AAP-48
(Edition 1)

NATO SYSTEM LIFE CYCLE STAGES AND PROCESSES

AAP 48

(Edition 1)

(February 2007)

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AAP-48
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION
NATO STANDARDIZATION AGENCY (NSA)
NATO LETTER OF PROMULGATION

28 February 2007

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RECORD OF CHANGES

Change No	Date Entered	NATO Effective Date	Signature	Rank/Rate/Grade

AAP-48
(Edition 1)

PREFACE

1. In January 2006 the North Atlantic Council approved the NATO System Life Cycle Management (SLCM) Policy[1].

2. AAP-48 defines the SLCM framework and provides guidance for implementing the SLCM Policy. It is based on the civil standard ISO/IEC 15288 and provides for a common understanding of the principles and terminology of SLCM.

3. To support the implementation of SLCM, AAP-48 needs to be complemented by additional publications, some of which are under development in AC/327.

4. Since the SLCM framework is still under development, references to documents as well as the content of published documents may change.

5. AAP-48 should be read in conjunction with ISO/IEC 15288.

[1] C-M(2005)0108

Table of Contents

1 GENERAL

1.1 Introduction

NATO has adopted the System Life Cycle Management (SLCM) approach following the approval by the North Atlantic Council of a NATO Policy for SLCM in January 2006[2]. The intention of the policy is to achieve an integrated approach to the delivery of defence related capabilities.

SLCM is a development of the civil sector and is being applied in a wide range of civil and governmental fields. An international standard for SLCM has been developed, ISO/IEC 15288[3], to provide a working methodology through which the principles of SLCM may be applied and it is part of the NATO Policy for SLCM that the ISO/IEC 15288 standard is used as the basis for implementing SLCM in NATO.

Allied Administrative Publication – 48 (AAP-48) serves as guidance for implementing NATO's System Life Cycle Management (SLCM) Policy. It establishes a common framework for describing and implementing life cycle management for NATO defence related capabilities.

AAP-48 needs to be complemented by additional document frameworks (covering for example management, quality, systems engineering), which serve as operational enablers (see Figure 1-1).

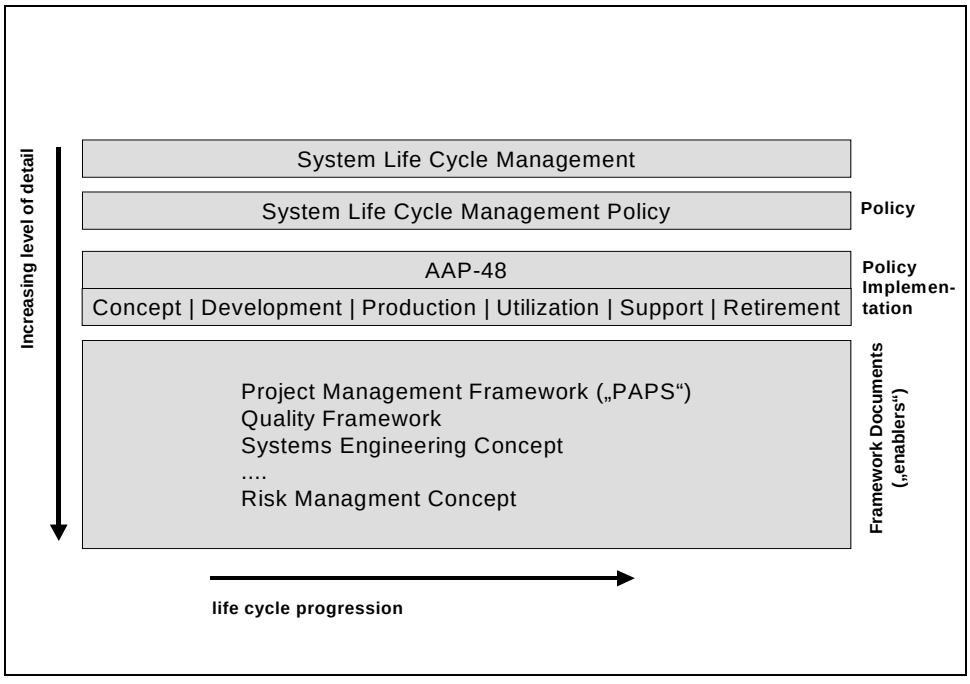


Figure 1-1: Conceptual Framework

[2] C-M(2005)0108
[3] International Standards Organization/International Electrotechnical Commission 15288 – "Systems Engineering – Systems Life Cycle Processes".

AAP-48 considers the following principles as stated in the SLCM Policy:

Commitment to System Life Cycle Management: This requires commitment to an integrated approach by all parties involved and the adoption of consistent processes necessary to achieve their objectives.

Cooperation and Interoperability: Nations and NATO have the responsibility to provide systems that meet the Alliance's capability and interoperability needs. Implementation of SLCM enables these needs to be met through cooperation and standardization.

Efficiency: Effective and economic use of National and NATO resources is essential for the Alliance to sustain military operations. Implementation of SLCM better enables efficient acquisition, use, support and disposal of systems.

Collaboration with Industry: SLCM needs a close working relationship with Industry, maximum use of civil standards where appropriate, full exploitation of new technologies and shared domain expertise in order to benefit from commercial best practices.

Quality: The defence capability depends to a great extent, on the quality of systems. Quality is best achieved through an integrated systems approach throughout the life cycle (AQAP 2000 – NATO Policy on an integrated system approach to Quality through the Life Cycle.).

1.2 Purpose

The purpose of AAP-48 is to provide guidance on the implementation of SLCM, which is used to mitigate risk, reduce acquisition times and to identify, quantify and control Life Cycle Cost, from the earliest possible opportunity. It does this in two ways, first through explaining the principles and techniques of SLCM and, second, by presenting mechanisms for applying SLCM to defence related capabilities in the NATO context.

SLCM will assure that the processes used across projects are consistent, harmonized, and that there is effective sharing and coordination of resources, information and technologies. This publication defines a set of stages, processes and associated terminology. Complemented by the enabling frameworks (see paragraph 1.1) and tailored accordingly these stages and processes are used to achieve the identified stakeholders' requirements and support an organizations specific needs of attaining customer satisfaction (see Figure 1-2).

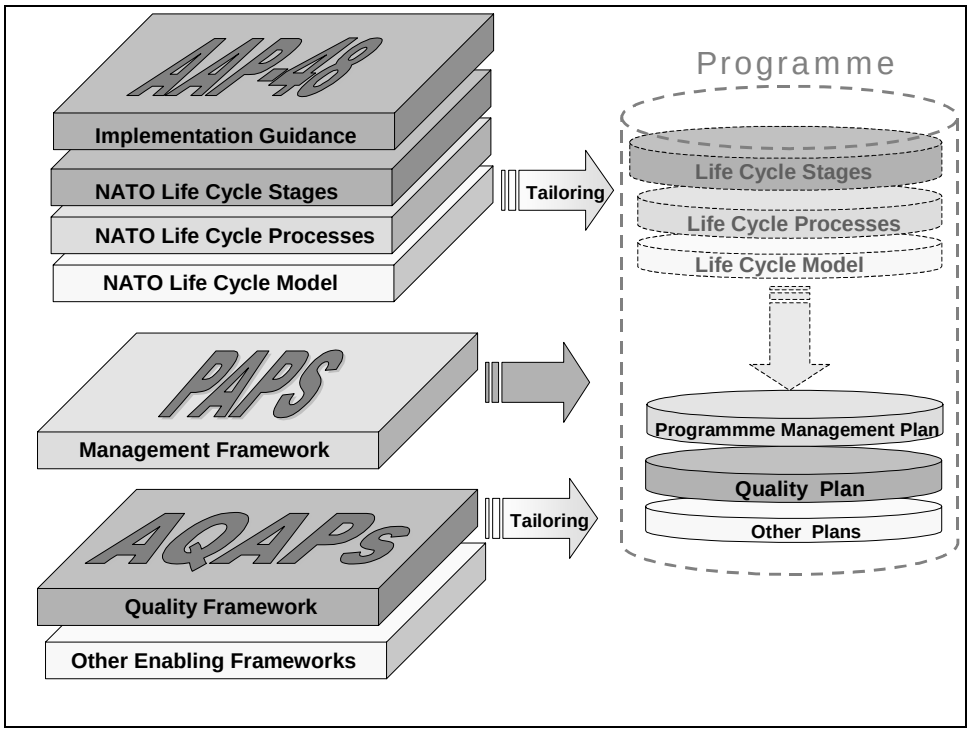


Figure 1-2: Utilizing the conceptual framework

1.3 Applicability

NATO, Nations and industry, in their role as acquirer or supplier, may use this publication. It can be used by either a single party or in a multiple-party situation either within or among organizations.

1.4 Composition

This document is comprised of 5 sections:

1. General
2. System Life Cycle Stages
3. System Life Cycle Processes
4. System Life Cycle Models
5. Annexes

1.5 References

(a)	C-M-(2005)0108 (NATO Policy for Systems Life Cycle Management)
(b)	Report to the CNAD on Life Cycle Management in NATO Ed. 2, 2000
(c)	ISO/IEC 15288:2002 Systems Engineering - System Life Cycle Processes
(d)	ISO/IEC TR 19760:2003 System engineering – A guide for the application of ISO/IEC 15288 (System life cycle processes)

1.6 Definitions

Definitions from ISO/IEC 15288 apply unless otherwise stated. A list is provided as Annex 2 – Glossary.

