 to entry: Examples of critical items include safety critical items, fracture critical items, mission critical items, key characteristics, etc.

Note 2 to entry: This definition is adapted from (AS/EN/JIS Q) 9100:2009.

3.4
conditional process
process that may be mandatory under some specified conditions, may be optional under other specified conditions, and may be out of scope or not applicable under other specified conditions

Note 1 to entry: These are to be observed if the specified conditions apply.

[SOURCE: ISO/IEC TR 29110-5-1-3:2017, 3.3]

3.5
disposed system
system (3.10) that has been transformed (i.e. state change) by applying the disposal process

Note 1 to entry: A systems approach considers the total system and the total lifecycle of the system. This includes all aspects of the system and the system throughout its life until the day *users* (3.13) depose of the system and the external enterprises complete the handling of the disposed system products.

3.6
enabling system
system (3.10) that supports a *system-of-interest* (3.11) during its life cycle stages but does not necessarily contribute directly to its function during operation

EXAMPLE A configuration management system used to control software elements during software development.

Note 1 to entry: Each enabling system has a life cycle of its own. This document is applicable to each enabling system when, in its own right, it is treated as a system-of-interest.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.18, modified — The original EXAMPLE has been replaced with a new one.]

3.7
operator
individual or organization that performs the operations of a *system* (3.10)

Note 1 to entry: The role of operator and the role of *user* (3.13) can be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: An individual operator combined with knowledge, skills and procedures can be considered as an element of the system.

Note 3 to entry: An operator may perform operations on a system that is operated, or of a system that is operated, depending on whether or not operating instructions are placed within the system boundary.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.26]

3.8
systems engineering management plan
SEMP
systems engineering plan
top-level plan for managing the SE effort which, as such, defines how the project will be organized, structured, and conducted and how the total engineering process will be controlled to provide a product that satisfies stakeholder requirements

Note 1 to entry: This definition is adapted from INCOSE:2010.

3.9
small and medium enterprise
SME
enterprise which employs less than 250 persons

Note 1 to entry: This definition is adapted from OECD:2005.

3.10
system
combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: A system is sometimes considered as a product or as the services it provides.

Note 2 to entry: In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g., aircraft system. Alternatively, the word "system" is substituted simply by a context-dependent synonym, e.g., aircraft, though this potentially obscures a system principles perspective.

Note 3 to entry: A complete system includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46]

3.11
system-of-interest
SOI
system (3.10) whose life cycle is under consideration in the context of this document

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46, modified — The abbreviated term "SOI" has been added.]

3.12
trade-off
decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the stakeholders

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.51]

3.13
user
individual or group that benefits from a *system* (3.10) during its utilization

Note 1 to entry: The role of user and the role of *operator* (3.7) are sometimes vested, simultaneously or sequentially, in the same individual or organization.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.51, modified — The words "interacts with a system" have been removed.]

3.14
system structure
decomposition of a *system-of-interest* (3.11) into a set of interacting *systems* (3.10) and system elements
Note 1 to entry: The system structure is described in a System Breakdown Structure (SBS).

3.15
statement of work
SOW
document used by the *acquirer* (3.2) that includes the needs and expectations, the scope, objectives and deliverables

3.16
work breakdown structure
WBS
<Output/Input> deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables

Note 1 to entry: It organizes and defines the total scope of the project.

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.4603, modified — The domain "<Output/Input>" has been added; Note 1 to entry has been added.]

4 Conventions and abbreviated terms

4.1 Naming, diagramming and definition conventions

The following process structure description and notation are used to describe the processes:

Name — process identifier, followed by its abbreviation in parenthesis "( )".

Purpose — general goals and results expected of the effective implementation of the process. The implementation of the process should provide tangible benefits to the stakeholders.

Objectives — specific goals to help ensure the accomplishment of the process purpose. The objectives are identified by the abbreviation of the process name, followed by the letter "O" and a consecutive number, for example PM.O1, SR.O2, etc. Annex B presents a mapping between the objectives of this document and the base standards used to develop this profile.

Input Work Products — work products required to perform the process and its corresponding source, which can be another process or an external entity to the project, such as the Acquirer. They are identified by the abbreviation of the process name and showed as a two-column table of work product names and sources.

Output Work Products — work products generated by the process and its corresponding destination, which can be another process or an external entity to the project, such as Acquirer or Organisational Management. They are identified by the abbreviation of the process name and showed as a two-column table of work product names and destinations.

Internal Work Products — work products generated and consumed by the process. They are identified by the abbreviation of the process name and showed as a one-column table of the work product names.

All work products' names are printed in italics and begin with capital letters. Some work products have one or more statuses attached to the work product name surrounded by square brackets "[ ]" and separated by ",". The work product status may change during the process execution. See Clause 12 for the alphabetical listing of the work products, its descriptions, possible statuses and the source of the work product. The source can be another process or an external entity to the project, such as the Acquirer.

Rectangle boxes — the rectangle boxes following the description of process objectives correspond to ISO/IEC/IEEE 15288.

Roles involved — names and abbreviation of the functions to be performed by project team members. Several roles may be performed by a single person and one role may be assumed by several persons. Roles are assigned to project participants based on the characteristics of the project. The role list is identified by the abbreviation of the process name and showed as a two-column table. See Clause 11 for the alphabetical list of the roles, its abbreviations and required competencies description.

Diagram — graphical representation of the processes. The large round-edged rectangles indicate process or activities and the smaller square-edged rectangles indicate the work products. The directional or bidirectional thick arrows indicate the major flow of information between processes or activities. The thin directional or bidirectional arrows indicate the input or output work products. The notation used in the diagrams does not imply the use of any specific process lifecycle.

Activity — a set of cohesive tasks. Task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more objectives of a process. A process activity is the first level of process workflow decomposition and the second one is a task. Activities are identified by process name abbreviation followed by consecutive number and the activity name.

Activity Description — each activity description is identified by the activity name and the list of related objectives surrounded by parenthesis "( )". For example PM.1 Project Planning (PM.O1, PM.O5, PM.O6, PM.O7) means that the activity PM.1 Project Planning contributes to the achievement of the listed objectives: PM.O1, PM.O5, PM.O6 and PM.O7. The activity description begins with the task summary and is followed by the task descriptions table. The task description doesn't impose any technique or method to perform it. The selection of the techniques or methods is left to the VSE or project team.

The tasks description table contains four columns corresponding to:

— Role — the abbreviation of roles involved in the task execution.

— Task — description of the task to be performed. Each task is identified by activity ID and consecutive number, for example PM1.1, PM1.2, and so on.

— Input Work Products — work products needed to execute the task.

— Output Work Products — work products created or modified by the execution of the task.

Organisational Repository — list of work products to be saved in *Organisational Repository*; the *Configuration Management Strategy* needs to be applied to some of them. It is useful as a checklist for project manager and technical leader.

NOTE Tables used in process description are for presentation purpose only.

4.2 Notation used to document new processes, additions and modifications to the Basic profile processes

The Intermediate profile is the third profile of a four-profile roadmap (i.e. Entry, Basic, Intermediate and Advanced). The Intermediate profile has been designed to build upon the processes of the Basic profiles such that, when moving from the Basic profile to the Intermediate profile, a VSE needs to add to its existing Basic profile processes the new processes (e.g. objectives, activities, tasks, roles and work products) described in this document.

Since, in the Intermediate profile, there are additions and modifications to the Basic profile processes, this document has been written such that it will be easy for a VSE to identify these additions and modifications. The Project Management (PM) and System Definition and Realisation (SD) processes, of the Basic profile, have been complemented with additional objectives, tasks and work products in a context where a VSE is conducting more than one project in parallel with more than one work team. The following notation is used to highlight the addition/deletion/modification to the Basic profile:

— added text:

  — is underlined;

  — except for the processes of the Intermediate profile;

— deleted/modified text is struck out as follows: ~~the text is stroked out~~.

The Intermediate profile has two new processes that are not in the Basic profile: The Business Management (BM) process and a conditional process, the Acquisition Management (AM) process. The execution of the AM process is required only if a product/service needs to be obtained from an external Supplier by a VSE. To facilitate the identification of additional abbreviations, roles and work products of the BM and AM processes of the Intermediate profile, these items are underlined. To facilitate reading, the BM and AM processes have not been underlined.

The Intermediate profile terminology has been aligned with ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 15289. The following terms of old standards have been replaced with the new terms:

— “Agreement” and “Contract” have been replaced with “Agreement”;

— work products are identified with a unique code WP.XX where XX is a sequential number in Clause 12. These codes have not been used in the descriptions of activities and tasks in order to facilitate readability.

4.3 Abbreviated terms

The following abbreviations are used in this document:

ACQ	Acquirer
AM	Acquisition Manager
BM	Business Manager
HW	Hardware
IVV	Integration, Verification and Validation
PO	Purchase Order
PM	Project Management
PJM	Project Manager
PROM	Proposal Manager
SE	System Engineering
SEM	System Engineering Management
SEMP	System Engineering Management Plan
SMART	Specific, Measurable, Accepted, Realistic and Traced
SME	Small and Medium Enterprise
SBS	System Breakdown Structure
SDD	System Design Document
SOW	Statement of Work
SR	System Definition and Realisation
STK	Stakeholder
SUP	Supplier
SW	Software
TPM	Technical Performance Management
VSE	Very Small Entity
WBS	Work Breakdown Structure
WP	Work Product

5 Systems Thinking

The traditional approach to solve a problem is called Cartesian. This approach focuses on dividing a problem into small parts and, once each part is resolved, the whole problem is solved. This approach, however, has limitations because you can lose insight of the whole system. To overcome this limitation, there is the System Thinking, which analyses and observes the system as a whole and identifies the interrelationships among the parts that compose it and also with the system environment (e.g. enabling systems).

System Thinking allows for a better understanding of the systems as a whole: System Thinking is used to broaden the perspective to larger environments by considering the entire lifecycle of the system and

the different possible applications of the system. Systems can be immersed in different environments and multiple relationships will emerge. Every project has a context in which the system is embedded. Thus, a system is not only composed of software and hardware, but is always part of a larger operation, often involving people and other systems. The designer needs to clearly understand these relationships before defining a solution.

The "system" perspective enables the design of an optimized system considering all needs and constraints. This perspective also helps to invent new solutions to meet existing needs or in some cases create new needs.

For the purpose of this document, System Thinking should be considered when understanding the system to be designed so that, when identifying the requirements, all the stakeholders are considered as well as the context in which the system should operate. Following this approach, when deploying the requirements in smaller modules, it will help ensure effective integration the parts.

6 Overview

The Management and Engineering Guide of the Intermediate Profile applies to a Very Small Entity (VSE), i.e. enterprise, organisation, department, with more than one project having up to 25 people. The VSE is familiar with or have implemented the systems engineering Basic profile guide, i.e. ISO/IEC TR 29110-5-6-2, for their system development projects. It is possible that the VSE, being dedicated to software engineering find itself with systems engineering responsibilities. In this case the VSE should be familiar with or have implemented the software engineering Basic profile guide, i.e. ISO/IEC TR 29110-5-1-2, for their software development projects. The VSE efforts are dedicated to system development of non-critical systems. The projects may fulfil external or internal ~~contracts~~ agreements. The internal ~~contract~~ agreement between the project team and its Acquirer need not be explicit.

This document provides the following processes: Business Management, Acquisition Management, Project Management and, Systems Definition and Realisation. These processes integrate practices based on the selection of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 15289 standards elements. Annex A provides information about Deployment Packages which will facilitate the implementation of these processes.

This document is intended to be used by the VSE to establish processes to implement any development approach or methodology including e.g. agile, evolutionary, incremental, test driven development, etc. based on the VSE organisation or project needs.

Using the Guide, VSE can obtain benefits in the following aspects:

— An in-place business management process maintains and improves the business relationship across different projects. Business management is making sure that the human resources, infrastructure and supportive equipment (H/W and S/W) are available, known and functional for more than one project at a time. The business management process helps ensure that each project satisfies Acquirer needs and provides quality work products.

— A set of project needs (Acquirer's needs) and a set of technical requirements (technical part of the agreement ~~contract~~) and expected work products as are agreed with the Acquirer.

— A disciplined project management process, to plan and execute more than one project at a time and that provides project visibility and control; coupled with corrective actions of project problems and deviations, is performed.

— A disciplined system engineering management process that defines systematic System Definition and Realisation processes, which satisfies Acquirer needs and helps ensure quality work products, is followed.

To use the Guide the VSE needs to fulfil the following entry conditions:

— project *Needs and Expectations* are documented;

— feasibility of the project was performed before its start;

— project team, including project manager and system engineer, is assigned and trained; and

— goods, services and infrastructure to start the project are available.

To use this document, a VSE needs to be familiar with or have implemented ISO/IEC TR 29110-5-6-2, the systems engineering Basic profile, for their system development projects.

In previous systems engineering profiles of the Generic profile group, the Entry and the Basic profiles, the boundary between the VSE, its business environment and its work product were naturally vague as everyone had to focus on one work product. With the Intermediate profile, the VSE now having more than one project and therefore in need of more VSE actors, a difficult but necessary boundary needs to be defined. That boundary differentiates between what the VSE needs to do to survive in its business environment and what the VSE actors need to bring to fruition the different *Agreements* (engagement) undertaken by the VSE.

The Business Management (BM) process is covering more business areas than those pertaining exclusively to the management of the individual projects and system engineering required to define, design, produce, qualify and deliver these projects, ensuring the perennity of the VSE. The Business Management having identified business opportunities that fit with the organisational goals and resources (human, knowledge and material), it then seeks with the Subject Matter Experts, project management and systems engineering resources, the feasibility of the proposed opportunities in the context of the VSE. The same is true with proposed *Agreements*, where the Business Management will help ensure the feasibility and validity of any proposed *Agreements* arising from the interpretation of the *Request for Proposal (RFP) or business opportunities*, bringing the formal acceptance of *Agreements* into projects to help ensure the perennity of the VSE (*Until then no official project exists*). In the same manner, the protection of its Intellectual Properties (IP), the security of its assets and information items, the safety of its human resources are inherent activities of an Entity and should be outside the scope of this ISO document.

The purpose of the Project Management (PM) process is to establish and carry out in a systematic way the *Tasks* of the System Definition and Realisation process, while complying with the project's *Objectives* in the expected quality, time, cost and risks.

The purpose of the System Definition and Realisation (SR) process is the systematic performance of the analysis, design, construction, integration, verification, and validation activities for new or modified system according to the specified requirements.

The purpose of the Acquisition Management (AM) process is to obtain work products or services or both required by the VSE. The execution of the AM process is only required if a work product/service needs to be obtained from a supplier by the VSE, i.e. a conditional process.

The processes are interrelated (see Figure 2). The arrow connecting the AM process to the other processes and the process itself are dashed to indicate that this process is conditional.

