



JAXA PROCESS ASSESSMENT MODEL FOR SOFTWARE DEVELOPMENT

February 8, 2024

Japan Aerospace Exploration Agency

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1. General provisions

1.1 Introduction

The JAXA software development process assessment model (hereafter called JAXA-PAM) is an ISO/IEC 33004 conformant and ISO/IEC 33020 compliant process assessment model.

1.2 Purpose

JAXA-PAM provides indicators for Japan Aerospace Exploration Agency (hereafter called JAXA) or suppliers to understand and confirm the intent of the software development standard (JERG-0-049) when they perform a software development assessment.

JAXA-PAM has been developed by a total of over a hundred professionals in the domestic aerospace industry. They made various efforts in order to realize an improvements-driven process evaluation that capitalizes on strengths. JAXA-PAM is based on the key insight of the industry common software development processes that were identified when the domestic aerospace industry started considering introducing a software development standard. In the Japan aerospace industry, it is expected that continuous use of JAXA-PAM can contribute to promoting improvement activities. It is also expected that the process capability and process functional indicators will realize enhanced assessment by including more detailed evaluation perspectives and that the process capability standard will drive effective improvement activities by developing a standard that considers realistic improvement steps within the Japan aerospace industry.

1.3 Applicable scope

From various software development projects, JAXA-PAM is applied to only the organizations that have become a target of an assessment based on its plan. The target organizations can be JAXA and suppliers and JAXA-PAM shall be applied to not only their development department but also other relevant departments, such as purchase control and quality assurance departments in such organizations.

JAXA-PAM is compiled with quotations from ISO/IEC 15504-5 and ECSS-Q-HB-80-02 Part 2A, as well as JAXA's unique processes. All processes in JAXA-PAM can be applied to any process assessments performed by JAXA.

1.4 Relevant documents

Compliance document

- (1) ISO/IEC 33004:2015 Information technology -- Process assessment -- Requirements for process reference, process assessment and maturity models
- (2) ISO/IEC 33020:2015 Information technology -- Process assessment -- Process measurement framework for assessment of process c

References

- (1) JERG-0-049A Software development standard
- (2) ISO/IEC 15504-5:2006 Information technology - Process assessment - Part 5: An exemplar Process Assessment Model
- (3) ISO/IEC/IEEE 12207:2017 Systems and software engineering -- Software life cycle processes
- (4) CSA-114006A JAXA's software process assessment procedures
- (5) CSA-113008A JAXA's software process assessment guidebook

References relationship diagram

Figure 1-1 illustrates the relationship between JAXA-PAM and references. JAXA-PAM includes process reference models (PRMs) in itself.

It is compiled with quotations from ISO/IEC 15504-5 and ECSS-Q-HB-80-02 Part 2A, as well as JAXA's unique processes.

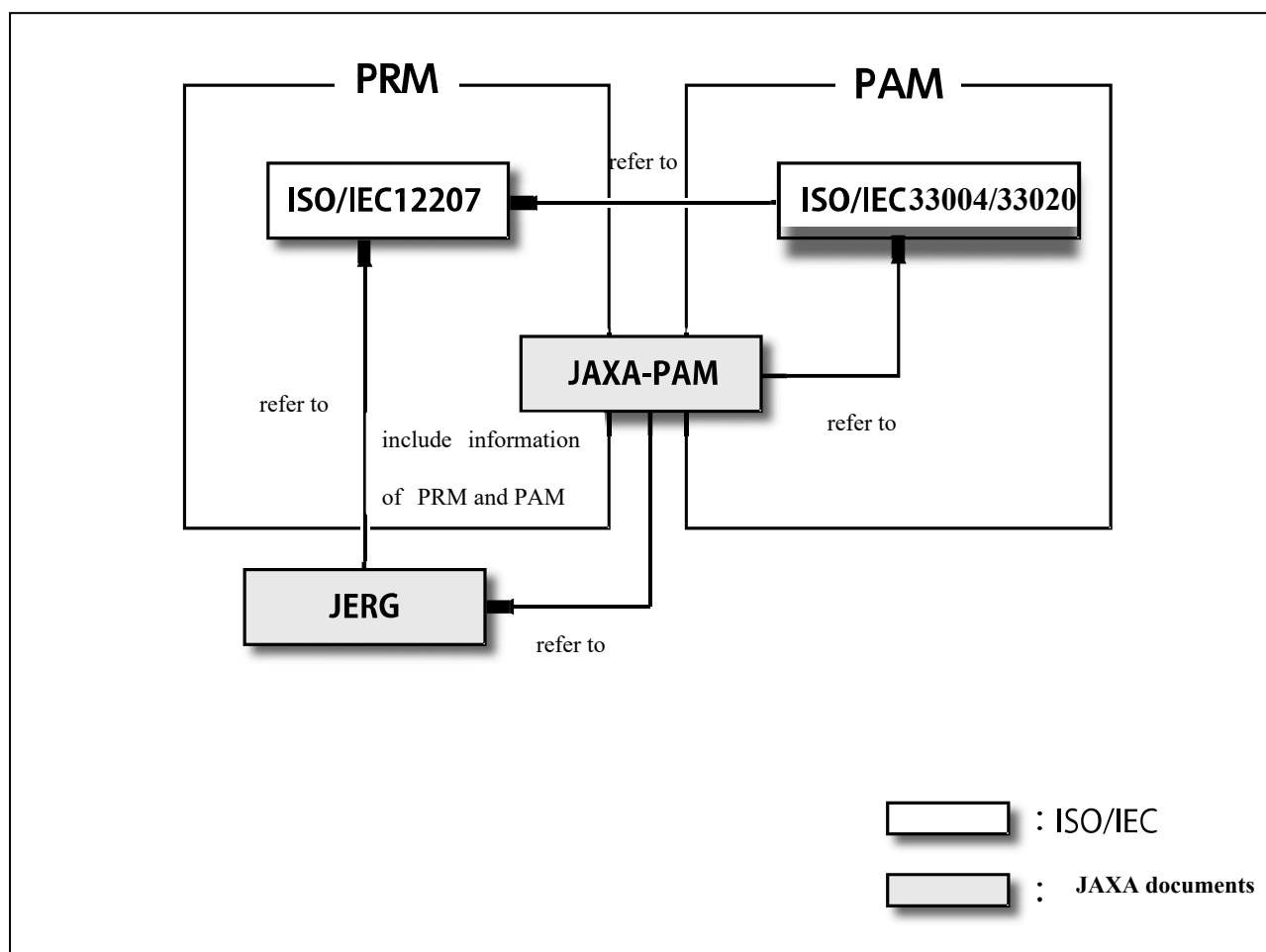


Figure 1-1 References relationship diagram

Notes

Quotation from ECSS-Q-HB-80-02 Part 2A is provided in English as is. When performing a process improvement, review the translated parts and do a translation to Japanese as needed.

The old format is still used for the non-revised processes cited from ISO/IEC 15504-5. When performing a process improvement, update the format as need.

2. JAXA software development process assessment model

2.1 Introduction

JAXA-PAM consists of a set of assessment indicators of process implementations and capability.

The assessment indicators provide criteria that allow assessors to collect objective evidence to support their process assessment.

JAXA-PAM defines a two-dimensional model: the process dimension and capability dimension.

In the process dimension, processes in JAXA-PAM are defined and classified into three lifecycle processes. Each process in the lifecycles falls into a process group based on the process type.

While, the capability dimension defines a set of process attributes that are broken down into several capability levels. The process attributes provide measurable characteristics of process capabilities.

Figure 2-1 illustrates two-dimensional structure of JAXA-PAM.

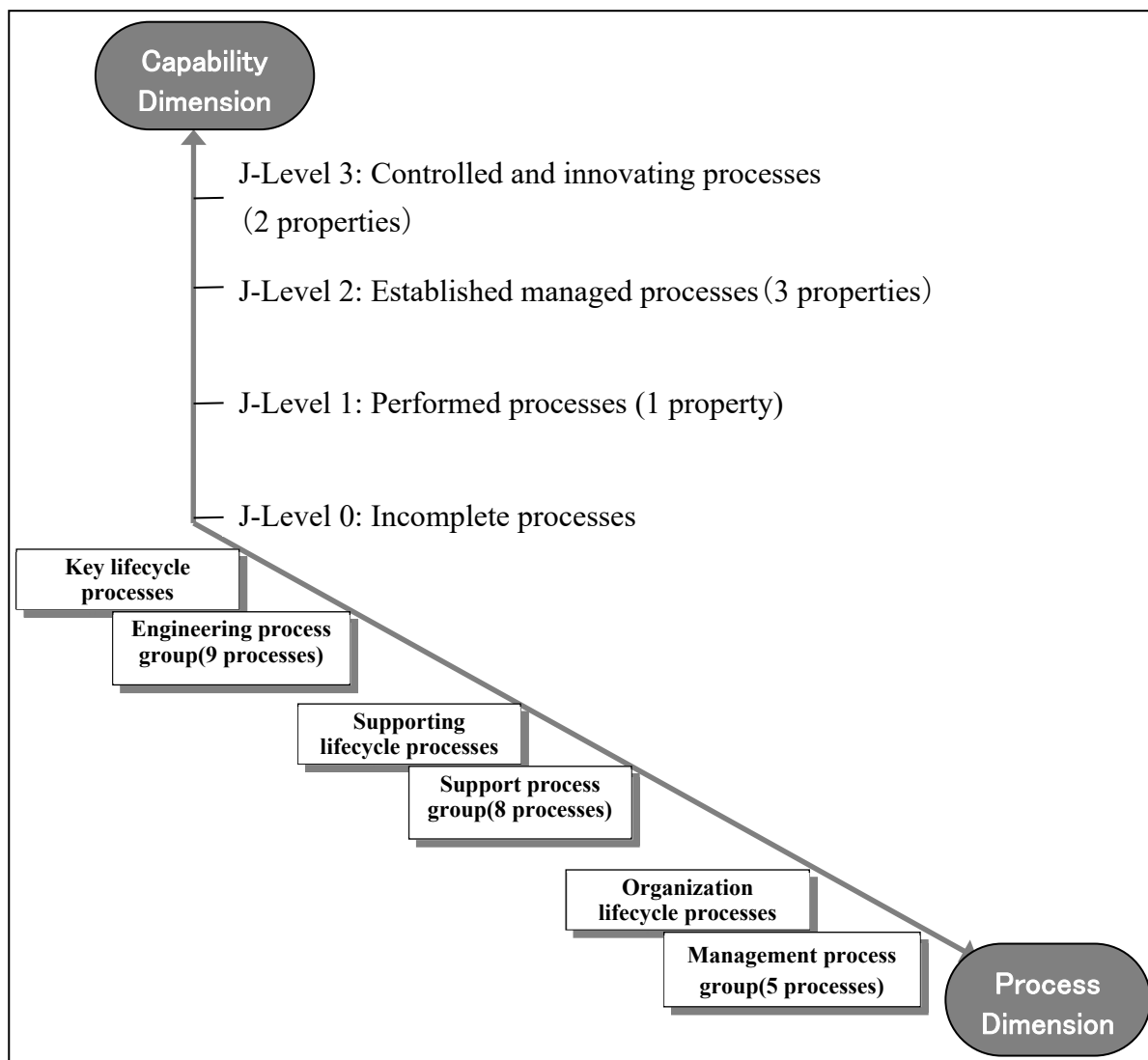


Figure 2-1 two-dimensional structure of JAXA-PAM

2.2 Process dimension

JAXA-PAM consists of three lifecycle processes (which are identical to the ones defined in ISO/IEC 12207 AMD 1 and AMD2) and contains processes that fall into three process groups. The table 2.1 lists processes that correspond to the ones in the relevant documents.

Table 2.1: A list of corresponding processes between JAXA-PAM

JAXA-PAM Process ID		JAXA-PAM Process name	Corresponding process in JERG-0-049	Corresponding process in ISO/IEC 12207
Key lifecycle processes				
Engineering process group				
	ENG.2	System requirements analysis	Computer system requirements analysis	System requirements analysis
	ENG.3	System architectural design	Computer system architectural design	System architectural design
	ENG.4	Software requirements analysis	Software requirements analysis	Software requirements analysis
	ENG.5	Software design	Software design	Software architectural design Software detail design
	ENG.6	Software construction	Software coding and testing	Software coding and testing
	ENG.7	Software integration	Software integration	Software integration
	ENG.8	Software comprehensive testing	Software integration testing	Software qualification testing
	ENG.9	System integration	Computer system integration and computer system comprehensive testing	System integration
	ENG.10	System comprehensive testing	Computer system integration and computer system comprehensive testing	System qualification testing
Supporting lifecycle processes				
Support process group				
	SUP.1	Quality Assurance	Quality Assurance	Quality Assurance
	SUP.2	Verification	Verification	Verification
	SUP.3	Validation	Validation	Validation
	SUP.4	Joint review	Joint review	Joint review
	SUP.8	Configuration management	Configuration management	Configuration management Change request management
	SUP.9	Problem resolution	Problem resolution	Problem resolution management
	SUP.13	Action items management	Requirements for official review for each process etc.	-
	SUP.14	Process assessment	Process assessment	Process assessment
Organization lifecycle processes				
Management process group				

JAXA-PAM Process ID		JAXA-PAM Process name	Corresponding process in JERG-0-049	Corresponding process in ISO/IEC 12207
	MAN.3	Project management	-	Project management
	MAN.4	Quality management	Quality assurance, measurement requirements for each project etc.	Quality management
	MAN.5	Risk management	-	Risk management
	MAN.6	Measurement	Measurement requirements for each process etc.	Measurement
	MAN.8	Engineering management	-	-

Table 2.2 lists the process components in JAXA-PAM.

Table 2.2 Process components in JAXA-PAM

Component	Descriptions
Process ID	An ID given to identify a process
Process name	A name given to identify a process
Purpose	Describes the purpose of a process implementation. (The reason why the process is implemented)
Process outcomes	Describes the ultimate expected outcomes of the process implementation. These become the aspects to ensure the process purpose has been successfully achieved by the implementation.
Base practices	Describes practices to achieve the process outcomes. A base practice consists of the following components.
BP identifier	An ID given to identify a base practice. This ID is unique in the process.
BP name	A brief explanation of a base practice.
BP body text	Definition of a base practice.
Supplementary explanation of BP	Describes the BP name and terms used in the body text. It is provided after the body text as required, outlined in the bullet list.
Process outcomes-BP correspondence table	A correspondence table between process outcomes and base practices

JAXA-PAM defines base practice categories for each process group that has the same process structure. Table 2.3 lists those categories.

Table 2.3 Base practice categories

Category		Descriptions
Engineering process group		
	Processes related to requirements analysis and designing (ENG2, 3, 4, 5)	
	Implementation	Consider what to do and implement it.
	Evaluation	Evaluate the implemented results from the technical aspects and build a consensus between stakeholders.
	Communication	Communicate technical information to the required people.
	Processes related to testing (ENG6, 7, 8, 9, 10)	
	Preparation	Define plans and rules for an implementation.
	Implementation	Prepare the test target and implement a test.
	Evaluation	Evaluate the test results and build a consensus between stakeholders.
	Communication	Communicate the test results to the required people.
Supporting process group		
	Plan	Develop detailed action plans to achieve a defined purpose.
	Implementation	Implement the developed plan.
	Check	Check the implementation results against the plan.
	Corrective action	Implement resolutions and preventive measures for issues deviated from the plan.
	Communication	Communicate and share information and statuses with required stakeholders.
Management process group		
	Plan	Identify objectives and a managed target, and develop and prepare a strategy and procedure as parts of the detailed plan to achieve the objectives.
	Implementation	Implement the developed plan.
	Check	Monitor and check the implementation status and result against the plan.
	Corrective action	Implement resolutions and preventive measures for issues deviated from the plan.
	Continuous improvement	Collect useful information to improve processes and utilize it to continuously improve organizational processes and systems.

2.3 Capability dimension

The capability dimension in JAXA-PAM defines JAXA's unique process capability level called "J-Level" and process attributes called "J-PA." They are convertible to the process capability levels and process attributes defined in ISO/IEC 33020.

Improvements of process capability are described in J-PAs, which are grouped into different J-Levels, in the PAM.

J-PA, a process attribute to allow evaluation of how well the goals are achieved, provides measurement criteria for process capabilities. It is also one of the aspects that allows managing and improving each process in order to contribute organizations to achieve their business goals. These process attributes can be applied to any processes.

J-Level is a group of J-PAs that need to be addressed to improve process implementation capabilities in a phased manner. Each J-Level provides significant improvements to process implementation capabilities. These levels consist of rational approaches to the organizational growth through improvements in process capabilities.

J-Level 0: Incomplete processes

Processes that have not been implemented or failed to achieve the goal. In this level, there is no or hardly any evidence that systematically proves that the goal has been achieved.

J-Level 1: Performed processes

Performed processes that have achieved the process goal.

J-Level 2: Established managed processes

Performed processes (stated above) that have been practiced under a managed (planned, monitored, and modified) condition by using the standard process to achieve the process outputs. The work products are appropriately developed, managed, and maintained.

J-Level 3: Controlled and innovating processes

Established managed processes (stated above) that have been practiced under a controlled (measured, analyzed, and corrected) condition in order to achieve the process outcomes, and continuously improved to achieve business goals.

Capability measurement is based on the J-PAs in JAXA-PAM. It is used to determine whether a process attains a certain capability level. Process capability-related aspects are measured by each J-PA, which covers the aspect related to the relevant J-Level. Table 2.4 lists J-level and J-PA.

Table 2.4 J-Level and J-PA

Process capability Level		
	Process attribute ID	Process attribute
J-Level 0: Incomplete process		
J-Level 1: Performed process		
	J-PA1.1	Process implementation attribute
J-Level 2: Established managed process		
	J-PA2.1	Standard process definition attribute
	J-PA2.2	Standard process deployment attribute
	J-PA2.3	Defined process implementation and management attribute
J-Level 3: Controlled and innovating process		
	PA3.1	Process innovation consideration attribute
	PA3.2	Process innovation implementation attribute

2.4 Assessment indicators

JAXA-PAM is based on a principle that a process capability can be evaluated by clarifying J-PA achievement using assessment indicators related evidence.

There are two types of assessment indicators as follows:

- Process capability indicator (applied to J-Level 1, 2 and 3)
- Process functional indicator (applied to J-Level 1 only)

J-PAs in the capability dimension have a set of process capability indicators that provides the extent of achievement for the relevant process attribute.

