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# 1 INTRODUCTION

## 1.1 Decision to proceed to the harmonization of WG7 documents

In May 2001 at the Nagoya plenary meeting, SC7 adopted resolution 629, which initiated a study period for the harmonization of ISO/IEC15288 and ISO/IEC 12207. Resolution 629 states:

“JTC1/SC7 intends to initiate a revision of ISO/IEC 15288 and ISO/IEC 12207 for harmonization between these standards and also the replacement for ISO 9000-3 and ISO/IEC 15504 as soon as ISO/IEC 15288 and ISO/IEC 12207 AM are published. To prepare for this work JTC1/SC7 instructs its WG7 to initiate a study period once a successful FCD and FDAM ballot have been completed.”

In this context, harmonization is an effort to assess and revise relevant SC7 documents (as necessary) to ensure consistency in terminology, document structure, and other factors that would facilitate the joint usage of the documents. The level of detail of the documents must be complementary and coherent. A one-year period called the "Harmonization Concept Exploration Period" resulted in the following:

1. Document WG7 N0559 (approved in January 2002), which defines the purpose, the mission, the objectives of the study, as well as the scope of the harmonization
2. Other informal documents showing the technical feasibility of the work and a potential schedule

In May 2002 at the Busan SC7 opening plenary meeting, the SC7 chairman requested WG7 to clearly define the scope of this harmonization and SC7 to act as a "system integrator".

## 1.2 Terms of reference

SC 7 Resolution 665 states that the terms of reference for the Harmonization Study Group are:

1. Provide input to the WG 7 vision for Life cycle management standards.
2. Provide the rationale for, and scope of, the effort to harmonize the WG 7 Life Cycle Process Standards, based on SC 7 Resolution 629.
3. Incorporate harmonization activities resulting from the SC 7 N2573 Report from the Study Group on System Engineering.
4. Define the process model to be applied for the harmonization.
5. Provide a preliminary schedule for the harmonization effort.

The present report addresses these terms.

## 1.3 Harmonization Study Group membership

The Harmonization Study Group is chaired by Alain Faisandier (FRA) and has a membership of:

WG7: Stuart Arnold (UK), Garry Roedler (USA), Dennis Ahern (USA), Bud Lawson (SWE), Johan Bendz (SWE), Matthew Young (AUS), Yan Zhang (CHN), Anatol Kark (CAN), DohJae Lee (KOR), Tanin Uthayanaka (THA), Noritoshi Murakami (JPN),

WG10: Alec Dorling (UK), Terry Rout (AUS).

The Harmonization Study Group interfaces with WG18 for related works : James Moore (USA).

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## **1.4 Rationale for the harmonization**

The users of ISO/IEC 15288 and ISO/IEC 12207, as well as other related WG7 standards and technical reports, will benefit from having one harmonized set of documents. It is customary to update the WG7 products on a regular basis as feedback on their use is received. From another perspective, as the needs of the Systems and Software community evolves, WG7 products should also evolve.

The following summarizes some of the harmonization rationale (not an exhaustive list) :

1. 12207 is composed of base text (1995) and an Amendment (2001); the Amendment material may be incorporated within the SC7 documents as appropriate
2. The comment resolution of ISO/IEC 15288 drafts resulted in many comments deferred to a revision; these need to be addressed
3. The level of detail of the two documents needs to be revised to ensure that they are complementary
4. The differences in architectural principles in the two documents may make it difficult for concurrent usage
5. There are places where the two documents overlap, and in those areas there are incompatibilities

In addition to the two primary life cycle process standards, other documents as defined in 3.1 must maintain consistency with changes made to the life cycle process standards.