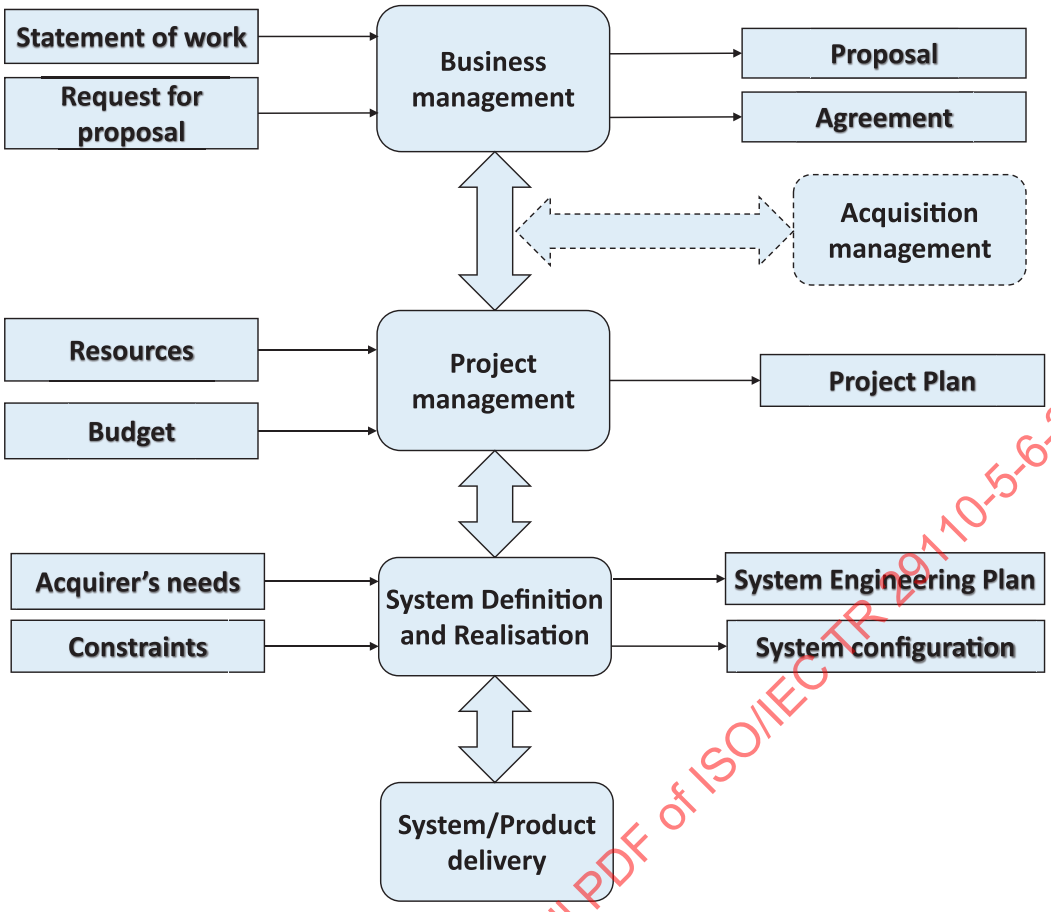


Figure 2 — Intermediate profile processes

7 Business Management (BM) process

7.1 BM purpose

The purpose of the Business Management process is to identify opportunities, evaluate all in-place *Agreements* or requests from customers for fit with organisational objectives and resources, obtain and provide the VSE with the necessary resources to perform all projects, monitor and evaluate all projects, conduct lessons learned to improve the VSE and protect its intellectual property and the security of its assets and information items.

This document is intended to be used by a VSE to establish processes to implement any development approach or methodology including, for example, agile, evolutionary, incremental, test driven development, etc. based on the VSE or project needs.

7.2 BM objectives

BM.O1. Initiate and sustain suitable projects that fit with the organisational goals and resources (human, knowledge and material) in order to meet the business objectives of the VSE.

BM.O2.Provide to the customer the work product that meets the agreed requirements.

BM.O3. Provide the VSE with necessary human resources and to maintain their competencies, consistent with business needs.

BM.O4. Provide an enabling infrastructure and services to all projects to support the VSE and the project objectives throughout the life cycle.

BM.05. Collect and analyse measures with VSE actors in order to disseminate internally the results as lessons and to institutionalise them as lessons learned for all projects.

BM.06. Protect the intellectual property and the security of the assets and information items of the VSE.

BM.07. Establish and maintain current an Organisational Repository, to capture, maintain history and disseminate the projects' relevant documentation. Including BM input and output work products.

BM.08. Provide structure for all projects evaluation, critiques and mentoring, if required, in order to deliver to the Acquirer a system of defined quality, in time, and on cost.

7.3 BM input work products

Table 2 provides a list of input work products.

Table 2 — BM input work products

Name	Source
Agreement	Customer
Request for Proposal	Customer
Change Request	Customer Project Manager
Resource Request	Project Manager
Purchase Order	Project Manager
Human Resource Record	Project Manager

7.4 BM output work products

Table 3 provides a list of output work products.

Table 3 — BM output work products

Name	Destination
~~*Contract*~~ *Agreement*	Business Management
Project Plan	Business Management
Proposal	Customer
System Configuration	Customer

7.5 BM internal work products

Table 4 provides a list of internal work products.

Table 4 — BM internal work products

Name
Business Objectives
Project Opportunities
Security and Intellectual Property Protection Plan
Resource Request
Budget Request
Organisational Lessons Learned Record
Process Improvement Record

7.6 BM roles involved

Table 5 provides a list of roles involved in the BM process.

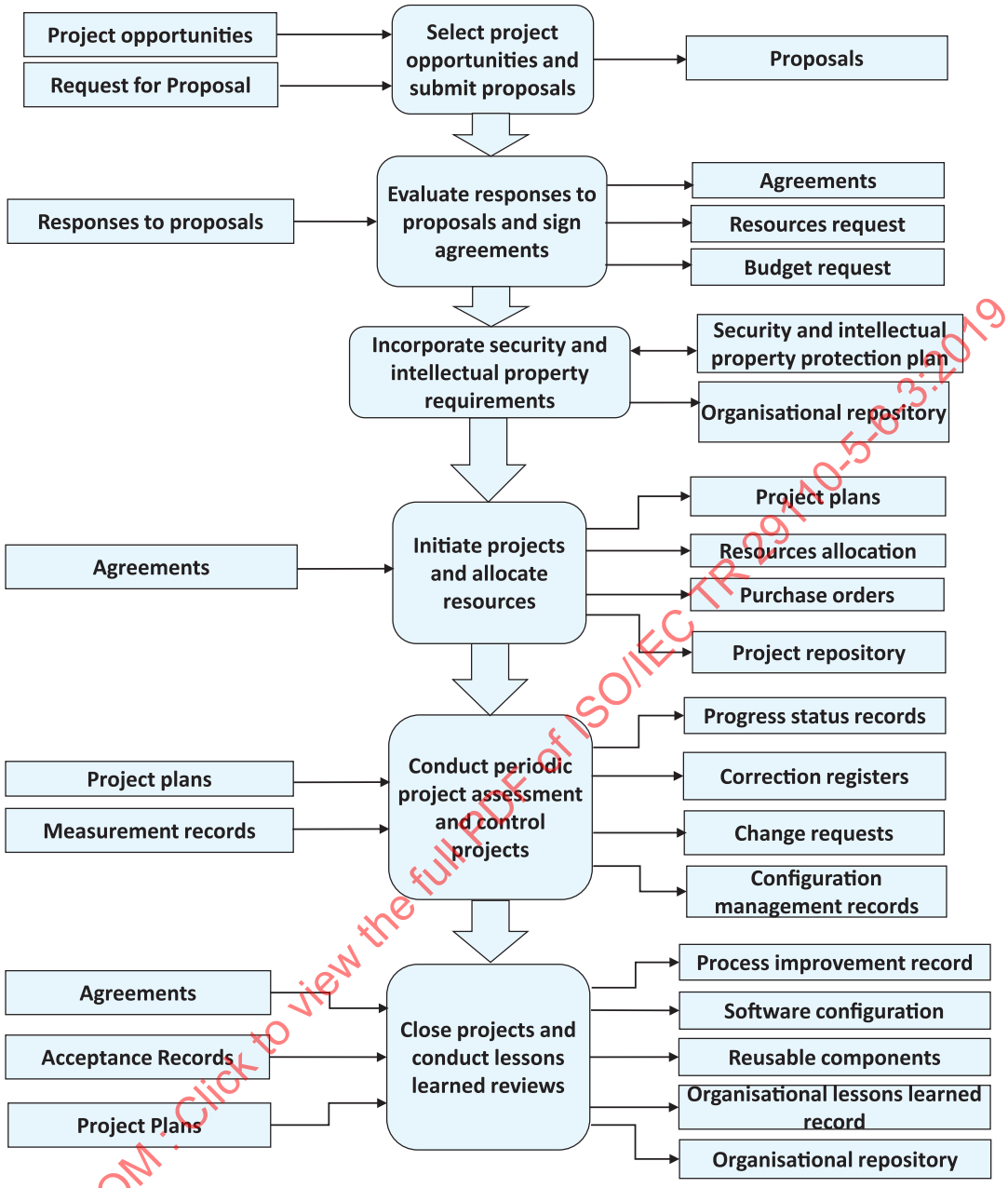
Table 5 — BM roles involved

Role	Abbreviation
Business Management	BM
Project Manager	PJM
Proposal Manager	PROM
Customer	CUS

7.7 BM process description

7.7.1 BM diagram

Figure 3 shows the flow of information between the Business Management Process activities including the most relevant work products and their relationships.



NOTE All the feedback lines are not all displayed to facilitate readability.

Figure 3 — Business Management Process diagram

7.7.2 BM activities

7.7.2.1 General

The Business Management Process has the following activities:

— BM.01.Select Project Opportunities and Submit Proposals;

— BM.02. Evaluate Responses to Proposals and Sign Agreements;

— BM.03. Incorporate Security and Intellectual Property Requirements;

— BM.04. Initiate Projects and Allocate Resources;

— BM.05. Conduct Periodic Project Assessment and Control Projects;

— BM.06. Close Projects and Conduct Lessons Learned Reviews and institutionalised them.

7.7.2.2 BM.01 Select Project Opportunities and Submit Proposals (BM.O1)

The Select Project Opportunities and Submit Proposals activity describes the tasks and information items needed to document project opportunities and proposals sent to potential customers. BM.01 task list is given in Table 6.

The activity provides:

— Project Opportunities, and

— Proposals submitted to potential customers.

Table 6 — BM.01 task list

Role	Task list	Input work products	Output work products
BM PJMs	BM.01.01 Document *Project Opportunities*. Agreements (e.g. contracts) and Statement of Work from past projects could be used to document the *Project Opportunities*.	*Statements of Work (from past projects)* *Agreements (from past projects)*	*Project Opportunities [initiated]*
BM PROM PJMs	BM.01.02 Select *Project Opportunities*.	*Project Opportunities [updated]* *Request for Proposal/ Statement of Work.*	*Proposal analysis [approved]* *Project Opportunities [approved]*
BM PROM PJMs SYS	BM.01.03 Prepare and approve *Proposals.* *Proposals could be developed using the Proposal template in the Work product description section of this document.*	*Project Opportunities [approved]* *Proposal template*	*Proposal [approved]*
BM PJMs	BM.01.04 Submit *Proposals* to potential Customers.	*Proposal [approved]*	*Proposal [submitted]*

7.7.2.3 BM.02. Evaluate Responses to Proposals and Sign Agreements (BM.O1)

The Evaluate Responses to Proposals and Sign Agreements activity involves the evaluation of the responses to proposals received from customers, the negotiation and signature of agreements with customers. Once an agreement is signed, a project manager is assigned to the project and the project manager documents its project plan. BM.02 task list is given in Table 7.

The activity provides:

— Request for Proposal(s), and

— Agreements.

Table 7 — BM.02 task list

Role	Task list	Input work products	Output work products
BM PROM	BM.02.01 Evaluate all responses to *Proposals* from potential Customers and Prepare *Agreements* for the accepted *Proposals.*	*Proposals [submitted]*	*Agreement [initiated]*

Table 7 *(continued)*

Role	Task list	Input work products	Output work products
BM CUS	BM.02.02 Negotiate, finalize and sign all *Agreements* with Customers.	*Agreement [initiated]*	*Agreement [signed]*
BM PJMs	BM.02.03 Approve Projects and assign Project Managers to develop *Project Plans and Resources Requests.* Update *Project Opportunities* (if applicable). Project Plans are developed according to the Planning activity of the PM Process.	*Agreement [approved]*	*Projects Managers assigned* *Project Opportunities [updated]*

7.7.2.4 BM.03 Incorporate Security and Intellectual Property Requirements (BMS.O6)

The Incorporate Security and Intellectual Property Requirements activity documents the tasks and information items needed to develop and implement security of its assets and information items and the protection of the intellectual property of the VSE. BM.03 task list is given in Table 8.

The activity provides:

— Security and Intellectual Property Protection Plan, and

— Organisational Repository to store assets and information items securely.

Table 8 — BM.03 task list

Role	Task list	Input work products	Output work products
BM	BM.03.01 Develop a *Security and Intellectual Property Protection Plan* using the template provided in the work product description table.	*Security and Intellectual Property Protection Plan Template*	*Security and Intellectual Property Protection Plan [initiated]*
BM PJMs	BM.03.02 Review and approve the *Security and Intellectual Property Protection Plan.*	*Security and Intellectual Property Protection Plan [initiated]*	*Security and Intellectual Property Protection Plan [approved]*
BM PJMs	BM.03.03 Implement the *Security and Intellectual Property Protection Plan.*	*Security and Intellectual Property Protection Plan [approved]*	*Security and Intellectual Property Protection Plan [implemented]*
BM	BM.03.04 Establish and maintain an *Organisational Repository.* The repository needs to protect the security and intellectual property of the VSE and its customers.	*Security and Intellectual Property Protection Plan [approved]*	*Organisational Repository [established]*

7.7.2.5 BM.04. Initiate Projects and Allocate Resources (BM.O3, BM.O3, BM.O7)

The Initiate Projects and Allocate Resources activity is initiated with the approval of Project Plans and the Resources Requests. Human resources are allocated to Projects. If work products or services have to be acquired, Purchase Orders are approved. A project repository is established. BM.04 task list is given in Table 9.

The activity provides:

— Approved Project Plans,

— Approved Resources Requests,

— Approved Purchased Orders, and

— Human Resource Record.