Process capability indicator is as follows

- Generic practice (GP)

Each process in the process dimension, as an additional indicator to support J-Level 1 process assessment, has a set of process functional indicators used to measure achievement of a process implementation attribute related to a process to be evaluated.

Process functional indicator is as follows:

- Base practice (BP)

Base practices (BPs) show achievements of a process purpose and outcomes.

3. Process functional indicators (J-Level 1)

3.1 Format

In this chapter, format shown in Fig. 3.1 below is used for quickly finding relevant information.

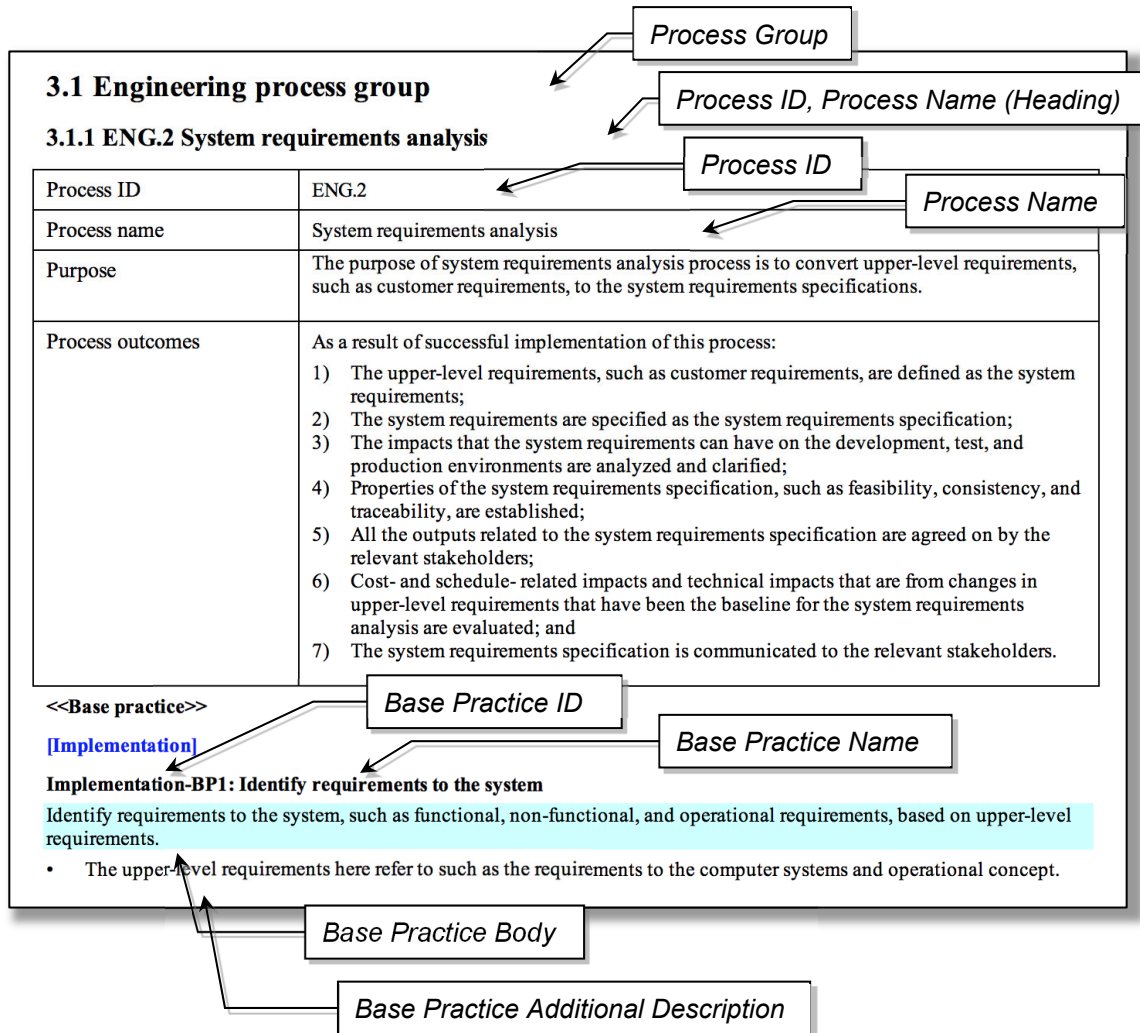


Figure 3.1 Format of Process description

3.2 Engineering process group

ENG.2 System requirements analysis

Process ID	ENG.2
Process name	System requirements analysis
Purpose	The purpose of system requirements analysis process is to transform upper-level requirements, such as customer requirements, to system requirements specifications.
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none">1) The upper-level requirements, such as customer requirements, are defined as the system requirements;2) The system requirements are specified as the system requirements specification;3) The impacts that the system requirements can have on the development, test, and operating environments are analyzed and clarified;4) Properties of the system requirements specification, such as feasibility, consistency, and traceability, are established;5) All the outputs related to the system requirements specification are agreed on by the relevant stakeholders;6) Cost- and schedule- related impacts and technical impacts that are from changes in upper-level requirements that have been the baseline for the system requirements analysis are evaluated; and7) The system requirements specification is communicated to the relevant stakeholders.

<<Base practice>>

[Implementation]

Implementation-BP1: Identify requirements to the system

Identify requirements to the system, such as functional, non-functional, and operational requirements, based on upper-level requirements.

- The upper-level requirements here refer to such as the requirements to the computer systems and operational concept.

Implementation-BP2: Consider system requirements

Consider system requirements based on the identified functional, non-functional, and operational requirements. Consider reusing a developed product as required.

- This consideration includes a prioritization of system requirements and identification of essential and optional requirements.

Implementation-BP3: Develop operational scenarios

Develop operational scenarios at the system level based on the identified operational requirements.
In the operational scenarios, identify state transition required for the system including operating modes.
Ensure the consistency between the operational scenarios and system requirements.

Implementation-BP4: Clarify the circumstances that lead to the outcome

Clarify the circumstances that lead to each requirements item of the system requirements.

- To “clarify the circumstances that lead to the outcome” refers to such activities as recording how things are discussed at meetings and on email. However, it does not require recording clear explanations on each requirements item but background information on key requirements items.

Implementation-BP5: Identify impacts from/ to the development, test, and operating environments

Identify the impacts from the system requirements and operational scenarios to the development, test, and operating environments and vice versa.

Implementation-BP6: Specify the system requirements

Define system requirements specifications to meet the following properties:

- Feasibility
- Consistency
- Traceability

- To “specify” means to remove ambiguities from the considered and optimized system requirements to verifiably define.

Implementation-BP7: Establish a verification plan

Establish a verification plan for the system requirements specification and operational scenarios.

- Verification planning is to develop a plan for the verification scope, details, method, environment (test equipment etc.) and schedule of a system to be developed, based on the system requirements specification and operational scenarios.

[Evaluation]

Evaluation-BP1: Evaluate the system requirements specification

Evaluate the system requirement specifications by using appropriate methods to ensure that intended properties including the followings are provided:

- Feasibility
- Consistency
- Traceability

- Feasibility, consistency, and traceability are the properties required to be evaluated in JERG-0-049.
- Evaluation aspects other than the above are as follows: (Refer to the aspects in IEEE 830 etc.)
 - Correctness
 - Unambiguous
 - Completeness
 - Consistency
 - Testability
 - Ranked for importance and/or stability
 - Modifiability
 - Usable during the operation and maintenance phase
 - Safety

Evaluation-BP2: Perform official review for system requirement analysis

Perform official review for all the outputs from this process and make a consensus with the stakeholders.

Evaluation-BP3: Evaluate changes in upper-level requirements

Evaluate with the customer the cost- and schedule- related impacts and technical impacts, as well as quality impact and risks caused by the changes in upper-level requirements which become the baseline of the system requirements analysis.

[Communication]

Communication-BP1: Communicate the system requirements specification

Communicate the system requirements specification, operational scenarios, and verification plan to the stakeholder who use them, and gain a common understanding of these descriptions. When any change occurs, inform the people to be affected.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The upper-level requirements, such as customer requirements, are defined as the system requirements.	Implementation-BP1: Identify requirements to the system
	Implementation-BP2: Consider system requirements
	Implementation-BP3: Develop operational scenarios
	Implementation-BP4: Clarify the circumstances that lead to the outcome
2) The system requirements are specified as the system requirements specification.	Implementation-BP6: Specify the system requirements
3) The impacts that the system requirements can have on the development, test, and operating environments are analyzed and clarified.	Implementation-BP5: Identify impacts from/ to the development, test, and operating environments.
	Implementation-BP7: Establish a verification plan
4) Properties of the system requirements specification, such as feasibility, consistency, and traceability, are established.	Evaluation-BP1: value the system requirements specification
5) All the outputs related to the system requirements specification are agreed on by the relevant stakeholders.	Evaluation-BP2: Perform official review for system requirement analysis
6) Cost- and schedule- related impacts and technical impacts that are from changes in upper-level requirements that have been the baseline for the system requirements analysis are evaluated.	Evaluation-BP3: Evaluate changes in upper-level requirements
7) The system requirements specification is communicated to the relevant stakeholders.	Communication-BP1: Communicate the system requirements specification

ENG.3 System architecture designing

Process ID	ENG.3
Process name	System architecture designing
Purpose	The purpose of system architecture designing is to allocate the system requirements specification to each component to optimize.
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none">1) The system requirements are assigned to the system components and the interfaces between the components are defined.2) The system architecture design is specified as the “system architecture design specification”.3) The impacts that the system architecture design specification can have on the development, test, and operational environments are analyzed and clarified.4) Properties of the system architecture design specification, such as feasibility and traceability are established.5) All the outputs related to the system architecture design specification are agreed on by the relevant stakeholders.6) The cost- and schedule- related impacts and technical impacts that are from changes in the system requirements specification that has been the baseline of the system architecture design are evaluated; and7) The system architecture design specification is communicated to the relevant stakeholders.

<<Base practice>>

[Implementation]

Implementation-BP1: Identify system components

Clarify the system components and their types (hardware, firmware, software, and operation) based on the upper-level requirements to identify as the system architecture.

- The upper-level requirements here refer to such as the system requirements specification and operational scenarios.

Implementation-BP2: Consider system architecture design

Allocate the system requirements specification to the system architecture as a request and optimize the system architecture. Consider interfaces between architectures and define the interface requirements related to software. Consider reusing a developed product as required.

- Within the requirements allocated to the system architecture, the ones allocated to the software are “software requirements” that become inputs of the software requirements analysis process.

Implementation-BP3: Identify operational prerequisites and restrictions

Identify operational prerequisites and restrictions of the system architecture, based on operational scenarios. Also, identify restrictions imposed as the result of the system architecture design.

Implementation-BP4: Clarify the circumstances that lead to the outcome

Clarify the circumstances that lead to each design item of the system architecture design.

- To “clarify the circumstances that lead to the outcome” refers to such activities as recording how things are discussed at meetings and on email. However, it does not require recording clear explanations on each requirements item but background information on key requirements items.

Implementation-BP5: Identify impacts from/ to the development, test, and operating environments

Identify the impacts from the system architecture design to the development, test, and operating environments and vice versa.

Implementation-BP6: Specify system architecture design

Analyze the following property of the optimized system architecture to define as the system design specification.

– Traceability

- To “specify” means to remove ambiguities from the considered and optimized system architecture design to verifiably define.

Implementation-BP7: Establish a verification plan

Establish a verification plan for the system architecture design specification.

- Verification plan is to develop a plan for the verification scope, details, method, environment (test equipment etc.) and schedule of the system to be developed, based on the system architecture design specification.
- When establishing a verification plan, evaluate whether it is planned well to verify every single system requirements specification. (verification coverage)

[Evaluation]

Evaluation-BP1: Evaluate the system architecture design specification

Based on the system requirements specification and operational scenarios, establish evaluation criteria for the system architectural design. Evaluate the system architectural design according to the criteria. Record the rationale for the chosen system architectural design.

– Feasibility
– Traceability

- “Feasibility” and “traceability” stated above are the properties required in JERG-0-049.
- Evaluation aspects other than the above are as follows; (refers to the aspects in IEEE 830 etc.)
 - Correctness
 - Unambiguous
 - Completeness
 - Consistency
 - Testability
 - Ranked for importance and/or stability
 - Modifiability
 - Usable during the operation and maintenance phase
 - Safety

Evaluation-BP2: Perform official review for the system architecture design

Perform official review for all the outputs from this process and make a consensus with the stakeholders.

Evaluation-BP3: Evaluate changes in the system requirements specification

Evaluate the cost- and schedule- related impacts and technical impacts as well as quality impact and risks caused by the changes in the system requirements specification that becomes the baseline of the system architecture design implementation.

[Communication]

Communication-BP1: Communicate the system architecture design specification

Communicate the system architecture design specification, software requirements and interface requirements to the stakeholders who use them, and gain a common understanding of the descriptions. When any change occurs, inform the people to be affected.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The system requirements are assigned to the system components and the interfaces between the components are defined.	Implementation-BP1: Identify system components
	Implementation-BP2: Consider system architecture design
	Implementation-BP3: Clarify the operational prerequisites
	Implementation-BP4: Clarify the circumstances that lead to the outcome
2) The system architecture design is specified as the "system architecture design specification.	Implementation-BP6: Specify system architecture design
3) The impacts that the system architecture design specification can have on the development, test, and operational environments are analyzed and clarified.	Implementation-BP5: Identify impacts from/ to the development, test, and operating environments
	Implementation-BP7: Establish a verification plan
4) Properties of the system architecture design specification, such as feasibility and traceability are established.	Evaluation-BP1: Evaluate the system architecture design specification
5) All the outputs related to the system architecture design specification are agreed on by the relevant stakeholders.	Evaluation-BP2: Perform official review for the system architecture design
6) The cost- and schedule- related impacts and technical impacts that are from changes in the system requirements specification that has been the baseline of the system architecture design are evaluated.	Evaluation-BP3: Evaluate changes in the system requirements specification
7) The system architecture design specification is communicated to the relevant stakeholders.	Communication-BP1: Communicate the system architecture design specification

ENG.4 Software requirements analysis

Process ID	ENG.4
Process name	Software requirements analysis
Purpose	The purpose of software requirements analysis process is to clarify the requirements of software that composes a system and establish the software requirements specification.
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none">1) The software requirements are developed based on the requirements for software and interfaces identified by the system requirements specification;2) The software requirements are specified as “software requirements specification”;3) The impacts that the operation requisites, restrictions, and software requirements specification can have on the development, test, and operational environments are analyzed and clarified;4) Properties of the software requirements specification, such as feasibility, consistency, traceability, and testability, are established;5) All the outputs related to the software requirements specification are agreed on by the relevant stakeholders;6) Cost- and schedule- related impacts and technical impacts that are from changes in the system architecture design specification that has been the baseline for the software requirements analysis are evaluated; and7) The software requirements specification is communicated to the relevant stakeholders.

<<Base practice>>

[Implementation]

Implementation-BP1: Identify software requirements

Identify software requirements including functional and non-functional requirements and operational prerequisites based on upper-level design specification.

- The upper-level design specification refers to the system architecture design specification, interface requirements, and software requirements (including non-functional requirements).

Implementation-BP2: Consider the software requirements

Consider the software requirements based on the identified software requirements and interface requirements. Consider introducing a COTS and reusable software as required. Analyze the consistency with the software requirements and compatibility with the system architecture design specification.

- The software requirements include functional and non-functional requirements and interface requirements.
- “COTS” stands for commercial off-the-shelf and means product publicly available.

Implementation-BP3: Identify operational prerequisites, restrictions, and information to be provided for operation

Identify operational prerequisites and restrictions of the software requirements. Also, identify restrictions imposed as the result of the software requirements analysis.

If user interfaces are incorporated in the software, include the specification in the software requirements. Identify the information to be provided to the users and include the specification of training required for the users.

Implementation-BP4: Identify state transition

Identify state transition required for the software including operating modes.

Implementation-BP5: Clarify the circumstances that lead to the outcome

Clarify the circumstances that lead to each requirements item of the software requirements.

- To “clarify the circumstances that lead to the outcome” refers to such activities as recording how things are discussed at meetings and on email. However, it does not require recording clear explanations on each requirements item but background information on key requirements items.

Implementation-BP6: Identify impacts from/ to the development, test, and operating environments.

Identify the impacts from the software requirements to the development, test, and operating environments and vice versa. If the software is required to migrate to the system that is currently operated, include the specification which meets the migration conditions.

Implementation-BP7: Specify software requirements

Analyze the following properties of the considered software requirements to define software requirements specification.

- Consistency
- Traceability

Analyze the interface requirements and document them as interface specification.

- To “specify” means to remove ambiguities from the considered and optimized software requirements to verifiably define.

Implementation-BP8: Establish a software verification plan

Establish a software verification plan. Evaluate “verification coverage of software function, software performance, and operational scenarios” as well as “software requirements specification and interface specification” against the plan.

- Software verification plan is to develop a plan for the verification scope, details, method, environment (test equipment etc.) and schedule of the software to be developed, based on the software requirements specification.
- When establishing a software verification plan, evaluate whether it is planned well to verify every single software requirements specification. (verification coverage)

[Evaluation]**Evaluation-BP1: Evaluate the software requirements specification**

Evaluate to ensure the software requirements specification properties including the followings by using an appropriate method.

- Feasibility
- Consistency
- Traceability
- Testability
- Feasibility, consistency, traceability and testability are the properties required for evaluation in JERG-0-049.
- Evaluation aspects other than the above are as follows; (refers to the aspects in IEEE 830 etc.)
 - Correctness
 - Unambiguous
 - Completeness
 - Consistency
 - Ranked for importance and/or stability
 - Modifiability
 - Usable during the operation and maintenance phase
 - Safety

Evaluation-BP2: Perform official review for the software requirements analysis

Perform official review for all the outputs from this process and make a consensus with the stakeholders.

Evaluation-BP3: Evaluate changes in the system architecture design specification

Evaluate the cost- and schedule- related impacts and technical impacts as well as quality impact and risks caused by the changes in the system architecture design specification that becomes the baseline of the software requirements analysis.