## **1.5 Inputs to harmonization**

All of the following inputs should be considered in the harmonization of the SC7 Life Cycle Processes standards work:

1. SC7 vision for Software and Systems Engineering standards
2. WG7 vision for life cycle management standards (including the 12207 2020 vision) - W07N0296
3. Comments to ISO/IEC 15288 and ISO/IEC 12207 with the status of "deferred until revision"
4. Readability guidance developed by WG7
5. Framework for ISO/IEC System and Software Engineering Standards / 2000 - SC7 N2380
6. ISO/IEC JTC1/SC7/SWG3 Guidelines for Process Definition - SC7 N2497
7. Report of the Study Group on Systems Engineering - WG 7 N0560

## 2 HARMONIZATION REPORT SCOPE

This Harmonization Study Group Report presents:

1. The **Scope of the Harmonization** (see § 3): outcomes of this harmonization work, inputs and the constraints of the harmonization
2. The **"Harmonization Processes"** (see § 4): the activities to perform the harmonization (this is an adaptation of ISO/IEC 15288 processes)
3. The **"Harmonization Project Management"** (see § 5): the activities are scheduled and assigned to skilled resources

## 3 SCOPE OF THE HARMONIZATION

### 3.1 SC7 & WG7 documents subject to harmonization

WG7 will harmonize ISO/IEC 15288 and ISO/IEC 12207. The need to revise other related standards and technical reports from WG7 and SC7 will be analysed and planned. A preliminary analysis shows the following priorities for revision.

a) Primary priority - standards to be revised are:

1. ISO/IEC 15288
2. ISO/IEC 12207

b) Secondary priority - standards or elements of standards to be revised are:

1. ISO/IEC 15939 - Software measurement process
2. ISO/IEC TR 15271 Guide for 12207
3. ISO/IEC TR 19760 Guide for 15288
4. ISO/IEC 15504 - parts 2, 5 and "6"

c) Additional secondary priority - standards or elements of standards to be revised may be:

1. ISO/IEC 14764 Software maintenance
2. ISO/IEC TR 16326 Project management
3. ISO/IEC 18019 Documentation process
4. ISO/IEC TR 15846 Configuration management
5. ISO/IEC 9000-3

### 3.2 Harmonization goal

Wherever possible, the harmonization of the documents will achieve consistency and or compatibility in these areas:

1. Concepts
2. Terminology
3. Readability
4. Level of detail and or compatibility
5. Processes
6. Document structure
7. Normative references
8. Common interfacing mechanism with the ISO 9000 family of standards
9. Conformance with requirements from ISO/IEC 15504 as applicable

Based on a consideration of these and other items, WG7 will evaluate alternatives relating to the structure of the set of SC7 documents.

### 3.3 Harmonization constraints and impacts

There are many constraints that affect the harmonization work. Most importantly, changes should not cause major disruptions to the users of current WG7 and SC7 documents, and should protect the investments that countries have made in the deployment of them. As a result, a key achievement of the harmonization must be to simplify use.

Documents that impose constraints on the harmonization include:

1. ISO/IEC 15504 - part 2 (constraints on the format and presentation of process reference models)
2. ISO 9000 family standards

Documents external to SC7 that may be impacted by the harmonization include:

1. IEEE 1220 - Standard for Application and Management of the Systems Engineering Process
2. ANSI/EIA 632 - Processes for Engineering a System
3. ISO 15704 - Enterprise architectures
4. ISO TR 18529 - Human-centred life cycle processes description
5. ISO 10303-AP233 - Product data representation and exchange: System Engineering and design