Table 9 — BM.04 task list

Role	Task List	Input work products	Output work products
BM PJMs	BM.04.01 Review and Approve all *Project Plans* Budget allocations and *Resource Requests.* Assign required Human resources and other resources to Project (e.g. work team, computer facilities).	*Agreements [approved]* *Project Plans [initiated]* *Resources Requests [initiated]* *Human Resource Record*	*Project Plans [approved]* *Resources Requests [approved]* *Budget [approved]*
BM PJMs	BM.04.02 Obtain *Resources* and train Project team members if needed.	*Resource Requests [approved]* *Human Resource Record*	*Resources obtained and trained* *Human Resource Record*
BM PJMs	BM.04.03 Decide if work products or services have to be acquired from *Suppliers* and list the work *products* or services to be acquired. NOTE If a work product (e.g. software component) or a service has to be acquired from supplier(s), use the Acquisition Management Process of this document.	*Project Plans [approved]*	*List of Products or Services to be acquired*
BM PJMs	BM.04.04 Approve all *Purchase Orders* to obtain work products or services from *Suppliers.* Purchase Orders are approved by the Project Plan Execution activity of the PM process.	*List of Products or Services to be acquired* *Purchase Orders [initiated]*	*Purchase Orders [approved]*
PJMs	BM.04.05 Establish and maintain an *Organisational Repository.*	*Security and Intellectual Property Protection Plan [approved]*	*Organisational Repository [established]*

7.7.2.6 BM.05. Conduct periodic Project Assessment and Control Projects (BM.O2, BM.O6)

The Conduct periodic Project Assessment and Control Projects activity evaluates the performance of all the plans against documented commitments. The information items needed to perform this activity are the outputs of the Project Assessment and Control activity of the PM process. BM.05 task list is given in Table 10.

The activity provides:

— Progress Status Record,

— Correction Register, and

— Change Request.

Table 10 — BM.05 task list

Role	Task list	Input work products	Output work products
BM PJMs	BM.05.01 Evaluate all projects progress with respect to the *Project Plans*, comparing: — actual Tasks against planned Tasks; — actual results against established project Objectives; — actual resource allocation against planned *Resources*; — actual cost against budget estimates; — actual time against planned schedule; — actual risk against previously identified; — identify deficiency in knowledge or training.	*Project Plans [approved]* *Progress Status Records* *Measurement Records* *Financial/Budget Records*	*Progress Status Records [evaluated]*
BM PJMs	BM.05.02 Establish actions to correct deviations or problems and identified risks. Concerning the accomplishment of the plan, as needed, document them in *Correction Register* and track them to closure.	*Progress Status Records [evaluated]*	*Correction Registers*
BM PJMs	BM.05.03 Identify changes to requirements or *Project Plans or both.* To address major deviations, potential risks or problems concerning the accomplishment of the plan, document them in *Change Requests* and track them to closure.	*Progress Status Records [evaluated]*	*Change Requests [initiated]*
BM	BM.05.04 Record and report the status of the items and modifications.	*Configuration Management strategy* *Configuration Management Records*	*Configuration Management Records [updated]*

7.7.2.7 BM.06. Close Projects and Conduct Lessons Learned Reviews (BM.O1, BM.O5)

The Close Project and Conduct Lessons Learned Reviews activity formalizes, at the organisational level, the project closure activity of the PM process, by delivering the work products to Customers. Organisational Lessons Learned reviews are performed using the output of the Project Closure activity of the PM process. Process Improvement opportunities are document and implemented and reusable components are identified and stored in the Organisational Repository. BM.06 task list is given in Table 11.

The activity provides:

— Acceptance Record;

— Delivery Instructions signed by Customer;

— Software Configuration;

— Organisational Lessons learned;

— Process Improvement Record;

— Reusable Components;

— Updated Organisational Repository.

Table 11 — BM.06 task list

Role	Task list	Input work products	Output work products
BM PJMs CUS	BM.06.01 Formalize the completion of the projects according to the *Delivery Instructions.* As established in the *Project Plans,* providing acceptance support and getting the *Acceptance Record* signed from the Customers.	*Agreements [approved]* *Acceptance Records [initiated]* *Delivery Instructions [signed by Customer]* *Software Configuration [delivered internally]*	*Acceptance Records [signed]* *Delivery Instructions [signed by Customer]* *Software Configuration [accepted]*
BM PJMs	BM.06.02 Conduct a lesson learned review of all projects. Analyse lessons learned to identify improvements to processes, document and prioritise them in the *Improvement Record*. Implement selected improvements.	*Agreements [approved]* *Project Plans* *Meeting Records* *Project Lessons Learned Record* *Measurement Records*	*Organisational Lessons Learned Record* *Process Improvement Record*
BM PJM	BM.06.03 Identify Reusable Components from Project Repositories and store them in the Organisational Repository.	*Software Configuration* *Project Repositories*	*Organisational Repository [updated]* — *Reusable Components*
BM PJM	BM.06.04 Update the *Organisational Repository.*	*Software Configuration [accepted]* *Project Repositories*	*Organisational Repository [updated]*

7.7.3 BM incorporation to the Organisational Repository

The list of work products to be saved in *Organisational Repository* is given in Table 12.

Table 12 — BM repository work products

Name
Organisational Objectives
Project Opportunities
Proposal
Agreement
Project Plan
Acceptance Record
Security and Intellectual Property Protection Plan
Organisational Lessons Learned Record
Process Improvement Record
Meeting Record
Purchase Order
Reusable Components
Resource Request
Human Resource record

8 Project Management (PM) process

8.1 PM purpose

The purpose of the Project Management process is to establish and carry out in a systematic way the *Tasks* of the system development project, which allows complying with the project's *Objectives* in the expected quality, time and costs.

The purpose of the Project Management process is to establish and carry out in a systematic way the *Tasks* of the System Definition and Realisation project, which allows complying with the project's *Objectives* in the expected quality, time and costs, within the acceptable risks.

The PM process of the Basic profile has been complemented with additional objectives, tasks and work products in a context where a VSE is conducting more than one project with more than one work team. In addition, new tasks have been added to the PM process of the Basic profile to improve the management of projects.

This document is intended to be used by the VSE to establish processes to implement any development approach or methodology including, e.g. agile, evolutionary, incremental, test driven development, etc. based on the VSE organisation or project needs.

8.2 PM objectives

PM.O1. The *Project Plan*, the approved VSE proposal and commitments are reviewed and accepted by both the Acquirer, the Organisational management and the Project Manager. The *Tasks* and *Resources* necessary to complete the work are sized and estimated.

PM.O2. Progress of the project is monitored against the *Project Plan* and recorded in the *Progress Status Record.* Corrections to remediate problems and deviations from the plan are taken when project targets are not achieved. Closure of the project is performed to get the Acquirer acceptance documented in the *Product Acceptance Record*. The System is disposed according to the Agreement.

PM.O3. *Change Requests* are addressed through their reception and analysis. Changes to system requirements are evaluated by the project team for cost, schedule, risks and technical impacts.

PM.O4. Review meetings with the Work Team and the Acquirer, suppliers are held. Reviews of work products of activities are conducted. Agreements are registered and tracked.

PM.O5. A *Risk Management Approach* is developed. Risks are identified, analysed, prioritized, and monitored as they develop and during the conduct of the project. Resources to manage the risks are determined.

PM.O6. A ~~product~~ project *Configuration Management Strategy* is developed. Configuration Items (CI) are identified, defined and baselined. Modifications and releases of the Configuration Items are controlled and made available to the Customer and Work Team. The status of the Configuration items and modifications are recorded and reported; the completeness and consistency of the Configuration Items is ensured; the storage, handling and delivery of the items are controlled

PM.O7. Quality Assurance is performed to provide assurance that PM process and work products comply with the Business Management goals and resources (human, knowledge and material), ensuring the respect of cost, schedule, risks for the perennity of the VSE.

NOTE The implementation of the Quality Assurance is through the performance of the verifications, validations and review *Tasks* performed in Project Management and System Definition and Realisation processes.

PM.O8. A *Disposal Management Approach* is developed <u>in accord with the Acquirer</u> to end the existence of a system entity <u>and dispose of it</u>

8.3 PM input work products

Table 13 provides a list of input work products.

Table 13 — PM input work products

Name	Source
Request for Proposal	Acquirer
Statement of Work	Acquirer
All deliverables from SR	Work Team
Change Request	Acquirer, Stakeholders Work Team Suppliers

8.4 PM output work products

Table 14 provides a list of output work products.

Table 14 — PM output work products

Name	Destination
Project Plan	System Definition and Realisation
Product Acceptance Record	Organisational Management
Organisational Repository	System Definition and Realisation
Meeting Record	Acquirer, Stakeholders, Systems Engineer
Measurement Record	Organisational Management
Product	Acquirer, Stakeholders System Definition and Realisation Suppliers
Purchase Order	Suppliers
Disposed System	Acquirer, Stakeholders Suppliers

8.5 PM internal work products

Table 15 provides a list of internal work products.

Table 15 — PM internal work products

Name
Change Request
Correction Register
Justification Document
Measurement Record
Meeting Record
Progress Status Record
Organisational Repository
Product Acceptance Record
Verification Report

8.6 PM roles involved

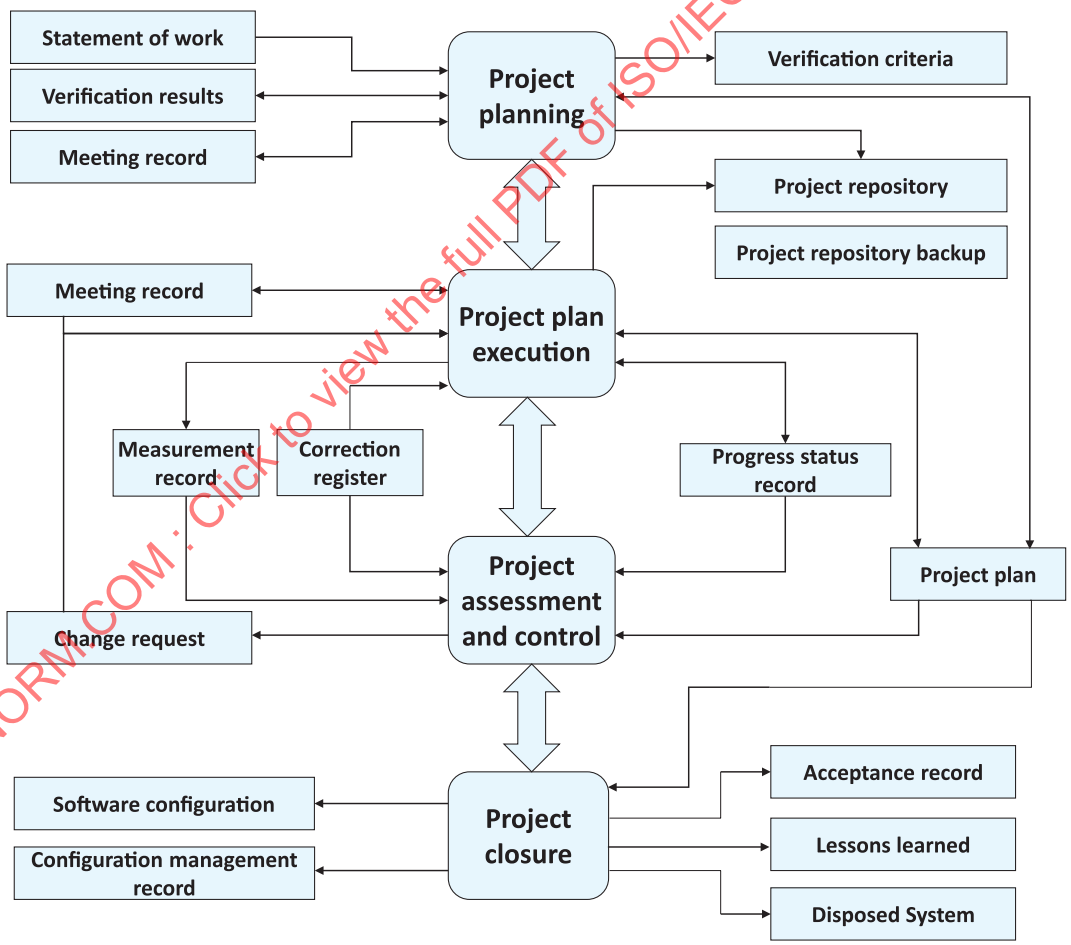
Table 16 provides a list of roles involved in the PM process.

Table 16 — PM roles involved

Role	Abbreviation
Project Manager	PJM
Acquirer	ACQ
Customer	CUS
Designer	DES
Systems Engineer	SYS
Technical Leader	TL
Tester	IVV

8.7 PM diagram

Figure 4 shows the flow of information between the Project Management Process activities including the most relevant work products and their relationship.



NOTE All the feedback lines are not all displayed to facilitate readability.

Figure 4 — Project Management Process diagram

8.8 PM activities

8.8.1 General

The Project Management Process has the following activities:

— PM.1 Project Planning

— PM.2 Project Plan Execution

— PM.3 Project Assessment and Control

— PM.4 Project Closure

8.8.1.1 PM.01 Project Planning, (PM.O1, PM.O5, PM.O6, PM.O7)

The Project Planning activity documents the planning details needed to manage the project. The activity provides:

— Reviewed Request for Proposal (RFP) and its Statement of Work (SOW) and the Tasks needed to provide the Agreement Deliverables.

— System Breakdown Structure (SBS), to provide the list of system and system elements of the project.

— Project life cycle planning, including task dependencies and duration.

— Project quality assurance strategy through verification and validationof work products/ Deliverables, Acquirer, Stakeholders and Work Team reviews.

— Work Team, Acquirer and other Stakeholders roles and responsibilities.

— Project *Resources* and training needs.

— Estimates of effort cost and schedule.

— *Risk Management Approach*.

— *Disposal Management Approach.*

— *Change Control Process* and *Configuration Management* strategy.

— *Project Repository* to store, handle and deliver controlled work products and document versions and baselines.

The task list for PM.01 is given in Table 17.

