APPENDIX B: ACRONYMS

A_a	Achieved availability
A_i	Inherent availability
A_o	Operational availability
act	Activity diagrams [SysML™]
AECL	Atomic Energy Commission Limited [Canada]
AIAA	American Institute of Aeronautics and Astronautics [United States]
ANSI	American National Standards Institute [United States]
API	Application programming interface
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
ASQ	American Society for Quality
ASAM	Association for Standardization of Automation and Measuring Systems
ASEP	Associate Systems Engineering Professional [INCOSE]
AUTOSAR	AUTomotive Open System ARchitecture
AVS	Associate Value Specialist [SAVE]
bdd	Block definition diagram [SysML™]
BRS	Business Requirements Specification
CAIV	Cost as an Independent Variable
CBA	Cost–benefit analysis
CBM	Condition-based maintenance
CCB	Configuration Control Board
CE	Conformité Européenne [EU]
CEA	Cost-effectiveness analysis
CFR	Code of Federal Regulations [United States]
CI	Configuration item
CMMI®	Capability Maturity Model® Integration [CMMI Institute]
CMP	Configuration management plan
ConOps	Concept of operations
COTS	Commercial off-the-shelf
CSEP	Certified Systems Engineering Professional [INCOSE]
CVS	Certified Value Specialist [SAVE]
DAU	Defense Acquisition University [United States]
DFD	Data flow diagrams
DMS	Diminishing material shortages
DoD	Department of Defense [United States]
DoDAF	Department of Defense Architecture Framework [United States]
DSM	Design Structure Matrix
DTC	Design to cost
ECP	Engineering Change Proposal
ECR	Engineering change request

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EIA	Electronic Industries Alliance
EM	Electromagnetic
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
EN	Engineering notice
ER	Entity relationship diagram
ESEP	Expert Systems Engineering Professional [INCOSE]
ETA	Event tree analysis
FAST	Function Analysis System Technique
FBSE	Functions-based systems engineering
FEA	Front-end analyses
FEP	Fuel enrichment plant
FFBD	Functional flow block diagram
FHA	Functional hazard analysis
FMEA	Failure Mode and Effects Analysis
FMECA	Failure modes, effects, and criticality analysis
FMVSS	Federal Motor Vehicle Safety Standards [United States]
FoS	Family of systems
FTA	Fault tree analysis
G&A	General and administrative
GAO	Government Accountability Office [United States]
GEIA	Government Electronic Industries Alliance
GENIVI	Geneva In-Vehicle Infotainment Alliance
GNP	Gross national product
GPP	Green Public Procurement
HALT	Highly accelerated life testing
HFE	Human factors engineering
HHA	Health hazard analysis
HSI	Human systems integration
HTS	Hazard tracking system
ibd	Internal block diagram [SysML™]
IBM	International Business Machines
ICD	Interface control document
ICS	Industrial control system
ICSM	Incremental Commitment Spiral Model
ICWG	Interface Control Working Group
IDEF	Integrated definition for functional modeling
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFWG	Interface Working Group
IID	Incremental and iterative development
ILS	Integrated logistics support
INCOSE	International Council on Systems Engineering
IPAL	INCOSE Product Asset Library [INCOSE]
IPD	Integrated Product Development
IPDT	Integrated Product Development Team
IPO	Input–process–output
IPPD	Integrated Product and Process Development
IPT	Integrated Product Team
ISO	International Organization for Standardization
IT	Information technology
IV&V	Integration, verification, and validation
JSAE	Japan Society of Automotive Engineers [Japan]
JPL	Jet Propulsion Laboratory [United States]
KDR	Key driving requirement
KM	Knowledge management
KPP	Key Performance Parameter
KSA	Knowledge, skills, and abilities
LAI	Lean Advancement Initiative
LCA	Life cycle assessment
LCC	Life cycle cost
LCM	Life cycle management
LEfMEP	Lean Enablers for Managing Engineering Programs
LEfSE	Lean Enablers for Systems Engineering
LINAC	Linear accelerator
LOR	Level of rigor
LORA	Level of Repair Analysis
MBSE	Model-based systems engineering
MIT	Massachusetts Institute of Technology
MoC	Models of computation
MODA	Multiple objective decision analysis
MoDAF	Ministry of Defense Architecture Framework [United Kingdom]
MOE	Measure of effectiveness
MOP	Measure of performance
MORS	Military Operations Research Society
MOS	Measure of suitability
MPE	Mass Properties Engineering
MTA	Maintenance Task Analysis
MTBF	Mean time between failure
MTBR	Mean time between repair
MTTR	Mean time to repair
N^2	N-squared diagram
NASA	National Aeronautics and Space Administration [United States]

NEC	National Electrical Code [United States]
NCOSE	National Council on Systems Engineering (pre-1995)
NCS	Network-Centric Systems
NDI	Nondevelopmental item
NDIA	National Defense Industrial Association [United States]
O&SHA	Operations and support hazard analysis
OAM&P	Operations, administration, maintenance, and provisioning
OEM	Original Equipment Manufacturer
OMG	Object Management Group
OOSEM	Object-Oriented Systems Engineering Method
OpEMCSS	Operational Evaluation Modeling for Context-Sensitive Systems
OPM	Object-Process Methodology
OpsCon	Operational concept
OSI	Open System Interconnect
par	Parametric diagram [SysML™]
PBL	Performance-based logistics
PBS	Product breakdown structure
PDT	Product Development Team
PERT	Program Evaluation Review Technique
PHA	Preliminary hazard analysis
PHS&T	Packaging, handling, storage, and transportation
PIT	Product Integration Team
pkg	Package diagram [SysML™]
PLC	Programmable logic controller
PLCS	Product Life Cycle Support
PLM	Product line management
PMI	Project Management Institute
PRA	Probabilistic risk assessment
PSM	Practical Software and Systems Measurement
QA	Quality assurance
QM	Quality management
R&D	Research and development
RAM	Reliability, availability, and maintainability
RBD	Reliability block diagram
RCM	Reliability-centered maintenance
REACH	Registration, Evaluation, Authorization, and Restriction of Chemical Substances
req	Requirement diagram [SysML™]
RFC	Request for change
RFP	Request for proposal
RFQ	Request for quote
RFV	Request for variance
RMP	Risk management plan
ROI	Return on investment
RUP	Rational Unified Process [IBM]
RUP-SE	Rational Unified Process for Systems Engineering [IBM]
RVTM	Requirements Verification and Traceability Matrix
SA	State Analysis [JPL]
SAE	SAE International [formerly the Society of Automotive Engineers]
SAR	Safety Assessment Report
SAVE	Society of American Value Engineers
SCM	Supply chain management
SCN	Specification change notice
sd	Sequence diagram [SysML™]
SE	Systems engineering
SEARI	Systems Engineering Advancement Research Institute
SEBoK	Guide to the Systems Engineering Body of Knowledge
SEH	Systems Engineering Handbook [INCOSE]
SEHA	System element hazard analysis
SEIT	Systems Engineering and Integration Team
SEMP	Systems engineering management plan
SEMS	Systems Engineering Master Schedule
SEP	Systems engineering plan
SHA	System hazard analysis
SLA	Service-level agreement
SOI	System of interest
SoS	System of systems
SOW	Statement of work
SROI	Social return on investment
SRR	System Requirements Review
SSDP	Service system design process
STEP	Standard for the Exchange of Product Model Data
stm	State machine diagram [SysML™]
StRS	Stakeholder Requirements Specification
SWOT	Strength–weakness–opportunity–threat
SysML™	Systems Modeling Language [OMG]
SyRS	System Requirements Specification
SYSPG	Systems Engineering Process Group
TADSS	Training Aids, Devices, Simulators, and Simulations
TCO	Total cost of ownership
TOC	Total ownership cost