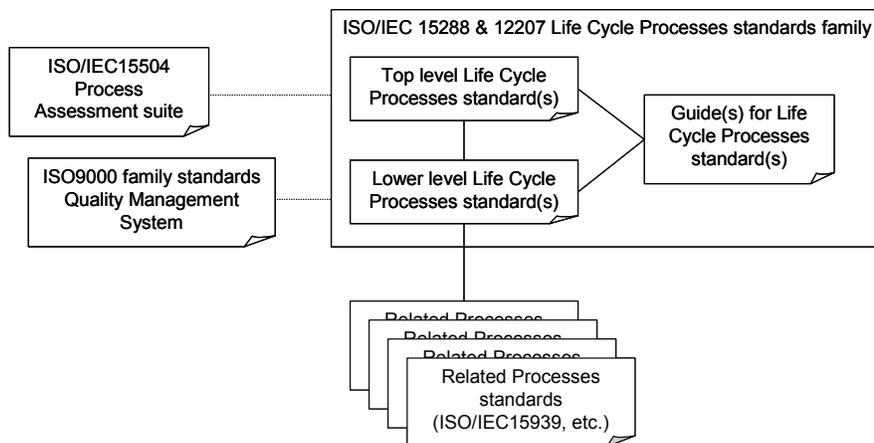
These documents, which are external to SC7, are outside the scope of the SC7 Resolution 629, and out of scope for the current effort.

### 3.4 Expected relationships among SC7 documents

Performing the Harmonization Processes, as described below in § 4, should result in a definition of the documents' relationships and contents that satisfies the needs of stakeholders, and the requirements and constraints of SC7.

WG7 will define the relationships among the documents and contents as part of the harmonization work.

The following figure provides an overview of notional harmonized documentation structure.



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## 4 HARMONIZATION PROCESSES

### 4.1 Using ISO/IEC 15288 for Harmonization

SC7/WG7 has decided to apply the principles of Life Cycle Management, as outlined in ISO/IEC 15288, to the Harmonization effort that is to be undertaken.

The Harmonization Processes that is outlined in paragraph 4.3 below describes the activities necessary to perform the harmonization work. The set of Harmonization Processes is tailored instances of ISO/IEC 15288 Systems Life Cycle Processes, adapted to the particular circumstances of the Harmonization effort.

The tailoring is based on the following interpretation assumptions:

1. Standards are SYSTEMS OF INTEREST
2. Standards have LIFE CYCLES
3. WG7 is an ORGANIZATION that conceptualises, develops, maintains and cancels standards
4. The Harmonization efforts is organized as a PROJECT

For traceability, the correspondence with the ISO/IEC 15288 activities are displayed in brackets [x], and a note at the end of each process description lists those non-applicable activities that have been tailored out. Outcomes of the ISO/IEC 15288 processes are instantiated as outputs.

### 4.2 Harmonization context and overview

In order to apply the ISO/IEC 15288 principles, the current standards documents are considered to be in their "Utilization stages".

SC7 has decided to improve the usability of the Life Cycle Process Standards documents. This corresponds to the decision gate whereby the concerned documents are entered into their respective "Support stages". Here, the tailored "Maintenance process" is executed, resulting in documents such as this study report. The documents serve as a basis for an SC7 decision to launch the Harmonization Project, i.e. effectively to trigger the actual harmonization work.

The Harmonization Project performs the set of Harmonization Processes in the designated Life Cycle Stages (Concept and Development stages), as described in the Harmonization Project Plan.

The project eventually results in new harmonized versions of documents that address life cycle processes. These are released to ISO/IEC for publishing (Production stage) and made available to the user community (Utilization stage).

As the new versions of the standards are released, the old versions are archived (Retirement stage) using the tailored "Disposal process".

### 4.3 Tailored harmonization processes

The following processes all originate from the Technical Processes in ISO/IEC 15288. In future Harmonization Project Plans, the applicable processes from the Enterprise Processes, Project Processes, and Agreement Processes will be tailored into the set of Harmonization Processes. The rationale of the tailoring is based on the nature of the present system which is documents.

#### 4.3.1 Maintenance process

This process investigates the opportunities for improvements to the current set of Life Cycle Processes Standards.