[Communication]**Communication-BP1: Communicate the software requirements specification**

Communicate the software requirements specification, interface specification and software verification plan to the stakeholders who use them, and gain a common understanding of these descriptions. When any change occurs, inform the people to be affected

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The software requirements are developed based on the requirements for software and interfaces identified by the system requirements specification.	Implementation-BP1: Identify software requirements
	Implementation-BP2: Consider the software requirements
	Implementation-BP4: Clarify the circumstances that lead to the outcome
2) The software requirements are specified as “software requirements specification”.	Implementation-BP4: Identify state transition
	Implementation-BP7: Specify software requirements
3) The impacts that the operation requisites, restrictions, and software requirements specification can have on the development, test, and operational environments are analyzed and clarified.	Implementation-BP3: Identify operational prerequisites, restrictions, and information to be provided for operation
	Implementation-BP6: Identify impacts from/ to the development, test, and operating environments
	Implementation-BP8: Establish a software verification plan
4) Properties of the software requirements specification, such as feasibility, consistency, traceability, and testability, are established.	Evaluation-BP1: Evaluate the software requirements specification
5) All the outputs related to the software requirements specification are agreed on by the relevant stakeholders.	Evaluation-BP2: Perform official review for the software requirements analysis
6) Cost- and schedule- related impacts and technical impacts that are from changes in the system architecture design specification that has been the baseline for the software requirements analysis are evaluated.	Evaluation-BP3: Evaluate changes in the system architecture design specification
7) The software requirements specification is communicated to the relevant stakeholders.	Communication-BP1: Communicate the software requirements specification

ENG.5 Software design

Process ID	ENG.5
Process name	Software design
Purpose	The purpose of the software design process is to satisfy requirements and provide a verifiable software design.
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none">1) Software components identified by the system requirements specification are defined as the software design;2) The software design is specified as the “software design specification”;3) The impacts that the software design specification can have on the development, test, and operational environments are analyzed and clarified;4) The software design specification, such as feasibility, consistency, and traceability, are established;5) All the outputs related to the software design specification are agreed on by the relevant stakeholders;6) Cost- and schedule- related impacts and technical impacts that are from changes in the software requirements specification that has been the baseline for the software design are evaluated; and7) The software design specification is communicated to the relevant stakeholders.

<<Base practice>>

[Implementation]

Implementation-BP1: Identify software components

Based on the upper-level requirements specification, decompose the software into key components, and clarify the relationship between those components and the structure of each component

- The upper-level requirements here refer to such as the software requirements specification and operational requisites and restrictions.
- Software components are the components broken up based on the related functions and roles when a software requirements specification is implemented as software.

Implementation-BP2: Consider software design

Consider and optimize the software design based on all the identified software requirements and interfaces between software components. Analyze the consistency between the upper requirements and reusable software items and COTS.

Implementation-BP3: Identify operational prerequisites and restrictions

Identify operational prerequisites and restrictions of the software design. Also, identify restrictions imposed as the result of the software design.

Implementation-BP4: Clarify the circumstances that lead to the outcome

Clarify the circumstances that lead to each design item of the system designing.

- To “clarify the circumstances that lead to the outcome” refers to such activities as recording how things are discussed at meetings and on email. However, it does not require recording clear explanations on each requirements item but background information on key requirements items.

Implementation-BP5: Identify impacts from/to the development, test, and operating environments.

Identify the impacts from the software design to the development, test, and operating environments and vice versa.

Implementation-BP6: Specify the software design

Analyze the following properties of the software design to define them as software design specification.

- Consistency
- Traceability
- To “specify” means to remove ambiguities from the considered and optimized software design to verifiably define.

Implementation-BP7: Establish a software testing plan

Establish a software testing plan and its specification based on the software verification plan

- Software testing plan is to establish a plan for the test scope, details, method, environment (test equipment etc.) and schedule of the software to be developed, based on the software verification plan and design specification.
- When establishing a software testing plan, evaluate whether it is planned well to test every single software design specification. (test coverage)
 - Software testing plan includes the following items:
 - Testing organization,
 - Testing schedule,
 - Testing environments,
 - Measuring activities for quality evaluation of the target software of software integration tests, and definitions and evaluation methods of the evaluation.
- Software testing specification includes the following viewpoints:
 - Operational scenarios,
 - Interface requirements,
 - Maximum load,
 - Coverage of software requirements specification and software design specification,
 - Exceptions, Failure, and other abnormal events, and
 - Compatibility of COTS and reused software with the system.

[Evaluation]

Evaluation-BP1: Evaluate the software design specification

Evaluate to ensure the software design specification properties including the followings by using an appropriate method.

- Feasibility
- Consistency
- Traceability
- Feasibility, consistency, and traceability are the properties required in JERG-0-049.
- Evaluation aspects other than the above are as follows; (refers to the aspects in IEEE 830 etc.)
 - Correctness
 - Consistency
 - Testability
 - Safety

Evaluation-BP2: Perform official review for the software design

Perform official review for all the outputs from this process and make a consensus with the stakeholders.

Evaluation-BP3: Evaluate changes in the software requirements specification

Evaluate the cost- and schedule- related impacts and technical impacts as well as quality impact and risks caused by the changes in the software requirements specification that becomes the baseline of the software design.

[Communication]

Communication-BP1: Communicate the software design specification

Communicate the software design specification, interface specification, software test plan and software test specification to the stakeholder who use them, and gain a common understanding of these descriptions. When any change occurs, inform the people to be affected.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Software components identified by the system requirements specification are defined as the software design.	Implementation-BP1: Identify software components
	Implementation-BP2: Consider software design
	Implementation-BP4: Clarify the circumstances that lead to the outcome
2) The software design is specified as the “software design specification”.	Implementation-BP6: Specify the software design
3) The impacts that the software design specification can have on the development, test, and operational environments are analyzed and clarified	Implementation-BP3: Identify operational prerequisites and restrictions
	Implementation-BP5: Identify impacts from/ to the development, test, and operating environments
	Implementation-BP7: Establish a software testing plan
4) The software design specification, such as feasibility, consistency, and traceability, are established.	Evaluation-BP1: Evaluate the software design specification
5) All the outputs related to the software design specification are agreed on by the relevant stakeholders.	Evaluation-BP2: Perform official review for the software design
6) Cost- and schedule- related impacts and technical impacts that are from changes in the software requirements specification that has been the baseline for the software design are evaluated; and.	Evaluation-BP3: Evaluate changes in the software requirements specification
7) The software design specification is communicated to the relevant stakeholders.	Communication-BP1: Communicate the software design specification

ENG.6 Software construction

Process ID	ENG.6
Process name	Software construction
Purpose	The purpose of software construction is to construct software correctly reflecting the software design.
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none">1) The policies and criteria related to software construction are defined;2) An environment and procedures that allow coding and unit testing are developed;3) Software is constructed based on the software design and interface specifications;4) Unit testing is performed and the problems that occurred are solved;5) All the outputs related to the software construction are evaluated and officially reviewed;6) Cost- and schedule- related impacts and technical impacts that are from changes in the software design specification that has been the baseline for the software construction are evaluated; and7) The officially reviewed outputs are communicated to the relevant stakeholders.

<<Base practice>>

[Preparation]

Preparation-BP1: Define rules to construct software

Define rules to be applied in software construction. Define criteria for quality evaluation to be performed in software construction.

- The rules include the coding standard and implementation policy for error handling etc.
- The criteria include the criteria for test coverage and quality criteria provided by code checking tool.

Preparation-BP2: Prepare development and test environments

Prepare the development and test environments for the software construction.

- The preparation of the construction environment includes a preparation of environment configuration files, such as Makefile, required for compiling.

Preparation-BP3: Create the unit test specification and test script

Create the unit test specification in accordance with the software verification and test plans. Create a test script based on the unit test specification and test environment.

- The test script above means a simple program for unit testing according to the unit test specification in the testing environment.

[Implementation]

Implementation-BP1: Create source code

Create source code based on the software design specification, interface specification, restrictions, and rules for the software construction. Analyze and record the traceability of the software design specification as well as the source code. Review the created source code. Analyze the source code with code checking tool.

Implementation-BP2: Perform unit testing

Perform unit testing in accordance with the unit test specification. Record the performed tests in a way in which pass or fail decisions can be made.

Implementation-BP3: Update the operational requisites and restrictions

Update the operational requisites and restrictions identified through coding and unit testing.

[Evaluation]

Evaluation-BP1: Evaluate the quality of source code and unit testing

Evaluate the source code quality from the unit testing results as well as the code checking tool analysis based on the criteria. Evaluate the unit testing.

Evaluation-BP2: Perform official review for the software construction

Perform official review for all the outputs from this process and agree on the results. Follow up any issues addressed.

Evaluation-BP3: Evaluate changes in the software design specification

Evaluate the cost- and schedule- related impacts and technical impacts, as well as quality impact and risks caused by the changes in the software design specification that becomes the baseline of the software construction.

[Communication]

Communication-BP1: Communicate the software construction results

Communicate the set of officially reviewed outputs to the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The policies and criteria related to software construction are defined.	Preparation-BP1: Define rules to construct software.
2) An environment and procedures that allow coding and unit testing are developed.	Preparation-BP2: Prepare the construction and test environments. Preparation-BP3: Create the unit test specification and test script.
3) Software is constructed based on the software design and interface specifications.	Implementation-BP1: Create source code.
4) Unit testing is performed and the problems that occurred are solved.	Implementation-BP2: Perform unit testing. Implementation-BP3: Update the operational requisites and restrictions.
5) All the outputs related to the software construction are evaluated and officially reviewed.	Evaluation-BP1: Evaluate the quality of source code and unit testing Evaluation-BP2: Perform official review for the software construction.
6) Cost- and schedule- related impacts and technical impacts that are from changes in the software design specification that has been the baseline for the software construction are evaluated.	Evaluation-BP3: Evaluate changes in the software design specification.
7) The officially reviewed outputs are communicated to the relevant stakeholders.	Communication-BP1: Communicate the software construction results.

ENG.7 Software integration

Process ID	ENG.7
Process name	Software integration
Purpose	The purpose of software integration process is by combining source codes to develop software that allow software integration testing.
Process outcomes	As a result of successful implementation of this process: <ol style="list-style-type: none">1) A plan and procedures for integrating the software is defined;2) An environment that allows software integration and operation checking of the integrated software is prepared;3) The software is integrated in accordance with the software integration plan;4) The integrated software is operationally verified and the problems that occurred are solved;5) Quality of the software is evaluated and the evaluation results are reported; and6) The evaluated integrated software is communicated to the relevant stakeholders.

<<Base practice>>

[Preparation]

Preparation-BP1: Plan software integration

Considering the restrictions for integration included in the software requirements and the software design, plan software integration activities. Define criteria for integration and the software quality evaluation during a software integration process.

- The integration plan includes the followings;
 - The units, sequence and procedure for the software integration
 - Debug procedure (operation checking, reviews, compiling, build, source code correction and recording debug information etc.) during the software integration
 - Source code version management method for the software integration
 - Measurement activities for the software quality evaluation during the software integration process and definition and evaluation method for data collected.
- The criteria for the quality evaluation during an integration include the points for verifying the software, the numbers per scale of issues pointed out in reviews and in debugging.

Preparation-BP2: Prepare the development environment

Prepare the development environment required for software integration

- The preparation of the development environment includes preparations of Makefile and environment configuration files required for compiling as well as for the software integration.

[Implementation]

Implementation-BP1: Integrate the software

Integrate the software in accordance with the integration plan, verify the operation, and record the debug information during the integration process.

Establish the baselines.

Follow up any issues addressed.

- The “debug information during the integration process” refers to information related to issues identified during the source code integration process and issues occurred in the operation checking.

[Evaluation]

Evaluation-BP1: Evaluate the software quality

Evaluate the software quality based on the debug information captured during the software integration process and report the evaluation results.

[Communication]

Communication-BP1: Communicate the integrated software

Communicate the set of outputs to the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A plan and procedures for integrating the software is defined	Preparation-BP1: Plan software integration
2) An environment that allows software integration and operation checking of the integrated software is prepared.	Preparation-BP2: Prepare the development environment
3) The software is integrated in accordance with the software integration plan.	Implementation-BP1: Integrate the software
4) The integrated software is operationally verified and the problems that occurred are solved.	Implementation-BP1: Integrate the software
5) Quality of the software is evaluated and the evaluation results are reported.	Evaluation-BP1: Evaluate the software quality
6) The evaluated integrated software is communicated to the relevant stakeholders.	Communication-BP1: Communicate the integrated software

ENG.8 Software integration testing

Process ID	ENG.8
Process name	Software integration testing
Purpose	The purpose of software integration testing is to ensure that integrated software meets the software requirements specifications.
Process outcomes	As a result of successful implementation of this process: 1) A plan related to the software integration testing are updated; 2) A testing environment that allows software integration testing is prepared and testing procedures that ensure repeatability of the testing conditions is developed; 3) The integrated software is tested, the test results are recorded, and the problems that occurred are solved; 4) The outputs related to the software integration testing are evaluated and officially reviewed; and 5) The officially reviewed integrated software is communicated to the relevant stakeholders.

<<Base practice>>

[Preparation]

Preparation-BP1: Plan software integration testing

Update software testing plans (test schedule, test procedure planning etc.) as required. Define indices of the software quality evaluation in a software integration testing.

- The quality evaluation indices in this test include the number of test cases per scale, the number of errors, and detection rate of serious errors.

Preparation-BP2: Establish a software integration testing procedure and its specifications

Establish a software integration testing procedure according to the software verification plan, software testing plan, and software testing specifications. If needed, update the software testing specifications developed in the software design process.

- Software integration testing procedure includes the software starting procedure in the test environment, as well as test scripts based on the test case, test script writing procedure, and check items.

Preparation-BP3: Prepare the test environment

Prepare the test environment and test data required for the software integration testing. Ensure that the software integration testing is feasible under the prepared test environment, software testing specifications, and the test procedure. Record information related to the test environment and maintain the test repeatability.

- The preparation includes a preparation of an environment configuration file required for the software testing.

[Implementation]

Implementation-BP1: Perform software integration testing

Perform the software integration testing according to the test procedure. Record the test result and test information to replicate the test in order to maintain repeatability. If there is a modification in software and software integration testing specifications, evaluate the validity of the past testing and develop and perform a new plan.

- The “past testing” indicates not only the software integration testing, but also all tests performed after software construction.

Implementation-BP2: Update operational prerequisites and restrictions

Update operational prerequisites and restrictions identified through the software integration testing.

[Evaluation]

Evaluation-BP1: Evaluate the software and software integration testing

Evaluate the quality of the tested integrated software from the test result based on the evaluation criteria. Evaluate the software integration testing and communicate the result to the stakeholders.

Evaluation-BP2: Perform official review for the software integration testing

Perform official review for the software integration testing against all the process outputs and agree on the result. Follow up on the items to be addressed.

[Communication]**Communication-BP1: Communicate information on tested integrated software**

Communicate all the officially reviewed outputs to stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A plan related to the software integration testing are updated.	Preparation-BP1: Plan software integration testing
2) A testing environment that allows software integration testing is prepared and testing procedures that ensure repeatability of the testing conditions is developed.	Preparation-BP2: Establish a software integration testing procedure and its specification Preparation-BP3: Prepare the test environment
3) The integrated software is tested, the test results are recorded, and the problems that occurred are solved.	Implementation-BP1: Perform software integration testing Implementation-BP2: Update operational prerequisites and restrictions
4) The outputs related to the software integration testing are evaluated and officially reviewed.	Evaluation-BP1: Evaluate the software and software integration testing Evaluation-BP2: Perform official review for the software integration testing
5) The officially reviewed integrated software is communicated to the relevant stakeholders.	Communication-BP1: Communicate information on tested integrated software

ENG.9 System integration

Process ID	ENG.9
Process name	System integration
Purpose	The purpose of system integration is to integrate components as a system that allows testing. The components make up a system including tested software.
Process outcomes	As a result of successful implementation of this process: 1) A plan and procedures for integrating the system are defined; 2) Criteria are defined for verifying that the interfaces between the system components are correctly implemented; 3) The integrated system is checked to satisfy the system requirements and the system architecture design; and 4) Results of the system integration are recorded.

<<Base practice>>

[Preparation]

Preparation-BP1: Plan system integration

Considering the restrictions for integration included in the system requirements and the system design, establish the system integration plan.

Establish criteria for integration and indices for evaluating quality of the system during system integration.

- A system integration plan includes the following:
 - What to integrate in what order until the full system is integrated, and the steps of integration,
 - Procedure to follow when debugging during the integration regarding how to check operation, review, compile, and build the changed integrated systems, how to record debugging information, etc.,
 - Methods of version management of the source code during the integration, and
 - Measurement activities for quality evaluation during the integration, definition of data to collect, and methods to evaluate the data.
- Examples of the indices of quality during the integration include the count of review comments per a scale unit, the points for verifying the software, and the count of debugging.

[Implementation]

Implementation-BP1: Install software into the target platform

If software is a part of the system components to be installed, install it to the target platform by following the installation procedure and prepare software-embedded system components.

- The installation procedure includes the followings
 - Installation procedure to the target platform
 - Installation checking procedure
- The “software-embedded system components” refer to components that embed software-

Implementation-BP2: Integrate system components

Integrate system components by following the system integration plan that allows the system comprehensive testing, and then check the operation. Record the debug information identified during the integration process.

- The “operation checking” here, which is a different operation from actual “testing,” is performed as a part of test preparations to ensure that integrated systems are available for being tested. “Operation checking” for system integration mainly checks the interfaces between system components. In this operation, test specification and cases are not necessary to be created; it is only necessary to ensure that arbitrary data is exchanged between system components.

[Evaluation]

Evaluation-BP1: Evaluate system integration results

Evaluate that systems are integrated as directed in the integration procedure and they are ready for system comprehensive testing.

[Communication]

Communication-BP1: Communicate the system integration results

Communicate the system integration results, such as a set of outputs of the reviewed system integration process, to the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A plan and procedures for integrating the system are defined.	Preparation-BP1: Plan system integration
2) Criteria are defined for verifying that the interfaces between the system components are correctly implemented.	Preparation-BP1: Plan system integration
3) The integrated system is checked to satisfy the system requirements and the system architecture design.	Implementation-BP1: Install software into the target platform Implementation-BP2: Integrate system components Evaluation-BP1: Evaluate system integration results
4) Results of the system integration are recorded.	Implementation-BP2: Integrate system components Evaluation-BP1: Evaluate system integration results Communication-BP1: Communicate the system integration results

ENG.10 System comprehensive testing

Process ID	ENG.10
Process name	System comprehensive testing
Purpose	The purpose of system comprehensive testing is to ensure that an integrated system meets the system requirements.
Process outcomes	As a result of successful implementation of this process: 1) A Plan related to the system comprehensive testing is clearly defined; 2) Criteria are defined for verifying that the integrated system meets the system requirements specification; 3) The integrated system is verified based on the verification criteria; and 4) Testing procedures, testing environment configuration, and the test results are recorded.