TOGAF	The Open Group Architecture Framework
TPM	Technical performance measure
TRL	Technology readiness level
TRP	Technology refreshment program
TQM	Total quality management
TR	Technical report
uc	Use case diagram [SysML™]
UIC	International Union of Railways
UK	United Kingdom
UL	Underwriters Laboratory [United States and Canada]
UML™	Unified Modeling Language™ [OMG]
US	United States
USB	Universal Serial Bus
USD	US dollars [United States]
V&V	Verification and validation
VA	Value analysis
VE	Value engineering
VM	Value management
VMP	Value Methodology Practitioner [SAVE]
VSE	Very small entities
VSME	Very small and micro enterprises
VV&A	Verification, validation, and accreditation
WBS	Work breakdown structure
WG	Working group

APPENDIX C: TERMS AND DEFINITIONS

Words not included in this glossary carry meanings consistent with general dictionary definitions. Other related terms can be found in SE VOCAB (2013).

Acquirer	The stakeholder that acquires or procures a product or service from a supplier
"*-ilities*"	The developmental, operational, and support requirements a program must address (named because they typically end in "ility"—availability, maintainability, vulnerability, reliability, supportability, etc.)
Acquisition logistics	Technical and management activities conducted to ensure supportability implications are considered early and throughout the acquisition process to minimize support costs and to provide the user with the resources to sustain the system in the field
Activity	A set of cohesive tasks of a process
Agile	Project execution methods can be described on a continuum from "adaptive" to "predictive." Agile methods exist on the "adaptive" side of this continuum, which is not the same as saying that agile methods are "unplanned" or "undisciplined"
Agreement	The mutual acknowledgment of terms and conditions under which a working relationship is conducted
Architecture	(System) fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution (see ISO 42010)

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Baseline
The gate-controlled step-by-step elaboration of business, budget, functional, performance, and physical characteristics, mutually agreed to by buyer and seller, and under formal change control. Baselines can be modified between formal decision gates by mutual consent through the change control process.
An agreed-to description of the attributes of a product at a point in time, which serves as a basis for defining change (ANSI/EIA-649-1998)

Black box/ white box
Black box represents an external view of the system (attributes). White box represents an internal view of the system (attributes and structure of the elements)

Capability
An expression of a system, product, function, or process ability to achieve a specific objective under stated conditions

Commercial off-the-shelf (COTS)
Commercial items that require no unique acquirer modifications or maintenance over the life cycle of the product to meet the needs of the procuring agency

Commonality
(Of a product line) refers to functional and nonfunctional characteristics that can be shared with all member products within a product line (ISO 26550 2nd CD)

Configuration
A characteristic of a system element, or project artifact, describing their maturity or performance

Configuration item (CI)
A hardware, software, or composite item at any level in the system hierarchy designated for configuration management. (The system and each of its elements are individual CIs.) CIs have four common characteristics:
1. Defined functionality
2. Replaceable as an entity
3. Unique specification
4. Formal control of form, fit, and function

Decision gate
A decision gate is an approval event (often associated with a review meeting). Entry and exit criteria are established for each decision gate; continuation beyond the decision gate is contingent on the agreement of decision makers

Derived requirements
Detailed characteristics of the system of interest (SOI) that typically are identified during elicitation of stakeholder requirements, requirements analysis, trade studies, or validation

Design constraints
The boundary conditions, externally or internally imposed, for the SOI within which the organization must remain when executing the processes during the concept and development stages

Domain asset
Is the output of a subprocess of domain engineering that is reused for producing two or more products in a product line. A domain asset may be a variability model, an architectural design, a software component, a domain model, a requirements statement or specification, a plan, a test case, a process description, or any other element useful for producing products and services. Syn: domain artifact (ISO 26550 2nd CD)

Note: In systems engineering, domain assets may be subsystems or components to be reused in further system designs. Domain assets are considered through their original requirements and technical characteristics. Domain assets include, but are not limited to, use cases, logical principles, environmental behavioral data, and risks or opportunities learned from the previous projects

Domain assets are not physical products available off-the-shelf and ready for commissioning. Physical products (e.g., mechanical parts, electronic components, harnesses, optic lenses) are stored and managed according to the best practices of their respective disciplines

Note: In software engineering, domain assets can include source or object code to be reused during the implementation

Note: Domain assets have their own life cycles. ISO/IEC/IEEE 15288 may be used to manage a life cycle

Domain scoping	Identifies and bounds the functional domains that are important to an envisioned product line and provide sufficient reuse potential to justify the product line creation. Domain scoping builds on the definitions of the product scoping (ISO 26550 2nd CD)
Element	See system element
Enabling system	A system that supports a SOI during its life cycle stages but does not necessarily contribute directly to its function during operation
Enterprise	A purposeful combination of interdependent resources that interact with each other to achieve buisness and operational goals (Rebovich and White, 2011)
Environment	The surroundings (natural or man-made) in which the SOI is utilized and supported or in which the system is being developed, produced, and retired
Facility	The physical means or equipment for facilitating the performance of an action, for example, buildings, instruments, and tools
Failure	The event in which any part of an item does not perform as required by its specification. The failure may occur at a value in excess of the minimum required in the specification, that is, past design limits or beyond the margin of safety
Functional configuration audit	An evaluation to ensure that the product meets baseline functional and performance capabilities (adapted from ISO/IEC/IEEE 15288)
Human factors	The systematic application of relevant information about human abilities, characteristics, behavior, motivation, and performance. It includes principles and applications in the areas of human-related engineering, anthropometrics, ergonomics, job performance skills and aids, and human performance evaluation
Human systems integration	The interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to SE practice
Interface	A shared boundary between two functional units, defined by functional characteristics, common physical interconnection characteristics, signal characteristics, or other characteristics, as appropriate (ISO 2382-1)
Integration definition for functional modeling (IDEF)	A family of modeling languages in the fields of systems and software engineering that provide a multiple-page (view) model of a system that depicts functions and information or product flow. Boxes illustrate functions and arrows illustrate information and product flow (KBS, 2010). Alphanumeric coding is used to denote the view: • IDEF0—functional modeling method • IDEF1—information modeling method • IDEF1X—data modeling method • IDEF3—process description capture method • IDEF4—object-oriented design method • IDEF5—ontology description capture method
IPO diagram	Figures in this handbook that provide a high-level view of the process of interest. The diagram summarizes the process activities and their inputs and outputs from/to external actors; some inputs are categorized as controls and enablers. A control governs the accomplishments of the process; an enabler is the means by which the process is performed
Life cycle cost (LCC)	The total cost of acquisition and ownership of a system over its entire life. It includes all costs associated with the system and its use in the concept, development, production, utilization, support, and retirement stages
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
Measures of effectiveness	Measures that define the information needs of the decision makers with respect to system effectiveness to meet operational expectations

Measures of performance — Measures that define the key performance characteristics the system should have when fielded and operated in its intended operating environment