1. Prepare a maintenance strategy (see § 1.3). [a]
2. Define the constraints on requirements (the present Harmonization report does). [b]
3. Obtain the resources to perform the work (WG7 members and an editorial team). [c]
4. Diagnose the problems and determine possible improvements (i.e. harmonization between WG7 documents). [d]
5. Define the process to perform the work (the present Harmonization report does). [e]
6. Maintain the history of documents. [j]

*Note: [f, g, h, i] are tailored out*

#### Outputs:

**Harmonization Study Report** (this document)

#### Harmonization Requirements

This is the list of the requirements and constraints applicable to the harmonization.

#### Harmonization checklist type of items

This list is useful and necessary to revisit the existing documents; they are derived from the Harmonization Requirements and from the System Requirements (see § 4.3.3).

#### 4.3.2 Stakeholder requirements definition process

This process investigates stakeholder needs and expresses them as stakeholder requirements.

1. Identify the users of the content of the documents. [a]
2. Identify the other stakeholders of the documents (contents of documents) :SC7, other TC, etc. [a]
3. Identify the needs, expectations and requirements of users and other stakeholders. [b]
4. Establish the requirements and constraints derived from the list of inputs documents - see § 3.1 [c]
5. Identify the scenarios (use cases) that potential users of the documents (content of documents) could achieve by using them and document a concept of operations (context of use). [d] & [e]
6. Verify the quality of the requirements (statements conform expressing rules). [g]
7. Resolve requirements problems. [h]
8. Review and obtain agreement from the stakeholders on their set of requirements. [i] & [j]
9. Document the stakeholders' needs, expectations and requirements in a database in order to initiate the traceability. Prioritise them as necessary. [k] & [l]

*Note: [f] are tailored out*

**Outputs:****WG7 Report number 1: Stakeholders' Requirements Document**

This document contains the list of users of documents, the scenarios (use cases), concept of operations (context of use), users' expectations and constraints. A preliminary list was initiated during the previous Harmonization Concept Exploration Period and shall be completed.

**4.3.3 Requirements analysis process**

This process translates all the stakeholders' requirements into a set of System Requirements for the family of Life Cycle processes Standards.

1. Identify the types of systems and software as well as the life cycles models (stages) that must be covered by the standard(s). [a]
2. Define functional requirements: i.e. define the set of information needed to achieve the life cycle models and stages (i.e. to conceptualise, specify, design, perform, assess ... life cycles). [b]
 

*Note: Functional requirements are centred on processes, activities, outcomes, etc., that are necessary to accomplish the user's expectations and scenarios*
3. Define implementation constraints (extracted from the list of documents in § 3.3) applicable to the form of information and on to the supporting media. [c]
4. Define constraints (extracted from the list of documents in § 3.3) applicable to the structure of the information: how the information must be presented, expressed, etc., to facilitate the readability, usability, etc. (i.e. description rules). [d]
5. Provide attributes /characteristics to the requirements in order to be able to further design the content (logical items) and the physical rendering (physical items) of the future documents; and check them (i.e. verify the quality of the requirements: statements conform expressing rules). [f]
6. Document the ordered list of all the System Requirements and check the traceability against the stakeholders' requirements. Prioritise them as necessary. [g]

*Note: [e] are tailored out*

**Outputs:****WG7 Report number 2: System Requirements Document**

This document is an intermediate report that is internal to the WG7 and the Editorial team. It contains the list of System Requirements that shall guide the design of the documents. Requirements are inserted into the database with the attributes needed to ensure their upstream and downstream traceability.

**4.3.4 Architectural design process**

This process allocates the requirements to "Standard elements," expressed as an architectural design.

