INTERNATIONAL STANDARD

# ISO/IEC/IEEE 24748-4

First edition
2016-05-15

# Systems and software engineering — Life cycle management —

## Part 4: Systems engineering planning

*Ingénierie des systèmes — Gestion du cycle de vie —*

*Partie 4: Ingénierie des systèmes*

Reference number
ISO 24748-4:2016(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
E-mail inmail@iec.ch
Web www.iec.ch

Institute of Electrical and
Electronics Engineers, Inc.
3 Park Avenue, New York
NY 10016-5997, USA
E-mail stds.ipr@ieee.org
Web www.ieee.org

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of ISO/IEC JTC 1 is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC/IEEE 24748-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Systems and software engineering*, in cooperation with the IEEE Computer Society Systems and Software Engineering Standards Committee, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

This edition cancels and replaces the first edition of ISO/IEC 26702:2007 – IEEE Std 1220-2005, which has been technically revised.

ISO/IEC 24748 consists of the following parts, under the general title *Systems and software engineering — Life cycle management*:

— *Part 1: Guide for life cycle management*

— *Part 2: Guide to the application of ISO/IEC 15288 (System life cycle processes)*

— *Part 3: Guide to the application of ISO/IEC 12207 (Software life cycle processes)*

— *Part 4: Systems engineering planning*

— *Part 5: Software development planning*

# Introduction

ISO/IEC/IEEE 15288, *Systems and software engineering – System life cycle processes*, provides a common process framework covering the life cycle of man-made systems. This life cycle spans the conception of ideas through to the retirement of a system. It provides the processes for acquiring and supplying systems. In addition, this framework provides for the assessment and improvement of the life cycle processes. This common framework improves communication and cooperation among the parties that create, utilize, and manage modern systems in order that they can work in an integrated, coherent fashion.

The acquisition or supply of a system is usually done within a project. A project prepares and implements the technical plans and schedules necessary to guide the project toward accomplishment of its objectives and proper conclusion. Given the project's authorization and objectives, the project should establish a Systems Engineering Management Plan (SEMP).

This part of ISO/IEC/IEEE 24748 replaces the former ISO/IEC 26702:2007 (IEEE Std 1220-2005), *Systems engineering — Application and management of the systems engineering process.* In preparation for harmonization, ISO/IEC 26702 provided explanations regarding key differences between IEEE Std 1220 and ISO/IEC/IEEE 15288 in areas such as terminology and structure.

The evolution of the harmonized set of ISO/IEC/IEEE 15288-12207 related standards and technical reports that are discussed in this part of ISO/IEC/IEEE 24748 provides detailed requirements and guidance on the application of system life cycle processes. This part of ISO/IEC/IEEE 24748 unifies technical and management requirements and guidance from several of these sources to specify the requirements for the content of a SEMP and to provide a common SEMP format. This part of ISO/IEC/IEEE 24748 also identifies the processes as defined in ISO/IEC/IEEE 15288 to perform the necessary project planning activities to accomplish the project's technical effort and to develop the project's SEMP. Due to close alignment with the content of ISO/IEC 24748, ISO/IEC 26702 is now Part 4 of the multi-part International Standard, ISO/IEC 24748 (*Systems and software engineering – Life cycle management*).

Taken together, the parts of ISO/IEC 24748 are intended to facilitate the joint usage of the process content of ISO/IEC/IEEE 15288 and ISO/IEC 12207, *Systems and software engineering – Software life cycle processes*, which in turn may be used together with related standards such as for service management, and various other lower-level process standards. In this way, ISO/IEC 24748 provides unified and consolidated guidance on the life cycle management of systems and software. Its purpose is to help ensure consistency in system concepts and life cycle concepts, models, stages, processes, process application, key points of view, adaptation, and use in various domains as the two International Standards (and others) are used in combination. It should help a project to design a life cycle model for managing progress on a project.

The five parts of ISO/IEC 24748 are:

— ISO/IEC TR 24748-1: *Systems and software engineering – Life cycle management – Part 1: Guide for life cycle management*

— ISO/IEC TR 24748-2: *Systems and software engineering – Life cycle management – Part 2: Guide for the application of ISO/IEC 15288 (System life cycle processes)*

— ISO/IEC TR 24748-3: *Systems and software engineering – Life cycle management – Part 3: Guide for the application of ISO/IEC 12207 (Software life cycle processes)*

— ISO/IEC/IEEE 24748-4: *Systems and software engineering – Life cycle management – Part 4: Systems engineering planning*

— ISO/IEC/IEEE 24748-5: *Systems and software engineering – Life cycle management – Part 5: Software development planning*

Whereas Part 1 addresses in generic terms the purpose stated above of guidance for the life cycle management of systems and software, Part 2 focuses on and expands the coverage of those aspects for systems. Part 2 will also, in conjunction with Part 1, aid in identifying and planning the use of the life cycle processes described in ISO/IEC/IEEE 15288. The proper use of these processes will contribute to a project being completed successfully, meeting its objectives and requirements for each stage and for the overall project.

This part of ISO/IEC/IEEE 24748 focuses on the processes required for successful planning and management of the project's systems engineering effort. It calls for development of a SEMP as the key vehicle for representing a project's application of systems life cycle processes. The SEMP is a top level technical planning document for a project which addresses Technical Management processes established by three principal sources (the project's contract or agreement, applicable organizational processes, and the systems engineering project team) as necessary to successfully accomplish the systems engineering-related tasks of the project. The terms technical planning and systems engineering planning are used interchangeably in this part of ISO/IEC/IEEE 24748 to emphasize or differentiate technical contributions in the processes under discussion. This part of ISO/IEC/IEEE 24748 draws on key aspects of the former ISO/IEC 26702 (IEEE 1220) to highlight additional practices and provide normative content for a SEMP.

# Systems and software engineering — Life cycle management — Part 4: Systems engineering planning

## 1 Scope

This part of ISO/IEC/IEEE 24748

- specifies the Technical Management processes from ISO/IEC/IEEE 15288 that are required to be implemented for planning a systems engineering project,
- gives guidelines for applying the required processes,
- specifies a required information item, a plan for the technical management and execution of the project that is to be produced through the implementation of the Project Planning process,
- gives guidelines for the format and content of the required information item, and
- provides normative definition of the content of the information item that results from the application of these processes to that end. In this part of ISO/IEC/IEEE 24748 that plan for technical project management is termed the Systems Engineering Management Plan (SEMP).

This part of ISO/IEC/IEEE 24748 is applicable to

- those who use or plan to use ISO/IEC/IEEE 15288 on projects dealing with man-made systems including software-intensive systems, software products, and services related to those systems and products,
- those who are responsible for the technical management of projects concerned with the engineering of systems,
- those responsible for executing ISO/IEC/IEEE 15288 system life cycle processes at a project level,
- organizations and individuals who are subcontracting a project management effort,
- anyone developing engineering management documentation to complete technical planning aspects of their project’s processes.

In many organizations, the various responsibilities of technical management are assigned to more than one person. Where the term "technical manager" or "systems engineering manager" is used in this part of ISO/IEC/IEEE 24748, the guidance, advice or normative requirement applies to the applicable role within the project or organization.

This part of ISO/IEC/IEEE 24748 is intended to provide guidance for two-party situations and may be equally applied where the two parties are from the same organization. This part of ISO/IEC/IEEE 24748 can also be used by a single party as self-imposed tasks.

This part of ISO/IEC/IEEE 24748 can also serve as guidance in multi-party situations, where high risks are inherent in the supply and integration of complex systems, and procurement can involve several suppliers, organizations or parties.

# 2 Conformance

## 2.1 Intended usage

This part of ISO/IEC/IEEE 24748 provides guidance for the execution of the ISO/IEC/IEEE 15288 processes that are required for planning and managing a project to implement a significant systems engineering effort. This part of ISO/IEC/IEEE 24748 also provides normative definition of the content and recommendations for the format of the related information item, the project's SEMP.

Users of this part of ISO/IEC/IEEE 24748 can claim conformance to the process provisions or to the information item provisions, or both.

The requirements in this part of ISO/IEC/IEEE 24748 are contained in 6.1, Clauses 7 and 9 and in Annex C.

## 2.2 Conformance to processes

This part of ISO/IEC/IEEE 24748 identifies required processes for planning the technical management and execution of projects that implement considerable systems engineering efforts regarding the project's system products.

The requirements for these processes in this part of ISO/IEC/IEEE 24748 are contained in 6.1.

If a user of this part of ISO/IEC/IEEE 24748 claims full conformance to ISO/IEC/IEEE 15288:2015, then by implication the user may claim conformance to the processes in this part of ISO/IEC/IEEE 24748.

NOTE A claim to tailored conformance to ISO/IEC/IEEE 15288:2015, does not necessarily imply conformance to the processes in this part of ISO/IEC/IEEE 24748.

## 2.3 Conformance to information item content

This part of ISO/IEC/IEEE 24748 provides the requirements for an information item – the SEMP.

A claim of conformance to the information item provisions of this part of ISO/IEC/IEEE 24748 means that

— the user produces the required information item stated in this part of ISO/IEC/IEEE 24748, and

— the user demonstrates that the information item produced during the project planning activities conforms to the content requirements defined in this part of ISO/IEC/IEEE 24748.

The requirements for the information item in this part of ISO/IEC/IEEE 24748 are contained in Clause 7.

The requirements for the content of the information item in this part of ISO/IEC/IEEE 24748 are contained in Clause 9.

NOTE 1 If a user of this part of ISO/IEC/IEEE 24748 claims full conformance to ISO/IEC/IEEE 15289, it does not imply that the user may claim conformance to the information items and information item content in this part of ISO/IEC/IEEE 24748. The reason is that this part of ISO/IEC/IEEE 24748 adds additional information items and additional detail.

NOTE 2 In this part of ISO/IEC/IEEE 24748, for simplicity of reference, an information item is described as if it were published as a separate document. However, information items will be considered as conforming if they are unpublished but available in a repository for reference, or divided into separate documents or volumes.

## 2.4 Full conformance

A claim of full conformance to this part of ISO/IEC/IEEE 24748 is equivalent to claiming conformance

— to the processes of ISO/IEC/IEEE 15288, cited in subclause 6.1,

— to the information item cited in Clause 7, and

— to content requirements of the information item in Clause 9.

### 2.5 Tailored conformance

A claim of tailored conformance to this part of ISO/IEC/IEEE 24748 is equivalent to claiming conformance in accordance with the tailoring direction provided in normative Annex C.

## 3 Normative references

The following document, in whole or in part, is normatively referenced in this document and is indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC/IEEE 15288:2015, *Systems and software engineering – System life cycle processes*

## 4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 15288:2015 and the following apply.

NOTE 1 ISO/IEC TR 24748-1 provides guidance on the application of ISO/IEC/IEEE 15288, including definition or expansion of important organization, project, process, and life cycle model concepts and their adaptation for successful project implementation. ISO/IEC TR 24748-1 is a publicly available technical report; please see the ISO - Publicly Available Standards site: http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html

NOTE 2 ISO/IEC TR 24748-1 also references and uses the terms and definitions from ISO/IEC/IEEE 15288.

**4.1**
**document**
uniquely identified unit of information for human use

EXAMPLE Report, specification, manual or book, in printed or electronic form.

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.2**
**include [information]**
having either the information or a reference to the information present in the document

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.3**
**information item**
separately identifiable body of information that is produced, stored, and delivered for human use

Note 1 to entry: Synonym: information product.

Note 2 to entry: An information item can be produced in several versions during a project life cycle.

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.4**
**information item content**
information included in an information item, associated with a system, product or service, to satisfy a requirement or need

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.5**
**information item type**
group of information items consistent with a pre-arranged set of generic criteria

Note 1 to entry: Synonym: generic document type.

EXAMPLE A “plan” is the information item type for all plans and “report” is the information item type for all reports.

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.6**
**integrated repository**
planned and controlled storage of information pertinent to the systems engineering effort

Note 1 to entry: The integrated repository typically includes key data, e.g., schema, models, tools, technical management decisions, process analysis information, requirement changes, process and product metrics, trade-offs and other analyses.

**4.7**
**measure of effectiveness**
**MOE**
“operational” measure of success that is closely related to the achievement of the operational objective being evaluated in the intended operational environment under a specified set of conditions

[SOURCE: ISO/IEC TR 24748-2:2010, Table A.15 k)]

**4.8**
**measure of performance**
**MOP**
engineering parameter that provides critical performance requirements to satisfy a measure of effectiveness (MOE)

Note 1 to entry: An MOP typically characterizes physical or functional attributes relating to the system operation.

**4.9**
**organization**
group of people and facilities with an arrangement of responsibilities, authorities and relationships

Note 1 to entry: A body of persons organized for some specific purpose, such as a club, union, corporation, or society, is an organization.

Note 2 to entry: An identified part of an organization (even as small as a single individual) or an identified group of organizations can be regarded as an organization if it has responsibilities, authorities and relationships.

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

**4.10**
**plan**
information item that presents a systematic course of action for achieving a declared purpose, including when, how, and by whom specific activities are to be performed

[SOURCE: ISO/IEC/IEEE 15289:2015]

**4.11**
**project**
endeavour with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

Note 1 to entry: A project is sometimes viewed as a unique process comprising co-coordinated and controlled activities and composed of activities from the Technical Management processes and Technical processes defined in ISO/IEC/IEEE 15288.

[SOURCE: ISO/IEC/IEEE 15288:2015, modified Note 1 to entry]

**4.12**
**system breakdown structure**
**SBS**
system hierarchy, with identified enabling systems, and personnel that is typically used to assign development teams, support technical reviews, and to partition the assigned work and associated resource allocations to each of the tasks necessary to accomplish the technical objectives of the project

Note 1 to entry: The SBS can be used as a basis for cost-tracking and control.

**4.13**
**stakeholder**
individual or organization having a right, share, claim, or interest in a system or in its possession of characteristics that meet their needs and expectations

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

**4.14**
**systems engineering management plan**
**SEMP**
top level technical plan for managing the systems engineering effort which defines how the technical aspects of the project will be organized, structured, and conducted and how the systems engineering processes will be controlled to provide a product that satisfies stakeholder requirements

[SOURCE: ISO/IEC TR 29110-5-6-2:2014, modified to specify technical aspects of the project]

**4.15**
**technical performance measure**
**TPM**
measure used to assess design progress, compliance to performance requirements, and technical risks for critical performance parameters

Note 1 to entry: TPMs are derived from the MOPs focusing on the critical performance parameters of specific architectural elements of the system as it is designed and implemented.

[ISO/IEC 29148:2011, 6.3.3.1]

**4.16**
**work breakdown structure**
**WBS**
hierarchical decomposition of the total scope of work to be carried our by the project team to accomplish the project objectives and create the required deliverables

[SOURCE: PMBOK Guide – Fifth Edition]

# 5 Concepts

## 5.1 Introduction

This Clause presents concepts that apply to and are necessary to understand the systems engineering planning aspects of a project and for the development and content of a project's SEMP.

The Agreement processes of ISO/IEC/IEEE 15288 specify the requirements for the establishment of agreements with organizational entities, both external and internal to the organization, for the acquisition and supply of products and services. The Organizational Project-Enabling processes of ISO/IEC/IEEE 15288 provide resources and infrastructure necessary to support projects and help ensure the satisfaction of organizational objectives and established agreements. The Technical Management processes of ISO/IEC/IEEE 15288 contain the generic activities and tasks, which may be employed by any party that has to manage a project dealing with systems or products. The Technical processes of ISO/IEC/IEEE 15288 transform the needs of stakeholders first into a product and then, by applying that product, provide a sustainable service, when and where needed in order to achieve customer satisfaction.

As discussed in this part of ISO/IEC/IEEE 24748, there are several standards that detail requirements and application guidance for use of ISO/IEC/IEEE 15288. Some of these standards further expand the requirements of ISO/IEC/IEEE 15288 to support its application and implementation in organizations and on projects. Their content includes pertinent requirements and guidance to support systems engineering planning activities and tasks; for the development of a SEMP for implementation on a project; or for a SEMP template for organizational use.

This part of ISO/IEC/IEEE 24748 unifies and supplements the extensive application information available in these standards to assist organizations and project management teams in performance of systems engineering planning activities and developing an engineering management plan to address a project's technical management needs. It must be noted that these referenced standards and other documents have been developed over different time spans and originated by different organizations, so the user may encounter some contradictions when applying these references.

Performance of systems engineering planning activities to manage the technical aspects of a project and for development of a SEMP presupposes an understanding of several key concepts. These include the concepts of: system, life cycle, process, organization, project, information item, and SEMP development. Foundational material that explains these concepts is discussed or identified in 5.2 to 5.7.

## 5.2 System concepts

System concepts for systems that are any mix of products and services are introduced in ISO/IEC/IEEE 15288, 5.2. Additional discussion is in ISO/IEC TR 24748-1, 3.1, which explains systems, system boundaries, structure in systems and projects, and enabling systems

## 5.3 Life cycle concepts

System life cycle concepts are introduced in ISO/IEC/IEEE 15288, 5.4. Additional discussion is in ISO/IEC TR 24748-1, 3.2.

Project life cycle concepts and application are addressed in ISO/IEC/IEEE 16326.

The INCOSE Systems Engineering Handbook discusses system life cycle concepts in terms of business, budget and technical aspects, and project cycles in terms of decision gates. Discussion of different methods, implementation strategies and case studies highlight some of the decisions facing organizations and projects in determining appropriate system and life cycle models to employ.

## 5.4 Process concepts

ISO/IEC TR 24774 provides foundational discussion of process concepts to encourage consistency in development of standard process reference models. It presents guidelines for the elements used most frequently in describing a process: the title, purpose, outcomes, activities, tasks and information items.

Process concepts are introduced in ISO/IEC/IEEE 15288, 5.5. Additional discussion for application is provided in ISO/IEC TR 24748-1, 3.3, and in ISO/IEC TR 24748-2, 4.4.

ISO/IEC/IEEE 15288 establishes a top-level architecture of the life cycle of systems from conception through retirement. The architecture is constructed with a set of processes and interrelationships among these processes.

Process principles are introduced in ISO/IEC TR 24748-2, 4.4.2.

The process categories of ISO/IEC/IEEE 15288 are discussed in ISO/IEC TR 24748-2, 4.4.3.

The recursive and iterative application of processes is discussed in ISO/IEC TR 24748-2, 4.4.4.