N^2 diagrams — Graphical representation used to define the internal operational relationships or external interfaces of the SOI

Operator — An individual who, or an organization that, contributes to the functionality of a system and draws on knowledge, skills, and procedures to contribute the function

Organization — Person or a group of people and facilities with an arrangement of responsibilities, authorities, and relationships (adapted from ISO 9001:2008)

Performance — A quantitative measure characterizing a physical or functional attribute relating to the execution of a process, function, activity, or task; performance attributes include quantity (how many or how much), quality (how well), timeliness (how responsive, how frequent), and readiness (when, under which circumstances)

Physical configuration audit — An evaluation to ensure that the operational system or product conforms to the operational and configuration documentation (adapted from ISO/IEC/IEEE 15288)

Process — A set of interrelated or interacting activities that transforms inputs into outputs (adapted from ISO 9001:2008)

Product line

1. Group of products or services sharing a common, managed set of features that satisfy specific needs of a selected market or mission. ISO/IEC/IEEE 24765 (2010), Systems and software engineering vocabulary
2. A collection of systems that are potentially derivable from a single-domain architecture. IEEE 1517-1999 (R2004) IEEE standard for information technology—Software life cycle processes—Reuse processes (3.14) (ISO/IEC FCD 24765.5)

Product line scoping — Defines the products that will constitute the product line and the major (externally visible) common and variable features among the products, analyzes the products from an economic point of view, and controls and schedules the development, production, and marketing of the product line and its products. Product management is primarily responsible for this process (ISO 26550 2nd CD)

Project — An endeavor with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

Proof of concept — A naïve realization of an idea or technology to demonstrate its feasibility

Prototype — A production-ready demonstration model developed under engineering supervision that is specification compliant and represents what manufacturing should replicate

Qualification limit — Proving that the design will survive in its intended environment with margin. The process includes testing and analyzing hardware and software configuration items to prove that the design will survive the anticipated accumulation of acceptance test environments, plus its expected handling, storage, and operational environments, plus a specified qualification margin

Requirement — A statement that identifies a system, product, or process characteristic or constraint, which is unambiguous, clear, unique, consistent, stand-alone (not grouped), and verifiable, and is deemed necessary for stakeholder acceptability

Resource — An asset that is utilized or consumed during the execution of a process

Return on investment — Ratio of revenue from output (product or service) to development and production costs, which determines whether an organization benefits from performing an action to produce something (ISO/IEC 24765.5 FCD; ISO/IEC/IEEE 24765, 2010)

Reuse
1. The use of an asset in the solution of different problems. [IEEE 1517-1999 (R2004)]
2. Building a software system at least partly from existing pieces to perform a new application. [ISO/IEC/IEEE 24765 (2010)]

Specialty engineering Analysis of specific features of a system that requires special skills to identify requirements and assess their impact on the system life cycle

Stage A period within the life cycle of an entity that relates to the state of its description or realization

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

Supplier An organization or an individual that enters into an agreement with the acquirer for the supply of a product or service

System An integrated set of elements, subsystems, or assemblies that accomplish a defined objective. These elements include products (hardware, software, firmware), processes, people, information, techniques, facilities, services, and other support elements (INCOSE)

A combination of interacting elements organized to achieve one or more stated purposes (ISO/IEC/IEEE 15288)

System element Member of a set of elements that constitutes a system

System life cycle The evolution with time of a SOI from conception to retirement

System of interest The system whose life cycle is under consideration

System of systems A SOI whose system elements are themselves systems; typically, these entail large-scale interdisciplinary problems with multiple, heterogeneous, distributed systems

Systems engineering Systems engineering (SE) is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the complete problem: operations, cost and schedule, performance, training and support, test, manufacturing, and disposal. SE considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs (INCOSE)

Systems engineering effort Systems engineering effort integrates multiple disciplines and specialty groups into a set of activities that proceed from concept to production and to operation. SE considers both the business and the technical needs of all stakeholders with the goal of providing a quality system that meets their needs

Systems engineering management plan (SEMP) Structured information describing how the systems engineering effort, in the form of tailored processes and activities, for one or more life cycle stages, will be managed and conducted in the organization for the actual project

Tailoring The manner in which any selected issue is addressed in a particular project. Tailoring may be applied to various aspects of the project, including project documentation, processes and activities performed in each life cycle stage, the time and scope of reviews, analysis, and decision making consistent with all applicable statutory requirements

Technical performance measures Measures that define attributes of a system element to determine how well a system or system element is satisfying or expected to satisfy a technical requirement or goal

Trade-off Decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the stakeholders

User Individual who or group that benefits from a system during its utilization

Validation Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled (ISO/IEC/IEEE 15288)

Note: Validation is the set of activities ensuring and gaining confidence that a system is able to accomplish its intended use, goals, and objectives (i.e., meet stakeholder requirements) in the intended operational environment

Value A measure of worth (e.g., benefit divided by cost) of a specific product or service by a customer, and potentially other stakeholders and is a function of (i) the product's usefulness in satisfying a customer need, (ii) the relative importance of the need being satisfied, (iii) the availability of the product relative to when it is needed, and (iv) the cost of ownership to the customer (McManus, 2004)

Variability Of a product line refers to characteristics that may differ among members of the product line (ISO 26550 2nd CD)

Variability constraints Denotes constraint relationships between a variant and a variation point, between two variants, and between two variation points (ISO 26550 2nd CD)

Verification Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled (ISO/IEC/IEEE 15288)

Note: Verification is a set of activities that compares a system or system element against the required characteristics. This may include, but is not limited to, specified requirements, design description, and the system itself

Waste Work that adds no value to the product or service in the eyes of the customer (Womack and Jones, 1996)

APPENDIX D: N^2 DIAGRAM OF SYSTEMS ENGINEERING PROCESSES

Figure D.1 illustrates the input/output relationships between the various SE processes presented in the handbook and shows the interactions depicted on the IPO diagrams throughout this handbook. The primary flows represent a typical system development program.

The individual processes are placed on the diagonal by abbreviation to the process names, as follows:

EXT	External inputs and outputs
BMA	Business or mission analysis
SNRD	Stakeholder needs and requirements definition
SRD	System requirements definition
AD	Architecture definition
DD	Design definition
SA	System analysis
IMPL	Implementation
INT	Integration
VER	Verification
TRAN	Transition
VAL	Validation
OPER	Operation
MAINT	Maintenance
DISP	Disposal
PP	Project planning
PAC	Project assessment and control
DM	Decision management
RM	Risk management
CM	Configuration management
INFOM	Information management
MEAS	Measurement
QA	Quality assurance
ACQ	Acquisition
SUP	Supply
LCMM	Life cycle model management
INFRAM	Infrastructure management
PM	Portfolio management
HRM	Human resource management
QM	Quality management
KM	Knowledge management
TLR	Tailoring

The off-diagonal squares represent the inputs/outputs interface shared by the processes that intersect at a given square. Outputs flow horizontally; inputs flow vertically and can be read in a clockwise fashion.

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Note 1: The absence of an *x* in an intersection does not preclude tailoring to create a relationship between any two processes.

Note 2: This is the result of one possible instance of the life cycle processes. Other instances of the process relationships are possible.