<<Base practice>>

[Preparation]

Preparation-BP1: Plan system comprehensive testing

Establish a plan for system comprehensive testing. Also, consider the roles and tasks for the people in charge of software during the system comprehensive testing.

Establish indices to evaluate quality of the system during the system comprehensive testing.

- Such indices may be one or more of, but not limited to, the following: ratio of test cases to the size of system, count of defects, and detection rate of serious defects.

Preparation-BP2: Establish the system comprehensive test specification and procedure

Create the system comprehensive test specification and procedure by following the verification plan and system comprehensive test plan.

- Consider the following aspects for the system comprehensive test specification
 - Operational scenarios
 - Software requirements specification
 - Maximum load
 - Coverage of the system requirements specification and the system architectural design specification
 - Abnormal events such as exceptions and malfunctions
 - System compatibilities with COTS and reusable software items

Preparation-BP3: Prepare the test environment

Prepare the test environment required for the system comprehensive test and verify the effectiveness. Ensure the repeatability for the test condition to allow performing testing under the same condition in case a change occurs in the system components.

- Regarding the test environment, record the followings to ensure the repeatability of the test condition
 - Operating instructions of the testing device
 - Layout and interconnection between the testing devices and equipment

Preparation-BP4: Record and manage problems

Record and manage incidents and problems found during preparation of the test.

- Preparation of the test includes check of the testing procedures and preparation of the test environment.
- When recording and managing incidents and problems, include not only the information about the testing procedures and

the test environment but also other related information such as test cases.

[Implementation]

Implementation-BP1: Perform system comprehensive test

Perform the system comprehensive test by following the test procedure, and record the test information. If any corrections are made in the software or system comprehensive test specification, evaluate the effectiveness of the past tests, develop a plan for testing again, and perform the test.

- The “past tests” refer to not only the system comprehensive test, but also all the tests performed after the software construction.

Implementation-BP2: Update operational prerequisites and restrictions

Update operational prerequisites and restrictions identified through the system comprehensive test

[Evaluation]

Evaluation-BP1: Evaluate the system comprehensive test

Evaluate the system comprehensive test results based on the evaluation criteria. Evaluate the system comprehensive test. Communicate the evaluation results to the stakeholders.

Evaluation-BP2: Perform official review for the system comprehensive test

Perform official review on the output of this process and establish agreement on it among the stakeholders. Follow up on any items identified to be addressed.

- In the official review process, check the test-related activities and validity of the test result.

[Communication]

Communication-BP1: Communicate the system comprehensive test results

Communicate the set of officially reviewed outputs to the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A Plan related to the system comprehensive testing is clearly defined.	Preparation-BP1: Plan system comprehensive testing
2) Criteria are defined for verifying that the integrated system meets the system requirements specification.	Preparation-BP2: Establish the system comprehensive test specification and procedure Preparation-BP3: Prepare the test environment
3) The integrated system is verified based on the verification criteria.	Implementation-BP1: Perform system comprehensive test Evaluation-BP1: Evaluate the system comprehensive test Evaluation-BP2: Perform official review for the system comprehensive test
4) Testing procedures, testing environment configuration, and the test results are recorded.	Implementation-BP1: Perform system comprehensive test Implementation-BP2: Update operational prerequisites and restrictions Communication-BP1: Communicate the system comprehensive test results

3.3 Supporting process group

SUP.1 Quality assurance

Process ID	SUP.1
Process name	Quality assurance
Purpose	The purpose of quality assurance process is to assure that all process activities in the software or system and project lifecycle are performed and work products are developed in accordance with the predefined plans.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) A strategy for performing quality assurance is developed and implemented.2) Quality assurance is performed independently and objectively.3) Perform activities to assure quality of product and service in accordance with the quality assurance strategy.4) Perform the process assurance activities in accordance with the quality assurance strategy.5) Make the quality assurance activity results available to the stakeholders.

<<Base practice>>

[Planning]

Planning-BP1: Develop a quality assurance strategy

Develop a strategy in order to ensure that product quality and process assurance is performed independently and objectively.

In the strategy, identify processes which affect product and service by prioritization.

The strategy includes problem resolution, product and service, and process improvement.

Planning-BP2: Define the people in charge

Ensure that responsibilities and authorities of the people in charge of performing the quality assurance activities are defined and that they are independent from the development organization.

Planning-BP3: Establish a plan for quality assurance

Develop a plan for quality assurance activities based on the strategy.

The plan includes specific evaluation criteria and methods, product and service, and activities considering specific aspects for the implemented process.

[Implementation]

Implementation-BP1: Assure quality of product and service

Perform quality assurance activities for product and service by following the quality assurance plan, and then record the results.

Implementation-BP2: Assure the process

Perform the process assurance activities by following the quality assurance plan, and then record the results.

[Check]

Check-BP1: Check the quality assurance activities

Ensure that the activities are performed based on the quality assurance plan.

[Action]

Action-BP1: Address issues on the quality assurance activities

If any, address the issues based on the checking results of the quality assurance activities. Review the quality assurance plan and quality management system as required.

[Communication]

Communication-BP1: Communicate the quality assurance activity results

Report the quality assurance activity results to the stakeholders who use them.

- The “quality assurance activity results” include the ones from the planning, implementation, check, and action.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A strategy for performing quality assurance is developed and implemented.	Planning-BP1: Develop a quality assurance strategy Planning-BP3: Establish a plan for quality assurance
2) Quality assurance is performed independently and objectively.	Planning-BP2: Define the people in charge
3) Perform activities to assure quality of product and service in accordance with the quality assurance activity strategy.	Implementation-BP1: Assure quality of product and service
	Check-BP1: Check the quality assurance activities
	Action-BP1: Address issues on the quality assurance activities
4) Perform the process assurance activities in accordance with the quality assurance activity strategy.	Implementation-BP2: Assure the process
	Check-BP1: Check the quality assurance activities
	Action-BP1: Address issues on the quality assurance activities
5) Make the quality assurance activity results available to the stakeholders.	Communication-BP1: Communicate the quality assurance activity results

SUP.2 Verification

Process ID	SUP.2
Process name	Verification
Purpose	The purpose of verification process is to provide objective evidence that the computer system meets the requirements and its characteristics.
Process outcomes	As the result of successful implementation of this process: 1) A verification strategy is developed. 2) A plan for the verification activities is developed based on the strategy. The scope, methods, and criteria for verification are specified. 3) Perform the verification activities in accordance with the verification activity plan. 4) Make the verification activity results available to the stakeholders.

<<Base practice>>

[Planning]

Planning-BP1: Develop a verification strategy

Develop a verification strategy. Identify constraints for integration included in requirements, architecture, and design of system and software in the strategy.

- Consider the following in the strategy.
 - Identification of the scope for verification (including target software, components, and deliverables), characteristics to be verified, and verification results expected
 - Constraints and limits of verification
 - Identification of priorities for the verification scenario

Planning-BP2: Develop a verification plan

Develop a verification plan based on the verification strategy,. Define verification activities to be implemented and procedures with the associated scope, methods, and criteria for verification in the plan. Determine schedule for performing the plan.

- Development of a plan includes that enabling systems or services required to support verification are identified and made available.
- Verification methods may include inspections, analysis, demonstration, and tests, with techniques, methods, and tools to be used for them.
- Verification criteria may include standards.
- The procedures include the methods for record, analysis, and report of verification results.
- The plan includes handling issues, if any.

[Implementation]

Implementation-BP1: Perform verification

Perform the verification process based on the verification plan and record the result. Include traceability for the verification targets in the record.

[Communication]

Communication-BP1: Communicate the verification results

Make verification results available to all the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A verification strategy is developed.	Planning-BP1: Develop a verification strategy
2) A plan for the verification activities is developed based on the strategy. The scope, methods, and criteria for verification are specified.	Planning-BP2: Develop a verification plan
3) Perform the verification activities in accordance with the verification activity plan	Implementation-BP1: Perform verification
4) Make the verification activity results available to the customer and other stakeholders.	Communication-BP1: Communicate the verification results

SUP.3 Validation

Process ID	SUP.3
Process name	Validation
Purpose	The purpose of validation process is to provide objective evidence that the computer system meets objectives expected of a mission or stakeholder requirements under the intended environment or use.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) A validation strategy is developed.2) A plan for the validation activities is developed based on the strategy. The methods and criteria for validation are specified for the software work products.3) Perform validation activities in accordance with the plan4) Provide evidence to show that the software is suited for the intended use.5) Make the validation activity results available to the customer and other stakeholders.

<<Base practice>>

[Planning]

Planning-BP1: Develop a validation strategy

Develop a validation strategy. Identify constraints for integration included in requirements, architecture, and design of system and software in the strategy.

- Consider the following in the strategy.
 - Identification of the scope for validation (including target software, components, and deliverables), characteristics to be verified, and verification results expected
 - Constraints and limits of validation
 - Identification of priorities for the validation scenario

Planning-BP2: Develop a validation plan

Develop a validation plan based on the validation strategy. Define validation activities to be implemented and procedures with the associated methods and criteria for validation in the plan. Determine schedule for implementing the plan.

- Development of a plan includes that enabling systems or services required to support validation are identified and made available.
- The plan includes handling issues and incidents, if any.
- The procedures include the methods for record, analysis, and report of validation results.

[Implementation]

Implementation-BP1: Perform validation

Perform the validation process based on the validation plan and record the result. Include traceability for the validation targets in the record.

Obtain agreement that the validation result meets the stakeholders' needs.

[Communication]

Communication-BP1: Communicate the validation results

Make validation results available to all the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A validation strategy is developed.	Planning-BP1: Develop a validation strategy
2) A plan for the validation activities is developed based on the strategy. The methods and criteria for validation are specified for the software work products.	Planning-BP1: Develop a validation strategy Planning-BP2: Develop a validation plan
3) Perform the validation activities in accordance with the plan	Implementation-BP1: Perform validation
4) Provide evidence to show that the software is suited for the intended use.	Implementation-BP1: Perform validation
5) Make the validation activity results available to the customer and other stakeholders.	Communication-BP1: Communicate the validation results

SUP.4 Joint review

Process ID	SUP.4
Process name	Joint review
Purpose	The purpose of the Joint review process is to maintain a common understanding with the stakeholders that the project satisfies the agreed-upon objectives and established criteria at both the project management and technical levels.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) Joint reviews are identified and planned on the needs of the project.2) Joint reviews are held on the basis of a plan and the status of the software development project.3) The project status is evaluated through the joint reviews between the stakeholders at both the project management and technical levels in accordance with the agreed-upon objectives and established criteria.4) Review results are made known to all affected parties.5) Action items with respect to identified problems are identified.

<<Base practice>>

[Planning]

Planning-BP1: Establish joint review plan

Establish a plan as to activities and schedule of joint reviews, so as to review the status with the stakeholders at both the project management and technical levels through the project.

Identify the purpose, scope, and review criteria of each joint review.

[Implementation]

Implementation-BP1: Prepare joint review

Identify specific date, scope, participants, purpose, and procedure for the review.

In order to effectively conduct joint review, prepare and distribute review materials when needed.

- Degree of requirements for documentation regarding date, scope, participants depends on the type of joint review; i.e., whether it is an “official review” or a “walk-through.”

Implementation –BP2: Conduct joint review

Conduct joint review and record the review results. Identify and record the problems from review results; determine priority for action items.

- The action items for the identified problems are handled in Action item management Process (SUP.13).
- Identify and approve responsibilities, criteria for resolution, and target date for each action item, and track its status to closure.

Implementation –BP3: Review joint review results

Review the review results and agree on the results with the stakeholders.

- In an official review, record the review results and collect quantitative data, including time spent in the review and questions/the required corrective actions, and then evaluate the quality of the official review.

[Communication]

Communication-BP1: Communicate joint review results

Disclose the review results to all affected parties. Communicate the review results to the stakeholders when needed.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Joint reviews are identified and planned on the needs of the project.	Planning-BP1: Establish joint review plan
2) Joint reviews are held on the basis of a plan and the status of the software development project.	Implementation-BP1: Prepare joint review
	Implementation-BP2: Conduct joint review
3) The project status is evaluated through the joint reviews between the stakeholders at both the project management and technical levels in accordance with the agreed-upon objectives and established criteria.	Implementation-BP2: Conduct joint review
	Implementation-BP3: Review joint review results
4) Review results are made known to all affected parties.	Communication-BP1: Communicate joint review results
5) Action items with respect to identified problems are identified.	Implementation-BP2: Conduct joint review

SUP.8 Configuration management

Process ID	SUP.8
Process name	Configuration management
Purpose	The purpose of configuration management process is to establish and maintain a status where software configurations are perfectly prepared (a status which allows you to determine groups of configuration management items and their structure, maintain the configuration histories and include items of which statuses are functionally optimized) and to make them available to the stakeholders, in order to define and ensure the configurations of the target products.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) A strategy for performing configuration management is developed and implemented.2) An activity plan is developed based on the configuration management strategy, configuration management items are identified, and the management methods for these identified items are defined.3) The histories of the identified configuration management items are maintained and made them and their information ready to be retrieved when needed.4) The configuration management items to be disposed are identified and disposed.5) Address change requests in accordance with predefined criteria and procedure and be ready to track the requests and changes. Evaluates the changes made as well as the details.6) Establish a storing system of configuration management items and actually store them.7) A third party evaluates whether the configuration management is performed as per the plan.8) Establish a system to inform statuses and modified information of the change requests and configuration management items to the stakeholders when appropriate.

<<Base practice>>

[Planning]

Planning-BP1: Develop a configuration management strategy

Develop a strategy so that configuration management is performed successfully.

- Consider the following in the strategy.
 - Management of software licenses, data authorities, and other Intellectual Property Rights
 - Management of frequency and priority of release, software version and contents, and distribution of release
 - The strategy and responsibility for configuration audit for continuous completeness of configuration definition information and validity of security
 - Change management involving the users of operational software/service

Planning-BP2: Develop a configuration management plan

Define configuration management activities and develop a configuration management plan based on the strategy. Identify roles and responsibilities and authorities for the configuration management activities and assign them. Include the activities that are related to approval of urgent change requests as well as normal change requests. Also, plan tools required to perform the activities.

If a branch development is required in your development, determine the policy.

-
- The configuration management activities include their evaluation activities and backups. Define the evaluation and backup plans.
- Include a configuration management board as a role for performing the configuration management activities.
- Develop a schedule to establish the baseline.

Planning-BP3: Identify configuration management items

Identify items that need to be managed as configuration management items from the deliverables generated through a software development and identify these item structures. If branch management is required in your development, identify items that require branch management.

Planning-BP4: Develop configuration management procedure

Develop a configuration management procedure (including the usage procedure for the configuration management system). Define the management unit.

Develop procedures; “Management procedure for change requirements”, “Change procedure to change deliverables when a change request is accepted”, and “Management procedure for disposal”.

Develop a release procedure and backup procedure for configuration management items.

[Implementation]

Implementation-BP1: Maintain configuration management items

Update the stakeholders the change histories and latest statuses of configuration management items.

Also, update the structures and their histories of each group of configuration management items to the stakeholders.

Identify the configuration management items to be disposed and dispose them.

- The configuration management items information includes groups of configured items, group structure of configuration management items, the latest configuration management items, and change requests for these items. It also includes identifiers of the items, version numbers, and change histories, as well as information of “detailed level of configuration items (such as the parts of configuration management items)” and “author and manager of the configuration management items.”
- Dispose the configuration items which are unnecessary, invalid, or inappropriate.

Implementation-BP2: Record change requests

Identify change requests, clarify their relations with other change requests, and record them. Analyze the change requests, consider the change methods, and determine the approval or disapproval of them.

Implementation-BP3: Implement the change

Implement the approved change method and check the change results of configuration management items. Allow tracking the change method and change results of configuration items from the change requests.

Implementation-BP4: Establish baselines

Establish a baseline for each configuration management item and group of configuration items.

- The baseline refers to version information of groups of deliverables that were formally agreed for a specific purpose. An example to establish a baseline is when the phase changes from the software requirements analysis to software design, in order to formally establish the documents that will become the software design inputs, a formal agreement is made for a set of deliverables having been created until the software requirements analysis phase.

Implementation-BP5: Store configuration management items

Backup and store configuration management items in accordance with the configuration management plan on a regular basis.

[Check]

Check-BP1: Evaluate configuration management activities

Check configuration management activities and evaluate groups of the configuration management items and each configured item.

[Communication]

Communication-BP1: Establish a system to inform configuration statuses

Establish a system to record the change requests and “Statuses and modified information of configuration management items” and inform to the stakeholders.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A strategy for performing configuration management is developed and implemented.	Planning-BP1: Develop a configuration management strategy
2) An activity plan is developed based on the configuration management strategy, configuration management items are identified, and the management methods for these identified items are defined.	Planning-BP2: Develop a configuration management plan Planning-BP3: Identify configuration management items Planning-BP4: Develop configuration management procedure
3) The histories of the identified configuration management items are maintained and made them and their information ready to be retrieved when needed.	Implementation-BP1: Maintain configuration management items Implementation-BP4: Establish baselines
4) The configuration management items to be disposed are identified and disposed.	Implementation-BP1: Maintain configuration management items
5) Address change requests in accordance with predefined criteria and procedure and be ready to track the requests and changes. Evaluates the changes made as well as the details	Implementation-BP2: Record configuration management items Implementation-BP3: Implement the change
6) Establish a storing system of configuration management items and actually store them.	Implementation-BP5: Store configuration management items
7) A third party evaluates whether the configuration management is performed as per the plan.	Check-BP1: Evaluate configuration management activities
8) Establish a system to inform statuses and modified information of the change requests and configuration management items to the stakeholders when appropriate.	Communication-BP1: Establish a system to inform configuration statuses

SUP.9 Problem resolution

Process ID	SUP.9
Process name	Problem resolution
Purpose	The purpose of the problem resolution process is to identify incidents and problems , resolve the problems by implementing the appropriate measures and prevent a recurrence of the same or similar problems.
Process outcomes	As the result of successful implementation of this process: 1) A management plan for managing the problem resolution is developed. 2) The incidents and problems are detected and resolution of the problems are ensured 3) The incidents and problems management statuses are monitored and the issues are addressed. 4) The incidents and problems related information is shared with stakeholders. 5) Improvement for preventing recurrence of the incidents and problems is identified. 6) The trend of the incidents and problems is analyzed and appropriate preventive measures are taken.