1. Perform comparisons between the elements submitted to harmonization (scope, definitions, concepts, processes, architectures, etc.; see § 3.2 & 3.3) that are contained in the current documents. [a]
 

*Note: The comparison must be performed against criteria that are determined by constraints analysis provided by the System Requirements Document*
2. Define the necessary logical items (definitions, concepts, processes, stages, models, etc.) to comply with the System Requirements. Document these items including the reviewed and updated existing elements or information (i.e. incorporation of 12207 amendment material; disposition of postponed 15288 comments, etc.). This activity results in logical architectures. [a]

3. Define the necessary physical items (type of documents, document structure, process structure, etc.) and layouts to comply with the System Requirements. Partition and allocate the logical items defined above. This activity results in physical architectures. [b]
4. Evaluate alternative documentation structures (physical architectures) against the set of System Requirements. [f]
5. Select the alternative that satisfy the best the requirements [h]
6. Document the selected documentation structures and contents. Establish traceability against System Requirements. [i] & [j]

*Note: [c, d, e, g] are tailored out*

#### **Outputs:**

##### **WG7 Report number 3: Architectural Design Document**

This document is an intermediate report that is internal to the WG7 and the Editorial team. It contains the list of logical and physical items included in the documentation structure, and their relationships. Traceability against the System Requirements is established.

### **4.3.5 Implementation Process**

This process enables the generation of the documents.

1. Define generation procedures in order to extract information from the database or from the intermediate reports and documents [a]
2. Realize the successive versions of documents (i.e. editorial work to issue WDi, CDi, FCD, FDIS) [c]
3. Package the documents and store original applying JTC1 rules [e]

*Note: [b, d] are tailored out*

#### **Outputs:**

##### **Versions of expected harmonized documents**

### **4.3.6 Integration Process**

The integration process will be defined when architecture will be designed.

### **4.3.7 Verification Process**

This process verifies that the standards have been correctly implemented with respect to the requirements.

1. Define a verification plan and define criteria for determining the fulfillment of System Requirements (i.e. verification can be interpreted at least as a set of reviews by WG7, including consistency check against System Requirements) [a], [b]
2. Ensure that sufficient resources and skilled personnel are available to conduct the verification [d]
3. Conduct verification to demonstrate consistency and that the harmonization is effective (i.e. using WG7 comment procedure) [e]
4. Analyze, record and report verification, discrepancy and corrective action information (use SC7/WG7 existing procedures for disposing comments) [g]

*Note: [c, f] are tailored out*

#### **Outputs:**

##### **Comments and Comment Dispositions**

##### **System Requirements Verification Matrix**

### 4.3.8 Transition Process

This process provides necessary material to facilitate the use of the standards.

1. Prepare a dissemination strategy to advertise and to train users of the standards. [a]
2. Deliver and disseminate appropriate material for advertising and training, etc. (on web site, in professional associations, etc.) [c]
3. Transfer the standards to ISO/IEC physical architectures (documents). [f]
4. Record defects, actions taken and lessons learned from the preliminary use of standards. [h]

*Note: [b, d, e, g] are tailored out*

### 4.3.9 Validation Process

This process validates that the stakeholders' requirements are met.

1. Define a validation plan and criteria for determining the fulfilment of stakeholders' requirements (i.e. validation can be interpreted as trials, and include consistency check against stakeholders requirements) [a] [b]
2. Ensure that sufficient resources and skilled personnel are available to conduct the validation [d]
3. Conduct validation to demonstrate consistency and that the harmonization is effective (apply the standards to several types of systems and software) [e]
4. Analyse, record and report validation, discrepancy and corrective action information [g]

*Note: [c, f] are tailored out*

#### Outputs:

**Trials Reports**

**Comments and Comment Dispositions**

**Stakeholders Requirements Validation Matrix**

### 4.3.10 Disposal Process

This process is used to discontinue standards or versions thereof.