EXT	X	X													X								X	X	X	X	X	X	X	X	X
	BMA	X				X									X		X	X	X	X	X									X	
	X	SNRD	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X									X	
			SRD	X	X	X			X						X		X	X	X	X	X									X	
				AD	X	X	X								X		X	X	X	X	X									X	
					DD	X	X	X	X						X		X	X	X	X	X									X	
						SA									X	X	X	X	X	X										X	
	X	X	X	X	X	X	IMPL	X		X		X	X		X	X	X	X	X	X			X							X	
	X	X	X	X	X	X		INT	X						X	X	X	X	X	X			X							X	
	X	X	X	X	X	X			VER	X	X				X	X	X	X	X	X			X							X	
	X	X	X	X	X	X				TRAN	X	X	X		X	X	X	X	X	X			X							X	
	X	X	X	X	X	X					VAL	X	X	X	X	X	X	X	X	X			X	X						X	
	X	X	X	X	X	X						OPER	X	X	X	X	X	X	X	X			X							X	
	X	X	X	X	X	X						X	MAINT	X	X	X	X	X	X	X			X							X	
	X	X	X	X	X	X								DISP	X	X	X	X	X	X			X	X						X	
	X	X													PP	X	X	X	X	X			X			X		X		X	
															X	PAC	X	X	X	X	X						X			X	
															X	X	DM	X	X	X										X	
															X	X	X	RM	X	X										X	
															X	X	X	X	CM	X										X	
															X	X	X	X	X	INFOM										X	
															X	X	X	X	X	X	MEAS									X	
															X	X	X	X	X	X		QA								X	X	
X								X							X	X	X	X	X	X			ACQ							X	
X															X	X	X	X	X	X				SUP			X			X	
X															X						X				LCMM					X	X
X																										INFRAM				X	
X															X											X	PM	X		X	
X															X													HRM		X	
X															X	X						X			X				QM	X	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	KM	
															X										X					TLR	

FIGURE D.1 Input/output relationships between the various SE processes. INCOSE SEH original figure created by David Walden. Usage per the INCOSE Notices page. All other rights reserved.

APPENDIX E: INPUT/OUTPUT DESCRIPTIONS

Combined list of all inputs and outputs defined in the processes described in Chapters 4–8.

Accepted system or system element	System element or system is transferred from supplier to acquirer and the product or service is available to the project
Acquired system	The system or system element (product or service) is delivered to the acquirer from a supplier consistent with the delivery conditions of the acquisition agreement
Acquisition agreement	An understanding of the relationship and commitments between the project organization and the supplier. The agreement can vary from formal contracts to less formal interorganizational work orders. Formal agreements typically include terms and conditions
Acquisition need	The identification of a need that cannot be met within the organization encountering the need or a need that can be met in a more economical way by a supplier
Acquisition payment	Payments or other compensations for the acquired system. Includes remitting and acknowledgement
Acquisition record	Permanent, readable form of data, information, or knowledge related to acquisition
Acquisition reply	The responses of one or more candidate suppliers in response to a request for supply
Acquisition report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the acquisition activities

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Acquisition strategy	Approaches, schedules, resources, and specific considerations required to acquire system elements. May also include inputs to determine acquisition constraints
Agreements	Agreements from all applicable life cycle processes, including acquisition agreements and supply agreements
Alternative solution classes	Identifies and describes the classes of solutions that may address the problem or opportunity
Analysis situations	The context information for the analysis including life cycle stage, evaluation drivers, cost drivers, size drivers, team characteristics, project priorities, or other characterization information and parameters that are needed to understand analysis and represent the element being analyzed. Relevant information from the process that invokes the analysis. Any existing models related to the element being analyzed. Any data related to the element being analyzed, including historical, current, and projected data. Can originate from any life cycle process
Applicable laws and regulations	International, national, or local laws or regulations
Architecture definition record	Permanent, readable form of data, information, or knowledge related to architecture definition
Architecture definition strategy	Approaches, schedules, resources, and specific considerations required to define the selected system architecture that satisfies the requirements
Architecture traceability	Bidirectional traceability of the architecture characteristics
Business or mission analysis record	Permanent, readable form of data, information, or knowledge related to business or mission analysis
Business or mission analysis strategy	Approaches, schedules, resources, and specific considerations required to conduct business or mission analysis and ensure business needs are elaborated and formalized into business requirements
Business requirements	Definition of the business framework within which stakeholders will define their requirements. Business requirements govern the project, including agreement constraints, quality standards, and cost and schedule constraints. Business requirements may be captured in a Business Requirements Specification (BRS), which is approved by the business leadership *Note: Business requirements may not always be formally captured in the system life cycle*
Business requirements traceability	Bidirectional traceability of the business requirements
Candidate configuration items (CIs)	Items for configuration control. Can originate from any life cycle process
Candidate information items	Items for information control. Can originate from any life cycle process
Candidate risks and opportunities	Risks and opportunities that arise from any stakeholder. In many cases, risk situations are identified during the project assessment and control process. Can originate from any life cycle process
Concept of operations (ConOps)	The ConOps is a verbal and/or graphic statement prepared for the organization's leadership that describes the assumptions or intent regarding the overall operation or series of operations of the enterprise, to include any new capability (ANSI/AIAA, 2012; ISO/IEC/IEEE 29148, 2011)
Configuration baselines	Items placed under formal change control. The required configuration baseline documentation is developed and approved in a timely manner to support required systems engineering (SE) technical reviews, the system's acquisition and support strategies, and production
Configuration management record	Permanent, readable form of data, information, or knowledge related to configuration management

Configuration management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the configuration management activities. Documents the impact to any process, organization, decision (including any required change notification), products, and services affected by a given change request
Configuration management strategy	Approaches, schedules, resources, and specific considerations required to perform configuration management for a project. Describes and documents how to make authorized changes to established baselines in a uniform and controlled manner
Customer satisfaction inputs	Responses to customer satisfaction surveys or other instruments
Decision management strategy	Approaches, schedules, resources, and specific considerations required to perform decision management for a project
Decision record	Permanent, readable form of data, information, or knowledge related to decision management
Decision report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the decision management activities. Should include a recommended course of action, an associated implementation plan, and key findings through effective trade space visualizations underpinned by defendable rationale grounded in analysis results that are repeatable and traceable. As decision makers seek to understand root causes of top-level observations and build their own understanding of the trade-offs, the ability to rapidly drill down from top-level trade space visualizations into lower-level analyses supporting the synthesized view is often beneficial
Decision situation	Decisions related to decision gates are taken on a prearranged schedule; other requests for a decision may arise from any stakeholder, and initial information can be little more than broad statements of the situation. Can originate from any life cycle process
Design definition record	Permanent, readable form of data, information, or knowledge related to design definition
Design definition strategy	Approaches, schedules, resources, and specific considerations required to define the system design that is consistent with the selected system architecture and satisfies the requirements
Design traceability	Bidirectional traceability of the design characteristics, the design enablers, and the system element requirements
Disposal constraints	Any constraints on the system arising from the disposal strategy including cost, schedule, and technical constraints
Disposal enabling system requirements	Requirements for any systems needed to enable disposal of the system of interest
Disposal procedure	A disposal procedure that includes a set of disposal actions, using specific disposal techniques, performed with specific disposal enablers
Disposal record	Permanent, readable form of data, information, or knowledge related to disposal
Disposal report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the disposal activities. May include an inventory of system elements for reuse/storage and any documentation or reporting required by regulation or organization standards
Disposal strategy	Approaches, schedules, resources, and specific considerations required to ensure the system or system elements are deactivated, disassembled, and removed from operations