<<Base practice>>

[Planning]

Planning-BP1: Develop a management plan for the problem resolution

Manage problems with the management resolution process. Develop a management plan for problem resolution that includes “incidents and problem types and their definitions,” “management methods and procedures for each incident and problem type,” and “a system to provide information to stakeholders.”

- Also define the methods to determine need for taking actions when detecting the incidents.
- The known incidents and problems are to be associated for management.
- The management method and procedures include the managing organization, personnel, tools, and forms as well as management status information (pending, in-process, completed, etc.) and workflow etc.

[Implementation]

Implementation-BP1: Identify and record problems

Identify incidents and issues raised and record them by following a management method and procedure defined for each type.

- The word “identify” here means, for example, using an identifier to uniquely identify each detected incident or problem.

Implementation-BP2: Analyze problems

Analyze and clarify phenomenon, conditions underneath, and the cause of the incidents and problems. Identify the extent of the their impact. Manage the incidents as the problems when a corrective action is required.

- The analysis includes the following aspects:
 - Applicable scope (Scope of the correction. It includes existing software.)
 - Extent of impact (Scope of impact from the correction. It includes existing software.)
 - Workload (Cost and time etc. required for the correction)
 - Severity (Impact on the performance, safety, and security etc.)
 - Urgency, time to implement the correction

Implementation-BP3: Consider the problem resolution methods

Consider the problem resolution methods and develop both emergency and permanent measures as plans based on the result of the problem analysis. Evaluate the impacts that the measures have on existing system and software.

- When considering the problem resolution methods, consider whether it needs rolling out to other relevant organizations or other projects that develop similar software.

Implementation-BP4: Determine a problem resolution method

Agree on a plan and a problem resolution method with the stakeholders in order to resolve the issue.

Implementation-BP5: Implement the problem resolution method

Implement the problem resolution plan and method in order to resolve the issue. Ensure whether the plan and the method are properly implemented.

- If the problem resolution method needs to be rolled out, plan a roll-out method and implement it.

Implementation-BP6: Track the problem resolution statuses

Monitor the incidents and problem handling statuses on a regular basis and track them until their statuses change to “complete.”

Take actions on pending issues.

Track them until you can ensure secondary problems will not occur due to the actions taken.

- If the problem resolution method is rolled out, track it until the completion.

Implementation-BP7: Identify improvement for prevention

Identify improvement to be performed for the processes and the software products to prevent known incidents and problems.

Implementation-BP8: Perform trend analysis for the problem

Perform trend analysis on incidents and problems raised and identify and remove the cause to prevent hidden defects from being exposed. Share required information with relevant departments.

[Check]

Check-BP1: Monitor management statuses for problem resolutions

Ensure whether problem resolutions are managed based on the problem resolution management plan, method and procedures, and take action on items not in compliance with them.

[Communication]

Communication-BP1: Share information related to the problem

Establish a system to share problem-related information with the stakeholders and a system to roll out the problem resolution method.

- The information shared includes the issues that have an impact on the stakeholders, the problem status, results of the trend analysis, and preventive measures.
- The entities with which you share information and roll out a problem resolution method to include relevant organizations and other projects that develop similar software.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) A management plan for managing the problem resolution is developed.	Planning-BP1: Develop a management plan to manage the problem resolution
2) The incidents and problems are detected and resolution of the problems are ensured.	Implementation-BP1: Identify and record problems
	Implementation-BP2: Analyze problems
	Implementation-BP3: Consider the problem resolution methods
	Implementation-BP4: Determine a problem resolution method
	Implementation-BP5: Implement the problem resolution method
	Implementation-BP6: Track the problem resolution statuses
3) The incidents and problems management statuses are monitored and the issues are addressed.	Check-BP1: Monitor management statuses for problem resolutions
4) The incidents and problems related information is shared with stakeholders.	Communication-BP1: Share information related to the problem
5) Improvement for preventing recurrence of the incidents and problems is identified.	Implementation-BP7: Identify improvement for prevention
6) The trend of the incidents and problems is analyzed and appropriate preventive measures are taken.	Implementation-BP8: Perform trend analysis and take preventive measures for the problem

SUP.13 Action item management

Process ID	SUP.13
Process name	Action item management
Purpose	The purpose of the Action item management process is to identify and record action items that emerge during the systems and software engineering, and to follow up on those action items until the time of their closure.
Process outcomes	As a result of successful implementation of this process: 1) The procedure to manage action items is established; 2) Action items are identified and managed; and 3) Status of action item management is monitored and its related problems are addressed.

<<Base practice>>

[Planning]

Planning-BP1: Establish the procedure to manage action items.

Make clear what to manage as an action item and establish a procedure to manage those. Get the stakeholders to agree on the procedure.

- Candidates of items to manage may be the action items recorded in minutes, items pointed out in a review, items to be determined later in a specification, items pointed out and/or requested in a meeting, requests in an email, etc.
- Determine a mechanism to follow up on the status of an item e.g., not started, postponed, started, completed, etc.

[Implementation]

Implementation-BP1: Identify and record action items.

Identify and record action items according to the action item management procedure.

Implementation-BP2: Perform action items.

Perform action items according to the action item management procedure.
Ensure that the action items are performed right at an appropriate timing.

Implementation-BP3: Follow up on action items.

Track the statuses of action items regularly and track them until the time of their closure.
Identify open items and follow up on each of them until the time of their closure.

[Check]

Check-BP1: Ensure the status of action item management.

Ensure that action items are properly managed according to the procedure of action item management. Address unconformities to the procedure.

[Communication]

Communication-BP1: Share information on the action items.

Communicate information relevant to the action item management to the stakeholders.

- Information to be shared may be statuses of the action items, impact on the stakeholders, outcome of an action, etc.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The procedure to manage action items is established.	Planning-BP1: Establish the procedure to manage action items.
2) Action items are identified and managed.	Implementation-BP1: Identify and record action items
	Implementation-BP2: Perform action item management.
	Implementation-BP3: Follow up on action items.
	Communication-BP1: Share information on the action item management.
3) Status of action item management is monitored and its related problems are addressed.	Check-BP1: Monitor the status of action item management.

SUP.14 Process assessment

Process ID	SUP.14
Process name	Process assessment
Purpose	The purpose of the Process assessment process is to understand the process performed in the project and identify improvement opportunity on the basis of the standard or criteria equivalent to the standard.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) Plan for the assessment is established and obtain the commitment of the sponsors and the organizational unit(s).2) Data required for objectively evaluating the processes are collected and validated.3) Strengths and weaknesses of the process implemented in the project are identified.4) Assessment records are kept and maintained.5) Assessment results including an improvement proposal are reported to the sponsors.

<<Base practice>>

[Planning]

Planning-BP1: Define requirements for assessment

Obtain and define sponsors requirements for the assessment. Identify the criteria to verify the achievement of the requirements.

- Major items to be studied and adjusted when defining the requirements for the assessment are as follows:
 - assessment purpose and policy;
 - target organization unit(s) and target system;
 - schedule of the assessment;
 - target process of the assessment and highest capability level;
 - reasons for the selections of the targets above;
 - leader of assessment team;
 - members of the assessment team (the number of members); and
 - estimated effort.

Planning-BP2: Establish assessment plan

Establish an assessment plan and obtain the commitment of the sponsors and the organizational unit(s) to be assessed.

- Major activities to be performed to establish an assessment plan are as follows:
 - determination of assessment target;
 - planning of resources necessary for assessment;
 - the identity of assessors and support staff with specific responsibilities for the assessment;
 - determination of a coordinator;
 - determination of an observer and its role and authority;
 - planning of time and place to conduct the assessment;
 - identification reports, the ownership of the reports and any restrictions on their use; and
 - creation of WBS.

[Implementation]

Implementation-BP1: Prepare assessment

Ensure that assessment team members have skills and knowledge of the organizational unit(s) to be assessed, in order to conduct the assessment activities effectively and efficiently and reliably achieve the requirements for the assessment.

Conduct training for the assessment team members and investigation of the assessment organizational unit(s) when needed.

- Major activities to be performed to prepare the assessment are as follows:
 - providing assessment training;
 - providing assessment briefing session; and
 - understanding of organizational unit(s).

Implementation-BP2: Perform the assessment to collect data

Perform the assessment to collect the data required for evaluating the processes within the scope of the assessment.

- Data collection activity includes documentation review and interview.

Implementation-BP3: Verify and validate collected data

Verify and validate collected data and maintain the data, so as to reliably achieve the requirements for the assessment.

- Major criteria used for verification and validation of data are as follows:
 - objectivity of the collected data (whether the data are limited to those obtained through the documentation review and interview);
 - unambiguity of the collected data;
 - consistency between the collected data; and
 - coverage of the collected data (whether the data sufficiently covers for base practice and generic practice of JAXA-PAM).

Implementation-BP4: Evaluate process

Evaluate the assessment target process by using the verified and validated data so as to understand the relative strengths and weaknesses of the organization's processes.

Implementation-BP5: Conduct assessment debriefing session

Develop assessment results and agree on it among the assessment team. Hold the assessment debriefing session for organizational unit(s), including sponsors.

Implementation-BP6: Document assessment final report

Document an assessment final report on the basis of the assessment results and maintain record of the assessment including assessment results.

[Check]

Check-BP1: Check assessment final report

Check the contents of the assessment final report and agree on it among the assessment team, sponsors, and organizational unit(s).

Check-BP2: Evaluate assessment activities

Evaluate the assessment activities and collect feedback to continually improve effectiveness and efficiency of the assessment activities.

- Major activities to perform are as follows:
 - administer questionnaire targeting the assessment team and organizational unit(s) and collect information;
 - collect project effort of the assessment team and coordinator; and
 - collect opinions as to good points, reflection points, improvement proposals for each of the major processes from the assessment team.

[Communication]

Communication-BP1: Communicate assessment final report

Communicate the assessment final report to organizational unit(s), including sponsors.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Plan for the assessment is established and obtain the commitment of the sponsors and the organizational unit(s).	Planning-BP1: Define requirements for assessment
	Planning-BP2: Establish assessment plan
2) Data required for objective evaluating the processes are collected and validated.	Implementation-BP1: Prepare assessment
	Implementation-BP2: Perform the assessment to collect data
	Implementation-BP3: Verify and validate collected data
3) Strengths and weaknesses of the process implemented in the project are identified.	Implementation-BP4: Evaluate process
	Implementation-BP6: Document assessment final report
	Check-BP1: Check assessment final report
4) Assessment records are kept and maintained.	Implementation-BP3: Verify and validate collected data
	Implementation-BP6: Document assessment final report
	Check-BP2: Evaluate assessment activities
5) Assessment results including an improvement proposal are reported to the sponsors.	Implementation-BP5: Conduct assessment debriefing session
	Communication-BP1: Communicate assessment final report

3.4 Management process group

MAN.3 Project management

Process ID	MAN.3
Process name	Project management
Purpose	The purpose of the Project management process is to plan and manage items necessary for satisfying requirements of the project, while seeking to harmonize assumptions and constraints.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) A development strategy is developed.2) The scope of the project is defined.3) The feasibility of achieving the goals of the project under the assumptions and constraints is evaluated.4) Affected parties of the project are identified and project's requirements, project plan, and status of the project are shared.5) Plan for the execution of the project based on the strategy is developed and implemented.6) Progress of the project is monitored and actions for achieving the project goals are taken.

<<Base practice>>

[Planning]

Planning-BP1: Develop a development strategy

Develop a strategy for development

- Consider the following in the strategy.
 - Policy for adequate safety, security, privacy, and environmental practice
 - Programming and coding conventions
 - Unit test policy
 - When using reusable software, methods for checking conformity to the computer system and safety of acquisition channels.
 - Policy of software integration
 - Review methods such as peer review or walkthrough
 - Priority for migration of related data and software associated with decommissioning of the computer system

Planning-BP2: Define scope

Identify requirements, assumptions, and constraints of the project, and define the project's objectives, goals, project lifecycle, and the scope of work to be undertaken by the project.

- The project management rules (Rule No. 19-29) define that the project goals are “quantitative criteria for measuring the success of the project including explanation of the contents to be realized by the project, realization time, and budget.”

Planning-BP3: Evaluate feasibility of achieving project goals

Identify risks and evaluate feasibility of achieving the project goals within assumptions and constraints.
Share risks, constraints, assumptions, and evaluation results with the affected parties.

Planning-BP4: Establish project plan

Establish a project plan based on the development strategy.
Define project activities and tasks, skills, and resources necessary to execute the project and estimate the cost.
Define roles, responsibilities and authorities, development processes and activities, phases, schedule, project interfaces,

communication plans, and infrastructure, and establish a project plan.
Include criteria for achieving goals in the methods for checking progress.
Agree on the project plan with the stakeholders.

- Resources include management plan including identification of COTS items and knowledge assets, definition of quality assurance process for identified COTS items and knowledge assets.
- Activities include those performed by the computer system and such.
- Phasing is segmentation of the project into phases for the purpose of reliably and efficiently developing a large and complicated system. Phasing is planned depending on the degrees of peculiarity, scale, and technological development elements of the project.
- Project interface means contact with (sub-) projects relevant to the project, organizational units and other affected parties.
- The communication plan includes information and methods exchanged between the project interfaces and requires agreement by the project interfaces.
- Infrastructure includes environment used in software development and verification (enabling systems or services such as simulator, actual hardware, and test environment), acquisition of and access to them.

[Implementation]

Implementation-BP1 Implement the project plan

Implement planned management activities of the project.

Implementation-BP2: Perform official review for phase transition

Perform official review as to validity of completion of a phase and whether or not to shift to the next phase.
Agree on the contents of the review with the stakeholders.

- If a phase is the last one in the project, perform Check-BP2 after this base practice.

[Check]

Check-BP1: Review project management activities

Review whether the project management activities are performed according to the project plan, and evaluate the status of the project performance.
If the performance of the project management activities deviates from the project plan, analyze impacts and risks in achieving the project goals and report the analysis results to the stakeholders.

- Reviewing the project management activities require not only checking whether the project plan is implemented but also evaluation of achievement status of the project goals.

Check-BP2: Conclude project

Evaluate the achievement status of the project goals.
Report the evaluation results to the affected parties and agree on the termination of the project with the affected parties.
Identify experiences and knowledge obtained through the project to provide lessons learned for future projects.

[Action]

Action-BP1: Act to correct deviations and prevent recurrence of problems

Take action to correct deviations from the plan and, as necessary, to prevent recurrence of the problems identified in the review of the project management activities.
Change the project scope and update project plan when needed.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) The development strategy is developed.	Planning-BP1: Develop development strategy
2) The scope of the project is defined.	Planning-BP2: Define scope
3) The feasibility of achieving the goals of the project under the assumptions and constraints is evaluated.	Planning-BP3: Evaluate feasibility of achieving project goals
	Planning-BP4: Establish project plan
4) Affected parties of the project are identified and project's requirements, project plan, and status of the project are shared.	Implementation-BP1: Implement the project plan
	Implementation-BP2: Perform official review for phase transition
	Check-BP1: Review project management activities
	Check-BP2: Conclude project
5) Plan for the execution of the project is developed and implemented.	Planning-BP4: Establish project plan
	Implementation-BP2BP1: Implement the project plan
6) Progress of the project is monitored and actions for achieving the project goals are taken.	Check-BP1: Review project management activities
	Check-BP2: Conclude project
	Action-BP1: Act to correct deviations and prevent recurrence of problems

MAN.4 Quality management

Process ID	MAN.4
Process name	Quality management
Purpose	The purpose of quality management process is to ensure that products and services meet customer requirements, and achieve customer satisfaction by managing them at organization as well as project levels.
Process outcomes	<p>As the result of successful implementation of this process:</p> <ol style="list-style-type: none">1) Define quality targets based on the customer needs and organization policy. Develop a comprehensive strategy related to quality management activities in order to achieve the defined quality targets.2) Establish a quality management system to perform the comprehensive strategy, and enforce the quality management activities.3) Ensure that the quality management activities are performed to achieve the quality targets, and then that the objectives are achieved.4) Take appropriate measures if the quality targets are not achieved.5) Collect feedback to examine the continuous improvement of quality.

<<Base practice>>

[Planning]

Planning-BP1: Define quality targets

Define quality targets for the organization and for the products and processes, based on the customer needs, organization policy, and quality requirements related to the customer environment (the quality requirements include implicit ones).

- It is desirable that the quality targets are ones of which the achievement status can be checked.
- The customer environment includes all persons concerned, the entire society, and regulations to be influenced.

Planning-BP2: Define quality achievement criteria

Define quality achievement criteria to evaluate whether you have met the standard and criteria to measure the achievement status of the defined quality targets and related quality targets.

- It is desirable that the quality targets are criteria that allow quantitative measurements.

Planning-BP3: Develop a comprehensive strategy

Develop a comprehensive strategy that covers resources and responsibilities in order to achieve the defined quality targets.

- The comprehensive strategy covers a policy, methods, roles, and responsibilities to achieve the quality targets. When developing a comprehensive strategy, consider time and resource constraints.

[Implementation]

Implementation-BP1: Perform quality management activities

Develop a quality management plan and perform management activities. Define and submit appropriate quality assurance requirements to the managed entities and monitor and check whether the quality assurance activities are enforced as per the quality assurance requirements.

- The quality management plan is developed by the quality manager based on a comprehensive strategy in order to plan activities for the managed entities (contracts, projects, domains, quality assurance department etc.). (It is a plan that includes the managed entities and management method (who/ when/ what) and differs from the quality assurance plan created in the quality assurance process. The quality assurance plans are created for each project to plan how to achieve the quality assurance requirements.)
- When defining quality assurance requirements for the project to be managed, if there are quality assurance requirements from the customer, incorporate them into our defining quality assurance requirements and submit to the project.

[Check]

Check-BP1: Ensure quality management activities

Ensure that the quality management activities are performed based on the quality management plan, and then report it to take proper action.

- This process, “to ensure quality management activities,” requires not only to ensure that the quality management activities are performed but also to monitor actual values against the defined quality target.

Check-BP2: Check achievement of the quality targets

Evaluate and check achievement of the quality targets on a regular basis by using the defined quality achievement criteria. Also, evaluate and check the validity of quality management system at the management level on a regular basis.

- “To evaluate and check the validity of quality management system” means to evaluate and check whether the quality management system is in place not project-wide but organization-wide, the current quality management system is effective, and whether there is anything to improve.

