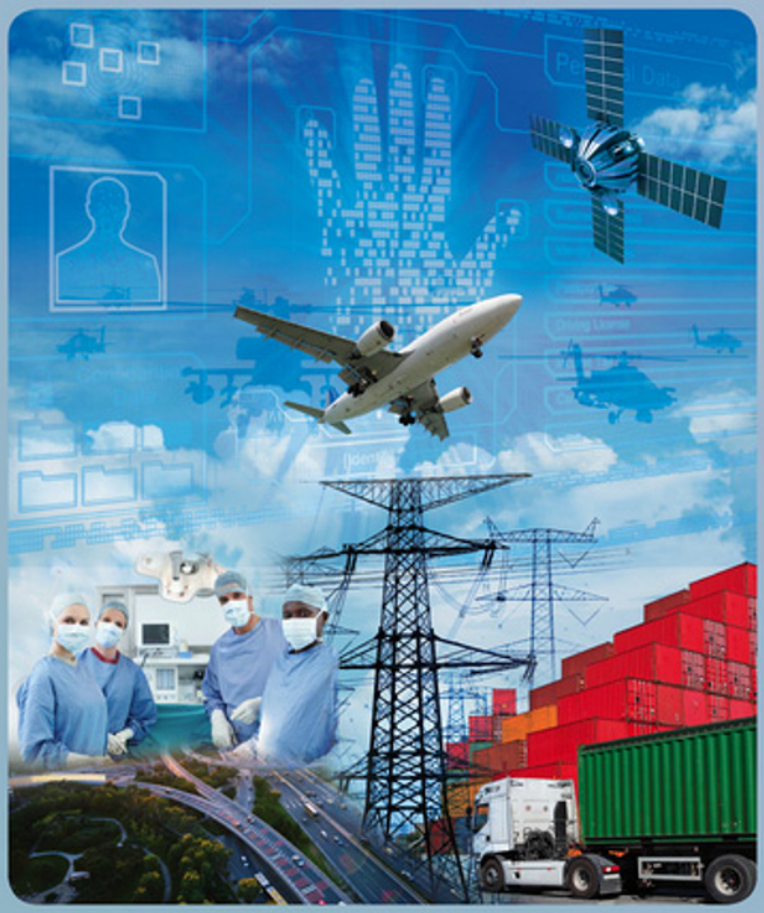
INCOSE

SYSTEMS ENGINEERING HANDBOOK

A GUIDE FOR SYSTEM LIFE CYCLE PROCESSES AND ACTIVITIES



FOURTH EDITION

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A GUIDE FOR SYSTEM LIFE CYCLE PROCESSES AND ACTIVITIES

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INCOSE NOTICES

HISTORY OF CHANGES

Revision	Revision date	Change description and rationale
Original	Jun 1994	Draft *Systems Engineering Handbook* (SEH) created by INCOSE members from several defense/aerospace companies—including Lockheed, TRW, Northrop Grumman, Ford Aerospace, and the Center for Systems Management—for INCOSE review
1.0	Jan 1998	Initial SEH release approved to update and broaden coverage of SE process. Included broad participation of INCOSE members as authors. Based on Interim Standards EIA 632 and IEEE 1220
2.0	Jul 2000	Expanded coverage on several topics, such as functional analysis. This version was the basis for the development of the Certified Systems Engineering Professional (CSEP) exam
2.0A	Jun 2004	Reduced page count of SEH v2 by 25% and reduced the US DoD-centric material wherever possible. This version was the basis for the first publically offered CSEP exam
3.0	Jun 2006	Significant revision based on ISO/IEC 15288:2002. The intent was to create a country- and domain-neutral handbook. Significantly reduced the page count, with elaboration to be provided in appendices posted online in the INCOSE Product Asset Library (IPAL)
3.1	Aug 2007	Added detail that was not included in SEH v3, mainly in new appendices. This version was the basis for the updated CSEP exam
3.2	Jan 2010	Updated version based on ISO/IEC/IEEE 15288:2008. Significant restructuring of the handbook to consolidate related topics
3.2.1	Jan 2011	Clarified definition material, architectural frameworks, concept of operations references, risk references, and editorial corrections based on ISO/IEC review
3.2.2	Oct 2011	Correction of errata introduced by revision 3.2.1
4.0	Jan 2015	Significant revision based on ISO/IEC/IEEE 15288:2015, inputs from the relevant INCOSE working groups (WGs), and to be consistent with the Guide to the Systems Engineering Body of Knowledge (SEBoK)