Disposed system	Disposed system that has been deactivated, disassembled, and removed from operations
Documentation tree	Defines the hierarchical representation of the set of system definition products for the system under development. Based on the evolving system architecture
Enabling system requirements	Enabling system requirements from all applicable life cycle processes, including implementation enabling system requirements, integration enabling system requirements, verification enabling system requirements, transition enabling system requirements, validation enabling system requirements, operation enabling system requirements, maintenance enabling system requirements, and disposal enabling system requirements
Final Requirements Verification and Traceability Matrix (RVTM)	Final list of requirements, their verification attributes, and their traces. Includes any proposed changes to the system requirements due to the verification actions
Human resource management plan	Approaches, schedules, resources, and specific considerations required to identify the skill needs of the organization and projects. Includes the organizational training plan needed to develop internal personnel and the acquisition of external personnel
Human resource management record	Permanent, readable form of data, information, or knowledge related to human resource management
Human resource management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the human resource management activities
Implementation constraints	Any constraints on the system arising from the implementation strategy including cost, schedule, and technical constraints
Implementation enabling system requirements	Requirements for any systems needed to enable implementation of the system of interest
Implementation record	Permanent, readable form of data, information, or knowledge related to implementation
Implementation report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the implementation activities
Implementation strategy	Approaches, schedules, resources, and specific considerations required to realize system elements to satisfy system requirements, architecture, and design
Implementation traceability	Bidirectional traceability of the system elements
Information management record	Permanent, readable form of data, information, or knowledge related to information management
Information management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the information management activities
Information management strategy	Approaches, schedules, resources, and specific considerations required to perform information management for a project
Information repository	A repository that supports the availability for use and communication of all relevant project information artifacts in a timely, complete, valid, and, if required, restricted manner
Infrastructure management plan	Approaches, schedules, resources, and specific considerations required to define and sustain the organizational and project infrastructures
Infrastructure management record	Permanent, readable form of data, information, or knowledge related to infrastructure management

Infrastructure management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the infrastructure management activities. Includes cost, usage, downtime/ response measures, etc. These can be used to support capacity planning for upcoming projects
Initial RVTM	A preliminary list of requirements, their verification attributes, and their traces
Installation procedure	An installation procedure that includes a set of installation actions, using specific installation techniques, performed with specific transition enablers
Installed system	Installed system ready for validation
Integrated system or system element	Integrated system element or system ready for verification. The resulting aggregation of assembled system elements
Integration constraints	Any constraint on the system arising from the integration strategy including cost, schedule, and technical constraints
Integration enabling system requirements	Requirements for any systems needed to enable integration of the system of interest
Integration procedure	An assembly procedure that groups a set of elementary assembly actions to build an aggregate of implemented system elements, using specific integration techniques, performed with specific integration enablers
Integration record	Permanent, readable form of data, information, or knowledge related to integration
Integration report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the integration activities. Includes documentation of the integration testing and analysis results, areas of nonconformance, and validated internal interfaces
Integration strategy	Approaches, schedules, resources, and specific considerations required to integrate the system elements
Interface definition	The logical and physical aspects of internal interfaces (between the system elements composing the system) and external interfaces (between the system elements and the elements outside the system of interest)
Interface definition update identification	Identification of updates to interface requirements and definitions, if any
Knowledge management plan	Establishes how the organization and projects within the organization will interact to ensure the right level of knowledge is captured to provide useful knowledge assets. Includes a list of applicable domains; plans for obtaining and maintaining knowledge assets for their useful life; characterization of the types of assets to be collected and maintained along with a scheme to classify them for the convenience of users; criteria for accepting, qualifying, and retiring knowledge assets; procedures for controlling changes to the knowledge assets; and definition of a mechanism for knowledge asset storage and retrieval
Knowledge management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the knowledge management activities
Knowledge management system	Maintained knowledge management system. Project suitability assessment results for application of existing knowledge. Lessons learned from execution of the organizational SE processes on projects. Should include mechanisms to easily identify and access the assets and to determine the level of applicability for the project considering its use. Can be used by any life cycle process

Life cycle concepts	Articulation and refinement of the various life cycle concepts consistent with the business needs in the form of life cycle concept documents on which the system of interest is based, assessed, and selected. The architecture is based on these concepts, and they are essential in providing context for proper interpretation of the system requirements. Typical concepts include: • Acquisition concept • Deployment concept • Operational concept (OpsCon) • Support concept • Retirement concept
Life cycle constraints	Constraints from all applicable life cycle processes, including implementation constraints, integration constraints, verification constraints, transition constraints, validation constraints, operation constraints, maintenance constraints, and disposal constraints
Life cycle model management plan	Approaches, schedules, resources, and specific considerations required to define a set of organizational life cycle models. Includes identification of new needs and the evaluation of competitiveness from the perspective of the organization strategy. Includes criteria for assessments and approvals/disapprovals
Life cycle model management record	Permanent, readable form of data, information, or knowledge related to life cycle model management
Life cycle model management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the life cycle model management activities
Life cycle models	Life cycle model or models appropriate for the project. Includes definition of the business and other decision-making criteria regarding entering and exiting each life cycle stage. The information and artifacts are collected and made available to be used and reused
Maintenance constraints	Any constraints on the system arising from the maintenance strategy including cost, schedule, and technical constraints
Maintenance enabling system requirements	Requirements for any systems needed to enable operation of the system of interest
Maintenance procedure	A maintenance procedure that includes a set of maintenance actions, using specific maintenance techniques, performed with specific maintenance enablers
Maintenance record	Permanent, readable form of data, information, or knowledge related to maintenance
Maintenance report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the maintenance activities
Maintenance strategy	Approaches, schedules, resources, and specific considerations required to perform corrective and preventive maintenance in conformance with operational availability requirements
Major stakeholder identification	List of legitimate external and internal stakeholders with an interest in the solution. Major stakeholders are also derived from analysis of the ConOps
Measurement data	Measurement data from all applicable life cycle processes, including measure of effectiveness (MOE) data, measure of performance (MOP) data, technical performance measures (TPM) data, project performance measures data, and organizational process performance measures data
Measurement needs	Measurement needs from all applicable life cycle processes, including MOE needs, MOP needs, TPM needs, project performance measures needs, and organizational process performance measures needs
Measurement record	Permanent, readable form of data, information, or knowledge related to measurement