Check-BP3: Collect feedback

Collect feedback from customers, projects, processes, and staff in order to continuously improve the quality at organization and project levels.

[Action]

Action-BP1: Take corrective actions and preventive measures

Take corrective actions and preventive measure if the defined quality targets are not achieved.

- Corrective actions” here shall mean to seek the cause why the target is not achieved and prevent the recurrence of this failure with the same cause.
- Preventive measures” here shall mean to identify potential issues that may prevent you from achieving the quality target, seek the cause, and take preventive measures.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Define the quality target based on the quality requirements from customers. Then, develop a comprehensive strategy for the quality activities established to achieve the target.	Planning-BP1: Define quality targets
	Planning-BP2: Define quality achievement criteria
	Planning-BP3: Develop a comprehensive strategy
2) Establish a quality management system to execute the comprehensive strategy and enforce the quality management activities.	Implementation-BP1: Perform quality management activities
3) Ensure that the quality management activities are performed to achieve the quality target, and ensure that it is actually achieved.	Check-BP1: Ensure quality management activities
	Check-BP2: Check achievement of the quality target
4) Take the appropriate measures if the target is not achieved.	Action-BP1: Take corrective actions and preventive measures
5) Collect feedback to allow verifying continuous quality improvements.	Check-BP3: Collect feedback

MAN.5 Risk management

Process ID	MAN.5
Process name	Risk management
Purpose	The purpose of the Risk management process is to lower the probability and impact of events that can hinder project performance. • The risks to manage in this process are the uncertain and potential events and states that will affect project goals negatively when they actually occur.
Process outcomes	As a result of successful implementation of this process: 1) Risk management is planned and the plan is agreed on by the stakeholders; 2) Methods and criteria for managing risks are defined and applied; 3) The identified risks are analyzed and the risks to apply risk handling methods are determined; 4) Measures to lower the probability and/or impact are applied; and 5) Information on grave risks is communicated to the stakeholders.

<<Base practice>>

[Planning]

Planning-BP1: Plan risk management.

Define the scope of risk management to be performed for the project according to the risk management policies of the organization.

Develop a risk management plan that includes the methods, criteria, procedures, tools to be used, and roles and responsibilities for managing the risks. Establish agreement among the stakeholders on the risk management plan.

- Of the risk management activities within the organization, a project shall perform the ones that address factors potentially inhibiting the project performance.
- The types of risk may be one or more of the following:
 - Cost-related,
 - System performance-related,
 - Resource-related,
 - Schedule-related, and
 - Technology-related.
- Criteria may be one or more of the following:
 - Criterion for accepting risks,
 - Count of risks to perform risk handling on, and
 - A set of criteria for prioritizing risks to perform risk handling on.

[Implementation]

Implementation-BP1: Identify risks

Identify risks regularly according to the risk management plan.

- Perform risk identification at the frequency defined in the risk management plan.

Implementation-BP2: Analyze the risks

Analyze the identified risks.

Select the risks to prepare risk handling for, according to the criteria. Establish agreement on the selection among the stakeholders.

- In risk analysis, risk handling prioritization may be determined by taking into consideration probability and impact of the risks.

- For the risks that can be accepted, it may be decided that they should be monitored with regard to their status change.

Implementation-BP3: Prepare risk handling.

Define risk handling methods for lowering the probability or impact of the risks and completion criteria for the risk handling and establish agreement on the risk handling and the completion criteria among the stakeholders.
Perform risk handling.

- Risk monitoring for an accepted risk may be a means of risk handling.
- Completion criteria may be one or more of the following:
 - End date of the measure, and,
 - The magnitude of impact at which a risk can be accepted after performing its measures.

Implementation-BP4: Monitor the risks

Monitor the status of each of the risks until its risk handling satisfies the completion criteria.
Monitor the performance of each risk handling and evaluate its effectiveness.

Implementation-BP5: Communicate the risks

Communicate the identified risks and their statuses to the stakeholders.

[Check]

Check-BP1: Monitor the risk management activities.

Ensure that the risk management activities are performed based on the risk management plan.
Identify issues of the risk management activities and the risk management plan.

- Following are examples of aspects to monitor:
 - Whether the risk management activities are performed according to the risk management plan, and
 - Whether the contents of the risk management plan are effective.

Check-BP2: Identify lessons learned.

Organize risk-related items and make them available to future projects.

[Action]

Action-BP1: Address issues in risk management activities.

Address issues related to risk management activities and risk management plan.
Revisit the risk management plan as necessary.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Risk management is planned and the plan is agreed on by the stakeholders.	Planning-BP1: Plan risk management.
2) Methods and criteria for managing risks are defined and applied.	Planning-BP1: Plan risk management.
	Implementation-BP2: Analyze the risks.
	Implementation-BP3: Prepare risk handling.
	Implementation-BP4: Monitor the risks.
3) The identified risks are analyzed and the risks to apply risk handling methods are determined.	Implementation-BP1: Identify risks
	Implementation-BP2: Analyze the risks.
4) Measures to lower the probability and/or impact are applied.	Implementation-BP3: Prepare risk handling.
	Implementation-BP4: Monitor the risks.
	Check-BP1: Monitor the risk management activities.
	Check-BP2: Identify lessons learned.
	Action-BP1: Address issues in risk management activities.
5) Information on grave risks is communicated to the stakeholders.	Implementation-BP5: Communicate the risks.

MAN.6 Measurement

Process ID	MAN.6
Process name	Measurement
Purpose	The purpose of measurement process is to collect, analyze and report data related to processes/work products that were implemented/created within an organization or project, in order to help effectively and objectively manage these processes/work products.
Process outcomes	As the result of successful implementation of this process: <ol style="list-style-type: none">1) Collect measurement needs and develop a measurement plan;2) Identify and define indices based on the measurement objectives;3) Identify and perform measurement activities;4) Collect, store and analyze the measured data;5) Use the information gained from the measurements as objective grounds for decision making and communications;6) Evaluate the measurement activities and communicate the results to the process owner; and7) Identify and address problems of the measurement activities.

<<Base practice>>

[Planning]

Planning-BP1: Establish a measurement plan

Identify the scope of measurement activities, measurement target, and the stakeholders who need the results, and collect the measurement needs. Establish a measurement plan including the scope, target, objectives (what to be clarified by the measurement), restrictions, and measurement frequency, and then gain the consensus.

- The scope of measurement activities can be departments, divisions, and projects.
- The target can be processes or work products.
- The restrictions include available staff, man-hours, funds, resources such as equipment, and confidential terms.
- The users refer to business management people and people in charge of project managements, quality management, and improvements activities.

Planning-BP2: Develop a measurement procedure

Define data to be measured and its evaluation method. Develop a measurement procedure.

- The procedure includes the followings;
 - Indices for the measured data
 - Collection, verification, storing, analysis and evaluation (including the calculating method for analysis and evaluation) methods for the measured data
 - Timing and frequency of the measurement
 - Methods, timing and frequency to report the measurement results
 - How to use measurement tools

[Implementation]

Implementation-BP1: Collect, store, analyze and evaluate measured data

Collect, store, analyze and evaluate measured data. Organize the measurement results according to the purpose of stakeholders who need them.

Implementation-BP2: Use the measurement results for decision making

Communicate the measurement results to the stakeholders who need them to use for decision-making or communications.

[Check]

Check-BP1: Evaluate the measurement activities

Ensure measurement activities are performed according to the measurement plan, and evaluate the measurement activities against the needs and purpose of measurement.

[Action]

Action-BP1: Address problems of measurement activities

Communicate problems of the measurement activities to the process owner and address them. Review the measurement plan as necessary.

<<Process outcomes-BP correspondence table>>

Process outcomes	BP
1) Collect measurement needs and develop a measurement plan.	Planning-BP1: Establish a measurement plan.
2) Identify and define indices based on the measurement objectives.	Planning-BP2: Develop a measurement procedure.
3) Identify and perform measurement activities.	Implementation-BP1: Collect, store, analyze, and evaluate measured data.
4) Collect, store, analyze and evaluate measured data.	Implementation-BP1: Collect, store, analyze, and evaluate measured data.
5) Use the information gained from the measurements as objective grounds for decision making and communication.	Implementation-BP2: Use the measurement results for decision making.
6) Evaluate the measurement activities and communicate the results to the process owner.	Check-BP1: Evaluate the measurement activities. Action-BP1: Address problems of measurement activities.
7) Identify and address problems of the measurement activities.	Action-BP1: Address problems of measurement activities.

MAN.8 Engineering management

Process ID	MAN.8
Process name	Engineering management
Purpose	<p>The purpose of the Engineering management process is to manage technical aspects of engineering activities so that the stakeholders, orderers and suppliers alike, will perform them consistently in accordance with given requirements.</p> <p>NOTE1: The difference between this process and the Project management process (MAN.3) is as follows. The latter focuses mainly on quality, cost, and delivery of a project while the Engineering management process on technical aspects, such as consistency with mission requirements and validity of the engineering activities.</p> <p>NOTE2: The Engineering management is performed through engineering management activities which manage technical aspects of engineering activities based mainly on the Engineering processes (ENG's).</p>
Process outcomes	<p>As a result of successful implementation of this process:</p> <ol style="list-style-type: none"> 1) The scope of the management is determined, requirements are managed, management items and managements methods are clear to support engineering activities consistent with the requirements; 2) The planned engineering management is performed and the engineering activities that serve the achievement of the mission; 3) The statuses of the engineering activities are being reviewed and shared among the stakeholders, and problem solution activities are performed as necessary; and 4) The engineering management activities are evaluated and actions are taken to deal with problems with the activities. <p>NOTE1: "Requirements are managed" means the state in which the requirements are baselined and any to-be-determined items are identified, and the undetermined items are being worked on to be finally determined.</p>

<<Base practice>>

[Planning]

Planning-BP1: Plan the engineering management.

Communicate the defined requirements to the stakeholders, orderers and suppliers alike, so that the mission requirements to be met and the requirement items in each phase of the project will be shared among the stakeholders.

Plan methods and activities for checking validity and consistency between the engineering activities and the requirement items.

- The engineering management plan shall contain the roles and responsibilities for the engineering activities.
- The mission requirements shall include the following:
 - The requirements for mission equipment;
 - The requirements for systems from the mission equipment;
 - The scope of development and the boundaries to the systems out of the scope;
 - The categories of development i.e., new development, modification, and reuse;
 - The concept of operations;
 - The mission success criteria;
 - Any constraints applicable; and
 - The decisions of the approaches of verification and validation, each of which shall define authorization criteria.
- The engineering management plan shall take into consideration official review activities in project phases and the project management plan.
- The engineering management plan shall be referred to in the project plan or a part of it.

[Implementation]

Implementation-BP1: Communicate the requirements.

Manage that the requirements items are communicated to the stakeholders, orderers and suppliers alike, and shared among those stakeholders.

Check regularly those items which are undetermined or ambiguous at the time of communication, and follow up on them until the time of their resolution.

- Follow SUP. 13 Action item management process to track and monitor items that are undetermined or ambiguous.

Implementation-BP2: Monitor the engineering activities.

Ensure the engineering activities are performed towards accomplishment of the given missions. Identify problems and issues that are obstacles to the engineering activities.

- Monitoring of engineering activities has to cover performance of official technical reviews, validity of the engineering activities addressing official technical review results, and performance of risk management. Follow MAN. 5 Risk management process for risk management.
- Ensuring of assurance cases may be used as a method for validating engineering activities. Ensuring of assurance cases proves engineering activities to be right in the sense that they are performed towards accomplishment of missions by evidences that represent the right set of engineering activities are performed.

Implementation-BP3: Check the work products.

Verify that the requirements are incrementally decomposed, detailed, refined, and bi-directionally consistent. Also, validate the refined requirements, design solutions, and technical decisions that have been made.

- Ensuring of the traceability between requirements, between requirements and designs, and between designs may contribute to consistency checking
- The results of official and other reviews shall be considered in validation of the corresponding requirements and design solutions.
- Consistency between the operational concepts and the requirements, and between the operational concepts and the design solutions shall be verified in validation of the requirements and the design solutions.

Implementation-BP4: Manage the interfaces between systems.

Verify that interfaces between the systems are defined, and that they are consistent with each other and with the upper requirements.

- This practice is especially important in the case that the system under development is composed of multiple subsystems and some of them are developed in different organizations. The responsibility for the entire system shall be made clear in such a case.

Implementation-BP5: Review the statuses of the engineering activities for the requirements to be met.

Review regularly the status of the engineering activities and that of the work products in order to achieve common understanding of current issues and current status towards accomplishment of the mission among the stakeholders. Results of the reviews shall be communicated to the stakeholders.

Implementation-BP6: Report problems that may affect accomplishment of the mission to the stakeholders and plan an action to solve them.

Report to the stakeholders any problems that may affect the fulfillment of the mission requirements or the incrementally decomposed requirements and plan an action to solve them.

- The requirements that are still to be determined shall also be taken into account in planning an action.
- The orderers, the developing organizations, and the managers of the development are stakeholders.

- Planned actions shall be managed in the Action item management process (SUP. 13).
- Solution of the problems shall be performed in cooperation with the Project management process (MAN.3) and the Problem resolution (SUP. 9).

[Check]

Check-BP1: Ensure the engineering management activities.

Ensure that the engineering management activities are performed based on the engineering management plan. Identify issues related to performing the activities.

- Issues shall be analyzed with the stakeholders such as the customers, the orderers, the project managers, etc. as necessary.

[Action]

Action-BP1: Take actions to solve problems in performing the engineering management activities.

Plan and execute an action to solve the problem identified in the engineering management activities.

<<Process outcomes-BP correspondence table>>

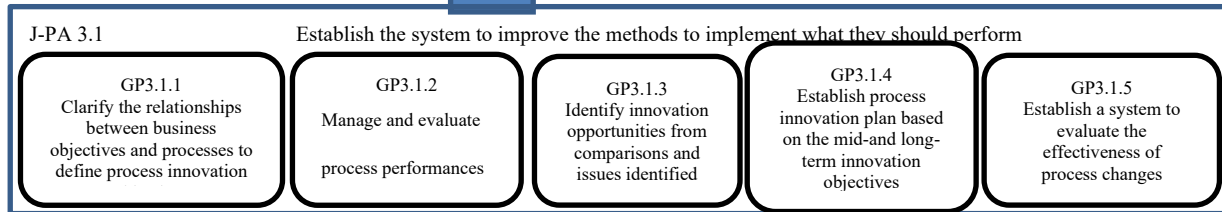
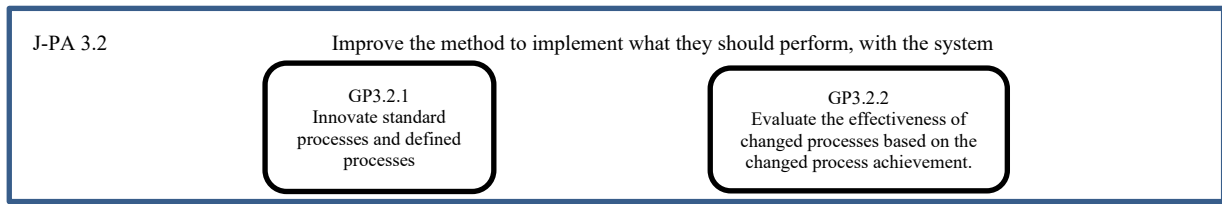
Process outcomes	BP
1) The scope of the management is determined, requirements are managed, management items and managements methods are clear to support engineering activities consistent with the requirements.	Planning-BP1: Plan the engineering management.
2) The planned engineering management is performed and the engineering activities that serve the achievement of the mission.	Implementation-BP1: Communicate the requirements. Implementation-BP2: Monitor the engineering activities. Implementation-BP3: Check the work products. Implementation-BP4: Manage the interfaces between systems.
3) The statuses of the engineering activities are being reviewed and shared among the stakeholders, and problem solution activities are performed as necessary.	Implementation-BP5: Review the statuses of the engineering activities for the requirements to be met. Implementation-BP6: Report problems that may affect accomplishment of the mission to the stakeholders and plan an action to solve them.
4) The engineering management activities are evaluated and actions are taken to deal with problems with the activities.	Check-BP1: Ensure the engineering management activities. Action-BP1: Take actions to solve problems in performing the engineering management activities.

4. Process capability indicator (J-Level 0 - 3)

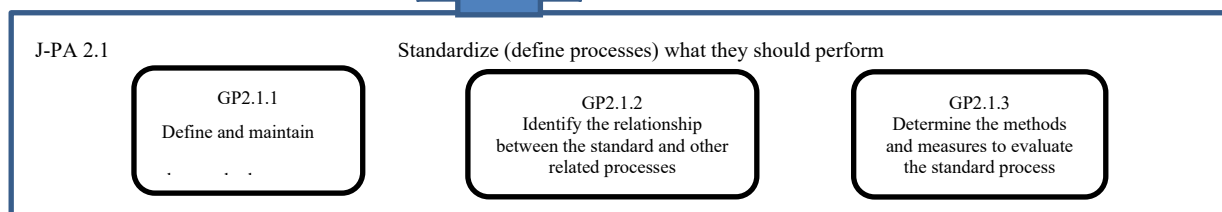
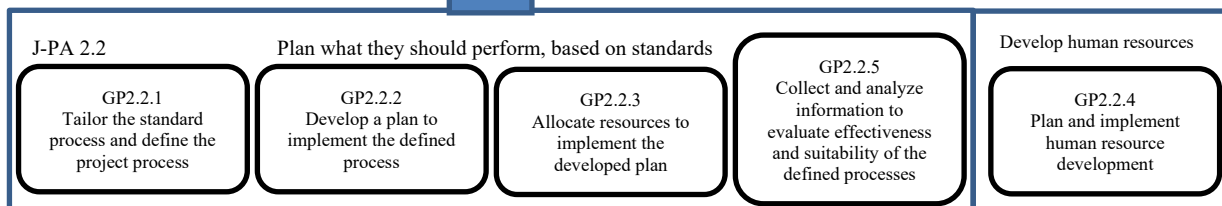
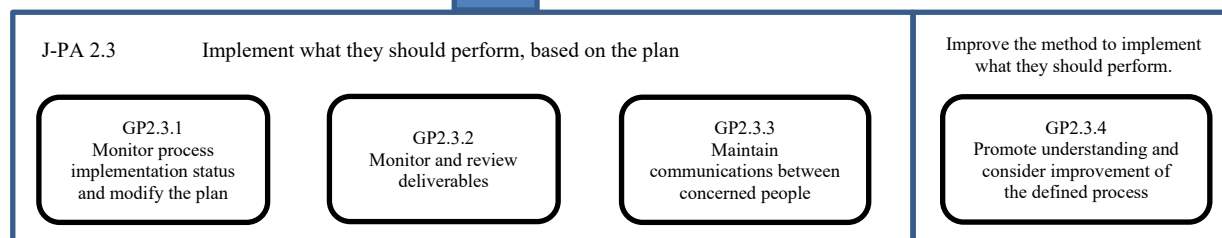
Process capability indicator is an indicator to evaluate process capability levels. This must be a supportive indicator to evaluate the achievement of process attributes by using the indicator evidence.