2 SYSTEM LIFE CYCLE STAGES

2.1 General

Every system-of-interest (SOI) has a life cycle. A life cycle can be decomposed into a set of stages consisting of processes and activities, which are detailed in section 3 of this publication. A SOI progresses through these stages as the result of actions, performed and managed by people in organizations.

NATO has decided to follow ISO/IEC 15288 in dividing the whole system life cycle into six stages (see Figure 2-1):

1. Concept
2. Development
3. Production
4. Utilization
5. Support
6. Retirement

Each stage represents one essential period of the life cycle of a system. The partitioning of the system life cycle into stages is based on the practicality of doing the work in small, understandable, timely steps. Stages, in addition, help address uncertainties and risk associated with cost, schedule, general objectives and decisions making. Each stage has a distinct purpose and contribution to the whole life cycle. The transition between stages uses decision gates and entry/exit criteria.

The stages are briefly described in paragraphs 2.2 to 2.7 of this publication. For more details refer to ISO/IEC 15288, Annex B.

Stages are assembled in life cycle models. The interrelationship and sequence (overlapping, iteration etc.) of stages in a life cycle model depends on the characteristics of the SOI. For more details see section 4 of this publication.

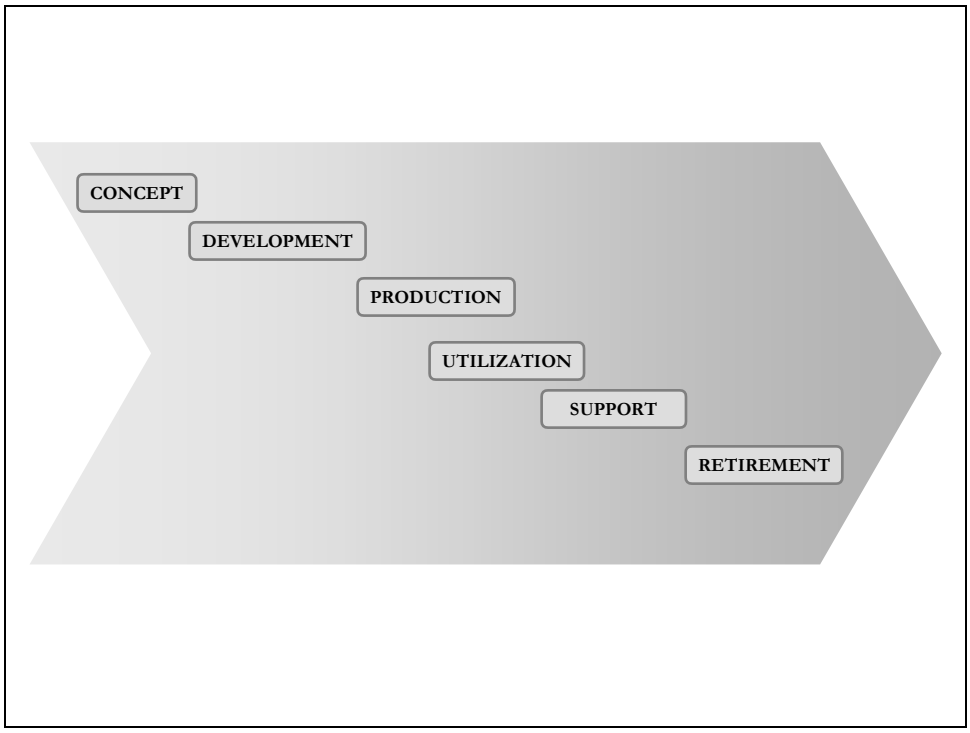


Figure 2-1: Life Cycle Stages

2.1.1 Decision Gates

Decision gates control the flow in and out of the stages and provide a control mechanism. The decisions taken at each of the gates may be to (see Figure 2-2):

- execute the next stage
- continue this stage
- go to a preceding stage
- terminate the project (life cycle)
- hold project (life cycle) activity

Decisions have to be documented.

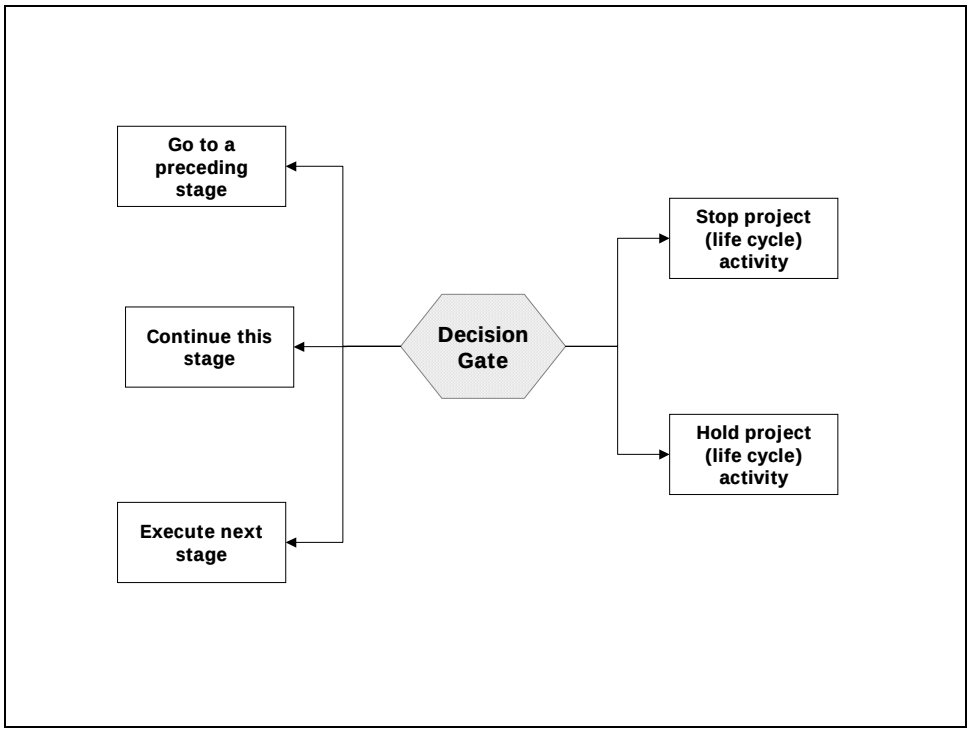


Figure 2-2: Decision Making at Decision Gates

2.1.2 Entry and Exit Criteria

Entry and exit criteria support the decision making process at the decision gates. They provide a mean to mitigate risks and uncertainty.

Figure 2-3 below shows three different ways entry and exit criteria can be used at a decision gate (specific models may contain any combination of these paths).

- Path 1: Moving from stage (a) to stage (b), both the exit criteria (for stage a) and the entry criteria (for stage b) may be used to control the transition.
- Path 2: Entering stage (b) the entry criteria may be used to control the transition.
- Path 3: Leaving stage (a) may be controlled by exit criteria.

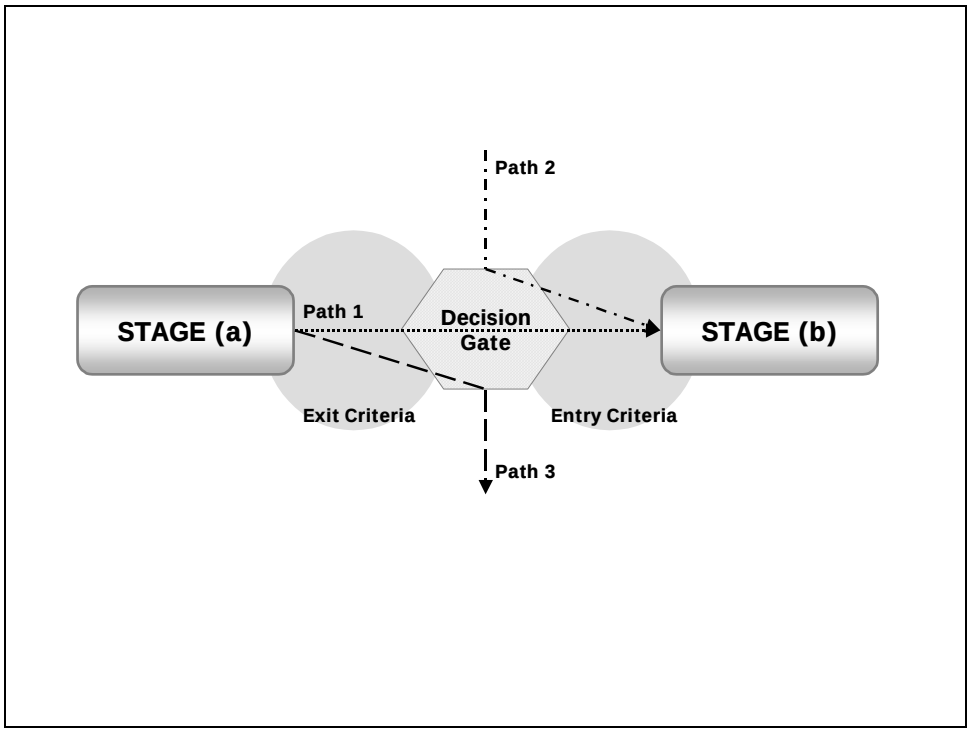


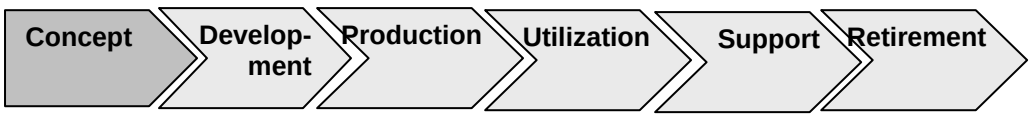
Figure 2-3: Use of Entry and Exit Criteria

When planning for system life cycle management, organizations or programmes should define their entry and exit criteria for all stages as early as possible. These criteria can be selected from

- Stage outcomes from ISO/IEC 15288, Annex B.
- The inputs and outputs of the processes described in section 3 of this publication.
- Experience from other programmes.
- Any other organization / programme specific requirement or deliverable.