## 5.5 Organizational concepts

Clause 4 provides a definition of organization as adapted from ISO/IEC/IEEE 15288. An identified part of an organization (even as small as a single individual) or an identified group of organizations can be regarded as an organization, if it has responsibilities, authorities and relationships. In ISO/IEC/IEEE 15288, when an organization, as a whole or a part, enters into an agreement, it is a party. Organizations are separate bodies, but the parties may be from the same organization or from separate organizations.

Organizational concepts, such as responsibility, organizational relationships and project organizational structure, are discussed in ISO/IEC TR 24748-2, 4.5.

## 5.6 Project concepts

Clause 4 provides a definition of project as adapted from ISO/IEC/IEEE 15288.

A project can be viewed as a single endeavour, unique in its purpose and consisting of various implemented lifecycle processes.

ISO/IEC TR 24748-1, 3.1.4, discusses system structure and implications in projects.

ISO/IEC TR 24748-1, 3.1.5, explains enabling systems in terms of the system-of-interest and its operational environment.

ISO/IEC TR 24748-2, 4.6, discusses project concepts, relationships among projects, project relationships with enabling systems and hierarchy of projects.

IEEE Std. 1490-2011, *IEEE Guide: Adoption of PMI Standard: A Guide to the Project Management Body of Knowledge*, provides more information on projects and project management.

ISO/IEC/IEEE 16326, *Systems and software engineering – Life cycle processes – Project management*, provides more information on project management and the information item, Project Management Plan (PMP).

## 5.7 Information items concepts

Clause 4 provides definitions of an information item and related terms as adapted from ISO/IEC/IEEE 15289.

ISO/IEC/IEEE 15289 provides more detail on information items and specifies how life cycle data is managed in information items.

ISO/IEC/IEEE 15289, 6.1, provides requirements for life cycle data characteristics of information items that are produced as documents.

ISO/IEC/IEEE 15289 indicates that an information item is required to be consistent with an information item generic type. The key information item addressed in this part of ISO/IEC/IEEE 24748 is of type plan.

ISO/IEC/IEEE 15289, Clause 7, identifies several generic types of information items and provides generic content for each information item type.

ISO/IEC/IEEE 15289, 7.3, provides generic content elements for plans.

ISO/IEC/IEEE 15289 makes a distinction between records and documents (which includes plans). Each information item produced as a document supports certain life cycle data characteristics. Documents are produced and communicated for human use and contain formal elements (such as purpose, scope, and summary), intended to make them usable by their intended audience.

ISO/IEC/IEEE 15289, 6.4, provides requirements for the management of information items through the application of ISO/IEC/IEEE 15288 and ISO/IEC 12207 processes. These include the Information Management process and select activities from the Knowledge Management process.

### 5.8 SEMP development concepts

The SEMP provides a plan for implementing the selected system life cycle processes across the full life cycle of the project. The SEMP should be developed in the earliest project planning stages. This is tightly coupled with Project Management Plan (PMP) development and content. Although sometimes combined, the SEMP is typically a subordinate document to the PMP and focuses on the technical management aspects of the project.

The SEMP should be a living document. A good SEMP provides a roadmap to the technical execution of a project. Project personnel should use the SEMP as a reference to understand the overall technical approach to a project. A SEMP should be periodically updated as plans are solidified or modified, activities move from plans to historical facts, known risks are mitigated or significantly changed, new risks are identified, new tools and technologies are adopted, and as a myriad of other factors cause an adjustment to the project's overall technical approach. Thus, it is expected that the SEMP will evolve over time and go through revisions when a new agreement is awarded, or as the project moves from stage to stage. The SEMP should reference or provide a link to the PMP, for direction on how the SEMP will be updated and controlled on the project.

The SEMP is the key technical management plan that integrates the system engineering effort. The following extract from ISO/IEC TR 24748-2, Table A.8 on Process Planning Notes, describes the engineering plan (which is referred to in this part of ISO/IEC/IEEE 24748 as a SEMP):

> The engineering plan provides an explanation of what needs to be done, how it will be done, who will do it, when it will be done and where it will be done; as well as how much of a resource is necessary to do the work for each technical process. The engineering plan explains the above within established constraints of resources and staff and in order to meet cost, schedule and performance requirements within acceptable risks.

ISO/IEC/IEEE 16326:2009 supplements the Technical Management processes of ISO/IEC/IEEE 15288, providing detailed guidance and normative content specifications for project management plans covering software projects and software-intensive system projects. ISO/IEC/IEEE 16326 notes that a SEMP is typically developed at a lower level of abstraction than the PMP to address and gather most of the other plans required to satisfy product requirements and agreement terms (e.g. specialty plans for safety, security, training, integration, transition). Technical plans such as the SEMP (also commonly called a Technical Management Plan or Engineering Plan) need to coordinate the technical and management aspects of a project (or many projects) across one or more organizations to help ensure successful achievement of organizational and agreement goals for the project. A SEMP will typically complete or supplement plan elements initiated at the PMP level. Organizational processes, agreement terms and project unique requirements contribute to the determination of PMP and SEMP content and their interfaces.

Informative Annex A notes the ISO/IEC/IEEE 16326 content specifications for key PMP elements. This annex also describes the relationship of the required SEMP content that is identified in Clause 9 to these informative descriptions of PMP elements.

Clause 8 contains guidance for SEMP development.

# 6 Technical Management processes for systems engineering planning

## 6.1 General

To plan the project's technical effort and to develop the project's SEMP, the project shall implement the following processes as defined in ISO/IEC/IEEE 15288:2015 and listed in Table 1:

**Table 1 — Technical Management processes of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 16326 guidance**

| Technical Management process | ISO/IEC/IEEE 15288 Clause | ISO/IEC/IEEE 16326 Guidance |
|---|---|---|
| Project planning | Clause 6.3.1 | Clause 6.1 |
| Project assessment and control | Clause 6.3.2 | Clause 6.2 |
| Decision management | Clause 6.3.3 | Clause 6.3 |
| Risk management | Clause 6.3.4 | Clause 6.4 |
| Configuration management | Clause 6.3.5 | Clause 6.5 |
| Information management | Clause 6.3.6 | Clause 6.6 |
| Measurement | Clause 6.3.7 | Clause 6.7 |
| Quality assurance | Clause 6.3.8 | Not applicable |

The related processes, activities, and tasks are found in the cited clauses of ISO/IEC/IEEE 15288. The process descriptions with outcomes and guidance for project management planning and development of project management plans are found in the cited clauses of ISO/IEC/IEEE 16326. The process descriptions with outcomes and supplemental guidance for technical planning and development of a project's SEMP are addressed in this part of ISO/IEC/IEEE 24748.

Clause 6 examines the eight Technical Management processes of ISO/IEC/IEEE 15288, providing detailed discussion and application advice as it applies to the management of projects dealing with systems. The guidance in Clause 8 and in Annex B support the analysis, selection, and adaptation of ISO/IEC/IEEE 15288 processes to populate a life cycle model for project application that is designed for the system life cycle stage or stages within the scope of the project. This combined guidance is intended to aid project and technical planners to produce the required technical planning contributions as specified in Clause 9 and allocate them to the SEMP, or other project plans, e.g. the PMP.

Normative process portions from ISO/IEC/IEEE 15288 are contained in boxed text, with discussion and advice for that portion immediately following.

ISO/IEC/IEEE 16326 explains these processes in terms of what the project manager should do to develop the project plans for the project. The SEMP is a specialization of one of these plans that focuses on the technical management aspects of the project to successfully manage and deliver the system products and services of the project. While many of the duties and activities of the project planning and technical or systems engineering planning are the same, the scope and focus can vary greatly – depending on project complexity and organizational influences.

NOTE The terms "technical planning" and "systems engineering planning" are used interchangeably in this part of ISO/IEC/IEEE 24748. Their use, especially in this Clause, is intended to emphasize or differentiate technical contributions in the processes under discussion. There is no intent to indicate that a particular person, group or organizational function should perform the activity.

If a project and its system products and services warrant separate project and technical management plans, such as creation of a SEMP, decisions need to be made early in the project's life cycle regarding the scoping and allocation of personnel responsibilities and the plans of the project. There needs to be direct and consistent communication between project and technical management. This helps to ensure that key technical stakeholders are identified with planned activities, and are involved as planned.

There are several prescriptive project management methodologies that support life cycle processes in the field of systems and software engineering, which are used in both government and the private sector. One example, the Project Management Body of Knowledge (PMBOK®)[1] Guide contains a comprehensive set of generic project management processes, which may be employed for implementing both general and technical project management tasks. One of the early project management and process planning activities will be to decide on the use and scope of methodologies, such as these, to support the project management and technical efforts of the project.

## 6.2 Project planning process

**ISO/IEC/IEEE 15288:2015**

**6.3.1 Project planning process**

**6.3.1.1 Purpose**

The purpose of the Project Planning process is to produce and coordinate effective and workable project plans.

This process determines the scope of the project management and technical activities, identifies process outputs, tasks and deliverables, establishes schedules for task conduct, including achievement criteria, and required resources to accomplish tasks. This is an on-going process that continues throughout a project, with regular revisions to plans.

NOTE The strategies defined in each of the other processes provide inputs and are integrated in the Project Planning process. The Project Assessment and Control process is used to assess whether the plans are integrated, aligned, and feasible.

**6.3.1.2 Outcomes**

As a result of the successful implementation of the Project Planning process:

a) Objectives and plans are defined.

b) Roles, responsibilities, accountabilities, authorities are defined.

c) Resources and services necessary to achieve the objectives are formally requested and committed.

d) Plans for the execution of the project are activated.

**Guidance:**

a) The responsibility for preparing, reviewing, and approving plans, including technical management plans, should be assigned and documented.

b) Systems engineering planning should help to ensure that requirements related to the technical effort are elicited, documented, analyzed, verified and managed. Technical project planning should include the following activities:

[1] 1) Project Management Body of Knowledge (PMBOK®) Guide is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of this product.”

1) Involve all identified stakeholders in the requirements definition, and related activities.

2) Establish verification strategy early and maintain verification activity as requirements evolve.

3) Manage change to the scope and requirements throughout a project's life cycle. Changes in scope and requirements should be carefully evaluated for impacts on stakeholder satisfaction, cost, schedule, risk, current scope and quality.

4) Review the selection of processes when the scope and requirements are changed, to confirm that the selected processes are still applicable after the changes in scope and requirements.

5) Define who is responsible for obtaining stakeholder agreement on requirements and for balancing opposing stakeholder views.

6) Establish and maintain requirements traceability.

c) System engineering efforts should be conducted with the required technical engineering resources and skills. When resources or skills are constrained, consider the criticality of the effort and the risk of failure on the effort in the allocation of limited resources or skills. Risk-driven scheduling provides one possible approach to address this. Although dynamically choosing the next task for implementation based on the current priority and risk rating, makes the schedule less predictable, it allows for better allocation of resources in a resource limited environment.

d) Systems engineering planning should supply the technical contributions to the description of the activities required to translate stakeholder requirements into project deliverables and activities to be carried out that will help ensure products are delivered as specified in an agreement, i.e., that a project includes all the work required, and only the work required, to complete the project and product successfully.

e) To support project scoping, systems engineering typically defines a hierarchy for the project's system-of-interest and establishes a related SBS.

f) All aspects of process tailoring and project planning should account for the type of project, systems, technologies, potential resources, and staffing that are expected to be encountered on the project.

g) The development of the project scope statement should allow for an iterative agreement process to be employed throughout the project life cycle. An initial scope statement is usually based on stated or elicited customer/user requirements, but risks, changes in stakeholder requirements, environment, project budget and schedule, and an evolving design make it necessary to continually reassess and reaffirm agreements and commitments, and make appropriate changes to the project scope statement, as required. Systems engineering planning should provide appropriate technical input to support determining the feasibility of the planned project processes to help ensure personnel, materials, facilities, System/Software Engineering Environment, and technology required to execute and manage the project are available, adequate and appropriate; and the predetermined times for completion are achievable, timely and economical. The results from these feasibility analyses could cause an adjustment to the initial project scope statement. Multiple iterations may be required to achieve a good fit between the project scope statement and the internal project and technical plans and processes.

h) Planning the scope of the project may be difficult when a new project has unprecedented elements. For such a project care should be taken to help ensure it is properly scoped and monitored. The organization's risk management process should identify detailed mitigation plans, if it is determined that additional risk exists due to the unfamiliar project. Often specialty engineering studies or activities are conducted to identify or help control project risks in unprecedented situations.

i) ISO 10006:2003 provides guidelines for project managers to help ensure proper quality of their project's products and services.

j) Project planning should include selection of a life cycle model that is appropriate to the project. The organization typically defines and provides potential life cycle policies, processes, models, and procedures to projects via the Life Cycle Model Management process. Technical planning should ensure that the system life cycle considerations and needs, which are within the project's purview, are addressed.

Incremental and evolutionary types of life cycle models should be considered. Some type of evolutionary model is appropriate when the requirements are not well understood at project initiation. Even when the requirements are relatively well understood, an incremental life cycle model (with more than one iteration) is often preferable over a waterfall life cycle model.

k) The planning process should include the allocation of activities and tasks with established completion criteria to the program organizational elements. This facilitates determination if a project, an organizational element, an activity or task has reached successful completion.

l) A project should have one master plan. Subordinate plans should be integrated and consistent with the master plan. This is commonly called an Integrated Master Plan (IMP).

m) A project should have one master schedule. Subordinate schedules should be integrated and consistent with the master schedule. This is commonly called an Integrated Master Schedule (IMS). Often subordinate technical schedules are used to control the systems engineering effort and teams.

n) A Work Breakdown Structure (WBS) is commonly used to effectively measure project progress and to provide visibility into processes and products. The PMBOK® Guide strongly recommends a WBS technique because it organizes and specifies the total scope of the project. The WBS should be constructed to allow a project to be managed at the appropriate level of granularity consistent with the size, complexity, criticality and risk of the project.

o) Project planning should make use of multiple cost estimation techniques, including system and software cost models. Project and technical planning should determine the complexity of the system and software products and should develop Measures of Effectiveness (MOEs) with the acquirer.

p) Project planning should determine if the existing organizational infrastructure resources, which are typically supplied through the organization's Infrastructure Management process, are sufficient for project needs, or whether a new or augmented infrastructure is needed. The Acquisition and Supply processes should be used if infrastructure systems need to be obtained.

q) Technical Plans, e.g. the SEMP and its subordinate plans, should be reviewed regularly and updated to be consistent with other project plans, e.g. the PMP. Traceability among key sections of technical plans, e.g. a Statement of Work, PMP, SEMP, IMP, and IMS, should be considered. Required content for a project's SEMP is described in Clause 9.

NOTE See 5.8 for additional guidance for updating Technical Plans.

r) The SEMP and subordinate plans should be placed under configuration control in accordance with the information management strategy determined for project documentation.

s) Project planning should include a mechanism for conflict resolution or escalation so an appropriately authorized level of organizational management is identified to resolve disagreements between the project management and supporting project stakeholders. Technical plans should reference this mechanism.

t) Whenever supporting processes are performed by organizations outside the direct organizational control of the project manager, it is important to realize the existence of two sets of relationships between:

   1) the project manager and the supporting process management, and

   2) the supported and supporting organizational management.

   The project manager should recognize this when considering aspects of planning, implementation, control and reporting through clearly specified technical and management reporting, information flow and dispute resolution. Synchronization of plans may be more difficult under subcontract agreements and tasking, but can be aided by having one master plan.

u) The project should make use of historical project and technical data when developing estimates and plans. The organization should collect, analyze, archive and retrieve project and technical data for process improvement purposes and to support planning and analysis for future projects.

v) When multiple teams from one or more organizations participate in a project, the project manager should integrate these teams by ensuring that each team establishes its charter and shared vision which are aligned with the project's objectives.

w) Systems engineering planning should include activities to resolve issues and resource needs for requirements, interfaces and design with relevant stakeholders.

x) Project planning should include contingency planning for both management and technical issues.

y) Project closeout strategy and planning should address the potential need for proper disposal, or continuing work, responsibilities, or support for project artifacts (including systems or enabling systems) after the project closeout.

## 6.3 Project assessment and control process

### ISO/IEC/IEEE 15288:2015

#### 6.3.2 Project assessment and control process

##### 6.3.2.1 Purpose

The purpose of the Project Assessment and Control process is to assess if the plans are aligned and feasible; determine the status of the project, technical and process performance; and direct execution to help ensure that the performance is according to plans and schedules, within projected budgets, to satisfy technical objectives.

This process evaluates, periodically and at major events, the progress and achievements against requirements, plans and overall business objectives. Information is provided for management action when significant variances are detected. This process also includes redirecting the project activities and tasks, as appropriate, to correct identified deviations and variations from other technical management or technical processes. Redirection may include re-planning as appropriate.

##### 6.3.2.2 Outcomes

As a result of the successful implementation of the Project Assessment and Control process:

a) Performance measures or assessment results are available.

b) Adequacy of roles, responsibilities, accountabilities, and authorities is assessed.

c) Adequacy of resources is assessed.

d) Technical progress reviews are performed.

e) Deviations in project performance from plans are investigated and analyzed.

f) Affected stakeholders are informed of project status.

g) Corrective action is defined and directed, when project achievement is not meeting targets.

h) Project re-planning is initiated as necessary.

i) Project action to progress (or not) from one scheduled milestone or event to the next is authorized.

j) Project objectives are achieved.

**Guidance:**

a) Technical working groups for the evaluation and implementation of key technical aspects of the project should be established and maintained as needed. For example, Interface Control Working Groups (ICWGs) are often formed for evaluation and successful implementation of interface constraints. ICWGs should consist of stakeholders from each organization affected by an interface. ICWGs provide a forum to discuss software and system interfaces, explore options and reach agreement on the best approach for implementing interfaces. ICWG recommendations requiring project changes should be submitted to whatever formal configuration management process the project has implemented (such as a configuration control board) for approval prior to implementation. Interfaces should be specified and controlled as an integral part of technical specification and interface description documents.

b) The project's technical assessment and control plans should contain sufficient activities to provide evidence of departures from planned schedules, resources, or constraints in a timely manner that allows recovery. However it is important to be aware that too much monitoring can be costly and interfere with the ongoing effort.

c) Systems engineering assessment and control tasks should include:

   1) Assessment of review results of products, activities and tasks.

   2) Compliance with project and technical management plans, philosophy, methodology and technology.

   3) Documentation and maintenance of technical plans and commitments.

   4) Satisfaction of requirements.