Table 17 — PM.01 task list

Role	Task list	Input work products	Output work products
PJM SYS	PM.01.01 Review the *Request for Proposal* (RFP) and its *Statement of Work.*	Request for Proposal Statement of Work	Request for Proposal Statement of Work *[reviewed]*
PJM ACQ	PM.01.02 Define with the *Acquirer* the *Delivery Instructions* of each one of the *Deliverables* specified in the *Statement of Work.*	Request for Proposal Statement of Work *[reviewed]*	*Project Plan* Delivery Instructions

Table 17 *(continued)*

Role	Task list	Input work products	Output work products
PJM DES	PM.01.03 Define the *System Breakdown Structure* (SBS) that represents the relationship between the system and its system elements. NOTE The system boundaries need to be defined. NOTE This task is iterative as the SBS is based on the System Design Document (SDD). The SDD is at the beginning preliminary and all system elements hierarchy is not necessary defined completely. The SBS is updated while the SDD is progressively completed.	System Design Document	Project Plan — System Breakdown Structure
PJM WT	PM.01.04 Select a product lifecycle and define milestones according to the *Statement of Work*.	Project Plan — System Breakdown Structure Statement of Work	Project Plan — Milestones
PJM SYS	PM.01.05 Identify the specific *Tasks* to be performed in order to produce the *Deliverables* and their *System Elements* identified in the *Statement of Work.* Include *Tasks* in the SR process along with verification, validation and reviews with Acquirer/other stakeholders and Work Team *Tasks* to develop quality of work products. Identify the *Tasks* to perform the *Delivery Instructions.* Document the *Tasks.* This task is performed in parallel with the definition of the SEMP.	Statement of Work *[reviewed]* Project Plan — System Breakdown Structure	Project Plan — Tasks
PJM	PM.01.06 Establish the *Estimated Duration* to perform each task.	Project Plan — Tasks	Project Plan — Estimated Duration
PJM	PM.01.07 Identify and document the *Resources*: human, material, equipment and tools, standards, including the required training of the Work Team to perform the project. Include in the schedule the dates when *Resources* and training will be needed.	Statement of Work *[reviewed]*	Project Plan — Resources
PJM	PM.01.08 Establish the *Composition of Work Team* assigning roles and responsibilities according to the *Resources.*	Project Plan — Resources	Project Plan — Composition of Work Team
PJM	PM.01.09 Assign estimated start and completion dates to each one of the *Tasks* in order to create the *Schedule of the Project Tasks* taking into account the assigned *Resources*, sequence and dependency of the *Tasks*. Define milestones of the project (e.g. end of phases, payments, deliveries).	Project Plan — Tasks — Estimated Duration — Composition of Work Team	Project Plan — Schedule of the Project Tasks — Milestones
PJM	PM.01.10 Calculate and document the project *Estimated Effort and Cost.* Using available in-house metrics or acquiring commercial Work estimation tool.	Project Plan — Schedule of the Project Tasks — Resources	Project Plan — Estimated Effort and Cost

Table 17 *(continued)*

Role	Task list	Input work products	Output work products
PJM	PM.01.11 Identify and document a *Risk Management Approach* and the risks which may affect the project.	All elements previously defined	Project Plan — Risk Management Approach
PJM	PM.01.12 Identify and document a *Disposal Management Approach*.	Request fo Proposal *[reviewed]* Statement of Work *[reviewed]*	Project Plan — Disposal Management Approach
PJM	PM.01.13 Document the *Configuration Management Strategy* in the *Project Plan.* Identify the Configuration items (CI). Define the applicable configuration status. Define the tasks and actors to manage the changes and the configuration.	Project Plan — System Breakdown Structure (SBS)	Project Plan — Configuration Management Strategy
PJM	PM.01.14 Include System Description, Scope, Objectives, Deliverables, and reference to the RFP and SOW in the Project Plan.	Request for Proposal *[reviewed]* Statement of Work *[reviewed]*	Project Plan — System Description — Scope — Objectives — Deliverables — Reference to the SOW

Table 17 *(continued)*

Role	Task list	Input work products	Output work products
PJM	PM.01.15 Generate the *Project Plan* integrating the elements previously identified and documented.	All elements previously defined	Project Plan — Reference to the SOW — Objectives — System Description — Scope — System Breakdown Structure — Tasks — Deliverables — Estimated Duration — Resources — Composition of Work Team — Milestones — Schedule of the Project Task — Estimated Effort and Cost — Risk Management Approach — Configuration Management Strategy — Delivery Instructions — Disposal Management Approach
PJM WT	PM.01.16 Verify and obtain approval of the *Project Plan.* Verify that all *Project Plan* elements are viable and consistent. The results found are documented in a *Verification Report* and corrections are made until the document is approved by PJM.	Project Plan	Verification Report — Project Plan Verification Report Project Plan *[verified]*
PJM ACQ STK	PM.01.17 Review and accept the *Project Plan.* Acquirer and other Stakeholders review and accept the *Project Plan*, making sure that the *Project Plan* elements match with the Request for Proposal and the *Statement of Work.*	Project Plan *[verified]* Statement of Work	Meeting Record Project Plan *[accepted]*

Table 17 *(continued)*

Role	Task list	Input work products	Output work products
PJM	PM.01.18 Establish the *Project Repository* using the *Configuration Management Strategy*.	Project Plan — Configuration Management Strategy	Project Repository [*established*]
PJM WT	PM.01.19 Assign *Tasks* to the work team members related to their role, according to the current *Project Plan*.	Project Plan *[accepted]* — Tasks	Project Plan *[accepted]* — Tasks [assigned]

8.8.1.2 PM.02 Project Plan Execution (PM.O2, PM.O3, PM.O4, PM.O5, PM.O7)

The Project Plan Execution activity implements the documented plan on the project. The activity provides:

— Progress Status Record of the project updated.

— Analysed and evaluated change requests to the plan impacting cost, schedule and technical requirements.

— Approved changes to the plan.

— Reviews and agreements with the Work Team (WT), Acquirer (ACQ) and Stakeholders (STK).

— Ensure safekeeping of the Project Organisational Repository, and its recovery if necessary.

The task list for PM.02 is given in Table 18.

Table 18 — PM.02 task list

Role	Task list	Input work products	Output work products
PJM WT	PM.02.01 Monitor the *Project Plan* execution and record actual data in *Progress Status Record*.	Project Plan *[accepted]*	Progress Status Record
ACQ PJM STK	PM.02.02 Analyse and evaluate the *Change Request* for cost, schedule and technical impact. The *Change Request* can be initiated externally by the Acquirer and other Stakeholders, or internally by the Work Team. Update the *Project Plan*, if the accepted change affects agreements with Acquirer and Stakeholders. *Change Request*, which affects those agreements, needs to be negotiated by both parties (see PM.02.4).	Change Request *[submitted]* Project Plan *[accepted]*	Change Request *[evaluated]*
PJM WT	PM.02.03 Conduct revision meetings with the Work Team, identify problems, review risk status, record agreements and track them to closure. * If an artefact has to be purchased, review and issue the Purchase Order (PO) developed in activity SR.3 to acquire the artefact.	Project Plan *[accepted]* Progress Status Record Correction Register Meeting Record *Purchase order *[initiated]*	Meeting Record *[updated]* * Purchase Order *[approved]*

Table 18 *(continued)*

Role	Task list	Input work products	Output work products
PJM ACQ STK WT	PM.02.04 Conduct revision meetings with the Acquirer, Stakeholders, record agreements and track them to closure. *Change Request* initiated by Acquirer, and other Stakeholders, or initiated by Work Team, which affects the Acquirer, Stakeholders needs to be negotiated to reach acceptance of both parties. If necessary, update the *Project Plan* according to new agreement with Acquirer and other stakeholders.	Project Plan *[accepted]* Progress Status Record Change Request *[evaluated]* Meeting Record	Meeting Record *[updated]* Change Request *[agreed]* Project Plan *[updated]*
PJM WT	PM.02.05 Perform configuration management. According to the configuration management strategy, manage in configuration the different artefacts of the project. Generate Product as planned. Identify changes (e.g. architecture, requirements) and/or *Project Plan* to address major deviations, potential risks or problems concerning the accomplishment of the project. Initiate Change Requests on baselined artefacts and analyse impacts (technical cost, quality) before change approval by PJM. Track the changes to closure.	— Project Plan — Stakeholders Requirements Specifications — * Concept of Operations — System Requirements Specifications — System Elements Requirements Specifications — System Design Document	Product Change Request *[submitted]*

Table 18 *(continued)*

Role	Task list	Input work products	Output work products
		— System — Bought, built or reused System Elements (HW, HW+SW) — Bought, built or re-used Software Elements — IVV Plan — IVV Integration Procedure — Integration Report — Verification Report — Validation Report — System Operation Guide — System User Manual — System Maintenance Document — System Training Specifications — Change Request *[agreed]* — Progress Status Record *[evaluated]*	
PJM	PM.02.06 *Manage Project Repository.* Update Project Repository at each new System Configuration. Perform backup and recovery testing according to the *Configuration Management Strategy.*	Project Plan [*updated*] — Configuration Management Strategy Product Project Repository	Project Repository *[updated]* Project Repository Backup
PJM	PM.02.7 Perform *Project Repository* recovery using the *Project Repository Backup*, if necessary.	Project Repository Backup	Project Repository *[recovered]*

8.8.1.3 PM.03 Project Assessment and Control (PM.O2)

The Project Assessment and Control activity evaluates the performance of the plan against documented commitments. The activity provides:

Evaluation of actual plan performance and progress against targets.

— Identified and evaluated significant cost, schedule and technical performance deviations and problems.

— Review of project risks and identification of new risks.

— Documented change requests, appropriate corrective action defined, and changes tracked to closure.

The task list for PM.03 is given in Table 19.

Table 19 — PM.03 task list

Role	Task list	Input work products	Output work products
PJM WT	PM.03.01 Evaluate project progress with respect to the *Project Plan*, comparing: — actual *Tasks* against planned *Tasks* — actual results against established project *Objectives* — actual resource allocation against planned *Resources* — actual cost against budget estimates — actual time against planned schedule — actual risk against previously identified	Project Plan [*updated*] Progress Status Record	Progress Status Record [*evaluated*]
PJM WT	PM.03.02 Establish and execute actions to treat deviations or problems and identified risks concerning the accomplishment of the plan, as needed, document them in *Correction Register* and track them to closure.	Project Plan — Risk Management Approach Progress Status Record [*evaluated*]	Correction Register — Rational of deviation correction actions [*initial*]
PJM WT	PM.03.03 Elaborate or update the *Justification Document* of the Project. Record the reasons of needs. Record issues, hypothesis, architecture trade-off studies and decisions of the project. Keep track of meetings and decisions. Regroup or reference the Verification and Validation Reports in the Justification Document (if appropriate or needed). Establish traceability between the rationale and the related Systems Engineering artefacts.	Correction Register — Rationale of deviation correction actions [*initial*] System Design Document — System Functional Architecture — System Physical Architecture Traceability Matrix Meeting Record	Justification Document — Justification of choices and decisions — Functional architecture trade-offs — Physical architecture trade-offs *[initiated]*

Table 19 *(continued)*

Role	Task list	Input work products	Output work products
		Validation Reports: — Stakeholders Requirements Specifications — System Requirements Specification — Product Delivery — System User Manual — System Verification Reports: — Project Plan — Stakeholders Requirements Specifications — System Requirements Specifications — System Design Document — IVV Plan — IVV Procedure — System — System Operation Guide — System User Manual — Product Delivery — System Configuration	

8.8.1.4 PM.04 Project Closure (PM.O2, PM.O8)

The Project Closure activity provides the project's documentation and work products in accordance with agreement ~~contract~~ requirements. The activity provides:

— Delivery of the work product as specified in the Delivery Instructions.

— Support of Acquirer and Stakeholders work product acceptance in accordance to Delivery Instructions.

— Completion of the project and sign of the Acceptance Record.

— Execution of the Disposal Management Approach.

The task list for PM.04 is given in Table 20.

Table 20 — PM.04 task list

Role	Task list	Input work products	Output work products
PJM ACQ	PM.04.01. Formalize the completion of the project according to the *Delivery Instructions* established in the *Project Plan,* providing acceptance support and getting the *Product Acceptance Record* signed.	Project Plan — Delivery Instructions Product [*delivered*]	Product Acceptance Record Product [*accepted*]
PJM WT	PM.04.02 Update *Project Repository.*	Product [*accepted*] Project Repository [*updated*]	Project Repository [*baselined*]
PJM WT	PM.04.03 Execute the *Disposal Management Approach.*	Project Plan	Disposed System

8.8.2 PM incorporation to Project Repository

The list of work products to be saved in *Project Repository*. After the incorporation, *Configuration Management Strategy* needs to be applied to *Project Plan.*

Table 21 — PM repository work products

Product
Project Plan
Change Request
Product Acceptance Record
Meeting Record
Correction Register
Progress Status Record
Purchase Order
Verification Report
Validation Report
Delivery Instructions
Justification Document

9 System Definition and Realisation (SR) process

9.1 SR purpose

The purpose of the System Definition and Realisation process is the systematic performance of the specification of system/system element, analysis, design, construction, integration and verification/validation activities for new or modified system according to the specified requirements.

This document is intended to be used by the VSE to establish processes to implement any development approach or methodology including, e.g. agile, evolutionary, incremental, test driven development, etc. based on the VSE organisation or project needs.

9.2 SR objectives

SR.O1. *Tasks* of the activities are performed through the accomplishment of the current *Project Plan*.

SR.O2. Acquirer's needs are analysed for coherence, correctness and validation, approved by the Acquirer, baselined and communicated.

SR.O3. System requirements are defined, analysed for coherence, correctness and ~~testability~~ verifiability, approved by the Acquirer, baselined and communicated.

SR.O4. The System architectural design is developed and baselined. It describes the *System elements* and internal and external interfaces of them. Coherence, ~~consistency~~ and traceability to system requirements are established.

NOTE System architecture and detailed design can be performed separately according to the project schedule.

SR.O5. System elements defined by the design are produced or acquired. ~~Acceptance tests are~~ Verification methods is defined and performed to verify the ~~consistency~~ coherence with requirements and the design. Traceability to the requirements and design are established.

SR.O6. System elements are integrated. Defects encountered during integration are corrected and ~~consistency~~ coherence with and traceability to *System Architecture* are established.

SR.O7. A *System Configuration*, as agreed in the Project Plan, and that includes the engineering artefacts is integrated, baselined and stored at the *Project Repository*. Needs for changes to the *Product* are detected and related change requests are initiated.

SR.O8. Verification and Validation *Tasks* of all required work products are performed using a defined criterion to achieve consistency among output and input work products in each activity. Defects are identified and corrected; records are stored in the *Verification/Validation Reports*.

It's not the intention that all verification activities and work products are made available to the acquirer and other stakeholders. Verifications should be performed by individuals that have organisational freedom, authority, to permit objective evaluation, and to initiate, effect, resolve and verify problem resolution. In the best process, every verification and validation tasks are witnessed by an "independent witness", this helps ensure that the evaluation is objective.

9.3 SR input work products

Table 22 provides a list of input work products.

Table 22 — SR input work products

Name	Source
Project Plan	Project Management
Project Repository	Project Management

9.4 SR output work products

Table 23 provides a list of output work products.

Table 23 — SR output work products

Name	Destination
All deliverables from SR	Project Management

9.5 SR internal work products

Table 24 provides a list of internal work products.

Table 24 — SR internal work products

Name
Validation Report
Verification Report

9.6 SR roles involved

Table 25 provides a list of roles involved in the SR process.

Table 25 — SR roles involved

Role	Abbreviation
Acquirer	ACQ
Systems Engineer	SYS
Designer	DES
Developer	DEV
IVV Engineer	IVV
Project Manager	PJM
Stakeholder	STK
Supplier	SUP
Work Team	WT

9.7 SR diagram

9.7.1 General

Figure 5 shows the flow of information between the System Definition and Realisation Process activities including the most relevant work products and their relationship.