PREFACE

The objective of the International Council on Systems Engineering (INCOSE) *Systems Engineering Handbook* (SEH) is to describe key process activities performed by systems engineers. The intended audience is the systems engineering (SE) professional. When the term *systems engineer* is used in this handbook, it includes the new systems engineer, a product engineer or an engineer in another discipline who needs to perform SE, or an experienced systems engineer who needs a convenient reference.

The descriptions in this handbook show what each SE process activity entails, in the context of designing for required performance and life cycle considerations. On some projects, a given activity may be performed very informally; on other projects, it may be performed very formally, with interim products under formal configuration control. This document is not intended to advocate any level of formality as necessary or appropriate in all situations. The appropriate degree of formality in the execution of any SE process activity is determined by the following:

1. The need for communication of what is being done (across members of a project team, across organizations, or over time to support future activities)
2. The level of uncertainty
3. The degree of complexity
4. The consequences to human welfare

On smaller projects, where the span of required communications is small (few people and short project life cycle) and the cost of rework is low, SE activities can be conducted very informally and thus at low cost. On larger projects, where the span of required communications is large (many teams that may span multiple geographic locations and organizations and long project life cycle) and the cost of failure or rework is high, increased formality can significantly help in achieving project opportunities and in mitigating project risk.

In a project environment, work necessary to accomplish project objectives is considered "in scope"; all other work is considered "out of scope." On every project, "thinking" is always "in scope." Thoughtful tailoring and intelligent application of the SE processes described in this handbook are essential to achieve the proper balance between the risk of missing project technical and business objectives on the one hand and process paralysis on the other hand. Chapter 8 provides tailoring guidelines to help achieve that balance.

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SYSTEMS ENGINEERING HANDBOOK SCOPE

1.1 PURPOSE

This handbook defines the discipline and practice of systems engineering (SE) for students and practicing professionals alike and provides an authoritative reference to understand the SE discipline in terms of content and practice.

1.2 APPLICATION

This handbook is consistent with ISO/IEC/IEEE 15288:2015, *Systems and software engineering—System life cycle processes* (hereafter referred to as ISO/IEC/IEEE 15288), to ensure its usefulness across a wide range of application domains—man-made systems and products, as well as business and services.

ISO/IEC/IEEE 15288 is an international standard that provides generic top-level process descriptions and requirements, whereas this handbook further elaborates on the practices and activities necessary to execute the processes. Before applying this handbook in a given organization or project, it is recommended that the tailoring guidelines in Chapter 8 be used to remove conflicts with existing policies, procedures, and standards already in use within an organization. Processes and activities in this handbook do not supersede any international, national, or local laws or regulations.

This handbook is also consistent with the *Guide to the Systems Engineering Body of Knowledge* (SEBoK, 2014) (hereafter referred to as the SEBoK) to the extent practicable. In many places, this handbook points readers to the SEBoK for more detailed coverage of the related topics, including a current and vetted set of references.

For organizations that do not follow the principles of ISO/IEC/IEEE 15288 or the SEBoK to specify their life cycle processes (including much of commercial industry), this handbook can serve as a reference to practices and methods that have proven beneficial to the SE community at large and that can add significant value in new domains, if appropriately selected and applied. Section 8.2 provides top-level guidance on the application of SE in selected product sectors and domains.

1.3 CONTENTS

This chapter defines the purpose and scope of this handbook. Chapter 2 provides an overview of the goals and value of using SE throughout the system life cycle.

INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, Fourth Edition.
Edited by David D. Walden, Garry J. Roedler, Kevin J. Forsberg, R. Douglas Hamelin and Thomas M. Shortell.