   5) Assessment of readiness for advancement to the next process, activity or task.

d) Systems engineering stakeholders should participate in critical reviews as identified in the PMP and SEMP. The SEMP should identify an appropriate series of technical reviews, planning to assess system maturity and progress toward project objectives. The PMP and associated plans should be the basis for tracking project processes and activities. A combination of event-driven, risk-driven and schedule-driven criteria may be used to manage review activities.

e) Supporting process activity for a project may occur at the organizational level, or directly within the project team's tailored processes. In either case, project management and systems engineering management should have local control of the supporting process activity that occurs within their purview. Problem or exception reports should be brought to the attention of the project manager for impact analysis on a project's cost, schedule, scope and quality.

f) Evaluation of work-in-progress should be performed by personnel familiar with the project requirements, technologies involved, product requirements, and processes and infrastructure being used. The use of non-advocate reviews, using non-program subject matter experts, should also be considered for complex technical projects to validate internal project evaluations. Management reviews should cover project activities in support of a system life cycle. Top-level reviews should rely heavily on functional/technical level reviews and should be used to form an overall project assessment. Special team reviews of independent reviewers (e.g., Red Teams), are often considered for critical schedule points or when program risk is unacceptable.

g) Where set milestones depend on achievement of technical milestones or upon reports and/or outcomes from any supporting process, the systems engineering manager should report these achievements in an accurate and timely manner in accordance with approved plans. Since it is common for project milestones to be contractually linked to achievement of technical milestones or performance of supporting processes (for example achievement of a particular baseline), it is essential that the plans be synchronized and the project manager be made aware (as soon as possible) of any difficulties experienced by supporting processes in completing assigned tasks.

h) Project and technical management should perform structured reviews of schedule performance that are based on realistic assessment techniques to support an accurate project assessment.

i) Documenting significant issues, action items with assignments and decisions resulting from reviews and evaluations should be required. Action items and significant issues should be periodically assessed and tracked to closure. Identified problems should be entered into a corrective action system.

j) Project and technical management should undertake the identification, documentation and management of interdependencies among project processes.

k) Management review of technical schedule performance should pay particular attention to the progress and technical measures (e.g. MOPs, MOEs, TPMs) set up during project planning.

l) Recovery from a schedule slip should be carefully assessed and should not be expected without a negative impact on performance, cost, risk, or quality.

m) Technical baselines (e.g. requirements, verification) should be regularly reviewed with stakeholders during a project to help ensure conformance with, or adjustment to, the objectives (e.g., cost, schedule and performance).

n) Management should specify and refine techniques to determine progress, so as to allow early detection of cost or schedule overruns.

o) Project management should be responsible for assessing completion of a project and that project requirements, criteria, and procedures have been satisfied. Systems engineering management should ascertain that proper notification of completion of the technical effort is provided to the project manager. This determination should be made when a project's products, processes, activities or tasks have been successfully completed.

## 6.4 Decision management process

### ISO/IEC/IEEE 15288:2015

#### 6.3.3 Decision management process

##### 6.3.3.1 Purpose

The purpose of the Decision Management process is to provide a structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives for a decision at any point in the life cycle and select the most beneficial course of action.

NOTE 1 This process is used to resolve technical or project issues and respond to requests for decisions encountered during the system life cycle, in order to identify the alternative(s) that provides the preferred outcomes for the situation. The methods most frequently used for Decision Management are the trade study and engineering analysis. Each of the alternatives is assessed against the decision criteria (e.g., cost impact, schedule impact, programmatic constraints, regulatory implications, technical performance characteristics, critical quality characteristics, and risk). Results of these comparisons are ranked via a suitable selection model and are then used to decide on an optimal solution. Key study data, (e.g., assumptions and decision rationale) are typically maintained to inform decision-makers and support future decision-making.

NOTE 2 When it is necessary to perform a detailed assessment of a parameter for one of the criteria, the System Analysis process is employed to perform the assessment.

##### 6.3.3.2 Outcomes

As a result of the successful implementation of the Decision Management process:

a) Decisions requiring alternative analysis are identified.

b) Alternative courses of action are identified and evaluated.

c) A preferred course of action is selected.

d) The resolution, decision rationale and assumptions are identified.

**Guidance:**

a) The decision strategy should include identification of decision makers and authorities, decision categories and prioritization. Decision strategy considerations might include:

   1) Implementation options for product functionality requirements.

   2) Specific controls to be applied to the project to avoid excessive process specification.

   3) Entry and exit criteria for life cycle stages.

   4) Critical thresholds (e.g. cost or schedule) for alternatives at which formal trade-off studies are required to support a decision.

   5) Make or buy decisions for components of the product or system to be delivered.

   6) Issues affecting the organization's business objectives.

   7) Categories of risk for which formal mitigation plans are required.

b) Key stakeholders should be involved in the decision management process in order to draw on their experience and knowledge. The roles, responsibilities, and authorities of project stakeholders involved in the decision management process should be specified. The extent of involvement and agreement of stakeholders should depend on the priority or criticality of the decision and should be stated in the strategy.

c) The project manager, systems engineering manager, or other key stakeholder in the decision process, should ascertain that the circumstances and need for a decision are identified. Decisions requests may arise as a result of an effectiveness assessment, an audit report, a technical trade-off, a problem needing to be solved, action needed as a response to risk exceeding the acceptable threshold, a new opportunity or approval for project progression to the next life cycle stage, among other things.

d) Each decision situation should be covered by the decision strategy, and should include desired outcomes and measurable success criteria.

e) For each identified decision situation, the balance of consequences of alternative actions should be evaluated in order to optimize the decision with respect to the evaluation criteria. To avoid unjustified changes, consider the null decision, i.e., keeping the status quo, when evaluating alternatives.

f) The implemented decision recommendations should be monitored to identify and address unanticipated implementation impacts.

g) The records of decisions implemented due both to problems, and to opportunities, should be maintained in a manner that supports auditing and learning from experience.

## 6.5 Risk management process

### ISO/IEC/IEEE 15288:2015

#### 6.3.4 Risk management process

#### 6.3.4.1 Purpose

The purpose of the Risk Management process is to identify, analyze, treat and monitor the risks continually.

The risk management process is a continual process for systematically addressing risk throughout the life cycle of a system product or service. It can be applied to risks related to the acquisition, development, maintenance or operation of a system.

NOTE Risk is defined in ISO Guide 73:2009 as "The effect of uncertainty on objectives". This has an attached NOTE 1, "An effect is a deviation from the expected — positive and/or negative." A positive risk is sometimes commonly known as an opportunity, and addressed within the risk management process.

#### 6.3.4.2 Outcomes

As a result of the successful implementation of the Risk Management process:

a) Risks are identified.

b) Risks are analyzed.

c) Risk treatment options are identified, prioritized, and selected.

d) Appropriate treatment is implemented.

e) Risks are evaluated to assess changes in status and progress in treatment.

**Guidance:**

a) Risk management is a key discipline for making effective decisions and communicating the results within organizations. The purpose of risk management is to identify potential managerial and technical problems before they occur so that actions can be taken that reduce or eliminate the probability and/or impact of these problems should they occur. It is a critical tool for continuously determining the feasibility of project plans, for improving the search for and identification of potential problems that can affect life cycle activities and the quality and performance of products, and for improving the active management of projects.

b) The risk management process uses a structured approach to manage the risks to mitigate the likelihood or impact of potential negative events and to manage opportunities to take advantage of potential positive events for project benefit. Project and technical managers should ensure that risks are communicated clearly among stakeholders and managers so that integrated mitigation plans can be effectively developed, implemented and tracked. Use of a common risk repository or risk tools may facilitate this.

c) Project and technical risk planning should identify analyses necessary to support risk management activities. Analyses should be conducted to allow for timely mitigations and contingency planning. Clause 9 discusses several types of analyses, related to the systems engineering effort that are used in support of risk management. These should be documented in the project's SEMP.

NOTE ISO/IEC 16085:2006 (IEEE Std 16085-2006) defines a process for the management of risk in the life cycle.

## 6.6 Configuration management process

**ISO/IEC/IEEE 15288:2015**

**6.3.5 Configuration management process**

**6.3.5.1 Purpose**

The purpose of Configuration Management is to manage and control system elements and configurations over the life cycle. CM also manages consistency between a product and its associated configuration definition.

**6.3.5.2 Outcomes**

As a result of the successful implementation of the Configuration Management process:

a) Items requiring configuration management are identified and managed.

b) Configuration baselines are established.

c) Changes to items under configuration management are controlled.

d) Configuration status information is available.

e) Required configuration audits are completed.

f) System releases and deliveries are controlled and approved.

**Guidance:**

a) Project management and technical stakeholders, should analyze project product, data and information management needs to determine the process strategy and items that will be subject to configuration management. The configuration management approach should clearly articulate the criteria for selecting configuration items, determination of configuration baselines, control of configuration changes, verification and audit of configuration items and baselines, and status of configuration items. Additional discussion is provided in 9.8.8.3.

b) Configuration identification criteria should be clearly defined and documented. Configuration management is applied to configuration items (CI) as determined by the configuration identification criteria and the process strategy.

c) Rigorous controls should be implemented for the registration, storage, updating, backup and maintenance of artifacts and environments that are subject to configuration management. Consideration should be given to the need to maintain baselines and records after project closure e.g., location, media and length of retention. This would be addressed in accordance with the Information Management process strategy.

d) Additional guidance for technical configuration management process implementation across system life cycle stages is included in Annex B.

NOTE IEEE Std 828-2012, IEEE Standard for Configuration Management in Systems and Software Engineering; ANSI/EIA 649-B-2011, Configuration Management Standard; and ISO 10007:2003, *Quality management systems – Guidelines for configuration management*, are detail level standards that support configuration management planning and execution.

## 6.7 Information management process

**ISO/IEC/IEEE 15288:2015**

**6.3.6 Information management process**

**6.3.6.1 Purpose**

The purpose of the Information Management process is to generate, obtain, confirm, transform, retain, retrieve, disseminate and dispose of information, to designated stakeholders.

Information management plans, executes, and controls the provision of information to designated stakeholders that is unambiguous, complete, verifiable, consistent, modifiable, traceable, and presentable. Information includes technical, project, organizational, agreement and user information. Information is often derived from data records of the organization, system, process, or project.

**6.3.6.2 Outcomes**

As a result of the successful implementation of the Information Management process:

a) Information to be managed is identified.

b) Information representations are defined.

c) Information is obtained, developed, transformed, stored, validated, presented, and disposed of.

d) The status of information is identified.

e) Information is available to designated stakeholders.

**Guidance:**

a) Systems engineering management should be responsible for satisfying communication requirements involving the technical program of the project, including timely technical and progress reporting to stakeholders, promulgation of revisions to plans and work authorization, and deviation reporting and documenting, as necessary.

b) When defining a project’s forms for information representation, technical inputs and considerations for different media should be addressed. Systems engineering documentation commonly involves mixed-media use, such as hard-copy (e.g., paper), electronic files (e.g., word processor outputs), data models (e.g. model-based systems engineering of evolving technical data), physical models (e.g., product mock-ups or prototypes).

c) Project management and technical stakeholders should ascertain that the project's information management process provides adequate protection of customer and other information (e.g. subcontractor and outsourced information) in accordance with customer, agreement terms, and any regulatory or statutory requirements. The process should address the retention, deletion or destruction of information upon the completion of the project, as required.

d) Approved versions of the SEMP and other technical plans and information should be controlled in an information management system and subject to applicable Configuration Management processes to help ensure correct data access and handling.

e) If information provided by the stakeholders or generated during execution of the technical effort is classified, the project's information management process should include the necessary physical protection of the information during both storage and use. It should also ascertain that the information is accessible only to those project personnel and stakeholders who have the required, documented approval(s) for access to the information. Access logs may be implemented to record the access history. Information security treatment is subject to the laws and regulations regarding handling, and may be subject to agreement terms. Project information security aspects are commonly defined at the organizational level with an expectation that organizational level security processes and procedures will be applied to projects. Project management and systems engineering management should document and communicate special information security needs to allow for timely project implementation.

f) At project closure, project information items, including technical records and documents, should be handled according to the project closeout strategy or plan. This typically involves archival, transfer, and or disposal according to laws and regulations, agreement terms and the organization's records management policy.

## 6.8 Measurement process

### ISO/IEC/IEEE 15288:2015

#### 6.3.7 Measurement process

#### 6.3.7.1 Purpose

The purpose of the Measurement process is to collect, analyze, and report objective data and information to support effective management and demonstrate the quality of the products, services, and processes.

#### 6.3.7.2 Outcomes

As a result of successful implementation of the Measurement process:

a) Information needs are identified.

b) An appropriate set of measures, based on the information needs are identified or developed.

c) Required data is collected, verified, and stored.

d) The data is analyzed and the results interpreted.

e) Information items provide objective information that support decisions.

**Guidance:**

a) Measurement supports the management and improvement of processes and products. Measurement is a primary tool for managing system and software life cycle activities, assessing the feasibility of project plans, and monitoring the adherence of project activities to those plans. System and software measurement is also a key discipline in evaluating the quality of products and the capability of organizational processes.

NOTE ISO/IEC 15939:2007 (IEEE Std 15939-2007) contains provisions for measurement which directly support the Measurement process outcomes, activities and tasks as defined in ISO/IEC/IEEE 15288. ISO/IEC 15939 identifies the activities and tasks that are necessary to successfully identify, define, select, apply, and improve measurement within an overall project or organizational measurement structure. It also provides definitions for measurement terms commonly used within the system and software industries.

b) Technical measurement activities should be documented, including the technical elements and processes to be measured, defined repositories, review cycles, and information flows. The project process and SEMP implementation strategies determine appropriate physical location and media (i.e., whether in, or distributed across, the SEMP, a project measurement plan, the PMP, or other information item).

Subclauses 9.8.1, 9.8,2, 9.8,8, and 9.9.1 and 9.9.3 discuss required and recommended measurement-related content for the SEMP.

Additional guidance for measurement process implementation across system life cycle stages is included in Annex B.

## 6.9 Quality assurance process

### ISO/IEC/IEEE 15288:2015

#### 6.3.8 Quality assurance process

#### 6.3.8.1 Purpose

The purpose of the Quality Assurance process is to help ensure the effective application of the organization's Quality Management process to the project.

Quality Assurance focuses on providing confidence that quality requirements will be fulfilled. Proactive analysis of the project life cycle processes and outputs is performed to assure that the product being produced will be of the desired quality and that organization and project policies and procedures are followed.

#### 6.3.8.2 Outcomes

As a result of successful implementation of the Quality Assurance process:

a) Project quality assurance procedures are defined and implemented.

b) Criteria and methods for quality assurance evaluations are defined.

c) Evaluations of the project's products, services, and processes are performed, consistent with quality management policies, procedures, and requirements.

d) Results of evaluations are provided to relevant stakeholders.

e) Incidents are resolved.

f) Prioritized problems are treated.

NOTE Outcomes a through d align with the outcomes of the Quality Management process subclause 4.1, General Requirements of ISO 9001:2008.

**Guidance:**

a) The Quality assurance process helps to ensure approved organizational Quality management process policies, procedures, and requirements are implemented on projects and by project teams. An acquirer, or customer, may also negotiate specific quality management provisions for project implementation into the agreement with a supplier. Project Quality assurance process activities are sometimes documented in a separate plan for quality assurance or in the PMP. Those activities that are integrated with technical efforts should be documented or referenced in the SEMP.

b) Quality assurance evaluation feedback to project management and organizational stakeholders is commonly used to support Project assessment and control or Risk process activities, customer satisfaction and project and organizational process improvement.

c) Although multiple approaches exist to establish independence of quality assurance assessors from evaluation subjects or material, quality assurance activity for a project sometimes originates or is coordinated at the organizational level to promote independence from an organization's projects. In any event, there should be a process to escalate significant quality issues to appropriate organizational stakeholders (e.g. high-level management) if the issues are not addressed at the project level.

# 7 Information items

The project shall produce the following information item – a Systems Engineering Management Plan (SEMP).

The information item shall include the content as defined in Clause 9.

NOTE 1 The content provisions in Clause 9, address the generic content elements for an information item of type plan as described in ISO/IEC/IEEE 15289.

The management of the information item shall be performed by applying the Information Management process of ISO/IEC/IEEE 15288. The project's information management strategy should be coordinated with the knowledge management strategy to help ensure that any organizational requirements for knowledge assets are addressed.

NOTE 2 ISO/IEC/IEEE 15289 provides more information on information item description, and the management of information items and documents, as discussed in subclause 5.7 of this part of ISO/IEC/IEEE 24748.

# 8 Guidelines for information items

## 8.1 Introduction

Clause 8 provides an organization with guidance and a common SEMP format to support the required SEMP content as specified in Clause 9. Typically, a project establishes a project-specific engineering plan which identifies applicable data for each system life cycle stage in the scope of the project and uses it to guide and track systems engineering activities. The project-specific engineering plan should be compliant with project management plans; organizational plans, capabilities, and constraints; and customer expectations.

Since each project may have unique life cycle dimensions, tolerance for risk, and need for data, the SEMP should be adapted for each application.

NOTE ISO/IEC/IEEE 15289, provides guidance on identifying and planning the specific information items to be produced during systems and software life cycles.

This Clause elaborates on the project planning activity necessary to develop a SEMP.

Besides the process requirements and guidance previously cited in ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 16326, additional detailed guidance that will support the project planning and adaptation of ISO/IEC/IEEE 15288 for SEMP development is provided in ISO/IEC TR 24748-1 and ISO/IEC TR 24748-2 and other standards discussed in this Clause.

Most of the foundational activity to adapt ISO/IEC/IEEE 15288 for organizational process development or to create the project's PMP should have previously occurred or may be on-going in parallel with SEMP development. Since accomplishment of these tasks contributes to successful SEMP development, they are highlighted in this Clause with references to the standards that contain detail descriptions for their implementation.

ISO/IEC TR 24748-1 and ISO/IEC TR 24748-2 provide high level and detailed guidance on the application of ISO/IEC/IEEE 15288, including definition or expansion of important organization, project, process, and life cycle model concepts and their adaptation for successful project implementation. ISO/IEC TR 24748-1 and ISO/IEC TR 24748-2 also identify plans and reviews commonly used across a systems life cycle. ISO/IEC TR 24748-2 provides guidance on applying ISO/IEC/IEEE 15288 from the aspects of strategy, planning, application in organizations, and application on projects. ISO/IEC TR 24748-2, Annex A contains informative notes for the application of each of the ISO/IEC/IEEE 15288 processes, while ISO/IEC TR 24748-2, A.4 contains specific notes for Project Planning process application including a checklist for engineering plan information content.

