Overview of ISO/IEC 15288 and INCOSE Inputs to COSYSMO

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Acknowledgements

- The basis of this presentation was derived from a presentation developed by delegates to ISO/IEC JTC 1/SC 7/WG 7 *Life cycle management* for the purposes of raising awareness about, and promoting the use of ISO/IEC 15288.
  - These charts are noted by a source statement and are used with the permission of the ISO/IEC JTC1/SC7/WG7
- Additional charts were provided by the following individuals with permission for use in this presentation.
  - Jerry Lake, Systems Management International
  - Alain Faisandier, Map Systeme

Agenda

- Background and History
- ISO/IEC 15288 overview
- Comparison of Key SE Standards

Background and History
Why and How ISO/IEC 15288 was developed

- Initial planning started in 1994
- Large international market for systems engineering (SE) services and related products
- Need for a common process framework
- Need for a SE standard that addressed hardware and software in a concurrent and integrated fashion
  - Establish common terminology
  - Integrate all necessary disciplines and technical processes
  - Integrate project management across full life cycle
  - Interactions with the organization/enterprise
- Standard was approved for release in July 2002
- Resulting standard achieved through participation of:
  - 18+ countries
  - Several liaison organizations (e.g., IEEE, INCOSE, and EIA)
  - Over 40 technical experts

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

ISO/IEC 15288 scope

- Provides a common, comprehensive & integrated framework for describing and managing the full life cycle of systems for:
  - Small, medium and large organizations
  - Internal self-imposed use, as well as providing a basis for contractual arrangements (i.e., any agreement)
- Defines a set of processes and associated terminology
  - Can be applied at any level in the hierarchy of a system's development
- Applies to man-made systems configured with one or more of the following:
  - Hardware, software, humans, or processes

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

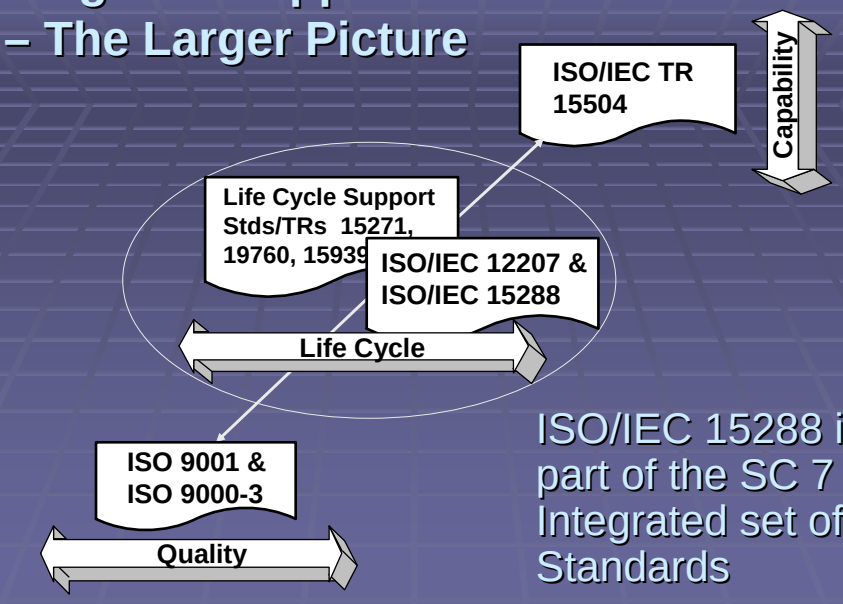
Applicability of ISO/IEC 15288

- Key business domains
  - Information Technology systems
  - Aerospace
  - Telecommunications
  - Transportation systems
  - Military systems
  - Ship building
  - Finance and Administrative systems