1. The previous version of the standards is replaced by a new version or by other standards. [d]
2. Archive the previous version of the standard [k]

*Note: [a, b, c, e, f, g, h, l, j] are tailored out*

#### Outputs:

**Archived standard**

## 5 HARMONIZATION PROJECT MANAGEMENT

### 5.1 Introduction

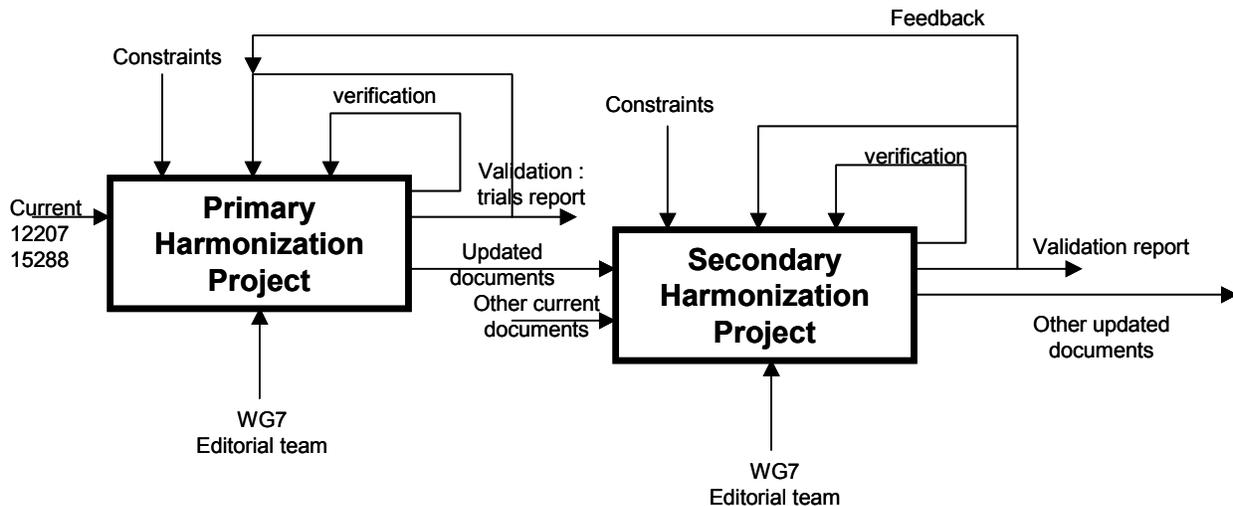
This paragraph:

1. Defines the milestones and the global schedule
2. Defines the organization of the editorial team
3. Identifies the necessary skills
4. Formulate information exchanges

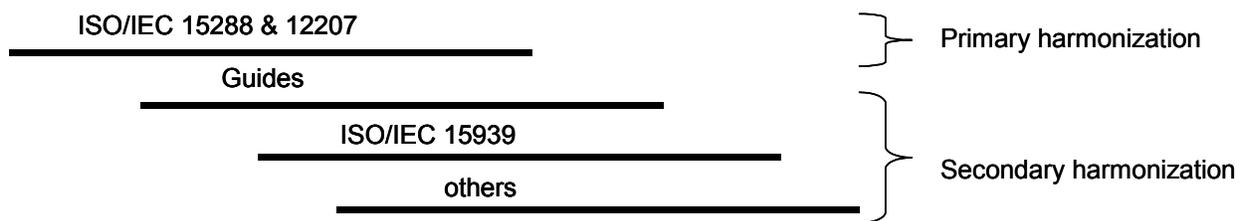
The global WG7 documents harmonization project is split in two sub-projects:

1. The primary harmonization project that deals with ISO/IEC 12207 & 15288
2. The secondary harmonization project that deals with the other impacted documents listed in § 3.1

The following figure shows the relationships between the two projects.



Incremental phasing:



The following table provides the list of WG7 documents that should be reviewed for harmonization with priority.