ISO/IEC/IEEE 16326 provides normative content specifications for project management plans covering software projects, and software-intensive system projects. It also includes detailed discussion and advice on applying the Technical Management processes of ISO/IEC/IEEE 15288 to aid in the preparation of the normative content of project management plans.

ISO/IEC/IEEE 29148 provides guidance for the execution of the ISO/IEC/IEEE 15288 (and ISO/IEC 12207) processes that deal with requirements engineering. ISO/IEC/IEEE 29148 specifies required information items to be produced in support of requirements engineering processes and provides normative content definition and recommendations for the format of the resulting documentation or information products. ISO/IEC/IEEE 29148 also discusses reviews, audits, baselines, measurement and other mechanisms for managing requirements as they evolve.

ISO/IEC/IEEE 42010 provides guidance for the execution of the ISO/IEC/IEEE 15288 processes that deal with architecture and design. ISO/IEC/IEEE 42010 addresses the creation, analysis and sustainment of architectures of systems through the use of architecture descriptions. ISO/IEC/IEEE 42010 provides concepts, guidance and specifies required content for architecture viewpoints, frameworks, and description languages, which may be used to support the architectural definition of systems.

ISO/IEC 15939 defines a measurement process applicable to system and software engineering and management disciplines. It identifies the activities and tasks that are necessary to successfully identify, define, select, apply, and improve measurement within an overall project or organizational measurement structure.

ISO/IEC 16085 defines requirements and guidance in a continuous process for systematically addressing risk throughout the life cycle of a product or service.

## 8.2 Adaptation of ISO/IEC/IEEE 15288

Based on the previously described concepts in Clause 5, ISO/IEC TR 24748-1 explains how to apply ISO/IEC/IEEE 15288 (and ISO/IEC 12207) for the creation of life cycle models that are meaningful to an organization and for implementation on a project. ISO/IEC TR 24748-1, Clause 6 makes a distinction between process tailoring and adaptation. The clause points out that tailoring is only one of five mechanisms for adaptation of ISO/IEC/IEEE 15288 (and ISO/IEC 12207) processes. Tailoring processes according to ISO/IEC/IEEE 15288 may involve the deletion of selected outcomes, activities, or tasks, where adaptation also entails process selection, process substitution (of ISO/IEC/IEEE 15288 processes for ISO/IEC 12207 processes declared as 'specializations' of those in ISO/IEC/IEEE 15288), use of outcomes or use of notes to populate a life cycle model.

ISO/IEC TR 24748-1 also describes six steps in this adaptation sequence and provides additional guidance for their performance. The steps include:

a) Identify the project environment and characteristics;

b) Solicit inputs;

c) Select the appropriate standards;

d) Select life cycle model;

e) Select stages and processes;

f) Document the adaptation decisions and rationale.

ISO/IEC TR 24748-2, Clause 5 cites and further expands the guidance from ISO/IEC TR 24748-2-1 for the application of ISO/IEC/IEEE 15288. This provides a detailed discussion of a five step application strategy. These steps include:

a) Plan the application;

b) Adapt ISO/IEC/IEEE 15288;

c) Conduct pilot project(s);

d) Formalize the approach;

e) Institutionalize the approach.

ISO/IEC TR 24748-2, 5.3 continues with explanation for application of ISO/IEC/IEEE 15288 in organizations and follows with subclause 5.4 to further detail application on projects. The subclauses dealing with project application provide additional guidance on each of the agreement processes and technical processes in ISO/IEC/IEEE 15288. ISO/IEC/IEEE 16326 contains additional detailed discussion and application advice on the Technical Management processes of ISO/IEC/IEEE 15288.

ISO/IEC 24748-2, 5.4.4 describes process application in life cycle models and discusses organizational and engineering views of a system life cycle. The organizational view covers general discussion, types of systems, risks and opportunities for different life cycle approaches including sequential, incremental and evolutionary. The engineering view discusses engineering across the life cycle and application of the "Vee" model at various levels of the system structure in each stage. This section also describes two types of configuration audits, and identifies common technical reviews (e.g. concept, baseline, design, test) for coordinated use with appropriate engineering views.

ISO/IEC TR 24748-2, Annex A contains notes that are intended to help in the application of ISO/IEC/IEEE 15288 process activities and tasks to realize the outcomes of each process. These notes are cross-referenced with the appropriate clauses in ISO/IEC/IEEE 15288. In addition, and of particular interest to this standard, ISO/IEC TR 24748-2, Table A.8 contains application notes for the Project Planning process including a checklist for the content of an engineering plan (also known as a SEMP).

In performing the six step life cycle model adaptation strategy as described in ISO/IEC TR 24748-1, it is important to note the expanded guidance supplied by ISO/IEC TR 24748-2. In this part of ISO/IEC/IEEE 24748, Annex B — SEMP considerations for system life cycle stages, provides guidance on how the SEMP should be developed or modified, depending on the system life cycle stage or stages encountered on the project.

When selecting life cycle model stages and processes for stage population, also consider the next lower tier of standards named directly in ISO/IEC/IEEE 15288, and those added to the harmonized set after the last publication of ISO/IEC/IEEE 15288. Key standards previously noted for consideration expand on ISO/IEC/IEEE 15288 processes, information items, and guidance. These include: ISO/IEC/IEEE 16326 for project management, ISO/IEC 16085 for risk management, ISO/IEC 15939 for measurement, and ISO/IEC/IEEE 29148 for requirements engineering. Other standards may be added for concurrent review based on organizational or project needs (e.g. organizational process improvement purposes, life cycle model stage to be supported, product or service domain to be supported). Some of these may include ISO/IEC 42010 for architectural description, ISO/IEC 15026 for information assurance, ISO/IEC 27001 for security techniques, ISO/IEC 20000 for service management, ISO 9000 for quality management, ISO/TR 18529 for human-centred processes like usability. A project should be able to draw on existing process assets from their governing organizational structure for implementation of the essential and frequently used domain standards for adaptation efforts. If not, then the project team may seek to obtain suitable standards for potential adaptation, or may look to develop suitable processes for use in the project's SEMP.

It is likely that even in the earliest stages of a project's life some form of these processes may be in use or draft versions of required information items may exist (e.g. continuing from a proposal period for the system prior to agreement with actual project funding and initiation, or perhaps in the transfer of a system in development or an operational system to a new party). These types of situations should factor into a project's development of a new SEMP or update of an existing SEMP. Any such existing material should be evaluated for contribution to, or incorporation in, the SEMP. If this material is not readily available (e.g. in situations involving transfer of work across unrelated organizations), consider formally requesting its transfer.

### 8.3 Elements of the SEMP

Table 2 provides an annotated outline and example format for a SEMP. Required SEMP content is described in Clause 9.

NOTE Although Clause 8 is identified as only guidance, additional detail from ISO/IEC/IEEE 15289 regarding information items is repeated here for emphasis: This Clause is not intended to address all possible information item contents, or to mandate the title of the information item, nor the order or titles of the sections.

**Table 2 — Example outline for a SEMP**

| Example SEMP outline | Example SEMP clause title | SEMP content requirements in Clause 9 | Annex A guidance - Corresponding PMP elements |
|---|---|---|---|
| | Front matter | 9.2 | |
| 1 | Technical project summary | 9.3 | |
| 1.1 | Purpose, scope and objectives | 9.3.2 | |
| 1.2 | Assumptions and constraints | 9.3.3 | |
| 1.3 | System description | 9.3.4 | |
| 1.4 | Schedule and budget summary | 9.3.5 | |
| 2 | References | 9.4 | |
| 3 | Definitions | 9.5 | |
| 4 | Technical project organization | 9.6 | Table A.1 |
| 5 | Planning for the technical definition | 9.7 | |
| 5.1 | Process definition | 9.7.2 | Table A.1 |
| 5.1.1 | Project process model – Technical view | 9.7.2.1 | Table A.1 |
| 5.1.2 | Life cycle development models | 9.7.2.2 | Table A.1 |
| 5.1.2.1-n | Provides key process implementation descriptions (technical and other) for the applicable stage | 9.7.2.2 | See Clause 8.2 and Annex B |
| 5.2 | Infrastructure planning | 9.7.3 | Table A.1 |
| 5.2.1 | Technical impacts | 9.7.3.1 | Table A.1 |
| 5.2.2 | Methods, tools and techniques | 9.7.3.2 | Table A.1 |
| 5.3 | Technical project planning | 9.7.4 | Table A.2 |
| 5.3.1 | Resource planning | 9.7.4.2 | Table A.2 |
| 5.3.2 | Technical cost and schedule estimation | 9.7.4.3 | Table A.2 |
| 5.3.3 | Integrating the technical effort | 9.7.4.4 | |
| 5.4 | Technical project execution and control | 9.8 | |
| 5.4.1 | Performance assessment and control | 9.8.1 | |
| 5.4.2 | Measurement | 9.8.2 | Table A.5 |
| 5.4.3 | Quality Assurance | 9.8.3 | Tables A.3, A.5 |
| 5.4.4 | Reviews and audits | 9.8.4 | Table A.5 |
| 5.4.5 | Subcontractor management | 9.8.5 | Table A.3 |
| 5.4.6 | Project management controls | 9.8.6 | Table A.3 |
| 5.4.7 | Technical project closeout | 9.8.7 | Table A.3 |
| 5.5 | Technical baseline management | 9.8.8 | |
| 5.5.1 | Requirements management | 9.8.8.2 | Table A.3 |
| 5.5.2 | Configuration management | 9.8.8.3 | Table A.5 |
| 5.5.3 | Information management | 9.8.8.4 | Table A.5 |
| 5.5.4 | Integrated Repository | 9.8.8.4.1 | |

| Example SEMP outline | Example SEMP clause title | SEMP content requirements in Clause 9 | Annex A guidance - Corresponding PMP elements |
|---|---|---|---|
| 5.5.5 | Documentation and data management | 9.8.8.4.2 | Table A.5 |
| 5.6 | Supporting processes | 9.9 | |
| 5.6.1 | Decision management | 9.9.2 | Table A.5 |
| 5.6.2 | Risk management | 9.9.3 | Table A.5 |
| 5.6.3 | Communications | 9.9.4 | Table A.5 |
| 5.6.4 | Verification and validation | 9.9.5 | Table A.5 |
| 5.7 | Specialty engineering activities and plans | 9.10 | Tables A.1, A.4 |
| | Annexes | | |

The ordering of elements presented in Table 2 is not meant to imply that the clauses and subclauses are developed in that order. The order of elements is intended for ease of reading, presentation, and use, and not as a guide to the order of preparation of the various elements of the SEMP. The content of the various clauses and subclauses of the SEMP may be included by direct incorporation or by reference to other plans and documentation.

If separate documents are chosen for the technical planning, for example, in a two party situation where a Systems Engineering Plan (SEP) is used for the acquirer or customer project management office responsibilities and a “SEMP” is used for a contractor effort, the documents should have a common systems engineering thread, linking the technical planning from the project management office down to the lowest level supplier. Essentially, there should be a “shared vision” across the project for the overall technical planning effort, regardless of how many documents contain that shared vision.

The length of the document will vary by project scope, maturity, and risk. It should cover the overall technical planning effort for the project and may cite subordinate plans when the project determines that additional planning detail is required. It should provide only as much detail as is required to convey to project stakeholders what the operational plan is for the technical management of the project. There should be sufficient detail for the reader to understand who does what, when, how, and where—and what control mechanisms are used to manage it all. However, if a PMP for the project does not exist, or the content information as cited from ISO/IEC/IEEE 16326, under Clause 9 does not already exist, it should be created during the project's development of the SEMP.

# 9 Information item content

## 9.1 General

This Clause states the normative content of the required information item, the SEMP.

The SEMP shall be prepared and updated as necessary throughout the life of the project to guide and control the technical efforts of the project. The SEMP should reflect an integrated technical management effort that addresses significant factors associated with meeting the project's system life cycle requirements. If an evolutionary or incremental development strategy is to be pursued, the SEMP should address the development strategy for initial product development and insertion of incremental capability or technology enhancements.

ISO/IEC/IEEE 16326 specifies required content and format for project management plans covering software projects, and software-intensive system projects. The SEMP is the key project plan for managing the technical effort, and as previously stated in this part of ISO/IEC/IEEE 24748, 5.8 SEMP development concepts, SEMP development is tightly coupled with PMP development and content.

The following subclauses identify topical content that shall be addressed by the SEMP. The text indicates whether a topical discussion should be in the SEMP, or is likely found in other documentation, where a systems engineering technical contribution should be made, or if just a reference or link should be made to other documentation to promote integration of the technical planning effort with other project efforts. In any event, the consideration of the topical content and potential systems engineering contribution is of importance; the media and location of the information or discussion should be implemented in accordance with applicable organizational and project information and documentation management strategies and procedures.

## 9.2 Front matter

Each version of a SEMP based on this part of ISO/IEC/IEEE 24748 shall contain front matter. Front matter should include:

a) a title section, which typically contains title summary information such as the date of issue, a unique identifier (e.g., draft number, baseline version number), identification of the issuing organization, and if applicable, agreement identification and statement of any limitations on distribution;

b) an approval section, which typically contains the written or electronic signature(s) of the stakeholder(s) responsible for approving the SEMP, or indication by other recognized approval mechanism;

c) a revision section or change history, which typically includes the project name, version number of the plan, date of release, an indicator of modified content (e.g. pages, clause numbers) in the current version of the plan, a brief statement describing the nature of changes incorporated into this version of the plan, and a list of version numbers and dates of release of all previous versions of the plan;

d) a table of contents;

e) a list of figures that appear in the SEMP; and

f) a list of tables that appear in the SEMP.

Front matter may also include a preface, which briefly describes the purpose, scope and context of the SEMP and identifies the intended audience for the SEMP. If such a preface is not included as front matter, this content should be incorporated into the introduction in the body of the SEMP.

## 9.3 Technical project summary

### 9.3.1 General

Technical project summary information shall be incorporated into the SEMP.

### 9.3.2 Purpose, scope and objectives

The SEMP shall identify the purpose, scope, and objectives of the project and the products to be delivered in terms of the systems engineering or technical effort.

A statement of purpose shall be provided that describes the relationship of this project to other projects, and, as appropriate, how this project will be integrated with other projects or ongoing work processes.

The SEMP should provide a brief statement of the business or system needs to be satisfied, with a concise summary of the project systems engineering objectives, the products to be delivered to satisfy those objectives, and the methods by which satisfaction will be determined.

The project scope shall be identified, defining the work that must be performed to deliver the product, and any specified features and functions. Significant considerations of scope or objectives that are to be excluded from the systems engineering product or effort should also be indicated.

A reference to the official statement of product requirements shall be provided (e.g., a statement of work).

NOTE Do not replicate information found in the PMP beyond that necessary to provide a brief overview of the project. Reference the PMP for more detailed information on the project description, purpose, scope, and objectives.

#### 9.3.3 Assumptions and constraints

The SEMP shall describe the project assumptions on which the systems engineering effort is based and shall identify imposed constraints on project factors such as the schedule, budget, resources, software to be reused, acquirer software to be incorporated, technology to be employed, and product interfaces to other products.

#### 9.3.4 System description

The SEMP shall provide a description of the system. The description shall include the major elements as the solution evolves.

The SEMP shall identify the work products that will be delivered to the acquirer, and should also identify significant work products that are deliverables internal to the project team, such as results from one project stage that are used by a subsequent stage. The list of project deliverables may be incorporated directly or by reference to the PMP or other external documentation such as a statement of work, contract data requirements list, a product parts list, or a baseline.

This system description paragraph should at a minimum contain the following: a description of the system, with its major system elements; description of the system's intended use; and a description of the system architecture. Use of available graphics or other media to convey description context, is encouraged.

#### 9.3.5 Schedule and budget summary

The SEMP shall include a brief summary of the schedule and budget for the project. The level of detail should be restricted to an itemization of the major work activities and supporting processes. Depicting the top level WBS for the project's duration highlighted with key milestones of the systems engineering effort provides one example.

### 9.4 References

The SEMP shall identify referenced material. A complete list of documentation and other sources of information that are referenced in the SEMP should be provided. Documentation should be identified so that it may be located, for example by title, report number, date, author, media reference, e.g. path/name for electronic access, and publishing organization. Other sources of information, such as electronic files, should be labelled using unique identifiers, such as date and version number.

Document relationships and order of precedence should be discussed if they impact team decisions. Sometimes a document hierarchy/tree and order of precedence is provided in the SEMPS's reference clause. Otherwise document relationships should be described later with regard to information management.

### 9.5 Definitions

The SEMP shall define, or provide references to documents containing the definition of those terms and acronyms required to properly understand the SEMP.

### 9.6 Technical project organization

The SEMP shall provide a summary description of the project organization including major subcontractors and teammates where they play significant roles in the systems engineering effort. The SEMP shall describe the systems engineering team, their roles, responsibilities and authorities, and how the team relates to internal and external entities.

The PMP is typically the document of record for project organization information and identifies interfaces to organizational entities external to the project, describes the project's internal organizational structure, and defines roles and responsibilities for the project. This record should be referenced by this Clause in the SEMP.

NOTE This information is often implemented in separate documentation media since it is commonly referenced by most project plans and the content may change frequently.

## 9.7 Planning for technical definition

### 9.7.1 General

The SEMP shall describe the project management planning and control processes applied to the technical effort.

The SEMP shall specify the technical management planning and control processes that are needed to achieve the systems engineering objectives. The PMP typically specifies the project management processes that are applicable across the project. These clauses that are documented in the SEMP should reference the related provisions in the PMP (or other project documentation) and should be consistent with the statement of project scope and project initiation plans, project work plans, project acquisition and supply plans, project assessment and control plans, and project closeout plans of the PMP.

Annex A contains a summary description of the typical corresponding foundational material that is expected to exist at the PMP level. ISO/IEC/IEEE 16326 contains more detailed description for each of these project management plans or plan elements.

Most of the following Project context and planning requirements are applicable considerations for technical planning and SEMP development, but much of this information description should remain at the PMP level with contributions from the engineering stakeholders. The level of supplemental discussion appropriate in the SEMP depends on the implementation detail pertinent to ongoing and upcoming systems engineering efforts. For example, key planning and related controls for complex system or enabling system engineering activities would likely be detailed by the engineering technical management, with related description in the SEMP and integrated with the overall project planning and control activities.