The maintenance of defined criteria is an activity of the System Life Cycle Processes Management Process (see paragraph 3.2.3 of this publication).

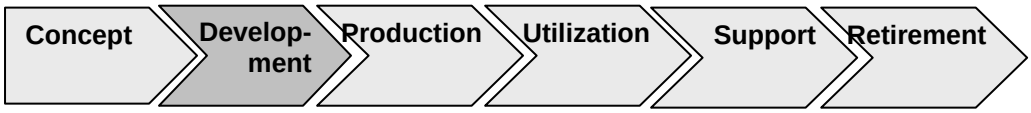
2.2 Concept Stage



The Concept Stage starts after the decision to fill a capability gap with a materiel solution and ends with the requirements specification for this materiel solution.

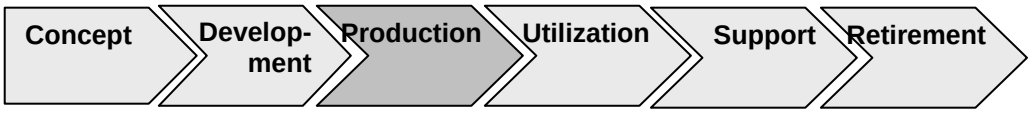
The purpose is to evaluate the needs, potential risks, and cost benefit of a proposed system, or a major upgrade of an existing system prior to any commitment of resources. One or more alternative solutions to meet the identified need or concept are developed through analysis, feasibility evaluations, estimations (such as cost, schedule, market intelligence and logistics), trade-off studies, and experimental or prototype development and demonstration.

2.3 Development Stage



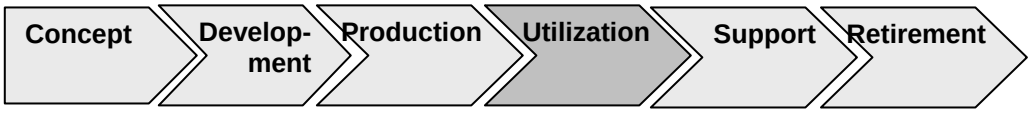
The Development Stage is executed to develop a SOI that meets user requirements and can be produced, tested, evaluated, operated, supported and retired. This stage also ensures that the aspects of future stages (production, utilization, support, and retirement) are considered and incorporated into the design through the involvement of all stakeholders.

2.4 Production Stage



The Production Stage is executed to produce or manufacture the product, to test the product and to produce related supporting and enabling systems as needed.

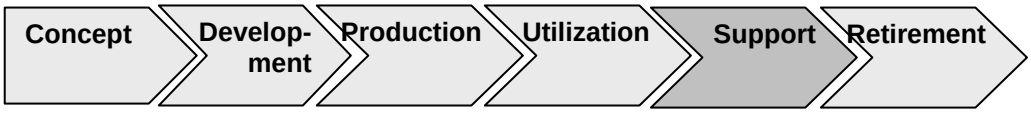
2.5 Utilization Stage



The Utilization Stage is executed to operate the product at the intended operational sites to deliver the required services with continued operational and cost effectiveness.

This stage ends when the SOI is taken out of service.

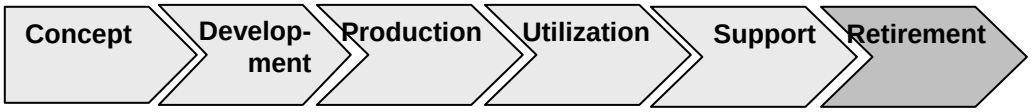
2.6 Support Stage



The Support Stage is executed to provide logistics, maintenance, and support services that enable continued SOI operation and a sustainable service.

The Support Stage is completed with the retirement of the SOI and termination of support services.

2.7 Retirement Stage



The Retirement Stage provides for the removal of a SOI and related operational and support services and to operate and support the retirement system itself.

This stage begins when a SOI is taken out of service.

3 SYSTEM LIFE CYCLE PROCESSES

ISO/IEC 15288 describes four process groups:

- Agreement processes
- Enterprise processes
- Project processes
- Technical processes

The role of the Enterprise and Project group processes is to achieve the project goals within applicable life cycle stages to satisfy an agreement. Enterprise processes provide enabling resources and infrastructure that are used to create, support, and monitor projects and to assess project effectiveness. The Project processes ensure that adequate planning, assessment, and control activities are performed to manage processes and life cycle stages. Appropriate processes are selected from the Technical processes and used to populate projects in order for the project to perform life cycle related work. A project may need to establish relationships with other projects within the organization, as well as those in other organizations. Such relationships are established through the Agreement processes.

Within a life cycle stage, processes are performed as required to achieve stated objectives. The progression of a system through its life is the result of actions managed and performed by people in one or more enterprises using the processes selected for a life cycle stage.

Each life cycle process may be invoked, as required, at any time throughout the life cycle and there is no definitive order in their use. Any life cycle process may be executed concurrently with any other life cycle process. Any life cycle process may apply at any level in the hierarchical representation of a system’s structure. Therefore, in the following description of the system life cycle processes, the order that the processes are presented and the process groups used do not imply any precedence in, or sequence of application of, processes during the life cycle of a system.

In addition to the following process details ISO/IEC 15288 and ISO/IEC TR 19760 provide further information.

3.1 Agreement Processes

The agreement processes are applicable for establishing the relationship and requirements between an acquirer and supplier. The agreement processes provide the basis for initiation of other project processes to enable arriving at an agreement to engineer, utilize, support or retire a system and to acquire or supply related services.

Agreement processes are:

- Acquisition Process
- Supply Process

3.1.1 Acquisition Process

Process	Acquisition Process	
Description	The purpose of the Acquisition Process is to obtain a product or service in accordance with the acquirer's requirements.	
Activities	- Establish a plan for how the acquisition will be conducted. - Prepare a request for the supply of a product or service. - Communicate the request for the supply of a product or service to identified suppliers. - Select a supplier. - Negotiate an agreement with the supplier. - Assess the execution of the agreement. - Confirm that the delivered product or service complies with the agreement. - Make payment or provide other agreed consideration to the supplier for the product or service rendered.	
Inputs	- Enterprise Acquisition Policy - National/international regulations/law - System Requirements - Financial means	
Outputs	- A strategy for the acquisition is established. - A supplier is selected. - Communication with the supplier is maintained. - A justification for the selection is declared.	

	- An agreement to acquire a system according to defined system acceptance criteria is established. - A system complying with the agreement is accepted. - Payment or other consideration is rendered.	
Tools/Methods		
Tailoring Considerations		
References	National/international regulations/law.	

3.1.2 Supply Process

Process	Supply Process	
Description	The purpose of the Supply Process is to provide an acquirer with a product or service that meets agreed requirements.	
Activities	- Determine the existence and identity of an acquirer who has, or who represents a party or parties having, a need for a product or service. - Evaluate a request for the supply of a product or service to determine feasibility and how to respond. - Prepare a response that satisfies the solicitation. - Negotiate an agreement with the acquirer. - Execute the agreement in accordance with agreed project plans considering e.g. accelerated fielding of equipment. - Assess the execution of the agreement. - Deliver the product or service in accordance with the agreement criteria. - Accept and acknowledge payment or other agreed consideration. - Transfer the responsibility for the product or service to the acquirer, or other party, as directed by the agreement.	
Inputs		
Outputs	- An acquirer for a product or service is identified. - A response to the acquirer's request is made. - An agreement to supply a product or service according to defined acceptance criteria is established. - Communication with the acquirer is maintained.	

	- A product or service conforming to the agreement is supplied according to agreed delivery procedures and conditions. - Responsibility for the acquired product or service, as directed by the agreement, is transferred. - Payment or other agreed consideration is received.	
Tools/Methods		
Tailoring Considerations		
References	National/international regulations/law.	

The Supply Process is executed by the Supplier.

3.2 Enterprise Processes

Enterprise processes are for that part of the general management that is responsible for establishing and implementing projects related to the products and services of an organization. Thus, the enterprise through these distinct processes provides the services that both constrain and enable the projects, directly or indirectly, to meet their requirements.

Enterprise processes are:

- Enterprise Environment Management Process
- Investment Management Process
- System Life Cycle Processes Management Process
- Resource Management Process
- Quality Management Process

3.2.1 Enterprise Environment Management Process

Process	Enterprise Environment Management Process	
Description	The Enterprise Environment Management Process is the process that assures the definition and updates of the policies and procedures necessary to implement this publication to support NATO Bodies and NATO Nations efforts to meet defined, operational goals.	
Activities	Enterprise Management review the processes of each business area in order to determine: - Applicability - Effectiveness	

	- Processes interrelationship	
Inputs	- Results from the System Life Cycle Processes Management Process. - Top Management commitment to adopt Life Cycle Management.	
Outputs	- Life Cycle Policies - Life Cycle procedures - An implementation plan for each business area including (but not limited to) the roles, authorities, responsibilities and the applicable communication. - Defined business area/body, which will be responsible for the assessment of the effectiveness of implemented Life Cycle Management. - Defined success criteria for the Life Cycle Management. - Published policies and procedures throughout the Enterprise.	
Tools/Methods		
Tailoring Considerations	The Enterprise management shall identify the appropriate standard, defining methods of implementing Life Cycle management most suitable for the Enterprise.	
References	AQAP 2050, ISO/IEC 15504	

3.2.2 Investment Management Process

Process	Investment Management Process	
Description	The Investment Management Process assures the definition and updates of the procedures necessary to support the control of funding and resources.	
Activities	- Enterprise Management identifies the capability gap based on operational needs. - Enterprise Management identifies the programme to fulfill the capability gap. - Enterprise Management allocates the necessary resources for Programme Management Teams.	