Figure 4.1 shows the whole structure of process capability indicators.

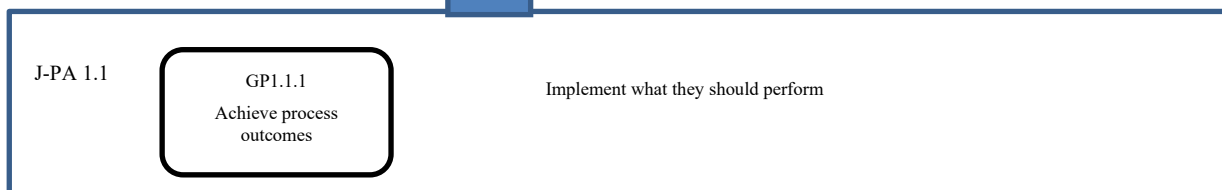
J-Level 3



J-Level 2



J-Level 1



J-Level 0



Figure 4.1 The whole structure of process capability indicators

Process capability indicator (expressed as J-Level in Figure 4.1) is characterized by process attribute (called J-PA in JAXA-PAM). The J-PAs included in each J-Level, together with the J-PAs included in lower J-Levels, demonstrate the achievement of this J-Level. Table 4.1 shows the outline of process capability indicators.

Table 4.1 The outline of process capability indicators

J-Level	Outline
0	There is nothing to mention against the software development process. This level is like it isn't clear that which processes there are and how they implement the processes.
1	This level is like they can show that they actually implement what they should do and outcomes are achieved against the software development process.
2	This level is like that what they should do are defined, how they combine and implement them are planned and what they actually have done are recorded against the software development process. Human resources are developed to implement the process. The way to improve the implemented result are considered.
3	This level is like that what they should do are defined, how they combine and implement them are planned and what they actually have done are recorded against the software development process. A system to improve the implemented result are considered and established. They perform activities to improve results using the established system.

4.1 Format

In this chapter, format shown in Figure 4.2 below is used for quickly finding relevant information.

4.3 J-Level2: Established and managed processes

Process capability level (Heading)

4.3.2 J-PA2.2 Standard process deployment attribute

"Standard process deployment attribute" is used for a process implementation. The "defined process" is defined by tailoring and adjusting the standard process considering the project and product features. As the result of having this attribute, it allows the following processes.

*The "defined process" can be a standard process or a tailored one.

Result of full achievement of the Process attribute (all bullets)

- a) Define the deliverables and a process adjusted by tailoring the standard process based on the target project and product features. (GP2.2.1)
- b) Develop a plan to implement the defined process. (GP2.2.2)
- c) Allocate resources required to implement the defined process. (GP2.2.3)
- d) Plan the human resources required to implement the defined process as well as their development activities as required. (GP2.2.4)
- e) Collect and analyze appropriate data to prove the effectiveness and suitability of the defined process. (GP2.2.5)

Generic practice ID

4.3.2.1 General practice for J-PA.2.2

Generic practice name

GP2.2.1 Define process by tailoring the standard process and fitting to the project and product features.

Based on the standard process, identify processes to employ for the development in accordance with the tailoring guidelines. Define the processes identified based on the standard process by fitting them to the project and product features. Verify the compatibility of the standard process and optimized process. Identify the roles, responsibilities, and privileges for the defined process implementation.

Generic practice description (all paragraphs)

GP2.2.2 Develop a plan to implement the defined process.

Develop a plan to implement the defined process. Verify the consistency between components defined in the developed plan.

Notes:

Generic practice notes, if any (all bullets)

- General components included in the plan are as follows:
 - Purpose of implementing the defined process
 - Applicable scope of the defined process
 - Activities and tasks required to implement the process (the tasks include the ones to review process implementation results and deliverables)
 - Schedule

4.4 J-Level 2: Established and managed processes

Process capability level (Heading) *ility description*

4.4.2 J-PA2.2 Standard process deployment attribute

Process attribute ID, Process attribute name (Heading)

“Standard process deployment attribute allows the determination of how well a defined process” is used for a process implementation. The “defined process” is defined by tailoring and fitting the standard process considering the project and product properties. As the result of having this attribute, it allows the following processes.

Result of full achievement of the Process attribute (all bullets)

*The “defined process” refers to a process defined for a project based on a standard process. Defined process can be a standard process or a tailored one.

- a) Define the deliverables and a process by tailoring the standard process and fitting it based on the target project and product properties. (GP2.2.1)
- b) Develop a plan to implement the defined process. (GP2.2.2)
- c) Allocate resources required to implement the defined process. (GP2.2.3)
- d) Plan the human resources required to implement the defined process as well as their development activities as required. (GP2.2.4)
- e) Collect, analyze, and deliver appropriate data to consider the effectiveness and suitability of processes for improvement. (GP2.2.5)

Generic practice ID

Generic practice name

4.4.2.1 Generic practice for J-PA.2.2

GP2.2.1 Define process for project by tailoring the standard process and fitting to the project and product properties.

Identify process guidelines. *Generic practice description (all paragraphs)* d process set in accordance with tailoring

When tailoring the standard process, maintain the integrity considering the sequence and interaction between the identified processes. Define the identified process by fitting it to the project and product properties.

Verify conformance of the defined process with the standard process.

Identify the roles, responsibilities, and resources for implementation.

Generic practice notes, if any (all bullets)

GP2.2.2 Develop a plan to implement the defined process.

Develop a plan to implement the defined process.

4.2 J-Level 0: Incomplete process

No process capability indicator is defined for J-Level 0. J-Level 0 refers to a process status that has not achieved J-Level 1.

Evaluate an assessment target process by using J-Level 1 indicator and if the process does not attain J-Level 1, it means that

the process is J-Level 0.

4.3 J-Level 1: Performed process

J-PA1.1 Process performance attributes

“Process performance attributes” allows evaluating how well you have achieved the process objectives defined in the process dimension. As a result of having “process implementation attributes”;

- a) Achieves process outcomes defined in the process dimension. (GP1.1.1)

4.3.1.1 Generic practice for J-PA1.1

GP1.1.1 Achieve process outcomes

Implements what is intended in the base practice defined in the process dimension.

Notes:

- JAXA-PAM’s process dimension defines base practices, which allow checking achievements of process outcomes.

4.4 J-Level 2: Established and managed processes

J-PA2.1 Standard process definition and maintenance attribute

“Standard process definition and maintenance attribute” allows an evaluation of how well the standard processes are defined and maintained to encourage the target projects to introduce effective processes. As the result of having this attribute, it allows for ways to

- a) define and maintain the standard processes (GP2.1.1)
- b) determine the sequence and interaction among the standard and other relevant processes (GP2.1.2)
- c) determine the evaluation method and measures of effectiveness and suitability of the standard process and maintain process effectiveness and suitability. (GP2.1.3)

*“Standard processes” are shared processes across target projects.

4.4.1.1 Generic practices for J-PA2.1

GP2.1.1 Define and maintain the standard processes

Identify shared process needs across the target projects and define and maintain deliverables and the standard processes that include the fundamental process components

Provide guidance and procedures, as required, to assist process implementations.

Prepare tailoring guide to be available as required.

Identify roles, responsibilities, authorities, and capabilities to implement the standard processes.

Identify the required infrastructure and operational environment to implement the standard processes

Notes:

- “Fundamental process components” shall consist of activities, requirements for input and output of the activities, and the quality criteria.
- The “tailoring guide” shall contain information about what conditions must be met to allow tailoring or why tailoring is not allowed etc.

GP2.1.2 Identify the sequence and interaction between processes to maintain the integrity between the standard and other related processes.

Identify the sequence and interaction between the standard and other related processes.

Notes:

- It intends to identify the sequences and interactions of processes in both JAXA software development standard and other standards, such as a standard document on quality assurance.
- “To maintain the integrity between processes” shall mean that there is no data missing in the input/output information and work products across the related processes, and the information and work products are exchanged timely without any inconsistency across the entire processes.
- The “standard process” here shall refer to the processes to be assessed. For example, if the “configuration management process” is the one to be assessed, the standard process here refers to the configuration management process, but not other processes.
- The standard process does not necessarily correspond one-to-one to the document prepared by the organization. For example, if a document called “quality assurance standard” is prepared by the organization, the correspondent document can include multiple standard processes other than the standard “configuration management process.”

GP2.1.3 Determine the methods and measures to evaluate the effectiveness and suitability of the standard process

Determine the methods and measures to evaluate effectiveness and suitability of the standard process.

Define the criteria and data required to evaluate effectiveness and suitability of the standard process.

Establish systems to perform internal audit and management review required to ensure the implementation of processes that meet the standard process requirements.

Maintain the effectiveness and suitability of the standard process by updating the process as required.

Notes:

- “Effectiveness of the standard process” shall indicate how much of the effective contents of the standard process to include in order to achieve the process goal. Adopting a less effective standard process makes you perform less effective activities to achieve the goal, which consequently prevents you from achieving the goal, or requires greater costs and time even if you could achieve it.
- “Suitability of the standard process” shall indicate how much of the related contents of the standard process to include in order to achieve the process goal. Adopting a less suitable standard process creates unnecessary work that may have nothing to do with achieving the process goal, and the process performer is forced to deal with such work.

J-PA2.2 Standard process deployment attribute

“Standard process deployment attribute” allows the determination of how well a “defined process” is used for a process implementation. The “defined process” is defined by tailoring and fitting the standard process considering the project and product properties. As the result of having this attribute, it allows the following processes.

*The “defined process” refers to a process defined for a project based on a standard process. Defined process can be a standard process or a tailored one.

- a) Define the deliverables and a process by tailoring the standard process and fitting it based on the target project and product properties. (GP2.2.1)
- b) Develop a plan to implement the defined process. (GP2.2.2)
- c) Allocate resources required to implement the defined process. (GP2.2.3)
- d) Plan the human resources required to implement the defined process as well as their development activities as required. (GP2.2.4)
- e) Collect, analyze, and deliver appropriate data to consider the effectiveness and suitability of processes for improvement. (GP2.2.5)

4.4.1.2 Generic practice for J-PA.2.2

GP2.2.1 Define process for project by tailoring the standard process and fitting to the project and product properties.

Identify process to be employed for project by tailoring the standard process set in accordance with tailoring guidelines. When tailoring the standard process, maintain the integrity considering the sequence and interaction between the identified processes. Define the identified process by fitting it to the project and product properties. Verify conformance of the defined process with the standard process. Identify the roles, responsibilities, and authorities for the defined process implementation.

GP2.2.2 Develop a plan to implement the defined process.

Develop a plan to implement the defined process.
Verify the consistency between components defined in the developed plan.

Notes:

- General components included in the plan are as follows:
 - Purpose of implementing the defined process
 - Applicable scope of the defined process
 - Activities and tasks required to implement the process (the tasks include the ones to review process implementation results and deliverables)
 - Schedule
 - Major milestones
 - Deliverables and the management method
 - Structure, roles, responsibilities, and authorities (including the ways to identify personnel and communication method in the process implementation)
 - Infrastructure required to implement the process

-Method and data to evaluate the effectiveness and suitability of the process

GP2.2.3 Allocate resources to implement the developed plan

Allocate and leverage human resources and infrastructure identified in the plan.
Inform the stakeholders of their and others' allocated roles, responsibilities, and authorities.

GP2.2.4 Plan and execute human resource development

Identify the knowledge, skills, and experience required to implement the defined process.
Identify and provide educational opportunities to develop the knowledge, skills, and experience required to implement the defined process.
For the purpose of human resource development, plan and provide opportunities to enforce processes that are appropriate for human resource development. Include the staffing and learning goals of the trained people in the plan.

Notes:

- The “educational opportunities to develop the knowledge, skills, and experience required” include not only training programs implemented within the organization but also opportunities to participate to external software communities as well as to write study papers etc.
- An example of the “opportunities to enforce processes that are appropriate for human resource development” is OJT and other training opportunities performed during the defined process implementation. In the opportunities, staff with a few years of development experience has roles allocated to negotiate with sub-leaders and customers in order to acquire the knowledge, skills, and experience required in the future.

GP2.2.5 Collect and analyze information to evaluate effectiveness and suitability of processes

Identify data required to evaluate the effectiveness and suitability of the defined process, based on the criteria and data to be required to evaluate effectiveness and suitability of processes.
Collect the identified data through the defined process implementation and analyze the effectiveness and suitability of the defined process on a regular basis.
Check and analyze whether processes that meet their requirements are ensured to be implemented, by internal audit and management review.
Results of the analysis are used to identify where continual improvement of the standard and defined process can be made.

Notes:

- The required data to evaluate the “effectiveness and suitability of the defined process” can be identified by adjusting data to the environment where the defined process is implemented based on the data and process properties required to evaluate the effectiveness and suitability of the standard process in GP.2.1.3.
- The data required for the “internal audit and management review” is identified with the items that have to be checked for the process in question, the items found among the evidences of the performance of the process that is defined based on the standard process through GP2.1.3.

J-PA2.3 Defined process implementation and management attribute

The “defined process implementation and management attribute” allow the determination of how well the implementation status of the defined process is monitored and adjusted. As the result of having this attribute, it allows to the following:

- a) Monitor implementation status of the defined process based on a plan and adjust the plan as required. (GP2.3.1)
- b) Develop and manage deliverables based on the plan. (GP2.3.2)
- c) Communicate on a regular basis between the people who implement the defined process(GP2.3.3)
- d) Check the defined process implementation on a regular basis, identify post-implementation issues, and consider the resolutions. (GP2.3.4)

4.4.1.3 Generic practice for J-PA.2.3

GP2.3.1 Monitor implementation status of the defined process based on a plan and modify the plan as required

Monitor the implementation status of the defined process based on its plan to achieve the intended result. Identify issues on the defined process implementation. Implement corrective measures to resolve the issues as required. If a change is required to the plan, adjust and modify it, and inform the stakeholders of the change.

GP2.3.2 Manage and review deliverables

Manage deliverables developed in accordance with a plan.
Review to ensure that the deliverables meet their requirements and quality criteria.
Identify issues on the developed deliverables. Implement corrective measures to resolve the issues as required.

Notes:

- The “Deliverables management method” include access authorities for the deliverables, naming rules, location to store, distribution and its method, backup method, relations between deliverables, deliverables status management method, change rule, version management rule, and approval rule.

GP2.3.3 Maintain communications between people who implement defined process

Maintain communications between stakeholders when implementing processes identified in a plan document. Identify people who are newly involved in, in accordance with the process implementation, and maintain communications with them.

GP2.3.4 Promote understanding and consider improvements of defined processes on a regular basis.

Check performed processes regularly and promote implementation and understanding of defined processes between the process implementers.
Evaluate implementing processes, identify issues, and consider the resolutions according to a plan.
Review defined processes after their implementation, then identify issues, and consider the resolutions to reflect the results to the future activities and processes.

Notes:

- The regular check on performed processes includes a “check about what to do today” and “check about what has been done today” performed in morning and evening meetings.
- The review is not intended to execute a certain method, such as a root cause analysis and postmortem, but for daily informal field activities.

4.5 J-Level 3: Controlled and innovating processes

J-PA3.1 Process improvement consideration attribute

“Process innovation consideration attribute” allows checking how many of the activities, such as defining process innovation objectives, identifying innovation opportunities, and establishing process innovation plan, and is considered in order to evaluate the way to promote and the effectiveness to perform effective process innovation activities. As the result of having this attribute:

- a) Clarify the relationships between mid- and long-term business plans and processes to define process innovation objectives. (GP3.1.1)
- b) Manage and evaluate process performances to identify innovation opportunities (GP3.1.2)
- c) Identify innovation opportunities from issues identified through comparisons with best practices and through performing defined processes. (GP3.1.3)
- d) Establish process innovation plans based on mid- and long-term innovation objectives. (GP3.1.4)
- e) Establish a system to evaluate the effectiveness of process changes. (GP3.1.5)

4.5.1.1 Generic practices for J-PA.3.1

GP3.1.1 Clarify the relationships between mid- and long-term business plans and processes to define process innovation objectives.

Clarify how the achievement of mid- and long- term business plans relate to processes and define a direction that process innovation should take.
Define quantitative and qualitative process innovation objectives in accordance with the direction that process innovation take.
Acquire commitment from the management people to process innovation activities.

Notes:

- “Business plans” refer to objectives shared within the target businesses. These plans can be company-wide or department-wide objectives depending on the assessment target scope.

GP3.1.2 Manage and evaluate process performances to identify innovation opportunities

Establish quantitative objectives of process performance as well as their management and evaluation methods, considering the business objectives.
Identify measurable relationships between process elements that contribute to the process performance.
Collect data and manage and evaluate processes and deliverables based on the evaluation method.
Validate results of measurement.
Implement corrective measures or identify innovation opportunities in accordance with the management and evaluation results.

Notes:

- “Their management and evaluation methods” include the target (processes, deliverables etc.), techniques, items, criteria, and measures to use for the management and evaluation.

GP3.1.3 Identify innovation opportunities from issues identified through comparisons with best practices and through performing defined processes

Identify industry best practices and new technologies that should be introduced into process innovation.
From assessment results, identify innovation opportunities that should be introduced into process innovation.
Based on daily reviews, identify innovation opportunities that should be introduced into process innovations

Acquire regular feedback on innovation opportunities.

GP3.1.4 Establish process innovation plans based on mid- and long-term innovation objectives

Develop process innovation ideas based on the defined process innovation objectives and identified innovation opportunities.
Evaluate the process innovation ideas based on the following aspects:

- Impacts on business objectives
- Impacts on standard and defined processes
- Impacts on defined process innovation objectives
- Impacts that each process innovation idea has on other process innovation ideas

Prioritize process innovation ideas based on their evaluation results

Based on the process innovation ideas, establish process innovation plans to change the standard process and defined processes, and clarify process changes

Acquire agreement from the management people on the process innovation plans

Notes:

- “Process changes” refer to the items that have been introduced from the process innovation ideas to the process innovation plans.