### 9.7.2 Process definition

#### 9.7.2.1 Project process model – Technical view

The SEMP shall provide a description, or reference to, the process model description that is applicable to the technical effort.

A brief description of the project process model with focus on the systems engineering aspects should be placed in the SEMP and the detail process model discussion from the PMP, or other documentation, should be referenced by the SEMP. See Table A.1 for typical PMP Process Model description.

A combination of graphical and textual notations may be used to describe the process model. Any adaptation of the project's process model should be indicated in this subclause.

#### 9.7.2.2 Life cycle development models

The overall Project Life Cycle model should be described in the PMP. The SEMP should reference the PMP discussion and should describe any additional contextual information about application of the model to the systems engineering effort.

The SEMP should include the description of the strategy for application of ISO/IEC/IEEE 15288. The SEMP should briefly discuss the life cycle model definition, stages and processes that are relevant for this project and should identify those that are described in detail in the SEMP.

NOTE Concepts for development of life cycle model stage and process information are discussed in Clause 5 and application guidance is discussed in Clause 8. Annex B provides guidance on how the SEMP should be modified, depending on the system life cycle stage or stages encountered on the project.

The SEMP’s description should provide enough detail regarding the stage implementation to successfully coordinate the technical effort and achieve technical goals. At a minimum the SEMP should contain the required outcomes, key process descriptions, activities, documentation, and reviews to be conducted.

The process descriptions for discussion in the SEMP should include, but are not limited to, technical processes and specialty engineering processes or procedures that are within the scope of the systems engineering effort and of the stage. Processes that are invoked, but not a key focus for the implementation can be described in less detail. Although process selection and description is to fulfil needs of a technical effort, any key processes should be described. For example, potential new enabling system alternatives may require objective evaluation by the project's engineering team to recommend selection, thus involving the decision management process and trade-off procedures. Selection may be followed by use of the organization's supplier acquisition, procurement and contracting processes, to obtain the recommended selection. Although these are not considered as technical processes, they may require considerable technical team involvement that should be documented in the SEMP. If applicable, the SEMP should describe the plan to develop downstream processes, e.g. the operational readiness and sustainability of a system throughout its life cycle; concept, development, production, utilization, support, and retirement of the system. The SEMP should also describe how life cycle management will integrate logistics support activities in the system development phases to support post-delivery phases of the system life cycle.

### 9.7.3 Infrastructure planning

#### 9.7.3.1 Technical impacts

The SEMP should include a brief description that highlights infrastructure plans of key importance to the technical effort, and the PMP level discussion on infrastructure planning should be referenced or linked from the SEMP. See Table A.1 for typical PMP Infrastructure plan content.

Technical impacts to project infrastructure planning should be addressed during the project planning process and technical planning estimation and integrated into the project's infrastructure plans. The infrastructure needs for the project's systems engineering effort may vary greatly depending on current and expected engineering activity. For example, a collaborative systems engineering support environment is often needed at project initiation, so requirements should be submitted early. Also, secure testing or manufacturing facilities, that need to be procured or built, may be required as part of an enabling system for an upcoming system stage within the project's lifespan. Key infrastructure needs should be determined and tracked. Performance of related risk analyses and monitoring related factors, e.g. slippage of scheduled items on critical path, or failure of a necessary tool, technology or process, contribute to project success.

#### 9.7.3.2 Methods, tools and techniques

The PMP should contain an overview of the methods, tools, and techniques which are applicable across the project; this should be referenced or linked from the SEMP. The SEMP should describe any systems engineering unique set used in support of the deliverable and non-deliverable systems engineering work products along with the implementation details that are pertinent to the project's technical effort. See Table A.1 for typical PMP method, tools and techniques description.

### 9.7.4 Technical project planning

#### 9.7.4.1 General

A high level description is listed for planning each of the following project initiation and work areas: estimation, staffing, resource acquisition, training, work activity, schedule allocation, resource allocation, budget, and procurement. Additional comments for SEMP implementation are listed below each. See Table A.2 for typical PMP plan content description.

The SEMP should reference the PMP and other appropriate plans and information, e.g. IMP, IMS, and WBS. Technical staffing plans, shortfalls, training plans, resource acquisition, work plans and packages should be addressed through supplemental technical planning contributions to existing plans. Efforts that are significant to the technical program should be described in the SEMP.

#### 9.7.4.2 Resource planning

Resource planning should include the following:

a) Estimation plan: project sizing and the cost and schedule for conducting the project.

b) Staffing plan: the number of staff required by skill level, the project phases in which the numbers of personnel and types of skills are needed, and the duration of need. Staffing shortfalls and any need for subcontractor utilization should be identified. Plans for subcontractor selection should be developed.

c) Resource acquisition plan: the plan for acquiring the resources in addition to personnel needed to successfully complete the project.

d) Staff training plan: the training needed to ascertain that necessary skill levels in sufficient numbers are available to successfully conduct the project

Training discussion in the SEMP should identify both internal and external (suppliers/customers) training needed. The SEMP discussion should include analysis of performance or behaviour deficiencies or shortfalls, required training to remedy, and schedules to achieve required proficiencies. SEMP training discussions should reference the PMP or other project training plan documentation as applicable, but systems engineering-unique training requirements should be identified as part of integrating the systems engineering effort, or may be highlighted as a risk.

#### 9.7.4.3 Technical cost and schedule estimation

Technical cost and schedule estimation includes:

a) Work activities: the various work activities to be performed in the project.

   A WBS should be used to depict the work-related tasks or products and the relationships among them. They should be decomposed to a level that exposes any project risk factors and allows accurate estimate of resource requirements and schedule duration.

NOTE The WBS could be task driven or product driven. A product driven WBS aligns with the System Breakdown Structure (SBS).

b) Schedule allocation: provides scheduling relationships among work activities in a manner that depicts the time-sequencing constraints and illustrates opportunities for concurrent work activities

NOTE 1 An IMS is normally maintained as part of (or as an annex to) the PMP. The IMS is oriented to the agreement structure, and includes major project events related to the project team structure and the upper levels of the WBS. The IMS is the controlling project schedule document and represents the baseline used by teams to develop supporting schedules and to implement project tasks. The IMS is a resource loaded schedule integrated with sufficient financial data to facilitate the budget computations and tracking.

NOTE 2 Subordinate schedules are often produced to control and coordinate the systems engineering teams and activities. These address engineering tasks and milestones in greater detail than in the summary IMS, while minimizing the representation of non-engineering tasks and milestones to de-clutter the schedule presentation.

   If the SEMP includes subordinate technical schedules, the critical path methodology and criteria for event transition that is used to derive the master schedule and supporting systems engineering schedules and their structure, should be included. It includes a description of the approach and methods planned to update and maintain both the master schedule and the detail schedule.

c) Resource allocation: provides a detailed itemization of the resources allocated to each major work activity in the project WBS.

   The SEMP discussion on resource allocation should also describe the method of resource allocation to technical tasks, including: resource requirements identification, procedures for resource control, and reallocation procedures.

d) Budget: provides a detailed breakdown of necessary resource budgets for each of the major elements in the WBS.

e) Procurement: lists the goods and services that will be purchased for the project and how they will be obtained.

The SEMP should identify and track key procurement items that are critical to the attainment of systems engineering goals. These are commonly the focus of risk analyses.

#### 9.7.4.4 Integrating the technical effort

The SEMP shall describe how the various inputs into the systems engineering effort will be integrated and how systems engineering teams will be defined and managed to integrate appropriate disciplines into a coordinated systems engineering effort to meet cost, schedule, and performance objectives. The SEMP should provide a brief description of the approach and methods planned to help assure integration of the engineering specialties needed to meet project objectives. The SEMP should include the following descriptions:

a) How the organizational structure will support management of subcontractors or other team members

b) The composition of teams organized to support a specific element of the SBS

c) Major responsibilities and authority of team members. This description should include present and planned project technical staffing. The description may also include planned personnel needs by discipline and performance level, human resource loading, and identification of key personnel.

d) The approach and methods for any systems engineering integration tasks to be implemented, such as technology verification, process proofing, fabrication of engineering test articles, development test and evaluation, implementation of software designs for system products, and customer and supplier engineering and problem-solving support. This description should include an articulation of the required support team.

## 9.8 Technical project execution and control

### 9.8.1 Performance assessment and control

The SEMP should describe the performance and control processes that are applied to the systems engineering effort.

The SEMP should reference or specify the procedures necessary to assess and control the product requirements, the technical project scope, schedules, budgets, and resources, the quality and timeliness of acquired products from subcontractors, and the quality of work processes and work products. The elements of the technical control plan should be consistent with the project's standards, policies, and procedures for project control as well as with any agreements for project control.

The main discussion of project assessment and control should remain at the PMP level. Separate plans, e.g. measurement plan and quality assurance plan, are commonly developed to support control. The PMP commonly references these supplemental plans and periodic monitoring of measurements and key milestones indicate when management action is needed.

The SEMP should reference or describe methods, models and techniques that are used to support performance assessment and control. For example, the PMP should provide the descriptions of any life cycle cost models or techniques (e.g. design-to-cost or cost as an independent variable) which may be in use on the project.

The SEMP should describe how these models and techniques are being implemented in support of decision analyses and how their results are monitored for technical management. The discussion should identify the technical focal point, how cost targets are devolved to project teams, and how cost is managed and status determined.

The SEMP should describe the technical objectives related to success of the project, system, and system effectiveness e.g., customer MOEs. Technical objectives may include those related to the system and enabling systems. The discussion should include system performance parameters, and sustainment performance parameters for both the primary and enabling systems. If applicable, reference thresholds and objectives for each to establish the trade space throughout the entire system life cycle.

A high level description is listed for each of the following plans that support project assessment and control: measurement, quality assurance, subcontractor management, reviews and audits, scope change control, schedule control, budget control and project closeout. Additional comments for SEMP implementation are listed below the plan. See Table A.3 and Table A.5 for typical PMP plan content description.

### 9.8.2 Measurement

Measurement plan: specifies the methods, tools, and techniques to be used in collecting and retaining project measures.

The SEMP provides discussion of measures, tools, techniques and measurement specifications that are used for technical management and control in the systems engineering program.

Technical Performance Measures (TPMs) are key indicators of system performance. Selection of TPMs is usually limited to critical Measures of Performance (MOPs) that, if not met, put the project at cost, schedule, or performance risk.

For technical performance measurement, the SEMP should describe the approach and methods to identify, establish, and control key technical parameters (limited to those that are critical and/or identified by the stakeholders). Measurement specifications should include the thresholds, methods of measuring and tracking, update frequencies, level of tracking depth, and response time to generate recovery plans and planned profile revisions. Described parameters should include identification of related risks. The TPM discussion should describe the relationship between the selected parameter and lower-level parameters that must be measured to determine the critical parameter achievement value, which is often depicted in the form of tiered dependency trees and reflects the tie in to the related system performance requirement (critical parameter). The discussion should include definition of the correlation of each parameter in the dependency tree to a specific SBS element.

### 9.8.3 Quality assurance

Quality assurance plan: specifies the mechanisms to be used to measure and control the quality of the work processes and the resulting work products. The quality assurance plan shall include provisions for vendor evaluation and control. Quality control mechanisms may include quality assurance of work processes, verification and validation, joint reviews, audits, and process assessment.

In the SEMP, reference the PMP, or the project's quality assurance plan, or describe the quality assurance process and activities in place to support the systems engineering effort. Quality assurance activity participation in analysis, inspections, reviews, audits, and assessments should be identified in the SEMP. The quality assurance plan should indicate the relationships among the quality assurance, verification and validation, review, audit, information management, configuration management, system engineering, and assessment processes.

### 9.8.4 Reviews and audits

Reviews and audits: specify the schedule, resources, and methods and procedures to be used in conducting project reviews and audits.

The SEMP should reference the PMP level description of project reviews and audits and should describe the technical reviews and/or audits for system and enabling system components applicable to the level(s) of engineering covered by the SEMP. The SEMP should include the approach and procedures planned to complete identified reviews and/or audits, and should also describe the tasks associated with the conduct of each review, including roles, responsibilities of personnel involved and any necessary procedures (e.g., specific review criteria, action item closeout procedures, or steps to provide objective evaluation). The SEMP should include a description of how conformance with the tasking activity engineering plan/master schedule and/or this engineering plan and enterprise master schedule will be determined, and how the discrepancies identified as not meeting engineering plan/master schedule requirements will be handled.

Some commonly required reviews and audits include: system requirements review, preliminary design review, critical design review, peer reviews, interface control working group reviews, technical interchange meeting reviews, and functional and physical configuration audits.

NOTE 1 Guidance for reviews and audits is available from multiple sources. Many overlap and some, e.g. ISO/IEC TR 24748-1, stress that they are generic in nature with no intent to imply that any particular review is required on a project.

NOTE 2 ISO/IEC/IEEE 29148 provides information on reviews for validating requirements.

NOTE 3 ISO/IEC TR 24748-1, Annex B provides guidance on Candidate Joint reviews and rationale (e.g. to resolve open issues or reach other decisions or agreement). Some of these reviews include: Project plan, test plan, system operational concept, system and software requirements and design, critical requirements, test readiness, usability and maintenance.

NOTE 4 ISO/IEC TR 24748-2, 5.4.4.3.2 provides expanded guidance and rationale on eight technical reviews. Their listed rationale shows meaningful application at various levels in the system structure or to satisfy a need at a particular point in the evolution of the system. Subclause 5.4.4.3.3 contains guidance on two types of Configuration Audits, functional and physical.

NOTE 5 IEEE Std 15288.2:2015 provides guidance on military technical reviews and audits for defence programs.

### 9.8.5 Subcontractor management

Subcontractor management plans: contain plans for managing any subcontractors that may contribute work products to the project.

The SEMP describes the technical control of suppliers and vendors. This includes the approach and methods to devolve requirements, manage interfaces, control quality, build long-term relationships, and assure participation on integrated teams.

### 9.8.6 Project management controls

The SEMP should reference and be consistent with the following control plans in the PMP:

a) Scope change control plan: describes how to detect activities out of the project's scope and the actions that are to be taken if such activities are found or requested.

b) Schedule control plan: specifies the control mechanisms to be used to measure the progress of work completed at the major and minor project milestones, to compare actual progress to planned progress, and to implement corrective action when actual progress does not conform to planned progress.

c) Budget control plan: specifies the control mechanisms to be used to measure the cost of work completed, to compare planned cost to budgeted cost, and to implement corrective action when actual cost does not conform to budgeted cost.

### 9.8.7 Technical project closeout

Project closeout plan: contains the plans necessary to help ensure orderly closeout of the project.

Key closeout items from the technical program should be addressed in the SEMP or in the project's closeout plan. This might include appropriate transfer of continuing work or responsibilities for the system or enabling systems, the archival or disposal of technical project materials, lessons learned report and analysis of technical objectives achieved, or items required per agreements.

### 9.8.8 Technical baseline management

#### 9.8.8.1 General

A high level description is listed for each of the following plans that support technical baseline management: requirements management, configuration management, information management and data-documentation management. Additional comments for SEMP implementation are listed below the plan. See Table A.3 and Table A.5 for typical PMP plan content description.

#### 9.8.8.2 Requirements management

Requirements management plan specifies the control mechanisms for measuring, reporting, and controlling changes to the product requirements, plus assessing the impact of requirements changes.

The SEMP should describe how requirement baselines will be established and managed. The description should include: the procedures for controlling the development, approval and incorporation of requirement changes; how the internal and external transfer functions are defined and controlled; and how interfaces (internal and external) are defined and documented.

The SEMP should identify how requirements traceability will be implemented. This discussion should include topics such as the traceability between system life cycle process activities, SBSs, and correlation, as pertinent, with the master plan and technical schedules. This interrelationship of requirements traceability with data management and the integrated repository should also be described.

NOTE 1 ISO/IEC/IEEE 29148, 6.5 provides guidance on requirements management, including an overview and discussion of change management and requirements measurement. This clause also identifies common baselines for requirements management as the functional, allocated, developmental, and product baselines.

NOTE 2 Similarly, ISO/IEC TR 24748-2, 5.4.4.3 discusses requirements baselines in light of the engineering view of processes in a life cycle model.

#### 9.8.8.3 Configuration management

Configuration management planning: contains the configuration management plan for the project, including the processes, procedures, methods and tools that are used to provide configuration identification, control, status accounting, evaluation, and release management.

The SEMP should reference the PMP or other project configuration management plan documentation and should describe how the configuration management plan for the project is used to manage the system definition (configuration) of identified system products and related enabling system products or other technical data. Briefly describe or reference description of configuration management tools used to support the configuration management process.

The SEMP should identify the types of baselines, configuration items, and data that are controlled through the configuration management function. The SEMP should also identify the role that configuration management plays in other key processes (e.g. corrective action or quality assurance processes) used to control the system configuration.

The SEMP should also describe the approach and methods planned to manage the system definition (configuration) of identified system products and related enabling system products. This includes a description of change management, configuration control procedures, and baseline management. It also describes the design record for alternatives, trade-off analyses, decisions/conclusions, and lessons learned.

The SEMP should also describe the approach and methods planned to manage the internal interfaces appropriate to the level of the system element. This helps ensure that external interfaces (external to the project or at a higher level of the architecture or design are managed and controlled. This includes description of change management and the interrelationship with configuration control procedures.

#### 9.8.8.4 Information management

##### 9.8.8.4.1 Integrated repository

Information management plan: contains the plans for identifying project information that is to be managed, responsible personnel, the forms and categories represented, and methods for recording, storage, communication, and disposal.

Systems engineering stakeholders should provide technical contribution to the information management plan, including description of an integrated repository. The SEMP should reference the information management plan for the technical effort.

Guidance on content of an integrated repository that should be implemented follows:

a) Provide a description of the project's information repository implementation, including how information will be captured, traced, and maintained.

b) Provide a description of the provisioning for any design-capture data, which may include: domain models (processes, technologies, etc.); product models (design prototypes—location, availability, characterization, etc.); archival data (lessons learned, past designs, empirical data); requirements, goals, and constraints; project management models (cost, schedule, and risk); integrated views, multiple views, and multidisciplinary designs and their rationale; trade-off analyses and system/cost-effectiveness analysis rationale and results; verification data; and product and process metrics.

##### 9.8.8.4.2 Documentation and data management

Documentation and data management plans include plans for generating and managing non-deliverable and deliverable work products.

NOTE 1 ISO/IEC/IEEE 15289 describes content for a large number of life cycle data and information items and contains provisions for data and documentation management.