Applicable to most domains in industry today

Source: ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

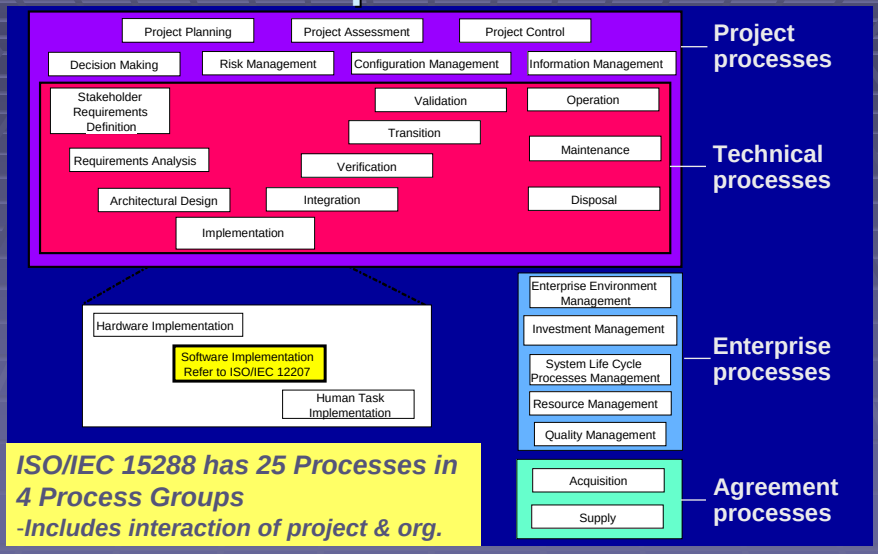
Integration Approach – The Larger Picture



ISO/IEC 15288 is part of the SC 7 Integrated set of Standards

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

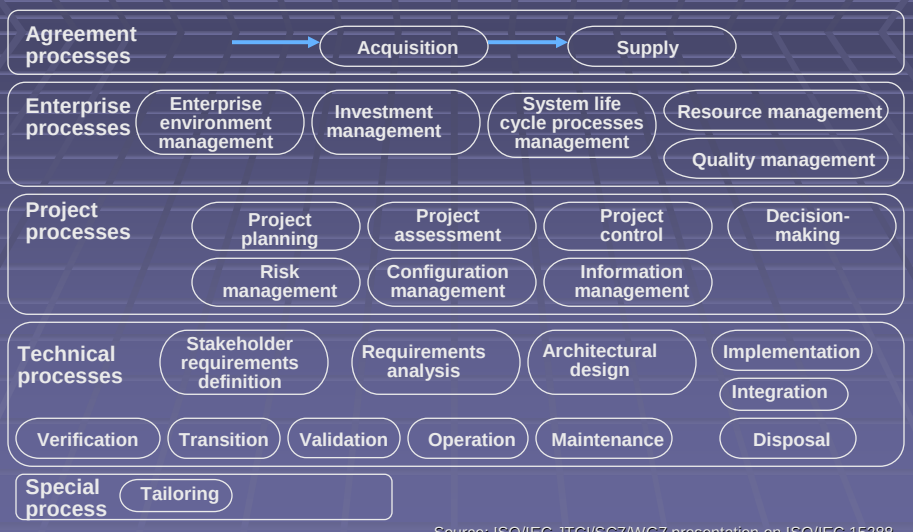
ISO/IEC 15288 Processes and Relationship to ISO/IEC 12207



ISO/IEC 15288 has 25 Processes in 4 Process Groups
-Includes interaction of project & org.

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

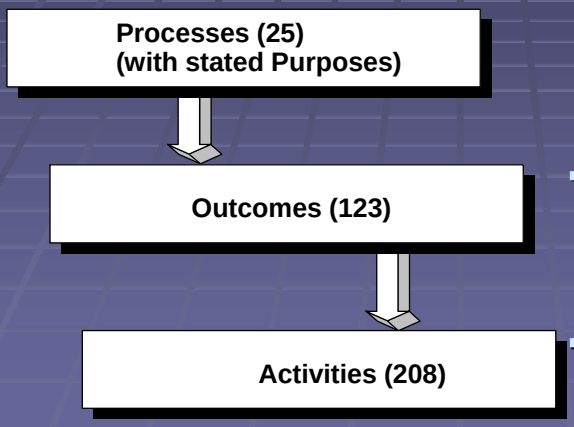
System life cycle processes
ISO/IEC 15288