GP3.1.5 Establish a system to evaluate the effectiveness of process changes to help achieve business objectives regarding the process changes

Define methods to evaluate effectiveness of process changes against the innovation objectives.
Define the quantitative objectives to implement process changes by explicitly reflecting business objectives.
Define criteria to use for monitoring, analyzing, and verifying the quantitative objectives to establish a system to collect necessary data and the data analysis method for all the criteria.

Notes:

- The “methods to evaluate effectiveness of process changes against the innovation objectives” include both quantitative and qualitative methods.
- One of the effective methods to achieve business objectives is to continuously improve processes. In order to gain understanding from management people, it is effective to clarify and define the relationships between the quantitative objectives to implement process changes and business objectives.

J-PA3.2 Process innovation implementation attribute

“Process innovation implementation attribute” allows checking how well process innovation activities are promoted based on the process innovation plans and how well the effectiveness of the innovation is evaluated. As the result of having this attribute:

- a) Innovate the standard process and defined processes based on agreed process innovation plans (GP3.2.1)
- b) Against the business objectives as well as process innovation objectives, evaluate the effectiveness resulting from a process change based on the changed process achievement (GP3.2.2)

4.5.1.2 Generic practices for J-PA3.2

GP3.2.1 Improve the standard process and defined processes based on agreed process innovation plans

Establish a system for changing the standard process and defined processes on necessity of the change. Identify and manage factors as follows that have impacts on effectiveness of the changes in the standard process and defined processes against the business objectives.

- Economy factors (growth rate, competitors etc.)
- Human factors (motivations, training etc.)
- Management factors (skills, commitments, leaderships etc.)
- Technology factors (technical expertise, development method, needs for new technology etc.)

Communicate the process changes to the people to be affected.

Plan and provide trainings required for changed processes to the people who implement the processes.

Record the details of performed process innovation plans.

GP3.2.2 Against the business objectives as well as process innovation objectives, evaluate the effectiveness resulting from a process change based on the changed process achievement

By using an established data collection system, collect and analyze data that is to be used to monitor, analyze, and verify quantitative objectives defined when process changes were implemented.

From the analysis results, if an issue is identified in terms of achieving quantitative objectives, identify the cause, implement corrective measures, and monitor and evaluate effectiveness of the corrective measures.

By using the method defined to evaluate the effectiveness of a process change, compare the process implementation results before and after a change is applied.

Analyze the process implementation results after a change is applied and establish a reporting system to the management people and people in charge of the process.

Notes:

- Both quantitative and qualitative comparisons are included in the “comparisons of the process implementation results before and after a change.”
- In J-PA3.1, data to which the business objectives reflected is collected in order to monitor the achievements of quantitative objectives for use when a process change is implemented. Using the measured achievement results of the business objectives with the data defined in J-PA3.1 allows quantitatively comparing process implementation results before and after a change is applied.

Appendix

Appendix A: Correspondence relationships between PA Achievements in ISO/IEC 33020 and GPs in JAXA-PAM

The following table shows the correspondence relationships between PA Achievements in ISO/IEC 33020 and GPs in JAXA-PAM

Table A.1 Correspondence relationship table between PA Achievements in ISO/IEC 33020 and GPs in JAXA-PAM

PA Achievement in ISO/IEC 33020	GP in JAXA-PAM
PA1.1 a) The process achieves its defined process outcomes.	GP1.1.1 Achieve process outputs
PA2.1 a) objectives for the performance of the process are identified	GP2.2.2 Develop a plan to implement the defined process
PA2.1 b) performance of the process is planned	GP2.2.2 Develop a plan to implement the defined process
PA2.1 c) Performance of the process is monitored	GP2.2.2 Develop a plan to implement the defined process
PA2.1 d) performance of the process is adjusted to meet plans	GP2.3.1 Monitor implementation status of the defined process based on a plan and modify the plan as required
PA2.1 e) responsibilities and authorities for performing the process are defined, assigned and communicated	GP2.2.1 Define process for project by tailoring the standard process and fitting to the project and product properties
PA2.1 f) Personnel performing the process are prepared for executing their responsibilities	GP2.2.3 Allocate resources to implement the developed plan
PA2.1 g) resources and information necessary for performing the process are identified, made available, allocated and used	GP2.2.3 Allocate resources to implement the developed plan
PA2.1 h) interfaces between the involved parties are managed to ensure both effective communication and also clear assignment of responsibility	GP2.3.3 Maintain communications between people who implement defined process

PA2.2 a) requirements for the work products of the process are defined	GP2.1.1 Define and maintain the standard processes
PA2.2 b) requirements for documentation and control of the work products are defined	GP2.2.2 Develop a plan to implement the defined process
PA2.2 c) work products are appropriately identified, documented, and controlled	GP2.3.2 Manage and review deliverables
PA2.2 d) work products are reviewed in accordance with planned arrangements and adjusted as necessary to meet requirements	GP2.3.2 Manage and review deliverables
PA3.1 a) a standard process, including appropriate tailoring guidelines, is defined and maintained that describes the fundamental elements that must be incorporated into a defined process	GP2.1.1 Define and maintain the standard processes
PA3.1 b) the sequence and interaction of the standard process with other processes are determined	GP2.1.2 Identify the sequence and interaction between processes to maintain the integrity between the standard and other related processes
PA3.1 c) required competencies and roles for performing the process are identified as part of the standard process	GP2.1.1 Define and maintain the standard processes
PA3.1 d) required infrastructure and work environment for performing the process are identified as part of the standard process	GP2.1.1 Define and maintain the standard processes
PA3.1 e) suitable methods and measures for monitoring the effectiveness and suitability of the process are determined	GP2.1.3 Determine the methods and measures to evaluate the effectiveness and suitability of the standard process
PA3.2 a) a defined process is deployed based upon an appropriately selected and/or tailored standard process	GP2.2.1 Define process for project by tailoring the standard process and fitting to the project and product properties

PA3.2 b) required roles, responsibilities and authorities for performing the defined process are assigned and communicated	GP2.2.1 Define process for project by tailoring the standard process and fitting to the project and product properties
PA3.2 c) personnel performing the defined process are competent on the basis of appropriate education, training, and experience	GP2.2.4 Plan and execute human resource development
PA3.2 d) required resources and information necessary for performing the defined process are made available, allocated and used	GP2.2.3 Allocate resources to implement the developed plan
PA3.2 e) required infrastructure and work environment for performing the defined process are made available, managed and maintained	GP2.2.3 Allocate resources to implement the developed plan
PA3.2 f) appropriated data are collected and analyzed as a basis for understanding the behavior of the process, to demonstrate the suitability and effectiveness of the process, and to evaluate where continuous improvement of the process can be made	GP2.2.5 Collect and analyze information to evaluate effectiveness and suitability of processes
PA4.1 a) The process is aligned with quantitative business goals	GP3.1.1 Clarify the relationships between mid- and long-term business plans and processes to define process innovation objectives
PA4.1 b) process information needs in support of relevant defined quantitative business goals are established	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.1 c) process measurement objectives are derived from identified process information needs	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.1 d) Measurable relationships between process elements that contribute to the process performance are identified	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.1 e) quantitative objectives for process performance in support of relevant business goals are established	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities

PA4.1 f) Appropriate measures and frequency of measurement are identified and defined in line with process measurement objectives and quantitative objectives for process performance	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.1 g) results of measurement are collected, validated and reported in order to monitor the extent to which the quantitative objectives for process performance are met	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.2 a) Techniques for analysing the collected data are selected	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.2 b) Assignable causes of process variation are determined through analysis of the collected data	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.2 c) Distributions that characterize the performance of the process are established	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.2 d) corrective actions are taken to address assignable causes of variation	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA4.2 e) Separate distributions are re-established (as necessary) following corrective action	GP3.1.2 Manage and evaluate process performances to identify innovation opportunities
PA5.1 a) process innovation objectives are defined that support the relevant business goals	GP3.1.1 Clarify the relationships between mid- and long-term business plans and processes to define process innovation objectives
PA5.1 b) appropriate data are analyzed to identify opportunities for innovation	GP3.1.3 Identify innovation opportunities from issues identified through comparisons with best practices and through performing the defined processes
PA5.1 c) Innovation opportunities derived from new technologies and process concepts are identified	GP3.1.4 Establish process innovation plans based on mid- and long-term innovation objectives

PA5.1 d) an implementation strategy is established to achieve the process innovation objectives	GP3.1.1 Clarify the relationships between mid- and long-term business plans and processes to define process innovation objectives
	GP3.1.4 Establish process innovation plans based on mid- and long-term innovation objectives
PA5.2 a) impact of all proposed changes is assessed against the objectives of the defined process and standard process	GP3.1.5 Establish a system to evaluate the effectiveness of process changes to help achieve business objectives regarding the process changes
PA5.2 b) implementation of all agreed changes is managed to ensure that any disruption to the process performance is understood and acted upon	GP3.2.1 Improve the standard process and defined processes based on agreed process innovation plans
PA5.2 c) effectiveness of process change on the basis of actual performance is evaluated against the defined product requirements and process objectives	GP3.2.2 Against the business objectives as well as process innovation objectives, evaluate the effectiveness resulting from a process change based on the changed process achievement

*There is no PA Achievement in ISO/IEC 33020 that is applicable to the GP “Promote understanding and consider improvements of defined processes on a regular basis (GP2.3.4)”

Appendix B: System to convert JAXA-PAM's assessment results to ISO/IEC 33020

The following table shows a system to convert the results of capability level assessed by JAXA-PAM to the ones defined in ISO/IEC 33020

Table B.1 Conversion table of JAXA-PAM's assessment results to ISO/IEC 33020

PA in ISO/IEC 33020	How to determine the achievement
PA1.1	Adopt the same result as J-PA1.1 in JAXA-PAM
PA2.1	Adopt one of the lower result between J-PA2.2 and J-PA2.3 in JAXA-PAM
PA2.2	Adopt one of the lowest result between J-PA2.1, J-PA2.2 and PA2.3 in JAXA-PAM
PA3.1	Adopt the same result as J-PA2.1 in JAXA-PAM
PA3.2	Adopt the same result as J-PA2.2 in JAXA-PAM
PA4.1	Adopt the same result as J-PA3.1 in JAXA-PAM
PA4.2	Adopt one of the lower result between J-PA3.1 and J-PA3.2 in JAXA-PAM
PA5.1	Adopt the same result as J-PA3.1 in JAXA-PAM
PA5.2	Adopt one of the lower result between J-PA3.1 and J-PA3.2 in JAXA-PAM

Appendix C: Conformity of the process reference model and process assessment model with ISO/IEC 33004 requirements

C1 Introduction

JAXA Process Assessment Model for Software Development conforms to requirements of ISO/IEC 33004 Information technology -- Process assessment — Requirements for process reference, process assessment and maturity models.

This annex provides conformance statements of process reference model and process assessment model to ISO/IEC 33004 clauses 5 and 6, respectively.

C2 Conformance of the process reference model with ISO/IEC 33004 Clause 5

Requirements in ISO/IEC 33004 Clause 5	JAXA Process Assessment Model for Software Development	
	relevant parts	explanation
5.3 Requirements for process reference models	-	Title
5.3.1 A process reference model shall contain:	-	Introductory sentence
a)	1.3 Applicable scope	The domain of JAXA-PAM (including PRM) is software development projects of JAXA and suppliers. The target organizations include not only their development department but also other relevant departments, such as purchase control and quality assurance departments.
b)	1.2 Purpose	Context of use intended by JAXA-PAM is to provide indicators for JAXA or suppliers to understand and confirm the intent of the software development standard (JERG-0-049).
c)	2.2 Process dimension Table 2.2 Process components in JAXA-PAM	The process components in JAXA-PAM shown in Table 2.2 meet requirements of clause 5.4.
d)	2.2 Process dimension Table 2.1: A list of corresponding processes between JAXA-PAM	The JAXA-PAM processes are structured as Table 2.1. When JERG-0-049A and ISO/IEC12207:1995, which are shown in clause 1.4.2 as references, are replaced with their revisions, the processes may be reorganized.
5.3.2 The process reference model shall document the community of interest of the model and the actions taken to achieve consensus within that community of interest:	-	Introductory sentence
a)	1.2 Purpose	The relevant community of JAXA-PAM is the Japan aerospace

		industry.
b)	1.2 Purpose	JAXA-PAM has been developed by a total of over a hundred professionals in the domestic aerospace industry.
c)	not applicable	JAXA-PAM is based on the key insight of the industry common software development processes.
5.3.3 The processes defined within a process reference model shall have unique process descriptions and identification.	2.2 Process dimension Table 2.2 Process components in JAXA-PAM 3. Process functional indicators (J-Level 1)	JAXA-PAM has unique process descriptions and identifications as shown in clause 3 according to the format shown in Table 2.2.
NOTE	-	Note
5.4 Process descriptions	-	Introductory sentence
a)	2.2 Process dimension Table 2.2 Process components in JAXA-PAM 3. Process functional indicators (J-Level 1)	JAXA-PAM has purpose and process outcomes as shown in clause 3 according to the format shown in Table 2.2.
b)	2.2 Process dimension Table 2.2 Process components in JAXA-PAM 3. Process functional indicators (J-Level 1)	The set of process outcomes of JAXA-PAM are necessary and sufficient as shown in clause 3 according to the format shown in Table 2.2.
c)	2.2 Process dimension Table 2.2 Process components in JAXA-PAM 3. Process functional indicators (J-Level 1)	The processes of JAXA-PAM are described with the set of base practices to achieve the process outcomes as shown in clause 3 according to the format shown in Table 2.2.
A process outcome describes one of the following: — ; — ; — etc.	-	Explanation of process outcomes and not requirement
NOTE 1	-	Note
NOTE 2	-	Note
NOTE 3	-	Note

C3 Conformance of the process assessment model with ISO/IEC 33004 Clause 6

Requirements in ISO/IEC 33004 Clause 6	JAXA Process Assessment Model for Software Development																			
	relevant parts	explanation																		
6.3 Requirements for process assessment models	-	Title																		
6.3.1	4. Process capability indicator (J-Level 0 - 3)	JAXA-PAM relates to capability as a process quality characteristic.																		
6.3.2	4. Process capability indicator (J-Level 0 - 3) Appendix A Appendix B	<p>The process capability of JAXA-PAM incorporates the ISO/IEC33020 process measurement framework, which conform to ISO/IEC33003 requirements.</p> <p>JAXA-PAM covers all the process attributes shown in clause 5, ISO/IEC 33020 (see Appendix A). The capability levels of JAXA-PAM are related to those shown in ISO/IEC 33020 as the following;</p> <table> <tr> <td>ISO/IEC 33020</td><td>=></td><td>JAXA-PAM</td></tr> <tr> <td>Level 1</td><td>=></td><td>Level 1</td></tr> <tr> <td>Level 2</td><td>=></td><td>Level 2</td></tr> <tr> <td>Level 3</td><td>=></td><td>Level 2</td></tr> <tr> <td>Level 4</td><td>=></td><td>Level 3</td></tr> <tr> <td>Level 5</td><td>=></td><td>Level 3</td></tr> </table> <p>Also, the capability levels of JAXA-PAM can convert to those of ISO/IEC 33020 (See Appendix B).</p>	ISO/IEC 33020	=>	JAXA-PAM	Level 1	=>	Level 1	Level 2	=>	Level 2	Level 3	=>	Level 2	Level 4	=>	Level 3	Level 5	=>	Level 3
ISO/IEC 33020	=>	JAXA-PAM																		
Level 1	=>	Level 1																		
Level 2	=>	Level 2																		
Level 3	=>	Level 2																		
Level 4	=>	Level 3																		
Level 5	=>	Level 3																		
6.3.3	3. Process functional indicators (J-Level 1) 4. Process capability indicator (J-	JAXA-PAM includes PRM and comply with ISO/IEC 33020.																		

	Level 0 - 3)	
6.3.4	2.2 Process dimension Table 2.1: A list of corresponding processes between JAXA-PAM 3. Process functional indicators (J-Level 1)	JAXA-PAM includes PRM. The processes listed in Table 2.1 are covered in clause 3.
6.3.5	-	Introductory sentence
a)	4. Process capability indicator (J-Level 0 - 3)	Capability is selected as a process quality characteristic.
b)	4. Process capability indicator (J-Level 0 - 3)	ISO/IEC 33020 compliant process measurement framework is selected.
c)	3. Process functional indicators (J-Level 1)	PRM is included in JAXA-PAM.
d)	3. Process functional indicators (J-Level 1)	All the processes of the PRM are covered.
e)	4. Process capability indicator (J-Level 0 - 3)	Process attributes and process capability indicators compliant with ISO/IEC 33020 are defined.
6.3.6	-	Not applicable, since JAXA-PAM adopts ordinal scale.
6.3.7	4. Process capability indicator (J-Level 0 - 3)	JAXA-PAM adopts ordinal scale and defines capability level 1 to 3.
Note:	-	Note:
6.3.8 Assessment Indicators	-	Introductory sentence
a)	3. Process functional indicators (J-Level 1)	JAXA-PAM includes PRM and purpose and process outcomes are defined for each PRM process.
b)	4. Process capability indicator (J-Level 0 - 3)	The achievement of process attributes are described.

c)	4. Process capability indicator (J-Level 0 - 3) Hanging paragraphs of clause 4, figure 4.1 and Table 4.1	The achievement of process capability levels are described.
6.3.9 Mapping process assessment Models	-	Introductory sentence
6.3.9.1 Mapping to process reference models	3. Process functional indicators (J-Level 1)	Process structure, and purpose and outcomes of each process are identical between PAM and PRM in JAXA-PAM.
6.3.9.2 Mapping to process measurement Framework	3. Process functional indicators (J-Level 1) 4. Process capability indicator (J-Level 0 - 3)	All the functional and capability indicators are related to process attributes.
6.3.10 Expression of assessment results	3. Process functional indicators (J-Level 1) 4. Process capability indicator (J-Level 0 - 3)	The processes in this process assessment model are identical to those defined in the process reference model as described in chapter3. The process attributes and the process attribute ratings in this process assessment model are identical to those defined in the process measurement framework as described in chapter4. As a consequence, results of assessments based upon this process assessment Model are expressed directly as a set of process attribute ratings for each process within the scope of the assessment. No form of translation or conversion is required.
NOTE	-	Note