Inputs	Enterprise Management define the financial authority of each Programme Management Team, including but not limited to: - Resources available - Reporting criteria - Goals for each Programme Management Team - Programme Management Team plans to control the use of resources.	
Outputs	Allocation and adjustment of budgets and identification of possible improvement (Cost-effectiveness)	
Tools/Methods		
Tailoring Considerations		
References		

3.2.3 System Life Cycle Processes Management Process

Process	System Life Cycle Processes Management Process	
Description	The System Life Cycle Management Process assures implemented Life Cycle Management Processes are operational, effective and in accordance with policies and procedures defined by NATO Bodies and NATO Nations.	
Activities	Enterprise Management should: - Identify the necessary System Life Cycle processes; - Identify tailoring methods and their acceptance criteria; - Establish assessment methods/measurements; - Execute process surveillance and register the measured result; - Execute trend analysis and propose necessary improvement of the processes. - Measure process effectiveness	
Inputs	- Enterprise management decision to implement Life Cycle Management. - Results from the Enterprise Environmental Management Process.	

Outputs	Measurements and proposals to improve the established Life Cycle Management.	
Tools/Methods	Trend analysis	
Tailoring Considerations		
References	ISO/IEC 15504, AQAP 2000 series.	

3.2.4 Resource Management Process

Process	Resource Management Process	
Description	The Resource Management Process assures the right infrastructure is established and made available to the NATO Bodies and NATO Nations in support of their efforts to meet defined operational goals.	
Activities	Enterprise Management should: - Determine the necessary infrastructure and make it available to the Programme Management Team. - Establish means to ensure the necessary knowledge is available (e.g. through a knowledge based management). - Assure that personnel are motivated and not over loaded. - Assure that resources are distributed to the programmes and cross training is executed. - Assess the Life Cycle Management system effectiveness, applicability and identify improvement opportunities(see also System Life Cycle Processes Management Process).	
Inputs	- Enterprise management decision to implement Life Cycle Management - Necessary resources made available by the Enterprise	
Outputs	- Available resources to the Enterprise - Measurements and proposals to improve the established Life Cycle Management	
Tools/Methods	Knowledge based management system	
Tailoring Considerations		
References	AQAP 2000 series, STANAG 4107	

3.2.5 Quality Management Process

Process	Quality Management Process	
Description	The Quality Management Process assures that the organization has an effectively implemented, maintained and improved quality management system. This quality management system is used to plan the quality activities at the organizational level and through auditing identifies effectiveness, corrective, preventive and improvement actions.	
Activities	Implementation of a quality management system. Description of the tailored quality activities defined during the concept stage; e.g: - quality activities that assure the operational needs are transformed into technical specifications, which are measurable. - quality activities in the programme. - the quality assurance activities during evaluation of potential suppliers. - the quality assurance activities, that assures appropriate quality assurance requirements are documented in the contract.	
Inputs	- Enterprise Management requirement for quality in the organization. - Requirement for the programme to deliver the product in the required quality.	
Outputs	- Quality Management System as documented in the Quality Manual - Programme specific Quality Plans. - Defined contractual quality requirements.	
Tools/Methods	Use of Programme Management Teams during the life of a capability and use of AQAP and STANAG and national procedures for Quality Assurance.	
Tailoring Considerations	There is a specific NATO need to use the AQAP series as contractual quality requirements, as this series of publications is the only one to allow the acquiring authority access to suppliers' facilities and allow for (free) mutual Government Quality Assurance in accordance with STANAG 4107.	
References	STANAG 4107, AQAP 2000 series	

3.3 Project Processes

The project processes should be used to manage technical process activities and to ensure satisfaction of an agreement. Project processes are performed to establish and update plans, to assess progress against plans and system requirements, to control work efforts, to make required decisions, to manage risks and configurations and to capture, store, and disseminate information. Outcomes from performing the project processes help in the accomplishment of the technical processes.

Project Processes are:

- Project Planning Process
- Project Assessment Process
- Project Control Process
- Decision-making Process
- Risk Management Process
- Configuration Management Process
- Information Management Process

3.3.1 Project Planning Process

Process	Project Planning Process	
Description	The purpose of the Project Planning Process is to produce and communicate effective and workable project plans.	
Activities	Detailed planning for the current life cycle stage and overall planning for all life cycle stages. This planning should include: - Scope definition - Activity definition - Activity sequencing - Activity duration estimating - Cost estimating - Schedule estimating - Cost budgeting - Project plan documentation	
Inputs	- Scope of the project - Outputs from other planning activities - Historical information (“lessons learned”) - Enterprise policies	

Outputs	- Project plan(s) - Work packages	
Tools/Methods	- Project planning methodology - Project management information system	
Tailoring Considerations	The level of planning needed will depend on the complexity of the project. Complexity will depend on several factors, such as: - Size - Technical complexity - System maturity - Number of stakeholders - Risk sensitivity	
References	PMBOK Guide, IEC 60300	

3.3.2 Project Assessment Process

Process	Project Assessment Process	
Description	The purpose of the Project Assessment Process is to determine the status of the project. This process evaluates, periodically and at major events, the progress and achievements against requirements, plans and overall business objectives. Information is communicated for management action when significant variances are detected.	
Activities	Status reporting for: - Activity completion assessment - Schedule assessment - Cost assessment	
Inputs	Project plan	
Outputs	Assessment reports	
Tools/Methods	- Performance measurement - Project management information system - Status review meetings	
Tailoring Considerations		
References	AQAP 2050, ISO 15504, PMBOK Guide	

3.3.3 Project Control Process

Process	Project Control Process	

Description	The purpose of the Project Control Process is to direct project plan execution and ensure that the project performs according to plans and schedules, within projected budgets and satisfies technical objectives for technical requirements. This process includes redirecting the project activities, as appropriate, to correct identified deviations and variations from other project management or technical processes. Redirection may include replanning as appropriate.	
Activities	Maintain momentum in the project in accordance with the project plan through proactive management	
Inputs	- Project plan - Assessment reports	
Outputs	- Preventive, corrective and improving actions - Adjustment to the project plan	
Tools/Methods	Project management information system	
Tailoring Considerations		
References	PMBOK, AQAP 2105, ACMP, ARMP	

3.3.4 Decision-making Process

Process	Decision-making Process	
Description	The purpose of the Decision-making Process is to select the most beneficial course of project action where alternatives exist. This process responds to a request for a decision encountered during the life cycle of a system, whatever its nature or source, in order to reach specified, desirable or optimized outcomes. Alternative actions are analyzed and a course of action selected and directed. Decisions and their rationale are recorded to support future decision-making.	
Activities	- Define decision strategy - Using the defined decision strategy, evaluate the balance of consequences of alternative actions to arrive at an optimization of, or an improvement in, an identified decision situation. - Record, track, evaluate and report decision outcomes to confirm that problems have been effectively resolved, adverse trends have been reversed and advantage taken of opportunities. - Maintain records of problems and opportunities and their disposition, as stipulated in agreements or organizational procedures and in a manner that permits auditing and learning from experience	

Inputs	- Project plan - Alternative solutions - Stakeholder requirements	
Outputs	- Decision-making strategy - Alternative courses of action are defined. - A preferred course of action is selected. - The resolution, decision rationale and assumptions are captured and reported.	
Tools/Methods		
Tailoring Considerations		
References		

3.3.5 Risk Management Process

Process	Risk Management Process	
Description	The purpose of the Risk Management Process is to minimize the effects of uncertain events that may occur and would result in adverse consequences to system cost, schedule and technical characteristics. This process identifies, assesses and handles all risks during the entire life cycle, including those that affect the success of the organization, the project and the technical actions, and those that arise during operational use of the system. It responds to each risk in terms of acceptance, avoidance action or mitigation actions.	
Activities	- Risk management planning - Risk identification - Qualitative risk analysis - Quantitative risk analysis - Risk response planning - Risk monitoring and control	
Inputs	Risk management policy	
Outputs	- Risk management plan - Identified risk - Risk evaluation and prioritisation - Risk mitigation	

	- Risk reports	
Tools/Methods	- Risk status meetings - Risk management software - Risk database	
Tailoring Considerations		
References	PMBOK Guide, ISO/IEC 16085, AQAP 2070	

3.3.6 Configuration Management Process

Process	Configuration Management Process	
Description	Configuration Management Process provides the means to apply technical and administrative direction over the life cycle of a product, its configuration items, and related product configuration information. Configuration management documents the product's configuration for both the supplier and the acquirer.	
Activities	- Configuration identification and documentation: The process of identifying and documenting the functional and physical characteristics of configuration items (CI). - Configuration Control: The systematic evaluation, coordination, approval or disapproval and dissemination of all proposed changes to a CI and/or its configuration documentation after formal establishment of its configuration baseline and verifying the implementation of all approved changes. - Configuration Status Accounting: The recording and reporting of the information that is needed to manage the configuration effectively, including a list of approved configuration documentation, the status of proposed changes to the configuration and the implementation status of approved changes. - Configuration audits: Checking an item for its compliance with the configuration documentation	
Inputs	- A documented change request to form, fit or function of a configuration item. - Need to control a new designed configuration item. - Contractual requirement for a Configuration Management Plan	