Measurement report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the measurement activities. Includes documentation of the measurement activity results, the measurement data that was collected and analyzed and results that were communicated, and any improvements or corrective actions driven by the measures with their supporting data
Measurement repository	A repository that supports the availability for use and communication of all relevant measures in a timely, complete, valid, and, if required, confidential manner
Measurement strategy	Approaches, schedules, resources, and specific considerations required to perform measurement for a project. Addresses the strategy for performing measurement: describing measurement goals, identifying information needs and applicable measures, and defining performance and evaluation methodologies
MOE data	Data provided for the identified measurement needs
MOE needs	Identification of the MOEs (Roedler and Jones, 2006), which define the information needs of the decision makers with respect to system effectiveness to meet operational expectations
MOP data	Data provided for the identified measurement needs
MOP needs	Identification of the MOPs (Roedler and Jones, 2006), which define the key performance characteristics the system should have when fielded and operated in its intended operating environment
Operation constraints	Any constraints on the system arising from the operational strategy including cost, schedule, and technical constraints
Operation enabling system requirements	Requirements for any systems needed to enable operation of the system of interest
Operation record	Permanent, readable form of data, information, or knowledge related to operation
Operation report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the operation activities
Operation strategy	Approaches, schedules, resources, and specific considerations required to perform system operations
Operator/ maintainer training materials	Training capabilities and documentation
Organization infrastructure	Resources and services that support the organization. Organizational-level facilities, personnel, and resources for hardware fabrication, software development, system implementation and integration, verification, validation, etc.
Organization infrastructure needs	Specific requests for infrastructure products or services from the organization, including commitments to external stakeholders
Organization lessons learned	Organizational-related lessons learned. Results from an evaluation or observation of an implemented corrective action that contributed to improved performance or increased capability. A lesson learned also results from an evaluation or observation of a positive finding that did not necessarily require corrective action other than sustainment
Organization portfolio direction and constraints	Organization business objectives, funding outlay and constraints, ongoing research and development (R&D), market tendencies, etc., including cost, schedule, and solution constraints

Organization strategic plan	The overall organization strategy, including the business mission or vision and strategic goals and objectives
Organization tailoring strategy	Approaches, schedules, resources, and specific considerations required to incorporate new or updated external standards into the organization's set of standard life cycle processes
Organizational policies, procedures, and assets	Items related to the organization's standard set of life cycle processes, including guidelines and reporting mechanisms. Organization process guidelines in the form of organization policies, procedures, and assets for applying the system life cycle processes and adapting them to meet the needs of individual projects (e.g., templates, checklists, forms). Includes defining responsibilities, accountability, and authority for all SE processes within the organization
Organizational process performance measures data	Data provided for the identified measurement needs
Organizational process performance measures needs	Identification of the organizational process performance measures, which measure how well the organization is satisfying it objectives
Portfolio management plan	Approaches, schedules, resources, and specific considerations required to define a project portfolio
Portfolio management record	Permanent, readable form of data, information, or knowledge related to portfolio management
Portfolio management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the portfolio management activities
Preliminary interface definition	The preliminary logical and physical aspects of internal interfaces (between the system elements composing the system) and external interfaces (between the system elements of the system and the elements outside the system of interest)
Preliminary life cycle concepts	Preliminary articulation of the various life cycle concepts consistent with the business needs in the form of life cycle concept documents on which the system of interest is based, assessed, and selected. The architecture is based on these concepts, and they are essential in providing context for proper interpretation of the system requirements. Typical concepts include: • Acquisition concept • Deployment concept • OpsCon • Support concept • Retirement concept
Preliminary MOE data	Preliminary data provided for the identified measurement needs
Preliminary MOE needs	Preliminary identification of the MOEs (Roedler and Jones, 2006), which define the information needs of the decision makers with respect to system effectiveness to meet operational expectations
Preliminary TPM data	Preliminary data provided for the identified measurement needs
Preliminary TPM needs	Preliminary identification of the TPM (Roedler and Jones, 2006), which measure attributes of a system element to determine how well a system or system element is satisfying or expected to satisfy a technical requirement or goal
Preliminary validation criteria	The preliminary validation criteria (the measures to be assessed), who will perform validation activities, and the validation environments of the system of interest
Problem or opportunity statement	Description of the problem or opportunity. Should be derived from the organization strategy and provide enough detail to understand the gap or new capability that is being considered
Procedures	Procedures from all applicable life cycle processes, including integration procedure, verification procedure, installation procedure, validation procedure, maintenance procedure, and disposal procedure

Project assessment and control record	Permanent, readable form of data, information, or knowledge related to project assessment and control
Project assessment and control strategy	Approaches, schedules, resources, and specific considerations required to perform assessment and control for a project
Project budget	A prediction of the costs associated with a particular project. Includes labor, infrastructure, acquisition, and enabling system costs along with reserves for risk management
Project change requests	Requests to update any formal baselines that have been established. In many cases, the need for change requests is identified during the project assessment and control process. Can originate from any life cycle process
Project constraints	Any constraints on the system arising from the technical management strategy including cost, schedule, and technical constraints
Project control requests	Internal project directives based on action required due to deviations from the project plan. New directions are communicated to both project team and customer, when appropriate. If assessments are associated with a decision gate, a decision to proceed, or not to proceed, is taken
Project direction	Organizational direction to the project. Includes sustainment of projects meeting assessment criteria and redirection or termination of projects not meeting assessment criteria
Project human resource needs	Specific requests for human resources needed by the project, including commitments to external stakeholders
Project infrastructure	Resources and services that support a project. Project-level facilities, personnel, and resources for hardware fabrication, software development, system implementation and integration, verification, validation, etc.
Project infrastructure needs	Specific requests for infrastructure products or services needed by the project, including commitments to external stakeholders
Project lessons learned	Project-related lessons learned. Results from an evaluation or observation of an implemented corrective action that contributed to improved performance or increased capability. A lesson learned also results from an evaluation or observation of a positive finding that did not necessarily require corrective action other than sustainment (CJCS, 2012)
Project performance measures data	Data provided for the identified measurement needs
Project performance measures needs	Identification of the project performance measures, which measure how well the project is satisfying it objectives
Project planning record	Permanent, readable form of data, information, or knowledge related to project planning
Project portfolio	The necessary information for all of the organizations' projects. The initiation of new projects or the setting up of a product line management approach. Includes the project goals, resources, budgets identified and allocated to the projects, and clearly defined project management accountability and authorities
Project schedule	A linked list of a project's milestones, activities, and deliverables with intended start and finish dates. May include a top-level milestone schedule and multiple levels (also called tiers) of schedules of increasing detail and task descriptions with completion criteria and work authorizations
Project status report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the overall project activities. Includes status on meeting the objectives set out for the project, information on the health and maturity of the project work effort, status on project tailoring and execution, and status on personnel availability and effectiveness for the project

Project tailoring strategy	Approaches, schedules, resources, and specific considerations required to incorporate and tailor the organization's set of standard life cycle processes for a given project
Quality management (QM) corrective actions	Actions taken when quality goals are not achieved. Resulting from project-related and process-related reviews and audits
Qualified personnel	The right people with the right skills are assigned at the right time to projects per their skill needs and timing
Quality assurance evaluation report	An account prepared for interested parties in order to communicate evidence of whether the project's quality assurance activities are effective. Includes the assessment of all the project-related process and any suggested improvements or necessary corrective actions. Provides constructive input for improvements to an organization's life cycle model implementation
Quality assurance plan	The set of project quality assurance activities, tailored to the project, designed to monitor development and SE processes. Describes the quality assurance organization and applicable audit, evaluation, and monitoring activities. This includes the set of policies and procedures, including specific methods and techniques that apply to quality assurance practices within the organization and within individual projects. It also includes quality objectives for processes and systems that are measurable, along with linkages to the assigned accountability and authority for QM within the organization. The plan also references activities performed by other organizations or functions that are monitored or audited by the quality assurance organization
Quality assurance record	Permanent, readable form of data, information, or knowledge related to quality assurance
Quality assurance report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the quality assurance activities. Includes information on deviations from nominal conditions during the product life cycle and actions to be taken when quality assurance goals and objectives are not achieved
Quality management evaluation report	An account prepared for interested parties in order to communicate evidence of whether the organization's QM activities are effective. Includes the assessment of all the organizational-related process and any suggested improvements or necessary corrective actions. Provides constructive input for improvements to an organization's life cycle model implementation
Quality management guidelines	Guidelines for quality practices within the organization, within individual projects, and as part of the execution of system life cycle processes
Quality management plan	The overarching guidance that explains the organization's quality philosophy and quality organization. Describes the QM organization and applicable audit, evaluation, and monitoring activities. This includes the set of policies and procedures, including specific methods and techniques that apply to QM practices within the organization. It also includes quality objectives for processes and systems that are measurable, along with the assigned accountability and authority for QM within the organization. The set of project QM activities form the basis of the project quality assurance
Quality management record	Permanent, readable form of data, information, or knowledge related to QM
Quality management report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the QM activities. Includes the results of any customer satisfaction surveys and any issues that need to be addressed