NOTE All the feedback lines are not all displayed to facilitate readability.

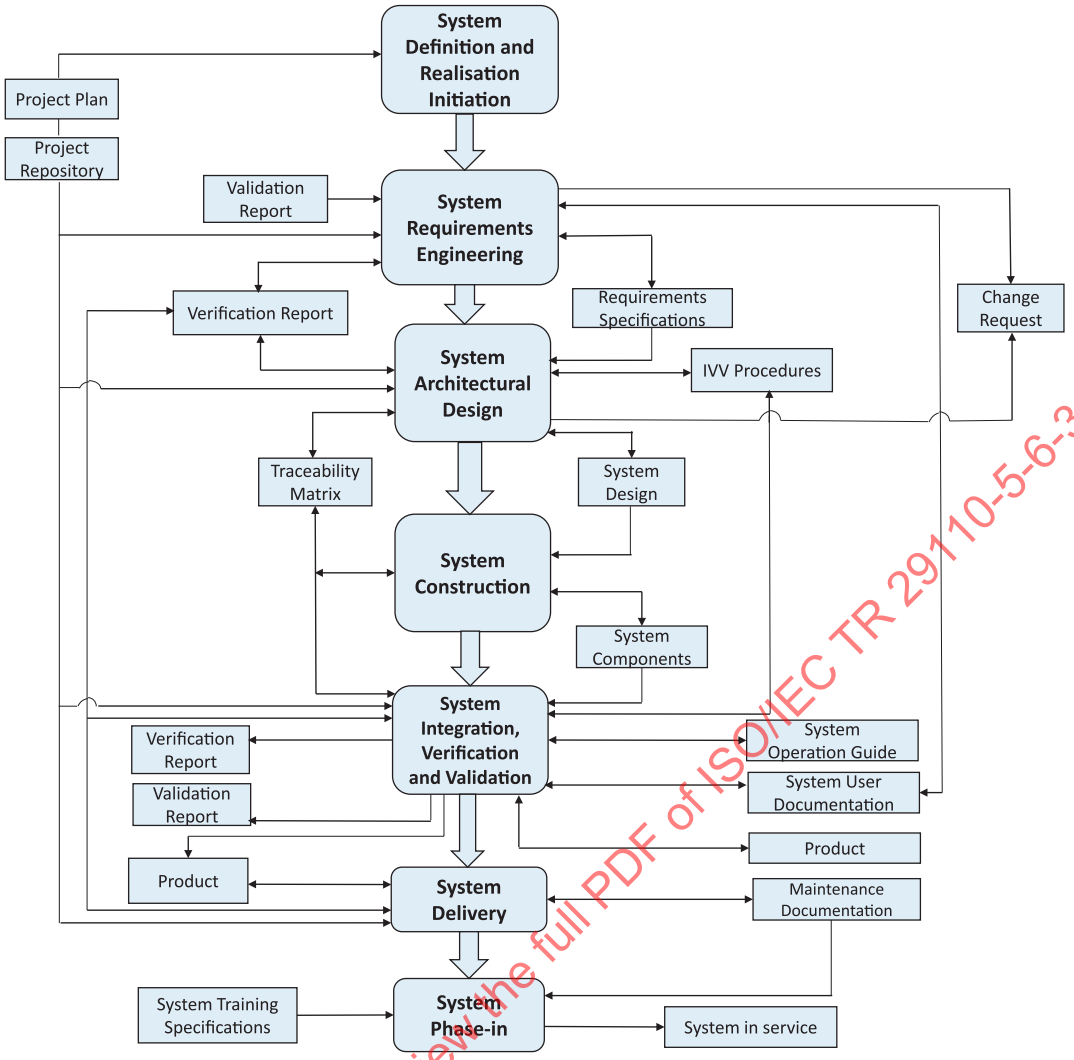


Figure 5 — System Definition and Realisation Process diagram

9.7.2 SR activities

9.7.2.1 General

The System Definition and Realisation Process has the following activities:

— SR.1 System Definition and Realisation Initiation

— SR.2 System Requirements Engineering

— SR.3 System Architectural Design

— SR.4 System Construction

— SR.5 System Integration, Verification and Validation

— SR. 6 Product Delivery

9.7.2.2 SR.01 System Definition and Realisation Initiation (SR.O1)

The System Definition and Realisation Initiation activity help ensure that the *Project Plan* established in Project Planning activity is committed to by the Work Team. The activity provides:

— Review of the *Project Plan* by the Work Team to determine task assignment.

— Commitment to *Project Plan* by the Work Team and Project Manager.

— An established implementation environment.

The task list for SR.01 is given in Table 26.

Table 26 — SR.01 task list

Role	Task list	Input work products	Output wok products
PJM WT	SR.01.01 Revise the current *Project Plan* with the Work Team members in order to achieve a common understanding and get their engagement with the project.	Project Plan	Project Plan [*reviewed*]
PJM SYS	SR.01.02 Define in cooperation with the PJM the technical activities and generate the SEMP.	Project Plan [*reviewed*]	Systems Engineering Management Plan
PJM WT	SR.01.03 Define the data model of the project. Define the entities to manage in the project (e.g. requirement, *system element*, *IVV plan*, *IVV procedure, Integration Report, Verification Report, Validation Report*), their properties (e.g. maturity, version, target release) and their relation (e.g. satisfy, allocated to, verify, validate).	Project Plan [*reviewed*]	Data Model
PJM WT	SR.01.04 Set or update the *Implementation Environment.*	Project Plan [*reviewed*] Data Model	Implementation Environment

9.7.2.3 SR.02 System Requirements Engineering (SR.O2, SR.O6, SR.O7)

The System Requirements Engineering activity elicits and analyses the Acquirer and other Stakeholders' requirements, including legal and/or regulatory requirements. It establishes the agreed system requirements. In parallel of the architectural design activities, it establishes System Element requirements. The activity provides:

— Work Team review of the *Project Plan* to determine task assignment.

— Elicitation, analysis and specification of Acquirer and other stakeholders' requirements.

— Specification ~~and agreement~~ on the System requirements.

— Specification of system elements' requirements

— Verification of implemented system against System and System elements requirements

— Validation of Stakeholder, System and System Elements requirements

— Validation of implemented system against Stakeholder requirements

— Establish and update the traceability between Stakeholders, System, System Elements requirements

— Establish and update the coverage of Requirements by IVV artefacts

— Configuration management of System Requirements Engineering work products as agreed in the Configuration Management Plan

The task list for SR.02 is given in Table 27.

Table 27 — SR.02 task list

Role	Task list	Input work products	Output work products
SYS ACQ STK	SR.02.01 Elicit acquirer and other stakeholders' requirements and analyse system context. Identify and consult information sources of requirements (e.g. Acquirer, users, stakeholders, previous systems, documents), Statement of Work, Concept documents, previous System description, etc. Analyse the context of use of the system with acquirer and other stakeholders: — Identify the stakeholders — Define the concepts of use of the system — Define scenarios, business processes Generate or update the * Concept of Operations that describes the way the system works from the operator's perspective. Identify and analyse requirements to — Determinate the scope and system boundary, — If applicable, identify the strengths and weaknesses of the previous system — Ensure that the Stakeholder requirements are complete and consistent — Elicit missing Stakeholder requirements Resolve conflicting, duplicated and out-of-scope Stakeholder requirements. Generate or update the *Stakeholders' Requirements Specifications.*	Project Plan — Tasks [*assigned*] Statement of Work [*reviewed*] Systems Engineering Management Plan	Stakeholders Requirements Specifications [*initiated*]
PJM WT	SR.02.02 Verify the *Stakeholders Requirements Specifications* with PJM. Obtain Work Team agreement on the *Stakeholder Requirements Specifications.*	Stakeholders Requirements Specifications [*initiated*]	Stakeholders Requirements Specifications [*verified*] Verification Report — Stakeholders Requirements Specifications *[published]*
PJM SYS ACQ STK	SR.02.03 Validate the *Stakeholders Requirements Specifications* with the Acquirer and other stakeholders. Obtain Acquirer and Stakeholder agreement on the *Stakeholder Requirements Specifications.*	Stakeholders Requirements Specifications [*verified*]	Validation Report — Stakeholders Requirements Specifications [*published*]

Table 27 *(continued)*

Role	Task list	Input work products	Output work products
			Stakeholders Requirements Specifications [*validated*]
SYS DES	SR.02.04 Elaborate System Requirements and Interfaces. Define the system boundary. Define interface requirements between the System and its environment. NOTE Interface requirements are included in *System Requirements Specifications.* Separate specification document can be established. Define System requirements, System design constraints and interface requirements with external entities/actors using the SMART criteria: Specific, Measurable, Accepted, Realistic and Traced. Define the external functions ensured by the system (black box). Define reuse constraints. Define the applicable requirements and constraints to the system. Generate or update the *System Requirements Specifications*	Stakeholder Requirements Specifications [*validated*]	System Requirements Specifications [*initiated*]
DES SYS	SR.02.05 Elaborate *System Elements Requirements Specifications* and the *System Interfaces Specifications.* NOTE System Element requirements are generally elaborated in parallel with the System Functional and Physical Architectural Design Activity (see Activities SR.3.1 and SR.3.3). Allocate System requirements to System elements using the functional and physical architecture and decompose requirements so that System element requirements are distinctively and clearly defined. Elaborate System element requirements derived from the System architectural design but that cannot be traced to a specific parent System requirement. Refine as necessary external interface requirements and identify internal interface requirements between System Elements. Generate or update a *System Element Requirements Specifications* for each System Element defined in the System Design Document. NOTE Interface requirements are included in System Elements Requirements Specifications. Separate specification document can be established. NOTE System elements requirements become needs and expectation in input of the system elements implementation.	System Requirements Specifications [*initiated*] System Design Document	System Elements Requirements Specifications System Interfaces Specifications [*initiated*]

Table 27 *(continued)*

Role	Task list	Input work products	Output work products
PJM WT	SR.02.06 Verify and obtain Work Team (WT) agreement on the *System and System Elements Requirements Specifications.* Ensure with WT that requirements are SMART. In particular: — are precise, concise, non-ambiguous; — are consistent (in the same specification, with input specifications); — are properly traced; — can be implemented (DES); — can be verified and validated (IVV); — fall within cost and schedule constraints of the project. The results found are documented in a *Verification Report* and corrections are made until the document is approved by PJM. If documents are under configuration, identify and characterize the impact of the change and initiate if necessary (i.e. change approved) a *Change Request.*	System Requirements Specifications [*initiated*] System Elements Requirements Specifications [*initiated*]	Verification Report — System Requirements Specifications System Requirements Specifications [*verified*] Systems Elements Requirements Specifications [*validated*] Change Request (if needed)
ACQ STK SYS	SR.02.07 Validate that System *Requirements Specifications* satisfies *Stakeholders Requirements Specifications*. The results found are documented in a *Validation Report* and corrections are made until the document is approved by the SYS.	System Requirements Specifications [*verified*] Stakeholders Requirements Specifications [*validated*]	Validation Report — System Requirements Specifications [*published*] System Requirements Specifications [*validated*]
SYS DES	SR.02.08 Define or update *Traceability Matrix* between Requirements. According to the *data model* defined in SR.1.2, at each level of decomposition of the system, define or update traceability between — System requirements, interface requirements and their parent stakeholder's requirements, — System elements requirements, interface requirements and their parent system requirements.	Stakeholder Requirements Specifications [*validated*] System Requirements Specifications [*validated*] System Elements Requirements Specifications [*validated*]	Traceability Matrix *[updated]*

Table 27 *(continued)*

Role	Task list	Input work products	Output work products
SYS IVV	SR.02.09 Establish or update the *IVV plan* and *IVV Procedures* for the System verification and validation. Establish traceability between IVV Plan and the specified Requirements, between IVV Procedures and IVV Plan. NOTE Verification is the confirmation, through the provision of objective evidence, that specified requirements have been fulfilled. Methods of verification are: inspection, review, simulation, test. NOTE Validation is the confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled. NOTE The IVV plan can be a single document or a separate document.	System Requirements Specifications [*validated*] System Elements Requirements Specifications Stakeholders Requirements specifications [*validated*]	IVV plan [*published*] IVV Procedures [*published*]

9.7.2.4 SR.03 System Architectural Design (SR.O3, SR.O6, SR.O7)

The System Architectural activity transforms the system requirements to the system functional and physical architecture. The activity provides:

— Work Team review of the *Project Plan* to determine task assignment.

— Design the system functional architecture and associated interfaces.

— Design the system physical architecture and associated interfaces, allocation of the functional to the physical architecture.

— Work Team review of the System *Requirements Specifications.*

— *Functional and physical Design* verified and defects corrected.

— Verified *IVV Plan (Integration, Verification, validation, Qualification) and Verification Procedures.*

— Traceability between the functional architecture definition and the System Requirements and between the physical architecture definition, the System Elements and the functional architecture definition.

— Design work products placed under configuration management.

The task list for SR.03 is given in Table 28.