The SEMP should describe the approach and methods planned to establish and maintain a data management system and the interrelationship with the design-capture system and integrated repository. This includes descriptions of how and which technical documentation will be controlled and the method of documentation of project engineering and technical information. This should also include plans for security and preparation of deliverable data.

Technical specifications that are to be developed and maintained by the project should be identified. The SEMP should include description of the relationships between engineering documents to be developed. Note that the most common way for providing this information is through a specification hierarchy or tree that depicts the standard engineering work products such as specifications, interface control documents, and engineering data packages. The SEMP should provide or reference an overview of the documentation hierarchy for the project indicating order of precedence (e.g., from the Project Statement of Work, through the PMP, and down through the key non-deliverable technical work products).

NOTE 2 ISO/IEC/IEEE 29148 and INCOSE TP-2003-002-03.2.2 identify and provide guidance on commonly required technical documents and documentation approaches that could be included in the SEMP's descriptions for information management, integrated repository and documentation plans.

NOTE 3 ISO/IEC/IEEE 29148 specifies required information items and information item content in support of the ISO/IEC/IEEE 15288 processes that involve requirements engineering. ISO/IEC/IEEE 29148, Clause 7 requires Project development of requirement specifications, including a Stakeholder requirements specification document (StRS), a System requirements specification document (SyRS), and Software requirements specification document (SRS), if adhering to ISO/IEC 12207. ISO/IEC/IEEE 29148, Clause 8 provides guidance and suggested outlines for each of these information items, while ISO/IEC/IEEE 29148, Clause 9 identifies the normative content of these information items.

NOTE 4 ISO/IEC/IEEE 29148 Annex A (Normative) provides the content for another commonly required information item, a System Operational Concept Document (OpsCon) - a user-oriented document that describes system characteristics of the to-be-delivered system from the user's viewpoint. ISO/IEC/IEEE 29148 Annex B (informative) provides the content for a Concept of Operations (ConOps) document, which at the organization level, addresses the leadership's intended way of operating the organization.

NOTE 5 INCOSE Systems Engineering Handbook contains a detailed discussion on developing common technical specifications portrayed in a corresponding generic specification tree.

## 9.9 Supporting process plans

### 9.9.1 General

The SEMP shall identify and address the project support plans for processes that span the project's technical efforts. These include areas such as decision management and risk management.

A high level description is listed for each of the following plans: decision management, risk management, communications, and verification and validation. Additional comments for SEMP implementation are listed below the plan. See Table A.5 for typical PMP level content description.

NOTE 1 Although commonly considered supporting processes used across the life cycle, the plans for configuration management, information management, documentation and data management, quality assurance, and measurement are discussed in 9.8.

Project support plans shall be developed to a level of detail consistent with the PMP. Any technical roles, responsibilities, authorities, schedule, budgets, resource requirements, risk factors, and work products for each supporting process are specified.

Many of these plans are considered engineering related, and although commonly created as separate documentation, they may be more aligned with the SEMP than the PMP. These plans supplement the PMP and SEMP and periodic monitoring of measurements and key milestones indicate when management action is needed. An overview of the technical contributions to these plans should be noted in the SEMP. The SEMP should reference these plans, as well as any related significant discussion in the PMP. The SEMP should describe and reference new support plans or plans for special engineering process support as needed.

NOTE 2 Plans for special engineering process support are described in 9.10.

### 9.9.2 Decision management

Decision management plan: specifies the plan for formally documented decision making, including decision categorization, strategies, methods, stakeholders, documentation and reporting.

The SEMP should describe, or reference, the PMP level description for decision management. The SEMP shall discuss decision management application and the analyses that will be performed to support technical management decisions.

*Systems Analysis:* If requirements engineering is in the project scope, the SEMP should describe an overview of the approach and methods planned to be utilized to arrive at a balanced set of requirements and a balanced functional architecture and design to satisfy those requirements and control the level of development dependent outputs of the engineering processes. The SEMP should provide an overview of the specific systems analysis efforts needed (including hardware, software, and human allocation analysis). The discussion should include methods and tools for trade-off analyses, systems and cost-effectiveness analyses, and risk management.

*Trade-off studies:* The SEMP should describe the studies planned to make trade-offs among stated requirements; design; project schedule; functional and performance requirements; function; task; and decision allocation between human, software, and hardware and life cycle/design to cost. The discussion should describe the use of criteria for decision-making and trade-off of alternative design solutions. A description of study objectives, criteria and weighting factors, and utility curves should be included as applicable. The discussion should also address the methods and tools planned to be used and any interfaces with the integrated repository.

*System/Cost Effectiveness Analyses:* The SEMP should include a description of system and cost effectiveness analyses that are used to support the development of life cycle balanced products and processes and to support risk management. The SEMP should describe the MOEs, how they interrelate, and criteria for the selection of MOPs to support the evolving definition and verification of the system. This should include description of the overall approach for system/cost-effectiveness analysis or other analyses, e.g. manufacturing analysis; verification analysis; distribution analysis; operational analysis; human engineering, manpower, personnel, and training analysis; usability analysis; supportability analysis; safety, health hazards, and environmental analysis; and life cycle cost analysis. An explanation should be included on how analytical results will be integrated.

*Risk Analyses:* Describe risk analyses in support of the technical risk program, see risk management plan below.

### 9.9.3 Risk management

Risk management plan specifies the plan for identifying, analyzing, and prioritizing project risks and opportunities, and how they are to be addressed.

The SEMP should describe the technical risk program, including the approach, methods, procedures, and criteria for risk assessment (identification and quantification), the selection of the risk-handling options, and integration into the decision process. Critical risk areas should be identified. The SEMP should describe plans that help minimize technical risks (e.g. additional prototyping, technology and integration verification, and evolutionary system development).

The SEMP should identify risk control and monitoring measures including special verifications, TPM parameters, and critical milestones/events. Discussion should include the method of relating TPM, the master schedule, and any subordinate technical schedules, to cost and schedule performance measurement, and the relationship to the SBS.

If transitioning critical technologies is of import to the project, the SEMP shall describe the approach and methods for identifying key technologies and their associated risks, and the activities and criteria for assessing and transitioning critical technologies from technology development and demonstration projects internal to the enterprise or from suppliers or other sources. The discussion should address how alternatives will be identified and selection criteria established to determine when and which alternative technology will be incorporated into the product when moderate-to-high risk technologies are assessed, as required, to meet functional and performance requirements. The SEMP should describe the planned method for engineering and technical process improvement, including procedures to enable an incremental improvement approach for system products as technologies mature or for evolution of the system.

### 9.9.4 Communications

The communication plan identifies the stakeholders that need to receive information about the project, the information to be communicated and the format, content and level of detail.

The SEMP should identify technical stakeholders, describe key technical communications, and reference project level communication plans.

### 9.9.5 Verification and validation

Verification and validation plan: describes the scope, strategy, tools, techniques, and responsibilities for the verification and validation work activities.

The SEMP should reference the PMP or other verification and validation plan for the project, and should describe the key elements for the technical program. It is important to describe the relationships between verification or validation activities and other project control activities, since verification and validation activities are commonly featured in other of the project's management plans, e.g., in requirements traceability under requirements management; milestone and progress reviews in the PMP; prototyping, simulation, and analyses in technical requirements and design documents; and tests, certifications, and demonstrations in product acceptance plans.

NOTE ISO/IEC/IEEE 29148 provides guidance on verification and validation planning for requirements engineering. ISO/IEC/IEEE 29148 describes four standard verification methods to obtain objective evidence that the requirements have been fulfilled: inspection, analysis or simulation, demonstration, and test.

## 9.10 Specialty engineering activities and plans

Supplemental plans that are required to satisfy product requirements and agreement terms shall be established, and their use should be documented in the SEMP. Additional plans for a particular project may include plans for assuring that safety, privacy, security and certification requirements are met, special facilities or equipment plans, product installation plans, user training plans, integration plans, data conversion plans, system transition plans, product maintenance plans, or product support plans.

For example, product acceptance and product delivery and installation plans are common engineering support plans that supplement the SEMP, or are written with considerable technical contributions to support the PMP. See Tables A.1 and A.4 for typical PMP product acceptance plan and product delivery plan content description.

Technical plans shall be prepared to supplement the PMP and SEMP, as needed. Technical plans should be prepared by the engineering and technical specialty areas to which they apply and should be used to measure technical progress.

The SEMP should reference and describe the plans for employing special engineering analyses that support life cycle definition or management. These plans are commonly used in support of system definition and analysis, performance assessment and control, and risk management. The specialty plans should identify the analysis or activity, rationale, supported work products or processes, and involved teams. Resulting specialty engineering work products or reports should be stored in the integrated repository. Specialty engineering activities should be detailed in the life cycle stage discussions identified for the project.

Table 3 identifies additional systems engineering activities that commonly result in supplemental plans or planning descriptions in the SEMP.

**Table 3 — Supplemental systems engineering planning**

| **Additional Systems Engineering Planning** | **Briefly describes other areas not specifically covered previously, but essential for planning a total systems engineering effort. Includes a brief description of additional systems engineering activities essential to successfully engineering a total system solution** |
|---|---|
| Long-lead Items | Describes the long-lead items that affect the critical path of the project |
| Engineering Tools | Describes the systems engineering methods and tools that are planned to be implemented on the program to support systems engineering. Identifies those tools to be acquired and training requirements. |
| Design to Cost or Affordability | Describes the design-to-cost planning or affordability analysis planning and how cost and capability will be balanced to provide greater value to the customer from the provided solution |
| Value Engineering | Describes the approach and methods planned to address value engineering throughout the development cycle |
| Systems Integration Plan | Describes the approach and methods by which the system is assembled and integrated |
| Interface with Other Life Cycle Support Functions | Describes the approach and methods to help assure compatibility with other life cycle support functions consistent with project and enterprise plans. |
| Safety Plan | Describes the approach and methods for conducting safety analysis and assessing the risk to operators, the system, the environment, or the public. |
| Security Plan | Describes the approach and methods for identifying security or information assurance risks, controls, and the implementation of |

| **Additional Systems Engineering Planning** | **Briefly describes other areas not specifically covered previously, but essential for planning a total systems engineering effort. Includes a brief description of additional systems engineering activities essential to successfully engineering a total system solution** |
|---|---|
| | the controls and risk mitigation elements across the system. |
| Other Plans and Controls | Describes the approach and methods for any other plans and controls designated by the tasking activity or which the enterprise system architect, systems engineer, or system integrator will use. |

NOTE 1 ISO/IEC/IEEE 29148 discusses requirements, engineering activities and tasks that commonly address specialty engineering activities and analyses, which may be used to support system concept definition or validation of requirements. For example: Quality requirements involving transportability, survivability, flexibility, portability, reusability, reliability, maintainability, and security; or human factors requirements involving interaction with human users (and other stakeholders affected by use) in terms of safety, performance, effectiveness, efficiency, reliability, maintainability, health, well-being and satisfaction. Analyses may also be performed to address characteristics such as measures of usability, including effectiveness, efficiency and satisfaction; human reliability; freedom from adverse health effects.

NOTE 2 The INCOSE Systems Engineering Handbook describes several types of analyses and techniques that may be used in support of the technical effort. Some include: Design for Acquisition Logistics–Integrated Logistics Support, Electromagnetic Compatibility Analysis, Environmental Impact Analysis, Interoperability Analysis, Manufacturing and Producibility Analysis, Life Cycle Cost Analysis, Sustainment Engineering Analysis and Training Needs Analysis.

# Annex A
(informative)

# Project Management Plan (PMP) elements

## Relationship of ISO/IEC/IEEE 24748-4 SEMP content to ISO/IEC/IEEE 16326 PMP content

The five tables below summarize PMP required content from ISO/IEC/IEEE 16326, Clause 5. These tables include most of the ISO/IEC/IEEE 16326 required PMP elements listed under five categories: Project context plans, Project planning material, Project assessment and control plans, Product delivery plan, and Project support plans.

Although ISO/IEC/IEEE 16326 is not a normative reference for this part of ISO 24748, and users that are claiming conformance to this part of ISO 24748 do not need to conform to ISO/IEC/IEEE 16326, the requirement provisions for SEMP content in Clause 9 presume that the project has developed foundational PMP content similar to that described in ISO/IEC/IEEE 16326. Most of the requirements in Clause 9 indicate that the PMP should be referenced for its content that applies across the whole project and presumes that the SEMP builds upon that existing project management material for the management and execution of the project's technical effort. For example, the PMP (or its related documentation) such as a Risk Management Plan, that governs the project's risk process, activities, tasks, tools, etc. for implementing risk and opportunity management, is expected to contain similar provision to that described in ISO/IEC/IEEE 16326, Clause 5. Then the project's SEMP risk management provisions reference that material as the base, and describe any significant changes and expanded tasks, special studies or analyses, etc. that are of importance to the project's technical risk program.

If during SEMP development, the foundational PMP-related material does not yet exist, at a minimum, the basic descriptions necessary to support the project's technical program should be documented in the SEMP, or other project documentation that can then be referenced by the related SEMP provisions.

Table A.1 contains the Project context plans.

**Table A.1 — Project context plans**

| **PMP element — ISO/IEC/IEEE 16326, Clause 5 content**<br>**NOTE: The use of “shall” in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4** |
|---|
| **Process model** — shall define the relationships among major project work activities and supporting processes by specifying the flow of information and work products among activities and functions, the timing of work products to be generated, reviews to be conducted, major milestones to be achieved, baselines to be established, project deliverables to be completed, and required approvals that span the duration of the project. The process model for the project shall include project initiation and project termination activities. To describe the process model, a combination of graphical and textual notations may be used. Any tailoring of an organization’s standard process model for a project shall be indicated in this subclause. |
| **Process improvement plan** —shall include plans for periodically assessing the project, determining areas for improvement, and implementing improvement plans. The process improvement plan should be closely related to the problem resolution plan; for example, root cause analysis of recurring problems may lead to simple process improvements that can significantly reduce rework during the remainder of the project. Implementation of improvement plans should be examined to identify those processes that can be improved without serious disruptions to an ongoing project and to identify those processes that can best be improved by process improvement initiatives at the organizational level. |

| PMP element — ISO/IEC/IEEE 16326, Clause 5 content<br>NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4 |
|---|
| **Infrastructure plan** — shall specify the plan for establishing and maintaining the development environment (hardware, operating system, network, and software), and the policies, procedures, standards, and facilities required to conduct the project. These resources may include workstations, local area networks, software tools for analysis, design, implementation, testing, and project management, desks, office space, and provisions for physical security, administrative personnel, and janitorial services. |
| **Methods, tools and techniques** — shall either reference the life cycle model management process or specify the development methodologies, programming languages and other notations, and the tools and techniques to be used to specify, design, build, test, integrate, document, deliver, modify and maintain the project deliverable and non-deliverable work products. |
| **Product acceptance plan** — shall specify the plan for acquirer acceptance of the deliverable work products generated by the project. Objective criteria for determining acceptability of the deliverable work products shall be specified in this plan and a formal agreement of the acceptance criteria shall be signed by representatives of the development organization and the acquiring organization. Any technical processes, methods, or tools required for product acceptance shall be specified in the product acceptance plan. Methods such as testing, demonstration, analysis and inspection should be specified in this plan. |
| **Project organization** — shall identify interfaces to organizational entities external to the project, describe the project's internal organizational structure, and specify roles and responsibilities for the project. |

Table A.2 contains most of the ISO/IEC/IEEE 16326 plan elements in the PMP considered necessary for project start up and working.

**Table A.2 — Project initiation and work plans**

| PMP element — ISO/IEC/IEEE 16326, Clause 5 content<br>NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4. |
|---|
| The PMP's Project initiation plans specify the details for: |
| **Estimation plan** — shall specify the cost and schedule for conducting the project as well as methods, tools, and techniques used to estimate project cost, schedule, resource requirements, and associated confidence levels. In addition, the basis of estimation shall be specified to include techniques such as analogy, rule of thumb, or local history and the sources of data. This subclause shall also specify the methods, tools, and techniques that will be used to periodically re-estimate the cost, schedule, and resources needed to complete the project. Re-estimation may be done on a monthly basis and periodically as necessary. |
| **Staffing plan** — shall specify the number of staff required by skill level, the project phases in which the numbers of personnel and types of skills are needed, and the duration of need. In addition, this subclause shall specify the sources of staff personnel; for example by internal transfer, new hire, or contracted. Resource Gantt charts, resource histograms, spreadsheets, and tables may be used to depict the staffing plan by skill level, by project phase, and by aggregations of skill levels and project phases. |
| **Resource acquisition plan** — shall specify the plan for acquiring the resources in addition to personnel needed to successfully complete the project. The resource acquisition plan should include a description of the resource acquisition process, including assignment of responsibility for all aspects of resource acquisition. The plan should include, but not be limited to, acquisition plans for equipment, computer hardware and software, training, service contracts, transportation, facilities, and administrative and janitorial services. The plan should specify the points in the project schedule when the various acquisition activities will be required. Constraints on acquiring the necessary resources shall be specified. This |

| **PMP element — ISO/IEC/IEEE 16326, Clause 5 content**<br>**NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4.** |
|---|
| subclause may be expanded into additional subclauses of the form 5.1.3.x to accommodate acquisition plans for various types of resources to be acquired. |
| **Staff training plan** — shall specify the training needed to ensure that necessary skill levels in sufficient numbers are available to successfully conduct the project. The training schedule shall include the types of training to be provided, numbers of personnel to be trained, entry and exit criteria for training, and the training method; for example, lectures, consultations, mentoring, or computer-assisted training. The training plan should include training as needed in both technical and managerial skills |
| Project work plans specify the: |
| **Work activities** — shall specify the various work activities to be performed in the project. A WBS shall be used to depict the work activities and the relationships among work activities. Work activities should be decomposed to a level that exposes all project risk factors and allows accurate estimate of resource requirements and schedule duration for each work activity. Work packages should be used to specify, for each work activity, factors such as the necessary resources, estimated duration, work products to be produced, acceptance criteria for the work products, and predecessor and successor work activities. The level of decomposition for different work activities in the WBS may be different depending on factors such as the quality of the requirements, familiarity of the work, and novelty of the technology to be used. |
| **Schedule allocation** — shall provide scheduling relationships among work activities in a manner that depicts the time-sequencing constraints and illustrates opportunities for concurrent work activities. Any constraints on scheduling of particular work activities caused by factors external to the project shall be indicated in the work activity schedule. The schedule should include frequent milestones that can be assessed for achievement using objective indicators to assess the scope and quality of work products completed at those milestones. Techniques for depicting schedule relationships may include milestone charts, activity lists, activity Gantt charts, activity networks, critical path networks, and PERT. |
| **Resource allocation** — shall provide a detailed itemization of the resources allocated to each major work activity in the project WBS. Resources shall include the numbers and required skill levels of personnel for each work activity. Resource allocation may include, as appropriate, personnel by skill level and factors such as computing resources, software tools, special testing and simulation facilities, and administrative support. A separate line item should be provided for each type of resource for each work activity. A summary of resource requirements for the various work activities should be collected from the work packages of the WBS and presented in tabular form. |
| **Budget allocation** — shall provide a detailed breakdown of necessary resource budgets for each of the major work activities in the WBS. The activity budget shall include the estimated cost for activity personnel and may include, as appropriate, costs for factors such as travel, meetings, computing resources, software tools, special testing and simulation facilities, and administrative support. A separate line item shall be provided for each type of resource in each activity budget. The work activity budget may be developed using a spreadsheet and presented in tabular form |
| **Procurement** — shall list the goods and services that will be purchased for the project and how they will be obtained. It shall specify the types of contracts to be used, who will conduct the procurement, sources of standard procurement documents, the deadline for obtaining each good and service and the lead times needed to conduct the procurement process. |

Table A.3 contains the Project Assessment and control plans, i.e. the ISO/IEC/IEEE 16326 plan elements in the PMP considered necessary to assess and control the product requirements, the project scope, schedule, budget, and resources, etc.