Records	Records from all applicable life cycle processes, including business or mission analysis record, stakeholder needs and requirements definition record, system requirements definition record, architecture definition record, design definition record, system analysis record, implementation record, integration record, verification record, transition record, validation record, operation record, maintenance record, disposal record, project planning record, project assessment and control record, decision record, risk record, configuration management record, information management record, measurement record, quality assurance record, acquisition record, supply record, life cycle model management record, infrastructure management record, portfolio management record, human resource management record, and QM record
Reports	Project reports from all applicable life cycle processes, including system analysis report, implementation report, integration report, verification report, transition report, validation report, operation report, maintenance report, disposal report, decision report, risk report, configuration management report, information management report, measurement report, quality assurance report, acquisition report, and supply report (other reports go to other process areas and are not aggregated here)
Request for supply	A request to an external supplying organization to propose a solution to meet a need for a system element or system (product or service). The organization can identify candidate suppliers that could meet this need. Inputs are received from the project personnel in the organization with the need
Risk management strategy	Approaches, schedules, resources, and specific considerations required to perform risk management for a project
Risk record	Permanent, readable form of data, information, or knowledge related to risk management
Risk report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the risk management activities. The risks are documented and communicated along with rationale, assumptions, treatment plans, and current status. For selected risks, an action plan is produced to direct the project team to update the project plan and properly respond to the risks. If appropriate, change requests are generated to mitigate technical risk. Risk profiles and/or risk matrices summarize the risks and contain the findings of the risk management process
SEMP	*Systems engineering management plan.* The top-level plan for managing the SE effort. It defines how the project will be organized, structured, and conducted and how the total engineering process will be controlled to provide a product that satisfies stakeholder requirements. Includes identification of required technical reviews and their completion criteria, methods for controlling changes, risk and opportunity assessment and methodology, and identification of other technical plans and documentation to be produced for the project
Source documents	External documents relevant to the particular stage of procurement activity for the system of interest. Includes the written directives embodied in the source documents relevant to organizational strategies and policies
Stakeholder needs	Needs determined from communication with external and internal stakeholders in understanding their expectations, needs, requirements, values, problems, issues, and perceived risks and opportunities

Stakeholder needs and requirements definition record	Permanent, readable form of data, information, or knowledge related to stakeholder needs and requirements definition
Stakeholder needs and requirements definition strategy	Approaches, schedules, resources, and specific considerations required to reflect consensus among the stakeholder classes to establish a common set of acceptable requirements. Includes the approach to capture the stakeholder needs, transform them into stakeholder requirements, and manage them through the life cycle
Stakeholder requirements	Requirements from various stakeholders that will govern the project, including required system capabilities, functions, and/or services; quality standards; system constraints; and cost and schedule constraints. Stakeholder requirements may be captured in the Stakeholder Requirements Specification (StRS)
Stakeholder requirements traceability	Bidirectional traceability of the stakeholder requirements
Standards	This handbook and relevant industry, country, military, acquirer, and other specifications and standards. Includes new knowledge from industry-sponsored knowledge networks
Strategy documents	Strategies for all applicable life processes, including business or mission analysis strategy, stakeholder needs and requirements definition strategy, system requirements definition strategy, architecture definition strategy, design definition strategy, system analysis strategy, implementation strategy, integration strategy, verification strategy, transition strategy, validation strategy, operation strategy, maintenance strategy, disposal strategy, project assessment and control strategy, decision management strategy, risk management strategy, configuration management strategy, information management strategy, measurement strategy, acquisition strategy, and supply strategy
Supplied system	The system or system element (product or service) is delivered from the supplier to the acquirer consistent with the delivery conditions of the supply agreement
Supply agreement	An understanding of the relationship and commitments between the project organization and the acquirer. The agreement can vary from formal contracts to less formal interorganizational work orders. Formal agreements typically include terms and conditions
Supply payment	Payments or other compensations for the supplied system. Includes receipt and acknowledgement
Supply record	Permanent, readable form of data, information, or knowledge related to supply
Supply report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the supply activities
Supply response	The organization response to the request for supply
Supply strategy	Approaches, schedules, resources, and specific considerations required to identify candidate projects for management consideration. May also include inputs to determine supply constraints. Should also include the identification of potential acquirers
System analysis record	Permanent, readable form of data, information, or knowledge related to system analysis
System analysis report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the system analysis activities. Includes the results of costs analysis, risks analysis, effectiveness analysis, and other critical characteristics analysis. Also includes all models or simulations that are developed for the analysis
System analysis strategy	Approaches, schedules, resources, and specific considerations required to accomplish the various analyses to be carried out, including methods, procedures, evaluation criteria, or parameters

System architecture description	Description of the selected system architecture, typically presented in a set of architectural views (e.g., views from architecture frameworks), models (e.g., logical and physical models, although there are other kinds of models that might be useful), and architectural characteristics (e.g., physical dimensions, environment resistance, execution efficiency, operability, reliability, maintainability, modularity, robustness, safeguard, understandability, etc.) (ISO/IEC/IEEE 42010, 2010). Architecturally significant system elements are identified and defined to some degree in this artifact. (Other system elements might need to be added during the design definition process as the design is fleshed out)
System architecture rationale	Rationale for architecture selection, technological/technical system element selection, and allocation between system requirements and architectural entities (e.g., functions, input/output flows, system elements, physical interfaces, architectural characteristics, information/data elements, containers, nodes, links, communication resources)
System design description	Description of the selected system design. System elements are identified and defined
System design rationale	Rationale for design selection, system element selection, and allocation between system requirements and system element. Includes rationale of major selected implementation options and enablers
System element descriptions	Design characteristics description of the system elements contained in the system; the description depends on the implementation technology (e.g., data sheets, databases, documents, exportable data files)
System element documentation	Detailed drawings, codes, and material specifications. Updated design documentation, as required by corrective action or adaptations caused by acquisition or conformance to regulations
System elements	System elements implemented or supplied according to the acquisition agreement
System function definition	Definition of the functional boundaries of the system and the functions the system must perform
System function identification	Identification of the system functions
System functional interface identification	Identification and documentation of the functional interfaces with systems external to the boundaries and the corresponding information exchange requirements
System requirements	What the system needs to do, how well, and under what conditions, as required to meet project and design constraints. Includes types of requirements such as functional, performance, interface, behavior (e.g., states and modes, stimulus responses, fault and failure handling), operational conditions (e.g., safety, dependability, human factors, environmental conditions), transportation, storage, physical constraints, realization, integration, verification, validation, production, maintenance, disposal constraints, and regulation. System requirements may be captured in a document called the System Requirements Specification (SyRS) or just System Specification. This includes the requirements at any level in the system hierarchy
System requirements definition record	Permanent, readable form of data, information, or knowledge related to system requirements definition