Outputs	- Implemented change to form, fit or function of a configuration item. - Configuration Management Plan	
Tools/Methods		
Tailoring Considerations		
References	STANAG 4159, AQAP 2000 series, ACMP, STANAG 4427	

3.3.7 Information Management Process

Process	Information Management Process	
Description	The Information Management Process will facilitate the right information, at the right time, for the right purpose, to the right user, with the lowest possible cost, with the highest possible quality, actuality and security, and abiding to current laws and regulations.	
Activities	Implement information resource management - Information creation Information identification Creation and authoring of information – for capability and system in focus - Information exchange Exchanging information between parties, systems, people and organizations. This includes catering for Information Interoperability, or Semantic Interoperability. Exchange provides Semantic Interoperability, ensuring that the meaning of the information exchange is contained and understood by the stakeholders - Information sharing Sharing information between stakeholders, information systems or organizations - Information hosting Hosting data and information in data repositories – managing and presenting data and information for stakeholders and information systems Implement information quality management - Verification of data and information accuracy - Information assurance	

	Control, maintain and improve information quality - Information security assurance Manage information resources in accordance with laws and regulations for security. Safeguard information repositories, transmissions and distribution. - Information legal assurance Managing information within laws and regulations – governing the content of information. (Personal protection, commercial protection – other legal issues for information) - Information governance Management methods and procedures for Information resources. Information governance include – information owners, information management routines, information accessibility.	
Inputs	Management commitment to Information Management	
Outputs	Confidence in information	
Tools/Methods		
Tailoring Considerations		
References	ISO/IEC 10303-239 , ISO/IEC 15408 AQAP 2110, 2120, 2130, 2131	

3.4 Technical Processes

The technical processes are used to define the requirements for a system, to transform the requirements into an effective product, to permit consistent reproduction of the product where necessary, to use the product to provide the required services, to sustain the provision of those services and to dispose of the product when it is retired from service. The technical processes define the activities that enable enterprise and project functions to optimize the benefits and reduce the risks that arise from technical decisions and actions.

Technical Processes are:

- Stakeholder Requirements Definition Process
- Requirements Analysis Process
- Architectural Design Process
- Implementation Process
- Integration Process
- Verification Process

- Transition Process
- Validation Process
- Operation Process
- Maintenance Process
- Disposal Process

3.4.1 Stakeholder Requirements Definition Process

Process	Stakeholder Requirements Definition Process	
Description	The purpose of the Stakeholder Requirements Definition Process is to define the requirements for a system that can provide the services needed by users and the stakeholders in a defined environment.	
Activities	- Identify stakeholders - Elicit stakeholder requirements - Document requirements - Identify constraints - Structure and prioritise requirements - Ensure stakeholders accept the documented requirements - Identify external interfaces - Identify interoperability requirements.	
Inputs	- Stakeholder needs and expectations - Identified capability gap	
Outputs	Basis for System Requirements	
Tools/Methods		
Tailoring Considerations		
References	AQAP 2000 series; ISO 10006, ISO 9241.	

3.4.2 Requirements Analysis Process

Process	Requirements Analysis Process	
Description	The Requirements Analysis Process produces the system requirements of the future system that will meet the stakeholders' requirements and enables implementation within existing constraints. System requirements represent the basis for the tests to validate stakeholders' requirements.	
Activities	- To perform an analysis of the stakeholder requirements and transform the stakeholder requirements into a set of measureable technical and performance requirements. - Create upward and downward traceability to ensure that no stakeholder requirement has been omitted and all defined technical requirements have a parent stakeholder requirement. - Maintain throughout the system life cycle the set of system requirements together with the associated rationale, decisions and assumptions. - Manage system requirements in accordance with the Configuration Management Process.	
Inputs	Stakeholder requirements	
Outputs	System requirements	
Tools/Methods		
Tailoring Considerations		
References	AQAP 2000 series	

3.4.3 Architectural Design Process

Process	Architectural Design Process	
Description	Architectural design synthesises a solution that satisfies system requirements, expressed as a set of separate problems of manageable, conceptual and, ultimately, realisable proportions and ensure that a defined design standard of materiel meets the requirements of the contract specification.	
Activities	- Identify and explore one or more implementation strategies at a level of detail consistent with the system's technical requirements and risks.	

	- Define a design solution in terms of the requirements for a complete set of technically viable components from which the system is configured. - Plan and devise an assembly and test strategy that will detect and diagnose faults during the integration steps. - Define areas of solution and establish a basis for detection/correction of errors throughout the system life cycle. - Establish traceability of architectural design to system requirements.	
Inputs	System Requirements	
Outputs	System Architecture and Design	
Tools/Methods		
Tailoring Considerations		
References	AQAP 2000 series, ISO 13407, STANAG 4457	

3.4.4 Implementation Process

Process	Implementation Process	
Description	The purpose of the Implementation Process is to produce a specified system element.	
Activities	- Define implementation strategy. - Identify implementation strategy/technology constraints on the design. - Realize system element. - Record objective evidence that system element meets supplier agreements, legislation, and organizational policy. - Package and store system element appropriately.	
Inputs	System Architecture and Design	
Outputs	Realized system element	
Tools/Methods		
Tailoring Considerations		

References	AQAP 2000 series

3.4.5 Integration Process

Process	Integration Process	
Description	The Integration Process is to assemble a system that is consistent with the architectural design. This process combines system elements to form complete or partial system configurations in order to create a product specified in the system requirements.	
Activities	- Define an assembly sequence and strategy that minimizes system integration risk. - Identify the constraints on the design arising from the integration strategy. - Obtain integration enabling systems and specified materials according to the defined integration procedures. - Obtain system elements in accordance with agreed schedules. - Assure that the system elements have been verified against acceptance criteria specified in an agreement. - Integrate system elements in accordance with applicable interface control descriptions and defined assembly procedures, using the specified integration facilities. - Record integration information.	
Inputs	- System architectural design - Realized system elements	
Outputs	Assembled and integrated system	
Tools/Methods		
Tailoring Considerations		
References	AQAP 2000 series	

3.4.6 Verification Process

Process	Verification Process	
Description	The purpose of the Verification process is to confirm that the specified design requirements are fulfilled.	
Activities	- Define the strategy for verifying the systems throughout the life cycle. - Define a verification plan based on system requirements. - Identify and communicate potential constraints on design decisions. - Ensure that the enabling system for verification is available and associated facilities, equipment and operators are prepared to conduct the verification. - Conduct verification to demonstrate compliance to the specified design requirements. - Make available verification data on the system. - Analyze, record and report verification, discrepancy and corrective action information.	
Inputs	- System requirements - Assembled and integrated system	
Outputs	- Verified system - Verification report including non-conformances	
Tools/Methods	Government Quality Assurance	
Tailoring Considerations		
References	AQAP 2000 series, STANAG 4107	

3.4.7 Transition Process

Process	Transition Process	
Description	The Transition Process establishes an integrated and verified system to provide services specified by stakeholder requirements in the operational environment.	
Activities	- Prepare the site of operation in accordance with installation requirements. - Deliver the system for installation at the correct location and time. - Install the system in its operational location and interfaced to its environment according to its system specification. - Demonstrate proper installation of the system. - Ensure user training. - Activate the system. - Demonstrate the installed system is capable of delivering its required services. - Record the installation data, including the operational configuration, anomalies detected, actions taken and lessons learned.	
Inputs	- Verified system - Verification report including non-conformances	
Outputs	System installed in its operational environment	
Tools/Methods		
Tailoring Considerations	In a military environment the system usually is validated prior to delivery.	
References	AQAP 2000 series	

3.4.8 Validation Process

Process	Validation Process	
Description	The Validation Process provides objective evidence that the services provided by a system when in use comply with stakeholders' requirements.	
Activities	Prepare a validation plan. - Ensure that any operators, enabling system for validation and associated facilities are ready in order to conduct validation. - Conduct validation to demonstrate conformance of services to stakeholder requirements. - Make available validation data on the system according to legal, regulatory or product sector requirements. - As appropriate to agreement terms or organizational objectives, conduct validation to isolate that part of the system giving rise to a non-conformance. - Analyse, record and report validation data according to criteria defined in the validation strategy.	
Inputs	- System installed in its operational environment - Stakeholder requirements	
Outputs	- Validated system - Validation report including non-compliances	
Tools/Methods		
Tailoring Considerations	In a military environment the system usually is validated prior to delivery.	
References	AQAP 2000 series	

3.4.9 Operation Process

Process	Operation Process	
Description	The purpose of the Operation Process is to use the system in order to deliver its services.	
Activities	Obtain other services related to operation of the system. - Assign trained, qualified personnel to be operators. - Activate the system in its intended operational situation to deliver instances of service or continuous service according to its intended purpose. - Consume materials, as required, to sustain the services. - Monitor operation to ensure that the system is operated in accordance with the operations plans, in a safe manner and compliant with legislated guidelines concerning occupational safety and environmental protection. - Monitor the system operation to confirm that service performance is within acceptable parameters. - Perform failure identification actions when a non-compliance has occurred in the delivered services. - Determine the appropriate course of action when corrective action is required to remedy failings due to changed need. - Introduce remedial changes to operating procedures, the operator environment, human-machine interfaces and operator training as appropriate when human error contributed to failure. - Continuously or routinely communicate with users to determine the degree to which delivered services satisfy their needs. - Request for corrective design change	
Inputs	Validated system	
Outputs	- System in operation - System for disposal	
Tools/Methods		
Tailoring Considerations		
References	IEC 60300	