Table 28 — SR.03 task list

Role	Task list	Input work products	Output work products
DES	SR.03.01 Document or update the *Functional System Design.* Elaborate the functional architecture with the internal functions of the system and their relations (interfaces), by analysing:	Project Plan — Tasks [*assigned*]	System Design Document: — System Functional Architecture

Table 28 *(continued)*

Role	Task list	Input work products	Output work products
	— The System Requirements; — The external functions of the system (black box) Define the internal functions and interfaces. Identify the artefacts to reuse. Decide whether to make, buy or reuse. * Elaborate the Purchase Order (PO) for the artefact to be purchased. Define in parallel the System elements requirements and interface requirements.	System Requirements Specifications [*validated*] Traceability Matrix [*updated*]	*Purchase order *[initiated]*
SYS DES	SR.03.02 Make trade-offs of the *System* Functional *Architecture.* Make trade-offs among the different possible functional architectures relative to the requirements. Update the *Justification Document* and establish traceability with the requirements as defined in PM. Functional architecture can be done in a model-based environment and generated as a document. NOTE Trade-offs is used here as a product name of a recording decision-making action within a *Justification Document.*	System Design Document: — System Functional Architecture	Justification Document — System Functional architecture trade-offs
DES	SR.03.03 Document or update the *Physical System Design.* Elaborate the physical architecture by: — analysing the System Requirements (e.g. non-functional requirements allocated directly the System Elements); — analysing the Functional Architecture and allocating internal functions to System Elements; — Identifying System Elements to reuse. Identify the artefacts to reuse. Decide whether to make, buy or reuse. * Elaborate the Purchase Order for the artefact to be purchased. Analyse the design as needed to demonstrate it can satisfy System Requirements (e.g. maintainability, reliability, security, safety integrity, usability). Elaborate the physical and functional interfaces (external and internal) between System Elements. Define in parallel the interface requirements.	System Requirements Specifications [*validated*] System Design Document: — System Functional Architecture	System Design Document: — System Physical Architecture *Purchase order *[initiated]*

Table 28 *(continued)*

Role	Task list	Input work products	Output work products
SYS DES	SR.03.04 Make trade-offs of the *System Physical Architecture.* Make trade-offs among the different possible physical architectures relative to the requirements and the functional architecture. Update the *Justification Document* and establish traceability with the requirements. Physical architecture can be done in a model based environment and generated as a document. Generate or update the Traceability Matrix. NOTE Trade-off is used here as a product name of a recording decision-making action within a *Justification Document.*	System Design Document: — System Functional Architecture — System Physical Architecture	Justification Document — System physical architecture trade-offs Traceability Matrix [*updated*]
SYS DES DEV	SR.03.05 Verify and obtain approval of the *System Design.* Verify correctness of *System Design*, its feasibility and consistency with their System *Requirements Specifications*. Use the *Traceability Matrix* to verify the adequate satisfaction of System Requirements. The results found are documented in a *Verification Report* and corrections are made until the document is approved by DES. If System Design is under configuration management, identify and characterize the impact of the change and initiate if necessary (i.e. change approved) a *Change Request.*	System Design Document — System Functional Architecture — System Physical Architecture Traceability Matrix System Requirements Specifications [*validated*]	Verification report — System Design Document System Design Document [*validated*] Change Request (if needed) Traceability Matrix [*updated*] Change request (if needed)
DES SYS	SR.03.06 Establish or update *the Integration plan and Integration Procedures* for System integration. Define or update the *IVV Plan and IVV Procedures* based in the System Design and the *System Elements Requirements Specifications.* Establish traceability between IVV Plan and the specified Requirements, between IVV Procedures and IVV Plan.	System Elements Requirements Specifications [*validated*] System Design Document [*validated*]	IVV Plan IVV Procedures Traceability Matrix [*updated*]
SYS	SR.03.07 Document the **System User Manual* or update the current one, if appropriate. NOTE The *System User Manual* can be initiated in a preliminary version from the *System Requirements Specifications*, **Concept of Operation* are available. *(Optional)	* Concept of Operations System Requirements Specifications System Design Document System [*verified*]	— System User Manual [*preliminary*]
SYS ACQ STK	SR.03.08 Verify and obtain approval of the * *System User Manual,* if appropriate. Verify consistency of the System *User Manual* with the System. Demonstrate the use of the System with its *User Manual.*	* System User Manual System [*preliminary*]	Verification Report — System User Manual Validation Report — System User Manual

Table 28 *(continued)*

Role	Task list	Input work products	Output work products
	The results found are documented in the *Verification Report* and corrections are made until the document is approved by ACQ and STK. *(Optional)		* System User Manual [*verified*]

9.7.2.5 SR.04 System Construction (SR.O4, SR.O6, SR.O7)

The System Construction involves Physical Construction and/or Software Construction.

The Software Construction develops the software elements of the system from the *System Design.*

The Hardware Construction develops the Hardware system elements from the *System Design*, that include (or not) software elements. The activity provides:

— Work Team review of the *Project Plan* to determine task assignment.

— Work Team review of the Physical *Design*.

— *Hardware System Elements* to be developed and tested.

— *Software System Elements* to be developed and tested.

— Traceability between Hardware *Construction, Software Construction* and *Physical Architecture.*

The task list for SR.04 is given in Table 29.

Table 29 — SR.04 task list

Role	Task list	Input work products	Output work products
DEV	SR.04.01 Construct or update Software System Elements. Software Construction could be performed according to the ISO/IEC TR 29110-5-1–3.	Project Plan — Tasks [*assigned*] System Elements Requirements Specifications [*validated*]	Bought, built or re-used Software System Elements Software System Elements data
DEV	SR.04.02 Construct or update Hardware System Elements. Buy, build or re-use the Hardware System Elements identified in the *System Design Document* and in accordance with the *Project Plan* with regards to fabrication stages (i.e. prototyping, first article, pre-series, series production) In case of Hardware System Elements with software, integrate the Software System Elements into the Hardware System Elements.	Project Plan — Tasks [*assigned*] System Design Document [*validated*] System Elements Requirements Specifications [*validated*] Software System Elements Software System Elements data	Bought, built or re-used System Elements (HW, HW+SW) System Elements data (HW, HW+SW)
DEV DES SYS	SR.04.03 Verify that the *System Elements* satisfy their *System Elements Specifications.* Perform in-coming acceptance verification of System Elements in accordance with:	Bought, built or re-used System Elements (HW, HW+SW) Project plan [*accepted*]	Bought, built or re-used System Elements (HW, HW+SW) [*verified*]

Table 29 *(continued)*

Role	Task list	Input work products	Output work products
	— the Project Plan — the System Design Document — the System Elements Requirements Specifications — the applicable Verification Procedures. NOTE For Hardware System Elements that include software, this task includes the verification of the integration of the software into the hardware System Elements.	System Design Document [*validated*] System Elements Requirements Specifications [*validated*] IVV Procedures [*verified*]	Bought, built or re-used System Elements (HW, HW+SW) [*rejected*]
DEV	SR.04.04 Correct the defects found until successful verification (reaching exit criteria) is achieved.	Bought, built or re-used System Elements (HW, HW+SW) [*rejected*]	Bought, built or re-used System Elements (HW, HW+SW) [*accepted*]

9.7.2.6 SR.05 System Integration, Verification and Validation (SR.05, SR.06, SR.07)

The System Integration and verification, validation activity helps ensure that the integrated System Elements (e.g. Hardware, Hardware + Software) satisfy the system requirements. The activity provides:

— Work Team review of the *Project Plan* to determine task assignment.

— Understanding of *IVV plan and Procedures* and the integration environment.

— Integrated *System Elements*, corrected defects and documented results.

— Documented and verified operational and system user documentations.

— Verified System baseline.

The task list for SR.05 is given in Table 30.

Table 30 — SR.05 task list

Role	Task list	Input work products	Output work products
DES SYS DEV IVV	SR.05.01 Verify *IVV plan and IVV Procedures.* Verify consistency between System *Requirements Specifications*, *System Design* and *IVV Plan and IVV Procedures*. The results found are documented in a *Verification Report.*	Project Plan — Tasks [*assigned*] IVV plan IVV Procedure System Requirements Specifications [*validated*] System Design Document [*validated*]	Verification Report — IVV plans — IVV Procedures IVV plan [*verified*] IVV Procedures [*verified*]

Table 30 *(continued)*

Role	Task list	Input work products	Output work products
IVV DES SUP	SR.05.02 Integrate the System using *System Elements* (HW, HW+SW). Verify the interfaces according to *IVV Plan* and *IVV Procedures* for integration testing. The results found are documented in the *Integration Report.*	System Design Document [*validated*] System Elements Requirements Specifications [*validated*] Traceability Matrix [*updated*] Bought, built or re-used System Elements (HW, HW+SW) [*accepted*] Integration Procedures [*verified*]	Integration Report System [*integrated*]
IVV SYS	SR.05.03 Verify the *System* against its Requirements. The results found are documented in a *Verification Report.* Prepare the acceptance of the system.	System Requirements Specifications [*validated*] Traceability Matrix [*updated*] IVV Procedures [*verified*]	System [*verified*] Verification Report
IVV SYS ACQ	SR.05.04 Validate the System against its Stakeholders Requirements. Accept the System by ACQ.	Stakeholders Requirements Specifications [*validated*] Traceability Matrix [*updated*] IVV Procedures [*verified*] System [*verified*]	System [*validated*] Validation Report Product Acceptance Record — System [*approved*]
WT	SR.05.05 Correct the defects found and retest to detect faults introduced by the modifications.	System [*validated*] Verification Report Validation Report IVV Procedures [*verified*]	System [*corrected*] Verification Report [*defects eliminated*] Validation Report *[defects eliminated]*
SYS DES	SR.05.06 Document the **System Operation Guide* or update the current guide, if appropriate. *(Optional)	System [*verified*]	*System Operation Guide [*preliminary*]
SYS ACQ STK	SR.05.07 Verify and obtain approval of the **System Operation Guide*, if appropriate Verify consistency of the *System Operation Guide* with the System. The results found are documented in a *Verification Report*. *(Optional)	*System Operation Guide	Verification Report — System Operation Guide *System Operation Guide [*verified*] and [*baselined*]

9.7.2.7 SR.06 Product Delivery (SR.O6, SR.O7)

The Product Delivery activity provides the integrated System (i.e. Product) to the Acquirer and other stakeholders. The activity provides:

— Work Team review of the *Project Plan* to determine task assignment.

— Verified System *Maintenance Document*.

— Delivery of the *Product* and applicable system documentation in accordance with the *Delivery Instructions*.

The task list for SR.06 is given in Table 31.

Table 31 — SR.06 task list

Role	Task list	Input work products	Output work products
PJM WT	SR.06.01 Review *Product*.	System elements Project Plan — Delivery Instructions	Product Acceptance Record — Product
SYS DES	SR.06.02 Document the *System Maintenance Document* or update the current one(s).	Project Plan — Tasks assigned System Configuration	System Maintenance Document [*initiated*]
SYS DES	SR.06.03 Identify training needs and develop System User and Maintenance Training Curriculum and Material in accordance with the *Project Plan*. NOTE The *System Training Specifications* is an input to develop the System and Maintenance training enabling systems.	System Requirements Specifications [*validated*] System User Manual [*verified*]	System Training Specifications [*initiated*]
PJM SYS DES STK ACQ	SR.06.04 Verify and obtain approval of the System *Maintenance Document and System Training Specifications.* Verify consistency of System *Maintenance Document* with *System Requirements Specifications*. Verify consistency of System Training Specification with System Requirements Specifications. Validate the System Training Specifications and System Maintenance Document with the acquirer and the other stakeholders. The results found are documented in a Verification Report and corrections are made until the document is approved by PJM and maintenance as a stakeholder (STK).	System Maintenance Document System Training Specifications	Product Acceptance Record — Product [*approved*] and [*published*] System Maintenance Document *[validated]* System training Specifications *[validated]*

Table 31 *(continued)*

Role	Task list	Input work products	Output work products
PJM ACQ	SR.06.05 Perform delivery. Support delivery of training to Acquirer and other Stakeholders including: — Training-the-trainer — Support to pilot training classes In case of Hardware/Software upgrades, support transition from previous to new system, according to Project Plan including; — Legacy data conversion/transfer — System transition provisions such as interim/bridge System or System Elements — Replaced/obsolete hardware/software/data "sun setting", archiving or disposal	Project Plan — Tasks on Product delivery assigned — Delivery Instructions Product System [*validated*]	Product [*delivered*]
PJM	SR.06.06 Transition to Manufacturing and Inservice/After-sales Support.	Product [*delivered*]	Product Acceptance Record [*published*]

9.7.3 SR incorporation to the Project Repository

The list of work products to be saved in the *Project Repository* is provided in Table 32. After the incorporation, the *Configuration Management* needs to be applied to: System *Requirements Specifications, System Design, Traceability Matrix, IVV Plan and IVV Procedure, System Elements (Hardware, Hardware + Software, Software), System, System Operation Guide, System User Documentation, Maintenance and Training Documentation*.

Table 32 — SR repository work products

Product
Implementation Environment
Stakeholders Requirements Specifications
System Requirements Specifications
System Elements Requirements Specifications
System Operation Guide
System Design Document — *System Functional Architecture* — *System Physical Architecture*
Justification Document
System Functional Architecture Trade-offs
System Physical Architecture Trade-offs
IVV plan
IVV Procedures
Traceability Matrix
Bought, built or re-used System Elements (HW, HW+SW)
System
System User Manual

Table 32 *(continued)*

Product
System Maintenance Document
System Training Specifications
Verification Reports
Validation Reports
System Configuration
Product Acceptance Record
Product Specification

10 Acquisition Management process (AM)

10.1 AM purpose

The purpose of the Acquisition Management process is to obtain the work products and/or services that satisfy the need expressed by the VSE.

This process, a conditional process, needs to be executed if a VSE requires work products or services from an external supplier. If this is the case, this process is included in the scope of an audit or an assessment.

10.2 AM objective

AM.O1. Obtain the work product and/or service that satisfies the needs expressed by the VSE.

10.3 AM input work products

Table 33 provides a list of input work products.

Table 33 — AM input work products

Name	Source
Purchase Order	Business Management
Statement of Work	Business Management or Project Management

10.4 AM output work products

Table 34 provides a list of output work products.

Table 34 — AM output work products

Name	Destination
Supplier Agreement ~~Contract~~	Supplier Business Management
Delivery Instruction	Supplier Project Management
Acceptance Record	Project Management
Meeting Record (with supplier)	Project Management Business Management

10.5 AM internal work products

Table 35 provides a list of internal work products.

Table 35 — AM internal work products

Name
List of potential Suppliers
Meeting Record

10.6 AM roles involved

Table 36 provides a list of roles involved in the AM process.

Table 36 — AM roles involved

Role	Abbreviation
Business Management	BM
Project Manager	PJM
Supplier	SUP

10.7 AM diagrams

10.7.1 General

Figure 6 shows the flow of information between the Acquisition Management process activities including the most relevant work.

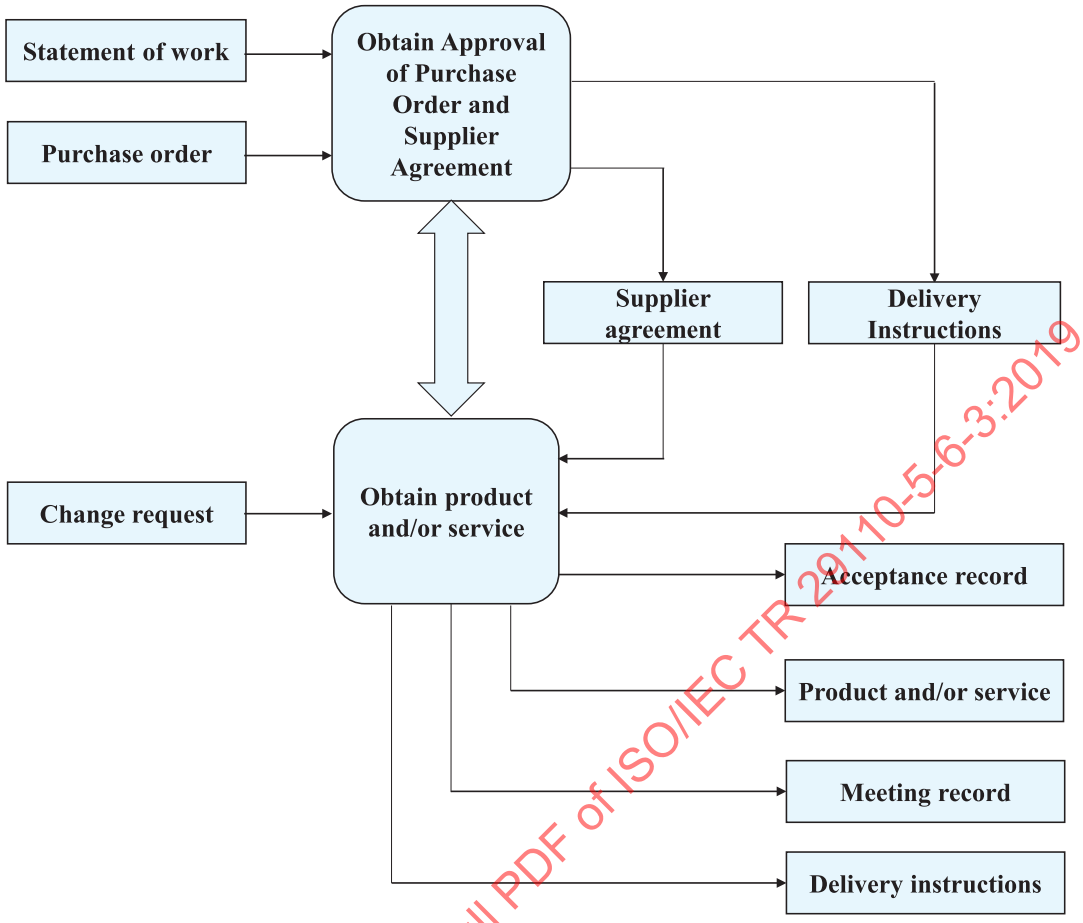


Figure 6 — Acquisition Management Process diagram

10.7.1.1 AM activities

10.7.1.2 General

The Acquisition Process has the following activities:

— AM.01 Obtain approval of *Purchase Orders and Supplier Agreements*;

— AM.02 Obtain Products and/or Services.