System requirements definition strategy	Approaches, techniques, resources, and specific considerations required to be used to identify and define the system requirements and manage the requirements through the life cycle
System requirements traceability	Bidirectional traceability of the system requirements
TPM data	Data provided for the identified measurement needs
TPM needs	Identification of the TPM, which measure attributes of a system element to determine how well a system or system element is satisfying or expected to satisfy a technical requirement or goal
Trained operators and maintainers	Trained humans that will operate and maintain the system
Transition constraints	Any constraints on the system arising from the transition strategy including cost, schedule, and technical constraints
Transition enabling system requirements	Requirements for any systems needed to enable transition of the system of interest
Transition record	Permanent, readable form of data, information, or knowledge related to transition
Transition report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the transition activities. Includes documentation of the transition results and a record of any recommended corrective actions, such as limitations, concessions, and ongoing issues. Should also include plans to rectify any problems that arise during transition
Transition strategy	Approaches, schedules, resources, and specific considerations required to transition the systems into its operation environment
Updated RVTM	An updated list of requirements, their verification attributes, and their traces
Validated requirements	Confirmation that the various requirements will satisfy the business and stakeholder requirements
Validated system	Validated system ready for supply and operation. Also informs maintenance and disposal
Validation constraints	Any constraint on the system arising from the validation strategy including cost, schedule, and technical constraints
Validation criteria	The validation criteria (the measures to be assessed), who will perform validation activities, and the validation environments of the system of interest
Validation enabling system requirements	Requirements for any systems needed to enable validation of the system of interest
Validation procedure	A validation procedure that includes a set of validation actions, using specific validation techniques, performed with specific validation enablers
Validation record	Permanent, readable form of data, information, or knowledge related to validation
Validation report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the validation activities. Includes validation results and the objective evidence confirming that the system satisfies its stakeholder requirements and business requirements or not. Should also communicate an assessment of the confidence level of the findings or results
Validation strategy	Approaches, schedules, resources, and specific considerations required to accomplish the selected validation actions that minimize costs and risks while maximizing operational coverage of system behaviors
Verification constraints	Any constraint on the system arising from the verification strategy including cost, schedule, and technical constraints
Verification criteria	The verification criteria (the measures to be assessed), who will perform verification activities, and the verification environments of the system of interest

Verification enabling system requirements	Requirements for any systems needed to enable verification of the system of interest
Verification procedure	A verification procedure that includes a set of verification actions, using a specific verification method/technique, performed with specific verification enablers
Verification record	Permanent, readable form of data, information, or knowledge related to verification
Verification report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the verification activities. Includes verification results and the objective evidence confirming that the system fulfills its requirements, architectural characteristics, and design properties or not. Should also communicate an assessment of the confidence level of the findings or results
Verification strategy	Approaches, schedules, resources, and specific considerations required to accomplish the selected verification actions that minimize costs and risks while maximizing operational coverage of system behavior
Verified system	Verified system (or system element) ready for transition
WBS	The *work breakdown structure* is the decomposition of a project into smaller components and provides the necessary framework for detailed cost estimating and control. Includes a data dictionary. The costs for and description of the physical end products (hardware and software) may be captured in a product breakdown structure (PBS). The PBS supports bottoms up and algorithmic (parametric) cost estimating (see 10.1.3). The PBS is a key ingredient of commercial cost estimating tools

APPENDIX F: ACKNOWLEDGMENTS

SEH V4 CONTRIBUTIONS

The *INCOSE Systems Engineering Handbook* version 4 editorial team owes a debt of gratitude to all the contributors to prior editions (versions 1, 2, 2A, and 3). Tim Robertson led the effort to create version 1 of the handbook. Version 2 was led by James Whalen (ESEP) and Richard Wray (ESEP). Version 3 was led at various times by Kevin Forsberg (ESEP), Terje Fossnes (ESEP), Douglas Hamelin, Cecilia Haskins (ESEP), Michael Krueger (ESEP), and David Walden (ESEP). The framework they provided gave a solid basis for moving ahead with this version. This revision reflects changes to the previous version based on three primary objectives: first, to reflect the updated ISO/IEC/IEEE 15288:2015 standard; second, to reflect the state of the practice based on inputs from the relevant INCOSE Working Groups (WGs); and third, to be consistent with the Systems Engineering Body of Knowledge (SEBoK) wherever possible. Version 4 also corrected several minor issues identified by the INCOSE community.

A great deal of effort and enthusiasm was provided by the section leads and key authors, most of whom also serve as INCOSE WG Chairs or SEBoK authors. We acknowledge them in alphabetical order: Erik Aslaksen (CSEP), Albertyn Barnard, Joe Bobinis, Barry Boehm, Ed Casey, Dan Cernoch, Hugo Chale Gongora, Matthew Cilli, John Clark (CSEP), Bjorn Cole, Judith Dahmann, Arnold de Beer, Charles Dickerson, Rick Dove, Joe Elm (ESEP), Tom Fairlie, Alain Faisandier, Gauthier Fanmuy, Paul Frenz (CSEP), Sandy Friedenthal, Katri Hakola, Alan Harding, Cecilia Haskins (ESEP), Mimi Heisey, Eric Honour (CSEP), Scott Jackson, Ken Kepchar (ESEP), Alain Kouassi, Gary Langford, Claude Laporte, Alain LePut, Howard Lykins, Ray Madachy, James Martin, Jen Narkevicius, Warren Naylor, Bohdan Oppenheim, Ricardo Pineda, Paul Popick, Derek Price, Melinda Reed, Kevin Robinson, Jean-Claude Roussel (ESEP), Mike Ryan, Frank Salvatore (CSEP), Hillary Sillitto (ESEP), Jack Stein, Richard Swanson (ASEP), Corrie Taljaard, Chris Unger, Beth Wilson (ESEP), and Mark Wilson (ESEP).

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Edited by David D. Walden, Garry J. Roedler, Kevin J. Forsberg, R. Douglas Hamelin and Thomas M. Shortell.

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Any errors introduced as part of the editorial process rest with the editors, not the contributors.

We apologize if we unintentionally omitted anyone from these lists.

Gratefully, David Walden (ESEP), Garry Roedler (ESEP), and Kevin Forsberg (ESEP).

APPENDIX G: COMMENT FORM

Reviewed document:	INCOSE SE Handbook v4.0
Name of submitter:	Given FAMILY (given name and family name)
Date submitted:	DD-MMM-YYYY
Contact info:	john.doe@anywhere.com (email address)
Type of submission:	Group (individual/group)
Group name and number of contributors:	INCOSE XYZ WG (if applicable)
Comments:	Detailed comments with reference to document section, paragraph, etc. Please include detailed recommendations, as shown in the table below

Send comments to info@incose.org

Comment ID	**Category** (TH, TL, E, G)	**Section number** (e.g., 3.4.2.1, no alpha)	**Specific reference** (e.g., paragraph, line, figure, table)	**Issue, comment, and rationale** (rationale must make comment clearly evident and supportable)	**Proposed change/ new text—mandatory entry** (must be substantial to increase the odds of acceptance)

E, editorial; G, general; TH, technical high; TL, technical low.

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