**Table A.3 — Project assessment and control plans**

| **PMP element — ISO/IEC/IEEE 16326, Clause 5 content**<br>**NOTE: The use of “shall” in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4.** |
|---|
| **Requirements management plan** — shall specify the control mechanisms for measuring, reporting, and controlling changes to the product requirements. This subclause shall also specify the mechanisms to be used in assessing the impact of requirements changes on product scope and quality, and the impacts of requirements changes on project schedule, budget, resources, risk and performance throughout the project’s life cycle. Techniques that may be used for requirements control include traceability, prototyping and modelling, impact analysis, and reviews. |
| **Scope change control plan** — shall describe how to detect activities out of the project's scope and the actions that are to be taken if such activities are found or requested. ISO/IEC TR 19759:2005, chapter 8, section 3.A.5.B.1 provides details on defining the project's scope |
| **Schedule control plan** — shall specify the control mechanisms to be used to measure the progress of work completed at the major and minor project milestones, to compare actual progress to planned progress, and to implement corrective action when actual progress does not conform to planned progress. The project manager should employ earned value techniques for these measures. The schedule control plan shall specify the methods and tools that will be used to measure and control schedule progress. Achievement of schedule milestones should be assessed using objective criteria to measure the scope and quality of work products completed at each milestone. |
| **Budget control plan** — shall specify the control mechanisms to be used to measure the cost of work completed, to compare planned cost to budgeted cost, and to implement corrective action when actual cost does not conform to budgeted cost. The budget control plan shall specify the intervals at which cost reporting will be done and the methods and tools that will be used to manage the budget. The budget plan should include frequent milestones that can be assessed for achievement using objective indicators to assess the scope and quality of work products completed at those milestones. A technique such as earned value should be used to report the budget and schedule plan, schedule progress, and the cost of work completed. |
| **Quality assurance plan** — shall specify the mechanisms to be used to measure and control the quality of the work processes and the resulting work products. The quality assurance plan shall include provisions for vendor evaluation and control. Quality control mechanisms may include quality assurance of work processes, verification and validation, joint reviews, audits, and process assessment. |
| **Subcontractor management plans** — shall contain plans for selecting and managing any subcontractors that may contribute work products to the project. The criteria for selecting subcontractors shall be specified and the management plan for each subcontract shall be generated using a tailored version of this standard. Tailored plans should include the items necessary to ensure successful completion of each subcontract. In particular, requirements management, monitoring of technical progress, schedule and budget control, product acceptance criteria, quality assurance, and measurement and risk management processes shall be included in each subcontractor plan. Additional topics should be added as needed to ensure successful completion of the subcontract. A reference to the official subcontract and prime contractor/subcontractor points of contact shall be specified. |
| **Project closeout plan** — shall contain the plans necessary to ensure orderly closeout of the project. Items in the closeout plan should include a staff reassignment plan, a plan for archiving project materials, a plan for post-mortem debriefings of project personnel, and preparation of a final report to include lessons learned and analysis of project objectives achieved. |

Table A.4 contains the Project delivery plan, i.e. the ISO/IEC/IEEE 16326 plan elements in the PMP considered necessary for the plans for delivery of the project's product(s).

**Table A.4 — Product delivery plan**

| **PMP element — ISO/IEC/IEEE 16326, Clause 5 content**<br>**NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4.** |
|---|
| **Product delivery plan** — shall contain plans for delivery of the project's product(s), and shall specify the product delivery approach, the required information flow both internal to the project and to all external organizations required to support the delivery, the packaging and physical delivery plans, and all associated customer documentation such as operation manuals, maintenance manuals and training materials. |

Table A.5 contains the Project support plans, i.e. the ISO/IEC/IEEE 16326 plan elements in the PMP considered necessary for the supporting processes that span the duration of the project.

**Table A.5 — Project support plans**

| **PMP element — ISO/IEC/IEEE 16326, Clause 5 content**<br>**NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4.** |
|---|
| **Project supervision and work environment** — shall state how the project manager provides day-to-day instructions, guidance, and discipline to help project members fulfil their assigned duties. The project manager shall provide a work environment in which project personnel can work together toward common project goals which ensures a free flow of correct information among project members and allows project personnel to make decisions and expend resources within the limitations and constraints of their roles. The project manager shall also set performance goals for teams as well as for individuals, and encourage constructive differences of opinion and help resolve the resulting conflicts. |
| **Decision management plan** — shall specify decision categories based on circumstances and the need for decisions, and shall specify a scheme for their categorization. It shall specify a decision strategy for each decision category, and shall identify the method of involving all relevant parties in each decision strategy. This subclause shall also identify the desired outcomes of the strategies and shall specify measurable success criteria with which to assess the outcomes. This subclause shall also identify method(s) for tracking and evaluating the outcomes, and for supplying the required information for documenting and reporting in accordance with the information management subclause. The need for decisions may arise as a result of an effectiveness assessment, a technical trade-off, a reported software or hardware problem needing resolution, action needed in response to risk exceeding the acceptable threshold, a new opportunity or approval for project progression to the next life cycle stage. |
| **Risk management plan** — shall specify the risk management plan for identifying, analyzing, and prioritizing project risk factors. This subclause shall also describe the procedures for contingency planning, and the methods to be used in tracking the various risk factors, evaluating changes in the levels of risk factors, and the responses to those changes. The risk management plan shall also specify plans for analyzing initial risk factors and the ongoing identification, analysis, and treatment of risk factors throughout the life cycle of the project. This plan should describe risk management work activities, procedures and schedules for performing those activities, documentation and reporting requirements, organizations and personnel responsible for performing specific activities, and procedures for communicating risks and risk status among the various acquirer, supplier, and subcontractor organizations. Risk factors that should be considered include risks in the acquirer-supplier relationship, contractual risks, technological risks, risks caused by the size and complexity of the product, risks in the development and target environments, risks in personnel acquisition, skill levels and retention, risks to schedule and budget, and risks in achieving acquirer acceptance of the product.<br><br>NOTE ISO/IEC 16085:2006 (IEEE Std 16085-2006) contains provisions for risk management and risk |

| PMP element — ISO/IEC/IEEE 16326, Clause 5 content<br>NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4. |
|---|
| management plans. |
| **Configuration management plan** — shall contain the configuration management plan for the project, to include the methods that will be used to provide configuration identification, control, status accounting, evaluation, and release management. In addition, this subclause shall specify the processes of configuration management to include procedures for initial baselining of work products, logging and analysis of change requests, change control board procedures, tracking of changes in progress, and procedures for notifying concerned parties when baselines are first established or later changed. The configuration management plan and procedures shall support the management and control of the software and/or system requirements. The configuration management process should be supported by one or more automated configuration management tools.<br><br>NOTE IEEE Std 828, and ISO 10007 contain provisions for configuration management |
| **Information management plan** — shall contain the plans for identifying what project information is to be managed, the forms in which the information is to be represented, who is responsible for the various categories of project information, and how project information is to be recorded, stored, made available to designated parties, and disposed of as required. This subclause shall include the plans for protection of both customer and vendor information |
| **Documentation** — shall contain the documentation plan for the project, to include plans for generating non-deliverable and deliverable work products. Organizational entities responsible for providing input information, generating, and reviewing the various documents shall be specified in the documentation plan.<br><br>Non-deliverable work products may include items such as requirements specifications, design documentation, traceability matrices, test plans, meeting minutes and review reports. Deliverable work products may include source code, object code, a user's manual, an on-line help system, a regression test suite, a configuration library and configuration management tool, principles of operation, a maintenance guide, or other items as specified in the PMP. The documentation plan should include a list of documents to be prepared, the controlling template or standard for each document, who will prepare it, who will review it, due dates for review copy and initial baseline version, and a distribution list for review copies and baseline versions.<br><br>NOTE ISO/IEC/IEEE 15289 contains provisions for documentation. |
| **Communication and publicity** — shall list the stakeholders that need to receive information about the project, the information to be communicated and the format, content and level of detail. Communication tools can include numerous types of publicity and marketing. The plan shall specify who is responsible for each element of communication, who will receive the communication, the methods and technologies that will be used, the frequency of communication, and how issues will be raised to higher levels of management if they are not resolved within specified timeframes. If the communication is to be by document distribution, this subclause shall list the documents and recipients both for distribution within the project team, and external to the team. It shall also describe how the plan will be updated, and it shall provide a glossary of terms and acronyms that are used on the project. If some aspects of communication, such as marketing, are outside the scope of the project, this should be stated and the plan should state how those aspects will be addressed. |
| **Quality assurance** — shall provide the plans for assuring that the project fulfils its commitments to the software process and the software product as specified in the requirements specification, the PMP, supporting plans, and any standards, procedures, or guidelines to which the process or the product must adhere. Quality assurance procedures may include analysis, inspections, reviews, audits, and assessments. The quality assurance plan should indicate the relationships among the quality assurance, verification and validation, review, audit, configuration management, system engineering, and assessment processes.<br><br>NOTE ISO 9001:2000 contains provisions for quality assurance.<br><br>NOTE ISO/IEC 90003:2004 (IEEE Std 90003-2009) contains specific guidance for applying the quality |

| PMP element — ISO/IEC/IEEE 16326, Clause 5 content<br>NOTE: The use of "shall" in the table below indicates ISO/IEC/IEEE 16326 imperatives, not ISO/IEC/IEEE 24748-4. |
|---|
| assurance requirements in ISO 9001:2000 to computer software. |
| **Measurement plan** — shall specify the methods, tools, and techniques to be used in collecting and retaining project measures. The measurement plan shall specify the identified information needs, the measures to be collected, the definitions of each measure, and the methods to be used in validating, analyzing, and reporting the measures.<br><br>NOTE The specification of the measures includes the data in the measurement information model in ISO/IEC 15939:2007 (IEEE Std 15939-2007), frequency of data collection, sources of data, etc. |
| **Reviews and audits** — shall specify the schedule, resources, and methods and procedures to be used in conducting project reviews and audits. The plan should specify plans for joint acquirer-supplier reviews, management progress reviews, developer peer reviews, quality assurance audits, and acquirer-conducted reviews and audits. The plan should list the external agencies that approve or regulate any product of the project. |
| **Verification and validation plan** — shall contain the verification and validation plan for the project to include scope, tools, techniques, and responsibilities for the verification and validation work activities. The organizational relationships and degrees of independence between development activities and verification and validation activities shall be specified. Verification and validation planning should result in specification of the techniques to be used. … Automated tools to be used in verification and validation should be specified.<br><br>NOTE IEEE Std 1012-1998 contains provisions for ensuring sufficient verification and validation of software. |

# Annex B
(informative)

# SEMP considerations for system life cycle stages

## B.1 Introduction

This Clause gives guidance on how the SEMP should be modified, depending on the system life cycle stage, or stages, that the project encompasses. For each stage, this annex first shows the purpose and example outcomes that ISO/IEC TR 24748-1, Clause 4, provides for that stage. Then this annex briefly discusses two arbitrarily selected processes in the context of a specific stage.

A project's scope may encompass only part of a system life cycle stage, or a single stage in its entirety, or multiple stages. In each case, the SEMP for the project will be written to cover the same scope. This part of ISO 24748, as well as ISO/IEC TR 24748-1, 4.1, emphasizes that:

*"Each life cycle process of ISO/IEC 12207 and ISO/IEC 15288 can be invoked at any point throughout the life cycle. . . The order and sequence in which processes are invoked, and when they are invoked, is driven by the project requirements and context: there is no unique definitive order or time sequence for their use within a stage or across several stages."*

However, even though any process can be invoked, including iteratively or recursively, at any system life cycle stage, some processes are more likely to be implemented in some stages than in others, depending on the purpose and outcomes intended for each stage.

Table B.1 gives the examples of processes that might be used in one stage (the concept stage). Note that the example outcomes are only illustrative for a given project, and its supporting SEMP. The actual processes used, as well as the outcomes, may well be quite different. Table B.1 can only be used as a starting point for considering a specific situation.

**Table B.1 — Example process usage in concept stage**

| Process | Example outcomes | Comments |
|---|---|---|
| Acquisition Process | Acquisition strategies established for material and services for at least the Development Stage and possibly for the Production and following stages | Establishing acquisition strategies should extend beyond one stage, and not be bounded by the scope of the current project |
| Supply Process | Negotiated contract that includes agreement on the baseline technical information that will be supplied at the end of development | The Development Stage Supply Process establishes for the supplier what they agree to provide in the Production Stage, and possibly following stages |
| Life Cycle Model Management Process | Recommendations for revision of life cycle models, policies or procedures to correct or adapt specific items based on Development Stage learning | Implementation of change recommendations may involve considerations above the individual project or stage level and implementation decisions will occur above the project level |
| Infrastructure Management Process | Implementation and maintenance of information technology assets required during the Development Stage | During this stage, requirements for infrastructure for following stages will be refined and some implementation may begin |
| Portfolio Management Process | None | This is addressed by the organization above the individual project level |

| Process | Example outcomes | Comments |
|---|---|---|
| Human Resource Management Process | Human resources provided to support the technical activities for the project | Implementing details will be in the SEMP, including staffing, skills development and knowledge management |
| Quality Management Process | As stated in the Quality Plan (or the part of the PMP that addresses quality) for the project | The SEMP will refer to the Quality Plan or PMP and may add implementing details for systems engineering |
| Project Planning Process | Development Phase technical objectives and constraints, with technical tasks, technical resources and key technical milestones | The PMP will establish the overall processes for the project and the SEMP will say how that will be applied to the technical effort. Generally, the strategic approaches will be developed in the Concept Stage, while specific plans will be created in the Development Stage. Those plans will generally be applied and refined in the Development Stage and subsequent stages. Effective knowledge management processes are necessary to help ensure these plans are carried forward to subsequent stages that are executed through completely different projects |
| Project Assessment and Control Process | Plan for assessment and control of the technical objectives of the system-of interest and enabling systems during the Development Stage | |
| Decision Management Process | Identification of key decisions and supporting trade-off studies | |
| Risk Management Process | Identified technical risks and their handling in support of the project | |
| Configuration Management Process | List of technical items that are configuration managed, including enabling system items | |
| Information Management Process | List of technical items that are information managed | |
| Measurement Process | Measurements of the results of the application of technical processes | |
| Quality Assurance Process | As stated in the Quality Assurance Plan or the part of the PMP that addresses quality assurance for the project | The SEMP will refer to the Quality Plan, Quality Assurance Plan or PMP and may add implementing details for systems engineering |
| Business or Mission Analysis Process | Identification of quantifiable need statements, alternative material approaches, and alternative concepts. | The SEMP will capture need statements in the initial Requirements Management Plan. |
| Stakeholder Needs and Requirements Definition Process | Defined set of elicited requirements to resolve problems and determine, e.g. constraints imposed by health, safety, security, etc. stakeholder requirements | The main focus will be on refining the elicited requirements and resolving problems as the Development Stage proceeds resulting in a stable record for traceability |
| System Requirements Definition Process | Basis for verifying that the system requirements are satisfied | In one direction, through extensive analysis, the system requirements will evolve as the Development Stage progresses and, in the other, the results of system requirements analyses will be applied in multiple ways (e.g. designs, supporting procedures, baseline for Production Stage) |
| Architecture Definition Process | High level description of one or more sets of interacting product and/or service functions that satisfy the requirements, along with identification of their interfaces | This yields one or more views of a conceptual approach to satisfying the requirements with some mix of hardware, software, facilities, people, processes and naturally occurring entities; Includes enabling systems |

| Process | Example outcomes | Comments |
|---|---|---|
| Design Definition Process | A description of system design. | Traceability of system requirements to system elements documented per the Requirements Management Plan. This evolves through the Development Stage. |
| Implementation Process | Enabling system(s) required to support concept assessments | For enabling systems, including e.g. partial or full models, mock-ups, prototypes, fixtures, user interfaces, facility renderings, needed to evaluate some or all aspects of the system concept(s) at this stage |
| Integration Process | Integration of enabling system(s) required to support concept assessments | |
| Verification Process | Verification of enabling system(s) required to support concept assessments | |
| Transition Process | Transition of enabling system(s) required to support concept assessments | |
| Validation Process | Validation of enabling system(s) required to support concept assessments | |
| Operation Process | Operation of enabling system(s) required to support concept assessments | |
| Maintenance Process | Maintenance of enabling system(s) required to support concept assessments | |
| Disposal Process | Disposal of enabling system(s) required to support concept assessments | For those enabling systems whose usage would not continue into the development stage |

If a process is invoked at more than one system life cycle stage, the result can be one or more new outcomes, or updates to one or more outcomes from prior stages, or a mix of both. This is illustrated by Table B.2 for three arbitrarily selected processes, showing example outcomes for each at each system life cycle stage.