Identifier	Title	Priority
ISO/IEC 12207:1995	Software life cycle processes	1
ISO/IEC TR 15271:1998	Guide for ISO/IEC 12207 (Software Life Cycle Processes)	2
ISO/IEC TR 15846:1998	Software life cycle processes -- Configuration Management	2
ISO/IEC TR 14759:1999	Mock up and prototype -- A categorization of software mock up and prototype models and their use	2
ISO/IEC 14764:1999	Software maintenance	2
ISO/IEC TR 16326:1999	Guide for the application of ISO/IEC 12207 to project management	2
ISO/IEC 15939:2002	Software engineering -- Software measurement process	2
ISO/IEC 15288:2002	Systems engineering - System life cycle processes	1
ISO/IEC 12207:1995/Amd 1:2002	Software life cycle processes	1
ISO/IEC 19760:2003	Systems engineering - A guide for application of ISO/IEC 15288	2
ISO/IEC 18019	Guidelines for the design and preparation of software user documentation.	2
ISO/IEC 9000-3	Guidelines for the Application of ISO 9001:2000 to Computer Software	2

## 5.2 Schedule

The tentative schedule of **Primary Harmonization project** is:

Step nb	Tasks	Inputs	Outputs	Dates
1	Plan the Harmonization Study	W7 N559	Harmonization study report	Korea - 05/2002 Capetown - 11/2002
2	Define Stakeholders' requirements	Harmonization study report	Stakeholders' requirements document	Korea - 05/2002 Capetown - 11/2002
3	Define System Requirements	Stakeholders' requirements document	System Requirements Document	Capetown - 11/2002 Montreal - 05/2003
4	Design preliminary architectures: terminology, concepts, processes, models, etc.; physical architecture of documents	System Requirements Document	Architectural Design Document  WD1	Montreal - 05/2003  Recife - 11/2003
5	Design architectures (refinements): terminology, concepts, processes, models, etc.; physical architecture of documents	Architectural Design Document & WD1	  WD2	Recife - 11/2003  Brisbane - 05/2004
6	Generate preliminary documents; perform verification, and do justification	WD2	  CD1	Brisbane - 05/2004  xxx - 11/2004
7	Generate final documents; perform verification, and do justification	CD1	  CD2 or FCD	xxx - 11/2004  yyy - 05/2005
8	Perform validation / trials: dispose final comments	FCD	  FDIS	yyy - 05/2005  zzz - 11/2005

Each step ends with a review of outputs.

Notes :

1. Publications should not exceed 2007 to comply the 5 year revision cycle.
2. Planning of scope and revisions for harmonization will consider current documents revision schedule.

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### 5.3 Organization

**Project team of primary harmonization standards project:**

1. The editorial team will be composed of one Editor and of Co-editors. The number of Co-editors is not fixed and could change as required depending on the necessary effort.
2. The Editorial team, supported by SWG5 has the role of architect and is accountable for contents of the two harmonized standards, ISO/IEC 15288 and 12207 ; WG7 Convener is accountable for schedule.
3. The Co-editors have technical preparation roles.
4. The Co-editors 1 and Co-editor 2 deal with the Life Cycle Processes Standards.
5. The Co-editor 3 deals with coordination of constraining standards (ISO/IEC 15504, ISO 9001) and impacted standards.
6. The precise roles of the Editorial team members may be adapted at each step of the Harmonization project.
7. The Co-editors take direction only from the Editor.
8. The Editor takes direction only from the WG7 Convener.
9. Active roles may be assigned to WG7 members (not only comments)
10. The Editor of the Harmonization project establishes a Harmonization Plan prior to starting the project, and updates it as appropriate.

**Expected skills of Editor and Co-editors:**

The Editorial Team members should fill at least some of the following skills and characteristics concerning systems engineering, software engineering as well as systems and software projects management:

1. are familiar with ISO/IEC 12207, 15288, 15504, ISO 9000 family of standards
2. are familiar with other Systems and Software Engineering standards
3. have implemented with success some of the approaches recommended by those standards in a real context of enterprises and projects
4. have performed assessments with ISO 15504, or CMM technologies, or ISO 9000 certification programs
5. commit themselves for the next 4 or 5 years with the necessary availability and funds

### 5.4 Information exchanges

The working documents and reports will be produced and reviewed conforming SC7 rules. In particular, established liaisons will receive reports and documents for comments.