3.4.10 Maintenance Process

Process	Maintenance Process	
Description	The purpose of the Maintenance Process is to sustain the capability of the system to provide a service.	
Activities	- Prepare and implement a maintenance strategy. - Obtain the enabling systems, system elements and services to be used during maintenance of the system. - Monitor the system's capability to deliver service and record problems for analysis. - Take corrective, adaptive, perfective and preventive actions and confirm restored capability. - Maintain a history of problem reports, corrective actions and trends to inform operations and maintenance personnel, and other projects, that are creating or utilizing similar system elements.	
Inputs	- Maintenance Concept - System requiring maintenance - User defect report	
Outputs	- Maintained system - Maintenance reports - System for disposal - Request for corrective design change	
Tools/Methods		
Tailoring Considerations		
References	AQAP 2000 series, IEC 60300	

3.4.11 Disposal Process

Process	Disposal Process	
Description	The purpose of the Disposal Process is to end the existence of a system entity.	
Activities	- Define a disposal strategy for the system, to include each system element and any resulting waste products. - Communicate unavoidable constraints on the system design arising from the disposal strategy. - Acquire the enabling systems or services to be used during disposal of a system. - Deactivate the system to prepare it for removal from operation. - Withdraw operating staff from the system and record relevant operating knowledge. - Disassemble the system into manageable elements to facilitate its removal for reuse, recycling, reconditioning, overhaul, archiving or destruction. - Remove the system from the operational environment for reuse, recycling, reconditioning, overhaul or destruction. - Specify containment facilities, storage locations, inspection criteria and storage periods if the system is to be stored. - Conduct destruction of the system, as necessary, to reduce the amount of waste treatment or to make the waste easier to handle. - Confirm that no detrimental health, safety, security and environmental factors exist following disposal. - Archive information gathered through the lifetime of the system to permit audits and reviews in the event of long-term hazards to health, safety, security and the environment, and to permit future system creators and users to build a knowledge base from past experiences.	
Inputs	System for disposal	
Outputs	- Disposed system elements - Archived system information	
Tools/Methods		
Tailoring Considerations		

References	ISO 14001

4 SYSTEM LIFE CYCLE MODELS

4.1 Introduction

The stages, processes, and decision gates described in the previous sections of this publication form the main building blocks of system life cycle models. Because of their generic nature they need to be tailored when creating specific life cycle models.

The following points show relationships between the elements of a system life cycle model:

Stages:
- Form the basis of the system life cycle model and transition through decision gates.
- Provide a framework within which processes can be identified, tailored and planned.

Processes:
- Deliver outputs in the stages through performed activities.
- Deliver outputs which can be used as entry/exit criteria at decision gates.

Decision gates:
- Provide mechanisms to control the transition between stages.
- Provide control mechanisms for processes.

Specific life cycle models may be used:

- By a Nation or Organization - to establish an environment of desired processes that can be supported by an infrastructure of methods, procedures, techniques, tools and trained personnel. The Nation or Organization may then employ this environment to run and control its projects and progress SOI through their life cycle stages.
- By a Programme, within a Nation or Organization - to select, structure, employ and perform the elements of the established environment. This model may be used also to assess conformance of the project/system with the declared, established environment.
- By stakeholders – as a common framework for communication and understanding.

4.2 Creating System Life Cycle Models

The basic purpose of a SOI specific life cycle model is to provide a framework within which all aspects of the SOI can be managed. Its creation involves (see Figure 4-1):

1. assembling and combining the various stages presented in section 2,
2. defining the appropriate decision gate elements (entry and exit criteria) required to control the transition between stages,
3. selecting the various processes described in section 3 for all the stages.

For further detail on tailoring refer to ISO/IEC 15288, Annex A and ISO/IEC TR 19760.

Tailoring is required to be documented for the benefit of all who execute or assess the resulting set of processes. Tailoring records have to be established and maintained.

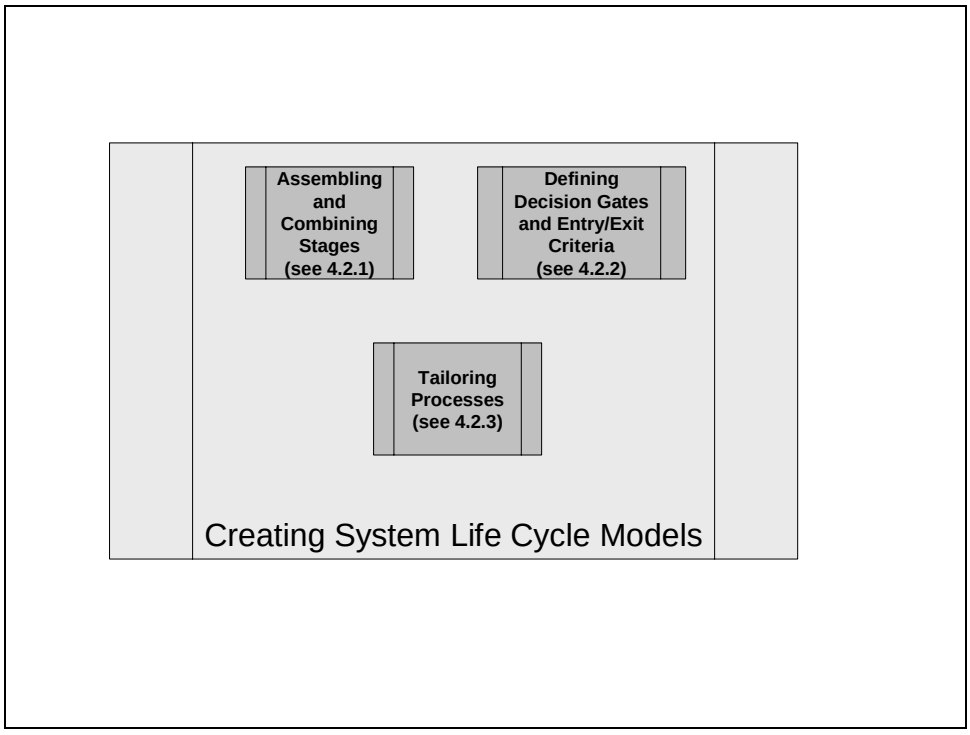


Figure 4-1: Creating System Life Cycle Models

4.2.1 Assembling and Combining Stages

The partitioning of the system life cycle into stages is based on the practicality of managing a SOI from concept through retirement by doing the work in small, understandable, timely steps. The stages thus provide Nations and Organizations with a framework within which their management has high-level visibility and control of project and technical processes.

The system life cycle model has to be created at the beginning of the concept stage and should be continuously evaluated, e.g. as described in the System Life Cycle Processes Management Process (see paragraph 3.2.3 of this publication).

A number of approaches to create system life cycle models can be used. The selection, development and use of one of these approaches by an organization depend on several factors such as those listed below:

- the acquisition policy of the organization;
- the nature and complexity of the system;
- the stability of system requirements;
- technological opportunities;
- the need for different system capabilities at different times;
- the availability of resources.

For further information refer to ISO/IEC TR 19760:2003, paragraph 7.2.1.

The following two figures show examples of possible models.

Figure 4-2 illustrates a system life cycle model created using a sequential approach. This is a possible representation of a life cycle model, where the concept, development, and production stages occur sequentially. The utilization and support stages start with the first "produced" system. Finally, the support stage, starting with utilization, continues past utilization to ensure the transition between the utilization and retirement stages. Decision gates are placed between stages to control the evolution of the SOI through the stages.

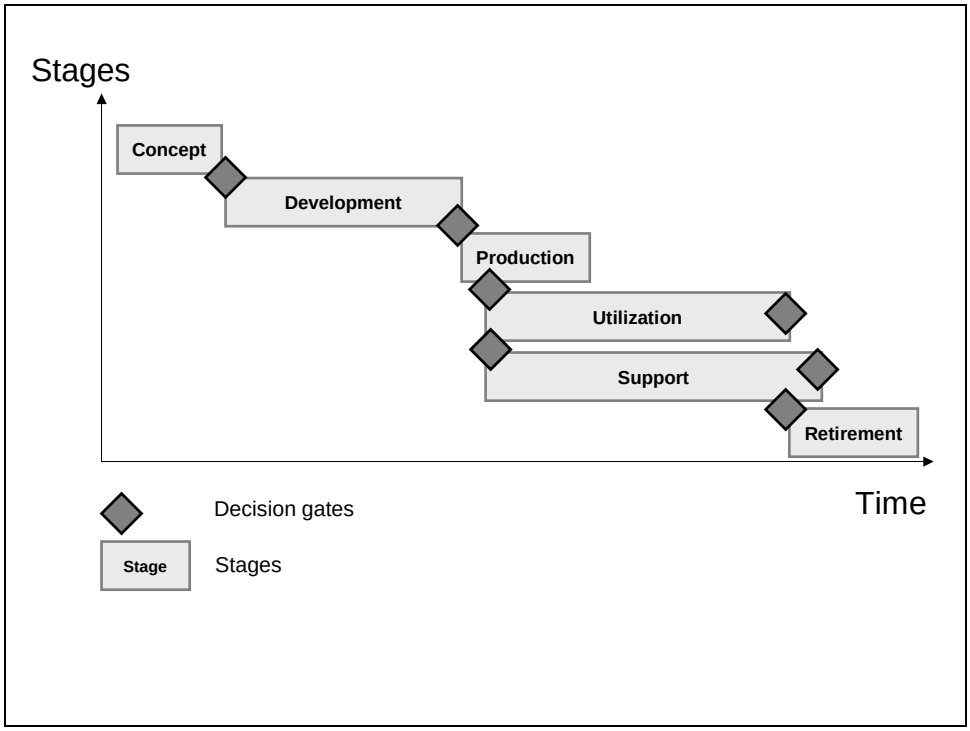


Figure 4-2: The Sequential System Life Cycle Model

Figure 4-3 illustrates a system life cycle model created using an incremental approach. The incremental system life cycle model attempts to break down the first stages into a number of increments. The SOI may enter the production stage when the first increment is delivered. The utilization stage may start with a limited set of capabilities. As time passes additional increments with additional capabilities are completed and added to the working system until the final increment containing all required capabilities is delivered to the users.