Source: ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

Development implemented by processes – ISO/IEC 15288 structure

Processes → Outcomes → Activities



- The purpose of the process is stated in a paragraph that describes at a high level the overall goal for performing the process
- An outcome is an observable result of the successful achievement of the purpose of the process
- The activities provide a structural decomposition of a process

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

Example of ISO/IEC 15288 outcomes

- Risk Management Process:
  - As a result of the successful implementation of the Risk Management Process:
    - Risks are identified and categorized
    - The probabilities and consequence of risks are quantified
    - A strategy to treat each risk is specified
    - Risk status is available and communicated
    - Risks that have become unacceptable are acted upon

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

Some Key Terms

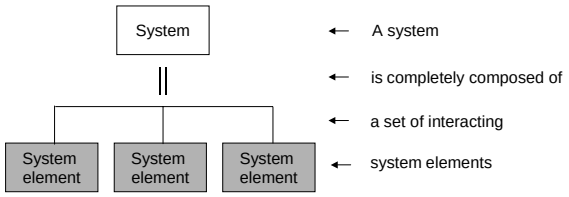
- **System**
  - a combination of interacting elements organized to achieve one or more stated purposes
- **System-of-Interest**
  - the system whose life cycle is under consideration in the context of this International Standard
- **System Element**
  - a member of a set of elements that constitutes a system

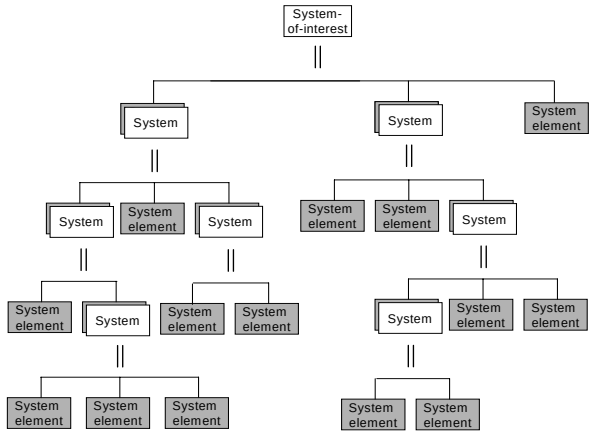
    NOTE: A system element is a discrete part of a system that can be implemented to fulfill specified requirements
- **Enabling System**
  - a system that complements a system-of-interest during its life cycle stages but does not necessarily contribute directly to its function during operation

    NOTE: For example, when a system-of-interest enters the production stage, an enabling production system is required.

Source: ISO/IEC 15288.

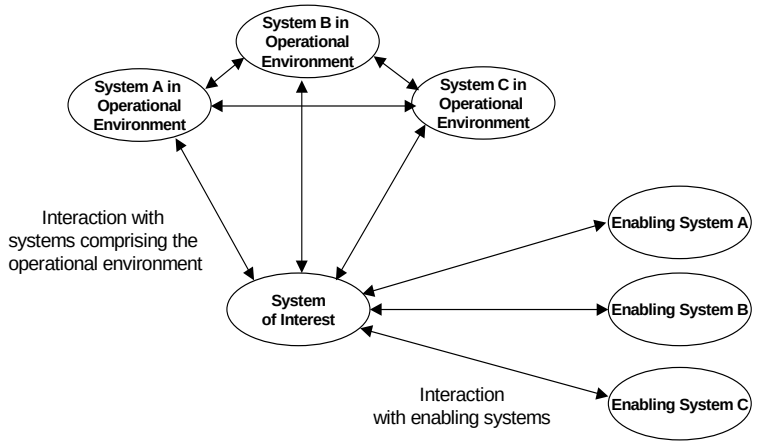
System-of-Interest Structure





Source: ISO/IEC 15288.

System-of-Interest, Operational Environment, and Enabling Systems



Source: ISO/IEC 15288.