10.7.1.3 AM.01 Obtain approval of Purchase Orders and Supplier Agreements (AM.01)

The Obtain approval of Purchase Orders and Supplier Agreements activity helps ensure that the work products and/or services that satisfy the need expressed by the VSE are obtained.

The activity provides:

— Approved Purchase Order(s), and

— Approved Supplier Agreement(s).

The task list for AM.01 is given in Table 37.

Table 37 — AM.01 task list

Role	Task list	Input work products	Output work products
PJM BM	AM.01.01 Obtain approval of *Purchase Order(s)* from BM. NOTE A *Purchase Order* has been initiated in activity SI.03.	*Agreement* *Purchase Order(s) [initiated]*	*Purchase Order(s) [approved]*
PJM	AM.01.02 Develop, using the approved *Purchase Order(s)*, the *Supplier Agreement* and the *Delivery Instructions.* NOTE A *Purchase Order* may describe a work product or a service.	*Purchase Order(s) [approved]*	*Supplier Agreement [initiated]* *Delivery Instructions [initiated]*
PJM BM	AM.01.03 Obtain approval from BM of the *Supplier Agreement* and the *Delivery Instructions.*	*Supplier Agreement ~~Contract~~ [initiated]* *Delivery Instructions [initiated]*	*Supplier Agreement [approved]* *Delivery Instructions [approved]*
PJM BM	AM.01.04 Identify and select *Supplier(s)* and document/update potential suppliers on the *List of potential Suppliers.*	*List of potential Suppliers*	*Selected Supplier(s)* *List of potential Suppliers [updated]*
PJM BM SUP	AM.01.05 Obtain signature of the *Supplier Agreement* and the *Delivery Instructions* by the Supplier.	*Supplier(s) Agreement [approved]* *Delivery Instructions [approved]*	*Supplier(s) Agreement [signed by BM and Supplier]* *Delivery Instructions [signed by BM and Supplier(s)]*

10.7.1.4 AM.02 Obtain Products or Services or both (AM.O1)

The Obtain Products or Services or both activities help ensure that the work products or services that satisfy the need expressed in the Supplier(s) Agreement is or are obtained.

The activity provides:

— Products and/or Services required by the Supplier Agreement;

— Acceptance Record;

— Delivery Instruction.

The task list for AM.02 is given in Table 38.

Table 38 — AM.02 task list

Role	Task list	Input work products	Output work products
PJM SUP	AM.02.01 Monitor the *Supplier Agreement(s)* such that specified constraints such as cost, schedule and quality are met. If needed, document a change to the *Supplier Agreement(s)* in a *Change Request*. Document any issue in *Meeting Record* and obtain signature of *Supplier(s).*	*Supplier Agreement(s) [signed by VSE and Supplier]* *Delivery Instructions*	*Meeting Record [signed by PJM and supplier(s)]* *Change Request*

Table 38 *(continued)*

Role	Task list	Input work products	Output work products
PJM BM SUP	AM.02.02 Accept Supplier deliverable(s) specified in the *Supplier Agreement(s)* and *Delivery Instructions*, describe open items in *Meeting Records* and obtain signature of supplier of the *Acceptance Record.* NOTE If the work product/service does not meet the acceptance criteria, PJM produce *Meeting Record* to document the issue(s).	*Supplier Agreement(s) [signed by BM and Supplier]* *Delivery Instructions [approved]* *Meeting Record [signed by PJM and Supplier(s)]*	*Acceptance Record [signed by PJM and Supplier(s)]* *Meeting Record [signed by PJM and Supplier(s)]* *Product/Service [accepted] or [pending acceptance]*
PJM BM SUP	AM.02.03 Track open item(s) in a satisfactory conclusion to the VSE and to the Supplier(s) and obtain signature of Supplier(s) of the *Acceptance Record and update the List of potential Suppliers.*	*Supplier Agreement(s)* *Delivery Instructions [approved]* *Product/Service [pending acceptance]* *Meeting Record [signed by VSE and Supplier(s)]* *Acceptance Record [signed by PJM and Supplier(s)]* *List of potential Suppliers [initiated]*	*Product/Service [accepted]* *Acceptance Record [signed by PJM and Supplier(s)]* *List of potential Suppliers [updated]*

10.7.2 AM incorporation to the *Project Repository*

The list of work products to be saved in *Project Repository* is given in Table 39.

Table 39 — AM repository work products

Work product
Purchase Order
Supplier Agreement
Delivery Instructions
Acceptance Record
Meeting Record
Product/Service (from Supplier)

11 Roles

Table 40 provides an alphabetical list of the roles, its abbreviations and suggested competencies description. All role names are printed in roman and abbreviated with capital letters. This list is showed as a four-column table for presentation purpose only.

Table 40 — Roles

	Role	Abbreviation	Competency
1.	Acquirer	ACQ	The Acquirer is the Stakeholders representative. He is responsible for the acquisition of the System. The acquirer may be internal or external to the supplier organisation. Acquisition of a work product may involve, but does not necessarily require, a legal contract or a financial transaction between the acquirer and supplier. In some context the Acquirer is the end user of the system. Knowledge of the Stakeholders processes and ability to explain the Stakeholders requirements. The Acquirer is the role of the organisation that receives the work product or service. In some context the Acquirer is the end user of the system. The Acquirer needs to have the authority to approve the requirements and their changes. The Stakeholders includes user representatives in order to help ensure that the operational environment is addressed. Knowledge and experience in the application domain.
2.	Designer	DES	Knowledge and experience in the architecture design. Knowledge of the revision techniques. Knowledge and experience in the planning and performance of integration tests. Knowledge of the editing techniques. Experience on the system development and maintenance.
3.	Developer	DEV	Knowledge in fabrication, development (HW, SW). Knowledge and experience in the application domain.
4.	IVV Engineer	IVV	Knowledge of the Requirements, Design. Knowledge in inspection, peer review, simulation, and review techniques. Knowledge in testing techniques.
5.	Project Manager	PJM	Leadership capability with experience making decisions, planning, personnel management, delegation and supervision, finances and system development.
6	Stakeholder	STK	Stakeholders are actors that have an interest in the system, all along its life cycle, such as, representatives of users, users, maintainers, security, trainers, regulatory bodies, suppliers. STK should have Knowledge of the Stakeholder (e.g. manufacturer, maintainer, tester, logistic) processes and ability to explain the Stakeholder requirements. The Stakeholder (representative) needs to have the authority to approve the requirements and their changes. Knowledge and experience in the application domain.
7.	Supplier	SUP	Supplier of a System Element of the system: hardware, software, or hardware with software.

Table 40 *(continued)*

	Role	Abbreviation	Competency
8.	Systems Engineer	SYS	Knowledge and experience eliciting, specifying and analysing the requirements. Knowledge in designing user interfaces and ergonomic criteria. Knowledge of the revision techniques. Knowledge of the requirements authoring. Knowledge of the business domain. Experience on system development, integration, operation and maintenance. Experience on the system development and maintenance.
9.	Work Team	WT	Knowledge and experience according to their roles on the project: SYS, DES, DEV, IVV. Knowledge on the standards used by the Acquirer and/or by the VSE.

12 Work product description

Tables 41 and 42 provide alphabetical lists of the input, output and internal process work products, its descriptions, possible states and the source of the work products. The source can be another process or an external entity to the project, such as the Customer.

The lists are shown as a four-column table for presentation purpose only. Work product items in the following tables are based on ISO/IEC/IEEE 15289 Information Items with some exceptions. Information items may be combined or subdivided consistent with the project, service, or processes, phases, and stakeholder needs by a VSE.

The work product status gives the information to the project team about the type of work (tasks) already done on the work product (for example: evaluated, verified, tested, baselined). This information can be used to start next tasks that can use the work product as an input. Some work products have no status assigned because they are only informative, and they do not change the content (for example: Acceptance Record, Correction Register, Project Repository Backup, Verification/Validation Results).

Table 41 lists the work products of the Basic profile. The following notation is used to highlight the addition/deletion/modification to the work products of the Intermediate profile:

— added text is underlined; and

— deleted/modified text is struck out as follows: the text is struck out.

Table 42 lists the work products developed specifically for the Intermediate profile.

Work products (WP) are identified with a unique code WP.XX where XX is a sequential number. These codes have not been used in the descriptions of activities and tasks in order to facilitate readability.

Table 41 — Work product descriptions common to the Basic profile

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.01	*Change Request*	Identifies a System, or documentation problem or desired improvement, and requests modifications. It may have the following characteristics:	System Definition and Realisation Project Management

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		— Identifies purpose of change; — Identifies request status; — Identifies requester contact information; — Impacted system(s), system element(s); — Impacted IVV facilities; — Impact to operations of existing system(s) defined; — Impact to associated documentation defined; — Criticality of the request, date needed. The applicable statuses are: submitted, evaluated, approved, rejected, postponed.	
WP.02	*Correction Register*	Identifies activities established to correct a deviation or problem concerning the accomplishment of a plan. It may have the following characteristics: — Identifies the initial problem; — Defines a solution; — Identifies corrective actions taken; — Identifies the ownership for completion of defined actions; — Identifies the open date and target closure date; — Contains a status indicator; — Indicates follow up actions; — Includes rational of deviation correction action. The applicable statuses are: initial and published.	Project Management
WP.03	*Data Model*	Defines the properties and relations between entities of a project. It may include: — Requirements; — Functions; — System elements; — IVV plans; — IVV results; — Justification elements.	Project Management
WP.04	*Disposed System*	A system that has been transformed (i.e. state change) by applying the disposal process.	
WP.05	*Implementation Environment*	The environment and tools (software and hardware) required to specify, design, develop, integrate, verify, validate, manage the configuration and deploy the system.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.06	*Integration Report*	Document the integration execution. It may include the record of: — Reference to the related VV procedures — Date — Place — Duration — Verification check-list — Passed items of integration — Failed items of integration — Pending items of integration: not run, partial execution — Defects identified during integration The applicable status is: published.	System Definition and Realisation
WP.07	*IVV Plan*	Elements needed to integrate, verify and validate the system. It may be a single document with dedicated paragraphs or separate documents (Integration plan, verification plan, validation plan, qualification plan). *IVV Plan* may include: — Identifies the IVV activities regarding the System Requirements: inspection, reviews, simulation, test items. — Identifies the System integration strategy regarding the System Elements Requirements and interfaces. — Environmental constraints. — Requirements for IVV means. — Special procedural requirements. The applicable statuses are: verified and published.	System Definition and Realisation
WP.08	*IVV Procedure*	Elements to execute the IVV tasks. It may be a single document with dedicated paragraphs or separate documents (e.g. Integration procedure, verification procedure, validation procedure, qualification procedure).	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		IVV Procedure may include: — Purpose of the IVV procedure — Reference to the IVV plan — Defines the prerequisites — Defines procedure steps including the step number, the required action and the expected results The applicable statuses are: verified, accepted, updated, and reviewed.	
WP.09	*Justification Document*	The justification document contains all the justifications of choices, decisions (e.g. trade-offs), results of integration verification validation. This document is elaborated progressively during the development of the system. It can be used to justify the compliance for certification or qualification. The applicable statuses are: initial and published.	System Definition and Realisation
WP.10	*Meeting Record*	Records the agreements established with Acquirer and/or Work Team. It may have the following characteristics: — Purpose of meeting — Attendees — Date, place held — Reference to previous minutes — What was accomplished — Identifies issues raised — Any open issues — Agreements — Next meeting, if any The applicable status is: published.	Project Management
WP.11	*Product Acceptance Record*	Documents the Acquirer acceptance of the *Deliverables* of the project. It may have the following characteristics: — Record of the receipt of the delivery — Identifies the date received — Identifies the delivered elements — Records the verification of any Acquirer acceptance criteria defined	Project Management

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		— Identifies any open issues (if applicable) — Signed by receiving Acquirer The applicable statuses are: approved and published.	
WP.12	*Product*	A uniquely identified and consistent set of system elements including: — *Stakeholders Requirements Specification System Requirements Specification* — *System Elements Requirements Specification* — *System Design Document* — *Traceability Matrices (includes Requirements traceability matrix, Requirements coverage matrix)* — *System Elements* — *System* — *Bought, built or re-used System Elements* — *IVV Plan* — *IVV Procedure* — *Verification Report* — *Validation Report* — *System Operation Guide* — *System User Manual* — *System Maintenance Document* The main applicable statuses are: delivered and accepted.	System Definition and Realisation
WP.13	*Project Plan*	Presents how the project processes and activities will be executed to help ensure the project's successful completion, and the quality of the deliverable system. It includes the following elements which may have the characteristics as follows:	Project Management

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		— Reference to the *SOW* — *System Description* — Purpose — General Acquirer requirements — *Scope* description of what is included and what is not — *Objectives* of the project — *Deliverables* — list of system items to be delivered to Acquirer — *System Breakdown Structure* — *Tasks with leaders and contributors*, including verification, validation and reviews with Acquirer and Work Team, to help ensure the quality of work products. *Tasks* may be represented as a Work Breakdown Structure (WBS). — Estimated Duration of tasks — Resources (humans, materials, standards, equipment and tools) including the required training, and the schedule when the Resources are needed. — Composition of Work Team and roles — Schedule of the Project Tasks, the expected start and completion date for each task, and the relationship and dependencies of the Tasks. — Milestones — Estimated Effort and Cost — Risk Management Approach — Identification of Project Risks — Evaluation of each risk — Assignation of a priority to each risk — Treatment of risks	

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		— Periodically monitor risks for change — Periodically reviewing risk information on the risks identified — *Configuration Management Strategy* — System configuration management tool and mechanisms identified — Version identification and control defined — Backup and recovery mechanisms defined — Storage, handling and delivery (including archival and retrieval) mechanisms specified — *Change control process* to manage the changes based on impact studies using traceability and change control boards. — *Delivery Instructions* — Elements required for system release identified (i.e. hardware, software, documentation) — Delivery requirements — Sequential ordering of *Tasks* to be performed — Applicable releases identified — Identifies all delivered *System Elements* with version information — Identifies any necessary backup and recovery procedures — *Disposal Management Approach* — Defines schedules, actions and resources — Defines how to transform the system into, or retain it in, a socially and physically acceptable state The applicable statuses are: verified, accepted, updated and reviewed.	