For risks and opportunities of the approaches see ISO/IEC TR 19760, paragraphs 7.2.2 and 7.2.3.

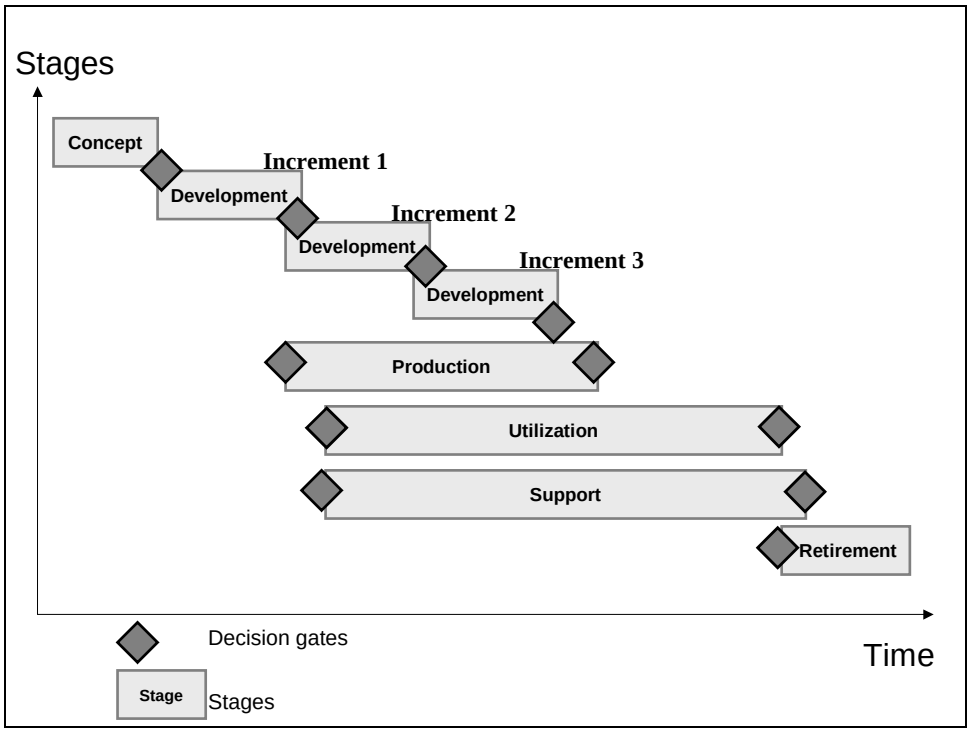


Figure 4-3: The Incremental System Life Cycle Model

4.2.2 Defining the Decision Gates and Entry / Exit Criteria

After combining the various stages in an appropriate model, the decision gates and the combination of entry / exit criteria has to be selected. Details are given in paragraphs 2.1.1 and 2.1.2 of this publication.

The definition of decision gates and entry/exit criteria is to a great extent influenced by the defined life cycle model. Consideration should be given to provide manageable decision criteria that reflect the interests of all stakeholders. In addition to decision gates and entry/exit criteria it may be useful to define additional control elements such as milestones.

Additional information is given in ISO/IEC TR 19760.

4.2.3 Tailoring the Processes

The progression of a SOI through its life cycle is achieved as the result of activities in processes. These processes are originally defined in ISO/IEC 15288 (Ref (c)) and further described in section 3 of this publication. They have to be selected and modified to satisfy life cycle stage outcomes.

Three steps are required to tailor the processes for a specific system life cycle model (see Figure 4-4 below):

- **Step 1**: The processes applying to the SOI and accompanying life cycle should be selected. Processes required but not included in Ref (c) (e.g. processes of ISO/IEC 12207) may be added.

- **Step 2**: The activities, inputs, outputs, methods, tools and other attributes of the processes (e.g. the stakeholders) as defined in section 3 of this publication and applicable to each stage of the system life cycle should be selected. The same applies to the attributes of other processes.
- **Step 3**: The selected processes and their attributes should be mapped to the system life cycle.

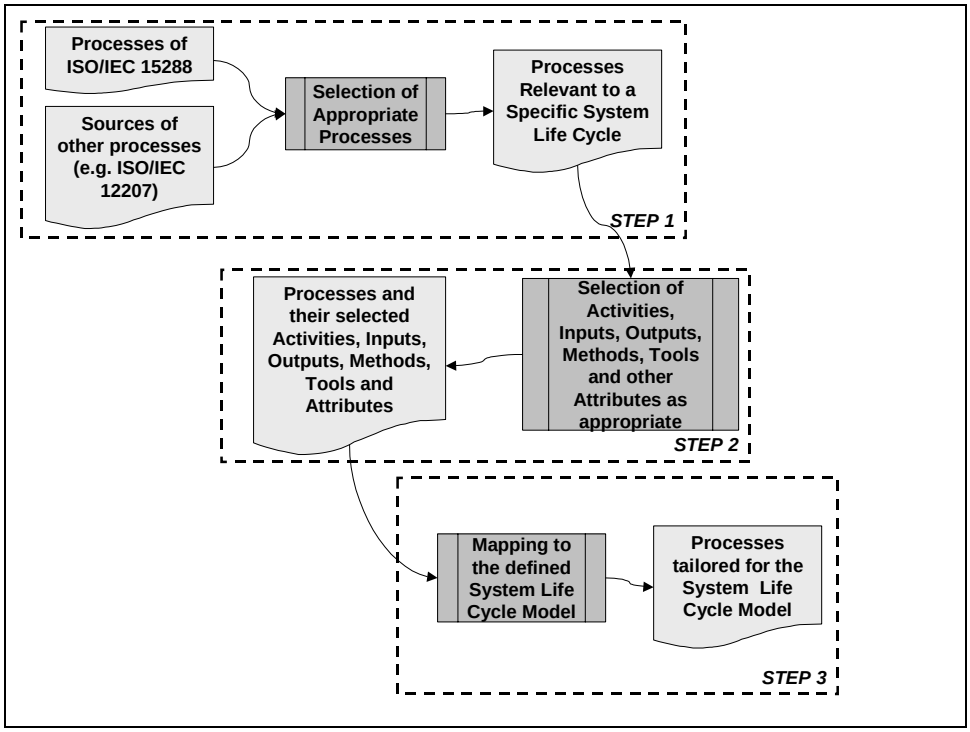


Figure 4-4: Tailoring of Processes for a System Life Cycle

4.2.4 Risk Considerations

The tailoring of processes or activities while creating system life cycle models involves risk. Consequently, risk management to control these risks forms an integral part of the tailoring.

There are four dynamic areas:

Risk identification:

Risks, their consequences and root causes have to be identified and described (knowledge/experience of the members in the organization, brainstorming and questionnaires).

After the risks are identified, they should be classified and divided into groups.

Potential interrelationship with other risks should be described.

Risk analysis:

The probability of the identified risks have to be quantified together with consequences and time to occurrence. Based on this quantification the risks should be prioritized in 1st priority, 2nd priority and 3rd priority.

See Annex 4 of this publication for a risk quantification example

Risk planning:

A Risk Management Plan is issued, containing the response to the identified risks:

- 1st priority risks: Mitigation actions and alternative plans are documented.
- 2nd priority risks: Mitigation actions are documented.
- 3rd priority risks: No specific actions, only surveillance, as the consequences and probability of the risk may change.

Risk control:

The mitigation actions for the priority 1 risks and, if necessary, alternative plans are executed. Surveillance on the priority 2 and 3 risks is maintained.

The Risk Management Plan is updated when necessary.

It is considered essential that NATO provides detailed guidance for risk management as part of the overall framework (see paragraph 1.1 of this publication).