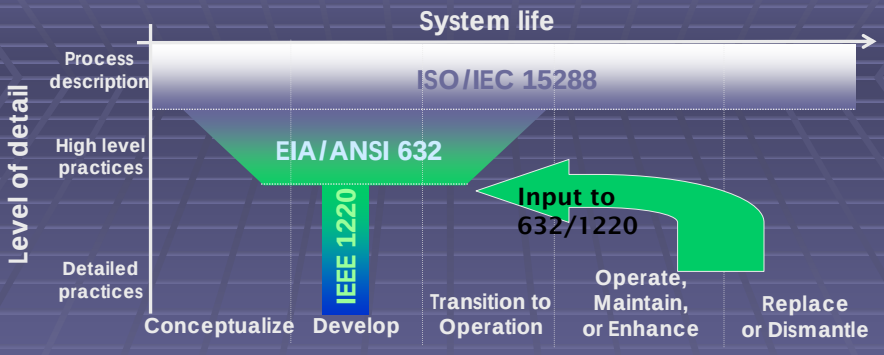
System Life Cycle – Example stages

Stage	Description
Concept	Analyze needs, identify concepts and develop solutions
Development	Engineer a product that is a producible item
Production	Manufacture, inspect and test the item(s)
Utilization	Operate and use the item(s)
Support	Maintain and support the item(s)
Retirement	Retire, dispose and archive

6 Stages that Span the Entire System Life Cycle

Source: Adapted from ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

Breadth and Depth of Key SE Standards



Purpose of the Standards:

ISO/IEC 15288 - *Establish a common framework for describing the life cycle of systems*

EIA/ANSI 632 - *Provide an integrated set of fundamental processes to aid a developer in the engineering or re-engineering of a system*

IEEE 1220 - *Provide a standard for managing systems engineering*

Source : Draft Report ISO Study Group May 2, 2000

Comparison of EIA 632 and ISO/IEC 15288

	EIA/ANSI 632	ISO/IEC 15288
System Concept	System consists of end products that perform the desired operational functions and enabling products that provide the required services for development, production, test, deployment, training, support and disposal of the end products.	Defines two systems: 1. System-of-interest that provides desired capabilities and services. 2. Enabling systems that provide the system-of-interest with required services in each system life cycle stage including concept, development, production, utilization, support, and retirement.
Process Model	▪13 processes with a purpose ▪33 activities with expected outcomes ▪Representative tasks with expected outcomes for each requirement (in Annex) ▪The developer is the actor to complete the requirement	▪25 processes with a purpose and 5-7 expected outcomes ▪Multiple activities for each process ▪The suppler, acquirer or organization is the actor to perform the activities ▪A Guide (ISO/IEC 19760 - PDTR) will be available to provide explanation, interpretation and guidance for implementation of the std
Life Cycle Model	Based on three life cycle models: •Enterprise – Five phases for management decision making •**Engineering – Conception, creation, realization phases for engineering a system** •Product – typical "lust" to "dust" life cycle	System Life Cycle Model consisting of 6 stages: 1. Concept 2. Development 3. Production 4. Utilization 5. Support 6. Retirement

Conclusion

- ISO/IEC 15288 spans the entire life cycle of the system
- It accounts for interactions of the system-of-interest with other systems in the operational environment and enabling systems

Source: ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

Further reading

- www.jtc1-sc7.org
- ISO/IEC 15288:2002
- ISO/IEC 19760 *Guide for ISO/IEC 15288* (to be published in 2003)

Source: ISO/IEC JTCI/SC7/WG7 presentation on ISO/IEC 15288.