**Table B.2 — Example process outcomes versus stage**

| Stage | Acquisition process | Project planning process | Implementation process |
|---|---|---|---|
| Concept Stage | Acquisition strategies established for material and services for at least the Development Stage and possibly for the Production and following stages | Concept Stage and Development Stage technical objectives and constraints, with technical tasks, technical resources and key technical milestones | Enabling system(s) required to support concept assessments |
| Development Stage | Acquisition strategies updated for material and services for at least the Development Stage and possibly for the Production and following stages | Updated Development Stage technical objectives and constraints, with technical tasks, technical resources and key technical milestones | Definition of implementation strategy and constraints and development of an implementation plan |
| Production Stage | Suppliers for Production Stage products and services are selected and production items from them are accepted | Plan for technical support and management of production effort, including enabling systems | Hardware fabrication, operator training, maintenance manual development |
| Utilization Stage | Agreement initiation or revision for cost reductions, deficiency reduction, or enhancement of system-of-interest or enabling systems | Plan for systems engineering support to be provided for Utilization Stage to accommodate changes, improvements, etc. | Development and test of software updates to reflect changes in enabling systems or system-of-interest during Utilization Stage |
| Support Stage | Agreement initiation or revision for cost reductions, deficiency reduction, or enhancement of | Plan for systems engineering support to be provided for Support Stage to accommodate changes, | Development and test of software updates to reflect changes in enabling systems or |

| Stage | Acquisition process | Project planning process | Implementation process |
|---|---|---|---|
| | system-of-interest or enabling systems | improvements, etc. | system-of-interest during Support Stage |
| Retirement Stage | Special services for removal of toxic or other waste and long-term archival of records | Plan for systems engineering support for Retirement Stage, including any transitions to new systems | Enabling system(s) required to dispose of, as well as safely package and store, system-of-interest elements |

Note should be taken that there is often not a one-to one association of process outcomes to stage outcomes: multiple processes are often involved in order to provide an outcome for a stage.

The information in this Clause is only to support consideration of what should be in the SEMP based on the life cycle stage or stages that the project encompasses. Refer also to ISO/IEC TR 24748-2, Clause 4 and Annex A, for additional guidance.

## B.2 Concept stage

From ISO/IEC TR 24748-1, the purpose of the Concept Stage is to address new business opportunities and to develop preliminary system requirements and a feasible design solution.

The example outcomes that ISO/IEC TR 24748-1 gives for the Concept Stage are:

a) The identification of new concepts that offer such things as new capabilities, enhanced overall performance, or reduced stakeholders' total ownership costs over the system life cycle.

b) An assessment of feasible system-of-interest concepts and solutions, including enabling systems throughout the life cycle, for closure against both technical and business stakeholder objectives.

c) The preparation and baselining of stakeholder requirements and preliminary system requirements (technical specifications for the selected system-of-interest and usability specifications for the envisaged human-machine interaction).

d) Refinement of the outcomes and cost estimates for stages of the system life cycle model.

e) Risk identification, assessment and mitigation plans for this and subsequent stages of system life cycle model.

f) Identification and initial specification of the services needed from enabling systems throughout the life of the system.

g) Concepts for execution of succeeding stages.

h) Plans and exit criteria for the Development Stage.

i) Development and satisfaction of stage exit criteria.

j) Approval to proceed to the Development Stage.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer’s needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-

2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Concept Stage.

— Project Planning process: There should be an overlap between what is stated in the PMP and the SEMP. Wherever possible, the SEMP should point to the PMP for material that applies to the entire project, then add discussion to elaborate on those aspects that bear most directly on the technical work of the project. For example, the PMP will include a project schedule, which should show at a summary level the key technical work and its milestones, while the SEMP will detail the technical tasks to a lower level and point to a systems engineering master schedule. That schedule, which in turn could be elaborated further in a systems engineering detail schedule for complex projects, will be referred to on multiple occasions in the SEMP to support discussions of TPMs, risks, reviews and transition points, critical paths, etc. Note that these considerations apply to enabling systems as well.

— Stakeholder Needs and Requirements Definition process: The table does not convey how iterative and/or recursive this process can be. In the Concept Stage, there is a strong element of discovery, often for the customer as well as the supplier. Associated with this can be a continuing process of change that will affect what has been considered for both the technical and project scope of effort. Accordingly, processes such as Configuration Management and Risk Management, just to name two, must be in place, must be known to be effective, and must be used, to keep the effort under control.

## B.3 Development stage

From ISO/IEC TR 24748-1, the purpose of the Development Stage is to develop a system-of-interest that meets stakeholder requirements and can be produced, tested, evaluated, operated, supported and retired.

The example outcomes that ISO/IEC TR 24748-1 gives for the Development Stage are:

a) Baselined technical information, including evaluated and refined system requirements and:

   — Hardware diagrams, drawings and models;

   — Software design documentation;

   — Interface specifications;

   — Production plans;

   — Operating instructions;

   — Training manuals for operators;

   — Maintenance procedures;

   — Retirement considerations.

b) Project budget and schedule baselines and life cycle ownership cost estimates.

c) A system-of-interest structure comprised of, for example, hardware elements, software elements, human elements and the interfaces (internal and external) of all such elements.

d) Verification and validation documentation.

e) Evidence supporting a decision, with all risks and benefits considered, that the system-of-interest meets all specified requirements and is producible, operable, supportable and capable of retirement and is cost effective for stakeholders.

f) Refined and baselined requirements for the enabling systems.

g) A prototype or final system-of-interest.

h) Refined outcomes and cost estimates for the Production, Utilization, Support and Retirement Stages.

i) Definition of the enabling system services required in subsequent life cycle stages.

j) Plans and exit criteria for the Production Stage.

k) Identification of current risks and determination of their treatment.

l) Satisfaction of stage exit criteria.

m) Approval to proceed to the Production Stage.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer's needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Development Stage.

— Risk Management process: In larger projects, the PMP will have a section on risk management and refer to a Risk Management Plan, as well as highlighting specific areas where risk management will be applied to the project. The Risk Management Plan will describe, among other things, the purpose, responsibilities, processes and outputs of the project's risk management effort. The SEMP will refer to both plans, then will give details on where risk management is to be used in conjunction with the technical work. As just a few of the possible examples, the SEMP could require risk assessments be made for: all major trade-off studies, as a part of decision analysis; as a part of requirements analysis; when developing integration, verification, and transition plans. If the project size is just that separate plans are not justifiable, the SEMP should at least make it clear where and how risk management is to be applied to the many technical activities at the core of the Development Stage.

— System Requirements Definition process: As is the case for risk management, the System Requirements Definition process should be at the heart of the Development Stage's effort. Even on the smallest project, failure to rigorously perform the activities and tasks described in the ISO/IEC/IEEE 15288 will have consequences that generally will be felt in the remaining stages of the system life cycle, well after the development project is completed.

## B.4 Production stage

From ISO/IEC TR 24748-1, the purpose of the Production Stage is to produce or manufacture the system-of-interest, test it and produce related supporting and enabling systems as needed.

The example outcomes that ISO/IEC TR 24748-1 gives for the Production Stage are:

a) Qualification of the production capability.

b) Acquisition of resources, material, services and system elements to support the target production quantity goals.

c) The system produced according to approved and qualified production information.

d) Packaged product transfer to distribution channels or acquirer.

e) Plans and exit criteria for the Utilization Stage and the Support Stage.

f) Updated concepts for execution of all succeeding stages.

g) Current risks and mitigating actions identified.

h) Quality assured systems-of-interest accepted by the acquirer.

i) Satisfaction of stage exit criteria.

j) Approval to proceed to the Utilization Stage.

k) Approval to proceed to the Support Stage.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer's needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Production Stage.

— Acquisition process: The SEMP may not seem like an obvious place to be discussing the Acquisition process; however, good systems engineering requires a life cycle, integrating viewpoint to achieve its intended effectiveness. Therefore, discussion of where and how to apply the Acquisition process to ascertain proper life cycle support of the system should be included in the SEMP. These discussions should be a part of the SEMP developed in the Concept Stage and a new or expanded SEMP for the Development Stage. These discussions should help ensure that requirements and agreements to acquire items for the Production Stage, and following stages, are identified and acted on in a timely manner. The items include all things required for enabling systems as well as for the system-of-interest itself. Weaknesses in considering these items early can have serious impacts on the Production Stage.

— Implementation process: The Implementation process consists of more than creating hardware and software (in the case of a product-based system). Processes to support the service parts of a system-of-interest, as well as operator/service provider training, plus documentation to support operations and maintenance, are all part of the Implementation process, as are materials for packaging and storing the system-of-interest. The SEMP at this stage should identify how all of these needs will be addressed in the Production Stage, building on the implementation strategy, plus technology and other constraints identified in the Concept and Development Stages.

## B.5 Utilization stage

From ISO/IEC TR 24748-1, the purpose of the Utilization Stage is to operate the product, or deliver the services within intended environments and to ensure continuing operational effectiveness.

The example outcomes that ISO/IEC TR 24748-1 gives for the Utilization Stage are:

a) Experienced personnel with the competence to be operators in the system-of-interest and provide operational services.

b) An installed system-of-interest that is capable of being operated and of providing sustainable operational services.

c) Performance and cost monitoring and assessment to confirm conformance to service objectives.

d) Identification of problems or deficiencies, informing appropriate parties (user, development, production, or support) of the need for corrective action.

e) New opportunities for system-of-interest enhancement through stakeholder feedback.

f) Plans and exit criteria for the Retirement stage.

g) Satisfaction of stage exit criteria.

h) Approval to proceed to the Retirement Stage.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer's needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Utilization Stage.

— Human Resource Management process: The acquisition of human resources would generally be addressed via procedures that the PMP refers to. The SEMP will focus more on the training requirements for operating, maintenance and other technical support staff. Once again, the activities and tasks that are executed to manage human resources during the Utilization Stage will depend on the thought that was applied to this area in the preceding stages.

— Measurement process: Well-focused measurement of key utilization parameters over the entire Utilization Stage sets the basis for cost control and process improvement. The SEMP should make clear, not only what is to be measured, but why—in business terms. Otherwise, misguided cost reduction efforts over a protracted Utilization Stage will undermine the key mechanism to effectively reduce costs. One challenge to achieving the proper outcome is to ensure that all stakeholder communities—technical, business, customer—interact to maintain focus on effective measurement.

## B.6 Support stage

From ISO/IEC TR 24748-1, the purpose of the Support Stage is to provide logistics, maintenance, and support services that enable continuing system-of-interest operations and a sustainable service.

The example outcomes that ISO/IEC TR 24748-1 gives for the Support Stage are:

a) Trained personnel who will maintain the system and provide the support services.

b) Organizational interfaces with the operating and production organizations that ensure problem resolution and corrective actions.

c) Maintained product and services and the provision of all related support services, including logistics, to the operational sites.

d) Product and service maintenance and corrected design deficiencies.

e) All required logistics support, including a spare parts inventory sufficient to satisfy operational availability goals.

f) Current risks and mitigating actions identified.

g) Agreement to terminate support services.

h) Satisfaction of stage exit criteria.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer's needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Support Stage.

— Configuration Management process: Maintaining the integrity of all identified outputs of a system-of-interest, as well as every one of its enabling systems, throughout the Support Stage, is a complex, unglamorous, and essential task. It requires ensuring that changes to sources, configurations, processes and inventories be exactingly documented, as well as that the reasons for these changes, along with their risks and benefits, are made a matter of permanent record, possibly for both operational and legal reasons. While most of the Configuration Management process may be covered in a separate plan, and discussed in the PMP, the SEMP must make it explicit where and when the Configuration Management process is to be applied to the system-of-interest and its enabling systems throughout the Support Stage. Note that it is particularly likely for the SEMP to fail to address configuration management of enabling systems in this stage, with unfortunate results.

— Quality Assurance process: Along with the Configuration Management process, steadfast execution of the Quality Assurance process is essential to determine that ”products, services and implementations of life cycle processes meet organizational quality objectives and achieve customer satisfaction.” While the Quality Assurance process is generally addressed in a separate plan, and referred to by the PMP, the SEMP must address where and how it applies to the technical effort during the Support Stage. Particularly susceptible to being overlooked are technical processes and documentation, where subtle drifts in what is done versus what is documented can occur, requiring, among other things, quality oversight and audits for detection.

## B.7 Retirement stage

From ISO/IEC TR 24748-1, the purpose of the Retirement Stage is to provide for the removal of a system-of-interest and related operational and support services, and to operate and support the retirements system itself.

The example outcomes that ISO/IEC TR 24748-1 gives for the Retirement Stage are:

a) Experienced personnel who can provide retirement services.

b) Required system-of-interest decommissioning, including disposal, refurbishing, or recycling, in accordance with applicable health, safety, security, privacy and environmental laws and regulations.

c) Plans and procedures for transferring the provision of services to the new system-of-interest if applicable.

d) Removal of waste.

e) Environment returned to original or agreed state.

f) Archived elements.

g) Operational staff is redeployed.

h) Satisfaction of stage exit criteria.

Two example outcomes are discussed below to further emphasize that there can be multiple outcomes for each process at each stage, that these depend on the specifics of the project and the customer’s needs that drive the project. Careful thought must be applied to each situation to thoroughly understand what is useful and necessary before proceeding any further. ISO/IEC/IEEE 15288, ISO/IEC TR 24748-1, ISO/IEC TR 24748-2, and the INCOSE Systems Engineering Handbook, should be reviewed and discussed in thorough detail to ascertain that the right processes and outcomes are identified in the SEMP for the Retirement Stage.

— Supply process: Both the Acquisition process and the Supply process have a high likelihood of use during the Retirement Stage. What can be more significant than usual is that both acquiring and supplying parties may have legal liabilities related to the proper disposal of items from the system-of-interest, or the enabling systems, or both, that is being retired, for example: hazardous waste. Liabilities can drive the need to determine that people involved have proper certifications and that specific aspects of disposal are documented as may be prescribed by law. The potential liability has no relation to the size or value of the item being disposed of. Because of these considerations, it is critical to begin outlining the factors that must be addressed in either a supply or acquisition agreement at the earliest stage in either the system life cycle or the pending project.

— Transition process: Transition of a system-of-interest from a fully operational status to a fully retired status rarely happens in one step and cannot happen in isolation from its operating environment. Therefore, the SEMP for the Retirement Stage must consider how the enabling systems as well as the system-of-interest are removed from the operating environment, or associated with a new system-of-interest. The new system-of-interest may have some new enabling systems of its own or require modification of existing enabling systems. Further, any new system may not have the maturity of the system being retired, requiring the old system to be ready to return to service on short notice. There will also be services and products supporting the old system that may no longer be needed for the new one, or require changes in amount or properties. Finally, there may be interim stages of transition that require temporary packaging or storage facilities. All of these may have been considered in the Concept Stage, but it is critical that they be revisited in updated SEMPs as the system (and its application and its enabling systems) mature and evolve over the following stages. A successful transition consists of a complete transition out as well as a transition in.

# Annex C
(normative)
# Tailoring policies

## C.1 Introduction

This Annex provides requirements for the tailoring of the information item contents in this part of ISO/IEC/IEEE 24748. Tailoring is not a requirement for conformance to this part of ISO/IEC/IEEE 24748. In fact, tailoring is not permitted if a claim of 'full conformance' is to be made. If a claim of 'tailored conformance' is made, then the following process shall be applied to perform the tailoring.

## C.2 Information item Tailoring Process

### C.2.1 Purpose

The purpose of the Tailoring Process is to adapt the information item contents of this part of ISO/IEC/IEEE 24748 to satisfy particular circumstances or factors that:

a) Surround an organization that is employing this part of ISO/IEC/IEEE 24748 in an agreement;

b) Influence a project that is required to meet an agreement in which this part of ISO/IEC/IEEE 24748 is referenced;

c) Reflect the needs of an organization in order to supply products or services.

### C.2.2 Outcomes

As a result of successful implementation of the Tailoring Process, modified or new information item contents are defined to achieve the purpose of the SEMP document provided in this part of ISO/IEC/IEEE 24748.

### C.2.3 Activities and tasks

If this part of ISO/IEC/IEEE 24748 is tailored, then the organization or project shall implement the following activities:

a) Identify and document the circumstances that influence tailoring. These influences include, but are not limited to:

   1) stability of, and variety in, operational environments;

   2) novelty, size, and complexity;

   3) starting date and duration of utilization;

   4) emerging technology opportunities;

   5) profile of budget and organizational resources available;

   6) availability of the services of enabling systems;

7) the need to conform to other standards.

b) Obtain input from all parties affected by the tailoring decisions. This includes, but may not be limited to:

1) the stakeholders;

2) the interested parties to an agreement made by the organization;

3) the contributing organizational functions.

c) Select the information item contents that require tailoring and delete them.

NOTE 1 Irrespective of tailoring, organizations and projects are always permitted to create additional information item contents beyond those required for conformance to this part of ISO/IEC/IEEE 24748.

NOTE 2 An organization or project may encounter a situation where there is the desire to modify the information item contents. Modification is performed by deleting the information item contents (making the appropriate claim of tailored conformance) and, with careful consideration of consequences, creating information item contents that describe additional information beyond those of the tailored standard.

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**Abstract:** The evolution of the harmonized set of ISO/IEC/IEEE 15288-12207 related standards and technical reports that are discussed in this International Standard provides detailed requirements and guidance on the application of system life cycle processes. This International Standard unifies technical and management requirements and guidance from several of these sources to specify the requirements for the content of a SEMP and to provide a common SEMP format. This International Standard also identifies the processes as defined in ISO/IEC/IEEE 15288 to perform the necessary project planning activities to accomplish the project's technical effort and to develop the project's SEMP. Due to close alignment with the content of ISO/IEC 24748, ISO/IEC 26702 is now Part 4 of the multi-part International Standard, ISO/IEC 24748 (*Systems and software engineering – Life cycle management*).

**Keywords:** acquisition, adaptation, agreement, analysis, assessment, audit, concept, configuration management, data management, decision management, design, development, documentation management, engineering planning, enabling system, implementation, information management, infrastructure, integration, interface, life cycle, life cycle model, life cycle stages, maintenance, measurement, operation, performance assessment and control, planning, process, process improvement, process tailoring, process view, product, production, project assessment and control, project planning, portfolio management, quality management, repository, requirements, retirement, review, risk management, service, stage, stakeholder requirements, specification, supply, support, system, system-of-interest, systems engineering management plan, SEMP, SEP, systems analyses, specialty engineering, tailoring, technical baseline, technical management, technical planning, technical project management planning, transition, utilization, validation, verification, MOE, MOP, TPM, SBS, WBS, PMP – SEMP relationships, SEMP outline.

**ICS 35.080.00**
**ISBN (PDF) 978-1-5044-0817-2; ISBN (Print) 978-1-5044-0818-9**
Price based on 62 pages