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.14	*Project Repository*	Container to store project work products and deliveries. It may have the following characteristics: — Stores project work products — Stores released *Deliverables* products — Storage and retrieval capabilities — Ability to browse content — Listing of contents with description of attributes — Sharing and transfer of work products between affected groups — Effective controls over access — Maintain work products descriptions — Recovery of archive versions of work products — Ability to report work products status — Changes to work products are tracked to *Change Requests* The applicable statuses are: established, recovered and updated.	Project Management
WP.15	*Project Repository Backup*	Repository used to back up the *Project Repository* and, if necessary, to recover the information.	Project Management

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.16	*Progress Status Record*	Records the status of the project against the *Project Plan*. It may have the following characteristics: — Status of actual *Tasks* against planned *Tasks* — Status of actual results against established *Objectives*/goals — Status of actual resource allocation against planned *Resources* — Status of actual cost against budget estimates — Status of actual time against planned schedule — Status of actual risk against previously identified — Record of any deviations from planned *Tasks* and reason why. The applicable status is: evaluated.	Project Management
WP.17	*Purchase Order*	Defines the artefact to be purchased. It may have the following characteristics: — Name and address of supplier — Description of the item purchased — Agreed price — Quantity — Delivery date The applicable statuses are: initiated and approved.	Business Management Acquisition Management Project Management

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.18	*Stakeholders Requirements Specifications*	Defines the acquirer and other stakeholder's requirements. It may be in a single document with all stakeholders explicitly identified or in separate documents. It may have the following characteristics: — Introduction — general description of *the main goals; needs and expectations* — Requirements description: — Regulation — Capabilities — Performances — Scenarios, * Concepts of operations — User interface — Interfaces — Reliability — Maintenance — Interoperability — Constraints The applicable statuses are: initiated, approved and baselined.	System Definition and Realisation
WP.19	*Statement of Work (SOW)*	Description of work to be done related to *System* development. It may Include: — *System Description (Needs and expectations)* — Purpose — Acquirer and stakeholders' requirements — Constraints (regulation, imposed solutions…) — *Scope* description of what is included and what is not — *Objectives* of the project — *Deliverables* list of work products to be delivered to Acquirer A SOW could be part of an agreement ~~contract~~ between the Acquirer and the Supplier. The applicable status is: reviewed.	Project Management
WP.20	*System*	Combination of interacting elements organized to achieve one or more stated purposes. The applicable statuses are: verified and validated.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.21	*Systems Engineering Management Plan (SEMP)*	Identifies and describes the project organisation, roles and responsibilities, overall tasks, and engineering management planning required to control the design, development, fabrication, and tests associated with the Project. It may have the following Characteristics: — Introduction, Purpose, Scope — Company and Government Documents — Technical Project Planning and Control — Project Organisation, Responsibility and Authority, Standards, Procedures, and Training, Work Breakdown Structures, Technical Design Verification and Validation, Change Control Procedures, Systems Integration, Interface Control, Project Schedule and Milestones, Project Reviews, Technical Performance Management (TPM), Technical Communication, Mission Assurance, Project Risk Analysis — Systems Engineering Process — Project Requirements Analysis and Definition, Functional Analysis, Requirement Allocation, Trade-off Studies, Design Optimization/ Effectiveness Compatibility, Lessons Learned, Synthesis, Logistics Support, Producibility Analysis, Documentation, Systems Engineering Tools, Information Technology Systems Security, — Integration of Speciality Engineering Effort — Speciality Engineering, Integration Design, Integrated Validation Plan, Safety, Security, and Mission Assurance — Acronyms list, project organisation, project WBS, project schedule, document tree The applicable statuses are: verified, accepted and reviewed.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.22	*System Design Document*	Textual and/or graphical information, model on the *System* structure (solution). This structure may include the following parts: Functional Architecture: — Identifies the required *Internal Functions* — Identifies the relationship between *Internal Functions* — Consideration is given to any required: — *System* performance characteristics — Functional and human interfaces — Security characteristics Physical Architecture: — Provides hardware design — Identifies the required *Physical Elements* — Identifies the allocation of *Internal Functions to Physical Elements* — Provides format of input/output interfaces: physical interfaces, functional data through physical interfaces — Defines the format of required data structures The applicable statuses are: verified and baselined.	System Definition and Realisation
WP.23	*System Element*	A work product, that is part of a system, and that can be implemented to fulfil specified requirements. EXAMPLE Hardware, hardware with software, software, data, humans, processes (e.g. processes for providing service to users), procedures (e.g. operator instructions), facilities, materials, and naturally occurring entities (e.g. water, organisms, minerals), or any combination.	System Definition and Realisation
WP.24	*System Elements Requirements Specifications*	Defines the system elements requirements that satisfy the system requirements according to the system functional and physical architecture. Interfaces resulting from the system functional and physical architecture may be defined within the *System Elements Requirements Specifications* or in separate document. Each requirement is uniquely identified and is described with the SMART criteria. The applicable statuses are: initiated, verified, validated and baselined.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.25	*System Maintenance Document*	Defines the requirements and operations to maintain the system. It may have the following characteristics: — Maintenance Strategy — Accounts for the system's technical availability, replacements for system elements and logistical support, maintenance personnel training and staff requirements — Maintenance Enabling System Requirements — Requirements for any system needed to enable maintenance of the system-of-interest need to be developed — Maintenance Constraints on Design — Any constraints on the design arising from the maintenance strategy — Maintenance Procedure — Maintenance Report — Including documentation of the maintenance activity results, reporting of failures and recommendations for action, and failure and lifetime performance data. This report also documents any required procedure or system changes that should be accomplished as part of on-going configuration management activities. The applicable statuses are: preliminary, verified and validated.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.26	*System Operation Guide*	Contains the necessary information to install and manage the *System*. It may have the following characteristics: — Criteria for operational use — A description of how to operate the product including: — operational environment required — supporting tools and material (e.g. system user manuals) required — possible safety warnings — start-up preparations and sequence — frequently asked questions (FAQ) — sources of further information and help to operate the product — Certification and safety approvals — Warranty and replacement instructions — It should be written in terms that the personnel responsible for the operation can understand. The applicable statuses are: preliminary, verified and baselined.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.27	*System Requirements Specifications*	Defines the system requirements that satisfy the stakeholders' requirements. It may have the following characteristics: — Introduction — general description of the *System* and its use within the *Scope* of the Acquirer business; — Requirements description: — Functionality — established needs to be satisfied by the System when it is used in specific conditions. Functionality needs to be adequate, accurate and safe — User interface — definition of those user interface characteristics that allow to understand and learn the *system* easily so the user be able to perform his/her *Tasks* efficiently including the interface exemplar description — External interfaces — definition of interfaces with other system, software or hardware — Reliability — specification of the system execution level concerning the maturity, fault tolerance and recovery — Efficiency — specification of the system execution level concerning the time and use of the *Resources* — Maintainability — degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers. — Portability — description of the *System* characteristics that allow its transfer from one place to other — Design and construction limitations/ constraints –Interoperability — capability for two or more systems or *System Elements* be able to change information each other and use it — Reusability — feature of any product/sub-product, or a part of it, so that it can be used by several users as an end product, in the own system development, or in the execution of other system products — Legal and regulative — needs imposed by laws, regulations, etc.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
		Each requirement is uniquely identified and is described with the SMART criteria. The applicable statuses are: initiated, verified, validated and baselined.	
WP.28	*System Training Specifications*	Describes the requirements and operation to train the users, maintainers, and support personnel of a system to accomplish required tasks at any point in the system life cycle (transition, use, maintenance, disposal). The applicable statuses are: initiated, verified, validated and baselined.	System Definition and Realisation
WP.29	*System User Manual*	Describes the way of using the *System* based on the user interface. It may have the following characteristics: — User procedures for performing specified *Tasks* using the *System* — Installation and de-installation procedures — Brief description of the intended use of the *System*: a user-oriented document that describes a system's operational characteristics from the end user's viewpoint (the concept of operations) — The supplied and required *Resources* — Needed operational environment — Availability of problem reporting and assistance — Procedures to access and exit the *System* — Lists and explains *System* commands and system-provided messages to the user — As appropriate for the identified risk, it includes warnings, cautions, and notes, with corrections — It includes troubleshooting and error correction procedures. It is written in terms understandable by users. The applicable statuses are: preliminary, verified and baselined.	System Definition and Realisation
WP.30	*Traceability Matrix*	Documents the relationship between engineering and IVV artefacts according to the data model. It may include: — Requirements traceability matrix — Requirements coverage matrix The applicable statuses are: verified, baselined and updated.	System Definition and Realisation

Table 41 *(continued)*

Work product identification	Name	Description — WP common to the Basic profile	Source
WP.31	*Validation Report*	Documents the validation execution. It may include the record of: — Reference to the related IVV procedures — Date — Place — Duration — Validation check-list — Passed items of validation — Failed items of validation — Pending items of validation: not run, partial execution — Defects identified during validation The applicable status is: published.	System Definition and Realisation
WP.32	*Verification Report*	Documents the verification execution. It may include the record of: — Reference to the related IVV procedures — Date — Place — Duration — Verification check-list — Passed items of verification — Failed items of verification — Pending items of verification: not run, partial execution — Defects identified during verification The applicable status is: published.	System Definition and Realisation

Table 42 — Work product descriptions specific to the Intermediate profile

Work product identification	Name	Description — Intermediate profile addition	Source
WP.33	*Agreement*	Describes the mutual acknowledgement of terms and conditions under which a working relationship is conducted. EXAMPLE Contract, memorandum of agreement. It may have the following characteristics: — identifies customer requirements (functional and non-functional); — identifies time frame for delivery; — identifies budget and resources provided by both parts; — identifies what is to be purchased; — identifies any warranty information; — identifies any copyright and licensing information; — identifies acceptance criteria (e.g. delivery instructions); — identifies change management and problem resolution procedures; — identifies the role of the customer; — evidence of review and approval by authorised signatories. The applicable statuses are: initiated, approved and updated.	Business Management
WP.34	*Configuration Management Record*	Documents the configuration and status of software and associated documentation. It may have the following characteristics: — list of the approved configuration; — status of proposed changes to the configuration; — implementation status of approved changes; — “as delivered” Software Configuration. The applicable statuses are: initiated, approved and published.	System Definition and Realisation

Table 42 *(continued)*

Work product identification	Name	Description — Intermediate profile addition	Source
WP.35	*Human Resource Record*	Personnel and training information of human resources. It may have the following characteristics: — Human Resource Register: — personal data; — education; — experience; — roles assigned; — training. — Training Plan/Record description of the training activities. It may have the following characteristics: — courses, workshops, mentoring, on the job training, etc.; — calendar (planned and actual information); — trainers; — logistics. The applicable statuses are: initial, approved and published.	Business Management
WP.36	*Integration Approach*	Describes the approach used to integrate the software and hardware components in order to obtain the system. One approach is a *global integration (*big-bang integration) where all the software and hardware elements are assembled in only one step. Another approach is to integrate hardware and software components as they become available. Other known approaches are top-down integration, risk driven integration (i.e. most critical components are integrated first) and bottom-up integration. It may have the following characteristics: — the order for assembling the implemented hardware and software components based on the priorities of the system requirements and architecture definition focusing on the interfaces; — regression strategy; — minimisation of integration time, cost, and risks. The applicable statuses are: verified and approved.	System Definition and Realisation

Table 42 *(continued)*

Work product identification	Name	Description — Intermediate profile addition	Source
WP.37	*List of Products or Services*	List the products or services to be acquired from Supplier(s). It may have the following characteristics: — software component(s); — hardware component(s); — service(s); — potential supplier(s); — delivery Instructions. The applicable status is: initiated.	Business Management
WP.38	*List of potential suppliers*	List potential Suppliers that could provide the product or service required. It may have the following characteristics: — product(s) required; — service(s) required; — potential supplier(s). The applicable statuses are: initiated and updated.	Acquisition Management
WP.39	*Measurement collection and analysis procedure*	Describes a collection procedure to help ensure that the right data is collected, is collected and stored properly and analysed. It may have the following characteristics: — specify the business/project goal of each measure; — specify the unit of each measure; — specify how to collect and store the data for each required measure; — specifies who is responsible for obtaining measurement data; — specifies how data are stored, retrieved; — specifies the appropriate data analysis methods and tools; — specifies the data storage format and location; — specifies the format of measurement reporting; — specifies who should receive the Measurement Record. The applicable statuses are: verified and baselined.	Project Management

Table 42 *(continued)*

Work product identification	Name	Description — Intermediate profile addition	Source
WP.40	*Measurement Record*	Records measurements collected during the execution of the tasks. It may have the following characteristics: — Process measures EXAMPLE Effort (person-hour), estimation accuracy (e.g. estimated/actual start and end dates), estimated cost, cost of rework, productivity. — Work product measures EXAMPLE for software: Quality (number of defects), size (number of requirements, number of pages, number of lines of code, number of function points). — EXAMPLE for hardware: Quality (number of defects), technical data package (number of requirements, technical drawings, product specification, verification (testing) procedure(s). The applicable statuses are: updated, approved and published.	All processes
WP.41	*Organisational Lessons Learned Record*	A lesson learned meeting is conducted after a few projects have been completed. The objective is to capture and document the organisational knowledge gained after a few projects have been completed and closed to improve the performance of the VSE. The information from the following documents could be used when performing a lesson learned review: — Organisational Management Plan; — Business Objectives; — Project Plans; — Progress Status Records; — Correction Register; — Meeting Records. It may have the following characteristics: — potential causes of problems; — recommendations to improve the performance of VSE and projects such as quality, estimates, schedule. The applicable statuses are: initiated, approved and published.	Business Management
WP.42	*Organisational Repository*	Electronic container to store organisational documents such as processes and work products. It may have the following capabilities:	Business Management