INCOSE Current Position and Input

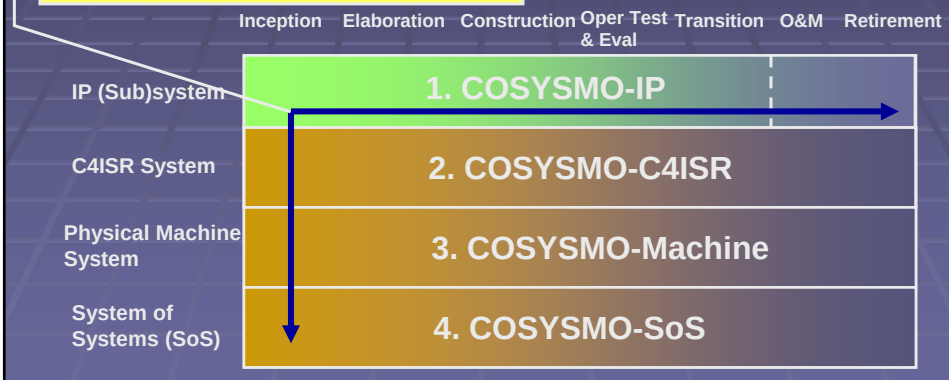
Current Focus by INCOSE and LMC

- Add remaining EIA 632 requirements
  - 20 = Implementation (of design solution)
  - 21 = Transition to Use
  - 31 = End product Verification (system test)
  - 32 = Enabling product readiness (support systems, infrastructure, etc)
  - 33b = End product Validation (non-COTS test articles)

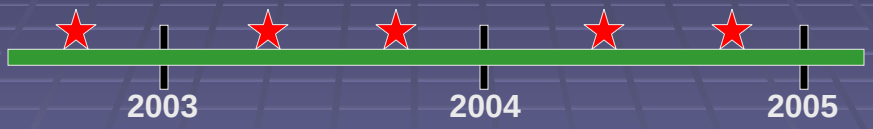
  ---------- Above in 1st increment ---------- Below – No later than 2nd increment ----------
  - 1 = Product Supply (developer establish and satisfy agreement with acquirer)
  - 2 = Product Acquisition (developer establish and satisfy agreement with lower tier suppliers)
  - 13 = Information dissemination
- Review processes and activities of ISO/IEC 15288, especially post deployment processes (ops, maint., retirement)
  - Prioritize additional SE activities in 15288 and allocate to specific increments
- Determine data needed versus data that can be collected; resolve differences
- Develop a schedule of model development at lower level detail and define planned increment content

INCOSE view of COSYSMO Evolution Path

How much of the lifecycle and how many of the domains?
Initiate data collection for all and let the amount of data received determine what is included.



Future Parameter Refinement Opportunities



- Driver definitions
- Data collection (Delphi & Project)
- First iteration of model
- Model calibration

Acceleration of schedule will be primarily dependent on data definition and collection.

Drivers - Additions are very preliminary

COSYSMO sizing/multiplying factors vs missing 623 process areas.	632 - 20 (Implement-ation)	632 - 21 (Transition)	632 - 31 (Verification)	632 - 32 (Readiness)	632 - 33b (Validation)	Operations	Maintenance or Support	Retirement
Sizing Factors								
# System Requirements	x		x	x	x		x	
# Major Interfaces	x		x	x	x		x	
# Unique Algorithms	x		x		x		x	
# Operational Scenarios	x	x		x	x	x	x	
# Recursive Levels in the Design	x	x	x	x				
# Systems being Phased Out (Covered by Migration Complexity?)	x	x						x
~~*# Operators / Maintainers*~~		x				x		
~~*# Training Courses*~~		x						
# Installations								
# System Elements								
Cost Drivers (Multiplying Factors) - Applications								
–Requirements understanding	x		x	x	x		x	
–Architecture complexity	x	x	x	x		x	x	x
–Level of service requirements, criticality, difficulty	x		x	x	x		x	
–Migration complexity		x						x
–Technology risk (maturity & obsolescence)	x						x	
~~*– Operational Complexity*~~						x		
Cost Drivers (Multiplying Factors) - Team								
–Stakeholder team cohesion	x	x						
–Personnel capability	x	x	x	x	x	x	x	x
–Personnel experience/continuity	x	x	x	x	x	x	x	x
–Process maturity	x	x	x	x	x			
–Multi-site coordination	x	x	x	x	x	x	x	x
–Formality of deliverables	x	x	x	x	x		x	
–Tool support	x						x	
others?								