Annex 1 - Cross-Reference between AAP 48 and ISO/IEC 15288

AAP-48	ISO/IEC 15288
2	6.3; D.2.2
0	B.2
0	B.3
0	B.4
0	B.5
0	B.6
0	B.7
3	5.1
0	5.2
3.1.1	5.2.2
3.1.2	5.2.3
0	5.3
0	5.3.2
0	5.3.3
0	5.3.4
0	5.3.5
0	5.3.6
0	5.4
0	5.4.2
0	5.4.3
0	5.4.4
0	5.4.5
0	5.4.6
0	5.4.7
0	5.4.8
0	5.5
0	5.5.2
0	5.5.3
0	5.5.4
0	5.5.5
0	5.5.6
0	5.5.7
0	5.5.8
0	5.5.9
0	5.5.10
0	5.5.11
0	5.5.12
4	6.2, D.2.1

Annex 2 – Glossary

Term	Definition	Source
acquirer	The stakeholder that acquires or procures a product or service from a supplier.	ISO/IEC 15288
acquisition	The process through which a Governmental and/or NATO Organization enters into a contractual relationship with a Supplier to obtain a product and/or service.	based upon AQAP 2110
activity	A set of actions that consume time and resources and whose performance is necessary to achieve, or contribute to, the realization of one or more outcomes.	ISO/IEC 15288
agreement	The mutual acknowledgement of terms and conditions under which a working relationship is conducted.	ISO/IEC 15288
architectural design	A synthesized solution that satisfies system requirements.	ISO/IEC 15288
capability	The ability to produce an effect that users of assets or services need to achieve.	ACT Capability Management Framework
configuration management	A discipline applying technical and administrative direction and surveillance to the following activities: - Configuration Identification and Documentation - Configuration Control - Configuration Status Accounting and - Configuration Audits.	ACMP-6
disposal	The process that deactivates, disassembles and removes the system and any waste products, consigning them to a final condition and returning the environment to its original or an acceptable condition.	ISO/IEC 15288
enabling system	A system that complements a system-of-interest during its life cycle stages but does not necessarily contribute directly to its function during operation. Note: For NATO use this is considered part of the system.	ISO/IEC 15288
enterprise	That part of an organization with responsibility to acquire and to supply products and/or services according to agreements.	ISO/IEC 15288
enterprise environment	The policies and procedures needed for the organization's business.	ISO/IEC 15288
life cycle	Preferred term: "system life cycle"	
life cycle model	A framework of processes and activities concerned with the life cycle, which also acts as a common reference for communication and understanding.	ISO/IEC 15288
management	Coordinated activities to direct and control an organization.	AQAP 2000

Term	Definition	Source
organization	A group of people and facilities with an arrangement of responsibilities, authorities and relationships.	ISO/IEC 15288
process	A set of interrelated or interacting activities which transforms inputs into outputs.	ISO/IEC 15288
programme	A group of related projects managed in a coordinated way. Note: Programmes usually include an element of ongoing work.	PMBOK (2000)
project	An endeavour with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements.	ISO/IEC 15288
quality	The degree to which a set of inherent characteristics fulfils requirements.	ISO 9000:2005
resource	An asset that is utilized or consumed during the execution of a process.	ISO/IEC 15288
risk	An uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objective.	PMBOK(2000)
risk management	Systematic application of management policies, procedures and practices to the task of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risk.	IEC 62198:2001
stage	A period within the life cycle of a system that relates to the state of the system description or the system itself.	ISO/IEC 15288
stakeholder	A party having a right, share or claim in a system or in its possession of characteristics that meet that party's needs and expectations.	ISO/IEC 15288
supplier	An organization or an individual that enters into an agreement with the acquirer for the supply of a product or service.	ISO/IEC 15288
supply	The procurement, distribution, maintenance while in storage, and salvage of supplies, including the determination of kind and quantity of supplies. Note: Two phases can be distinguished: a. producer phase--That phase of military supply that extends from determination of procurement schedules to acceptance of finished supplies by the Military Services. b. consumer phase--That phase of military supply which extends from receipt of finished supplies by the Military Services through issue for use or consumption.	JP 1-02
system	A combination of interacting elements organized to achieve one or more stated purposes. Note: For NATO use this includes enabling systems.	ISO/IEC 15288
system life cycle (SLC)	The evolution with time of a system-of-interest from conception through to retirement.	ISO/IEC 15288
system-of-interest (SOI)	The system whose life cycle is under consideration.	ISO/IEC 15288

Term	Definition	Source
systems engineering	An engineering discipline whose responsibility is creating and executing an interdisciplinary process to ensure that the customer and stakeholder's needs are satisfied in a high quality, trustworthy, cost efficient and schedule compliant manner throughout a system's entire life cycle.	Consensus of the INCOSE (International Council on Systems Engineering) fellows
tailoring	Deletion, alteration or addition in order to adapt stages and processes to satisfy particular project- or organization-specific circumstances or factors.	ISO/IEC 15288
user	Individual who or group that benefits from a system during its utilization.	ISO/IEC 15288
validation	Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled.	ISO/IEC 15288
verification	Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled.	ISO/IEC 15288

Annex 3 – Bibliography

This annex provides further details for documents listed as references in the tables of section 3.

ACMP-1	NATO REQUIREMENTS FOR THE PREPARATION OF CONFIGURATION MANAGEMENT PLANS
ACMP-2	NATO REQUIREMENTS FOR CONFIGURATION IDENTIFICATION
ACMP-3	NATO REQUIREMENTS FOR CONFIGURATION CONTROL – ENGINEERING CHANGES, DEVIATIONS AND WAIVERS
ACMP-4	NATO REQUIREMENTS FOR CONFIGURATION STATUS ACCOUNTING
ACMP-5	NATO REQUIREMENTS FOR CONFIGURATION AUDITS
ACMP-6	NATO CONFIGURATION MANAGEMENT TERMS AND DEFINITIONS
ACMP-7	NATO CONFIGURATION MANAGEMENT – GUIDANCE ON THE APPLICATION OF ACMPs 1 TO 6
AQAP 150	NATO QUALITY REQUIREMENTS FOR SOFTWARE DEVELOPMENT
AQAP 160	NATO INTEGRATED QUALITY REQUIREMENTS FOR SOFTWARE THROUGHOUT THE LIFE CYCLE
AQAP 2000	NATO POLICY ON AN INTEGRATED SYSTEMS APPROACH TO QUALITY THROUGH THE LIFE CYCLE
AQAP 2009	NATO GUIDANCE ON THE USE OF THE AQAP 2000 SERIES
AQAP 2050	NATO PROJECT ASSESSMENT MODEL
AQAP 2110	NATO QUALITY ASSURANCE REQUIREMENTS FOR DESIGN, DEVELOPMENT AND PRODUCTION
AQAP 2120	NATO QUALITY ASSURANCE REQUIREMENTS FOR PRODUCTION
AQAP 2130	NATO QUALITY ASSURANCE REQUIREMENTS FOR INSPECTION AND TEST
AQAP 2131	NATO QUALITY ASSURANCE REQUIREMENTS FOR FINAL INSPECTION
ARMP1	NATO REQUIREMENTS FOR RELIABILITY AND MAINTAINABILITY
ARMP4	GUIDANCE FOR WRITING NATO R&M REQUIREMENTS DOCUMENTS
ARMP7	NATO R&M TERMINOLOGY APPLICABLE TO ARMPs
IEC 60300	DEPENDABILITY MANAGEMENT
ISO 10006	QUALITY MANAGEMENT (GUIDELINES TO QUALITY IN PROJECT MANAGEMENT)
ISO 10303-239	INDUSTRIAL AUTOMATION SYSTEMS AND INTEGRATION - PRODUCT DATA REPRESENTATION AND EXCHANGE - PART 239: PRODUCT LIFE CYCLE SUPPORT
ISO 13407	HUMAN - CENTRED DESIGN PROCESSES FOR INTERACTIVE SYSTEMS
ISO 15288	SYSTEMS ENGINEERING - SYSTEM LIFE CYCLE PROCESSES
ISO 15408	INFORMATION TECHNOLOGY - SECURITY TECHNIQUES - EVALUATION CRITERIA FOR IT SECURITY
ISO 15504	INFORMATION TECHNOLOGY - PROCESS ASSESSMENT
ISO 16085	INFORMATION TECHNOLOGY - SOFTWARE LIFE CYCLE

	PROCESSES - RISK MANAGEMENT
ISO 9241	ERGONOMIC REQUIREMENTS FOR OFFICE WORK WITH VISUAL DISPLAY TERMINALS (VDTS) -PART 11: GUIDANCE ON USABILITY
PMBOK	A GUIDE TO THE PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK® GUIDE)
STANAG 4107	MUTUAL ACCEPTANCE OF GOVERNMENT QUALITY ASSURANCE AND USAGE OF THE ALLIED QUALITY ASSURANCE PUBLICATIONS
STANAG 4159	NATO MATERIEL CONFIGURATION MANAGEMENT POLICY AND PROCEDURES FOR MULTINATIONAL JOINT PROJECTS
STANAG 4427	INTRODUCTION OF ALLIED CONFIGURATION MANAGEMENT PUBLICATIONS (ACMPs)
STANAG 4457	ENGINEERING DOCUMENTATION IN A MULTINATIONAL JOINT PROJECT – AEDP-01

Annex 4 – Risk Quantification Example

Probability (P)	Consequences for functionality, performance and quality (F)	Consequences for costs (O)	Consequences for schedule (T)	Value
Small	No practical impact functionality, performance and quality	Budget exceeded with up to X %	Delivery schedule delayed with up to N weeks	1
Minor	Minor reduction in functionality, performance and quality.	Budget exceeded with up to X - 2X %	Delivery schedule delayed with up to N - 2N weeks	2
Moderate	Moderate reduction in functionality, performance and quality	Budget exceeded with up to 2X - 3X %	Delivery schedule delayed with up to 2N - 5N weeks	3
Significant	Significant reduction in functionality, performance and quality	Budget exceeded with up to 3X - 5X %	Delivery schedule delayed with up to 5N - 10N weeks	4
Big	Unacceptable reduction in functionality, performance and quality	Budget exceeded with up to end 5X %	Delivery schedule delayed with up to 10N weeks	5

In quantifying the risks the following method could be used:

Riskfactor = P*N*(F+O+T) where

P = probability

F = consequences for functionality, performance and quality

O = consequences for costs

T = consequences for schedule

Above mentioned factor should be rated on a scale from 1 to 5 where 5 is the highest rating.

N = time to occurrence

Where 1 is in the long term and 1,33 when the risk will happen soon (programme dependant).