

Systems Engineering and Geospatial/Geodetic Engineering

From SEBoK

[Systems Engineering and Geospatial/Geodetic Engineering](#)

[Jump to navigation](#) [Jump to search](#)

The printable version is no longer supported and may have rendering errors. Please update your browser bookmarks and please use the default browser print function instead.

Lead Author: *Ulrich Lenk*

[Geographic Information Systems \(GIS\)](#) Geographic Information Systems (GIS) and geospatial applications and [infrastructures](#) infrastructures are widely used and widely integrated into other [systems](#) systems. Among the most well-known such [systems](#) systems are those based on the Global Positioning System (GPS) and other Global Navigation Satellite Systems (GNSS). They have enabled such diverse applications as automobile navigation systems, smartphones that location-stamp photographs, and military weapon systems that target enemy locations. According to Hahmann and Burghardt (2013), about 80% of all data have a [spatial reference](#) spatial reference; i.e. the data can be related to a physical coordinate in a [spatial reference system](#) spatial reference system, or identified by a [geographic identifier](#) geographic identifier. [Systems](#) Systems and their constituents reside in or operate in space and often need to know where they or their parts, constituents, etc. are; where their mobile components go; or where objects observed by the system are. In other words (Longley et al. 2015): “Almost everything that happens, happens somewhere. Knowing where something happens can be critically important.” Extending this observation, potentially the system(s) and their associated constituents require synchronization of their activities and actions which is often achieved by triggering actions via time stamps; for this purpose, systems need to be time-wise synchronized to a certain extent or accuracy. The Geospatial/Geodetic Engineering (GGE) Knowledge Area provides a broad introduction into this overall topic in order to make the reader aware where relevant technologies are actually used in [systems](#) systems. It reflects the abundant uses and applications and even critical dependencies of geodetic and geospatial technologies in systems, such as GNSS & GPS ([satellite positioning systems](#) satellite positioning systems); [GIS](#) GIS; [spatial reference systems](#) spatial reference systems; processing, analysis and visualization ([portrayal](#) portrayal) of geographic data. It briefly analyzes to what extent the [Systems Engineering](#) Systems Engineering [Specialty Activities](#) Specialty Activities listed in the INCOSE Systems Engineering Handbook (2015) and modeling and [simulation](#) simulation may be supported by related subject matter expertise. As a consequence it concludes that GGE activities could be considered as dedicated [Specialty Engineering](#) Specialty Engineering activities themselves within [Systems Engineering](#) Systems Engineering.

□

Contents

- [1 Topics](#)
- [2 References](#)

- [2.1 Works Cited](#)
- [2.2 Primary References](#)
- [2.3 Additional References](#)

Topics

This Knowledge Area includes two topic articles:

- [Overview of Geospatial/Geodetic Engineering](#)
- [Relationship between Systems Engineering and Geospatial/Geodetic Engineering](#)

References

Works Cited

Hahmann, S. and D. Burghardt. 2013. How much information is geospatially referenced? Networks and cognition. *International Journal of Geographical Information Science* 27(6):1171-1189. DOI: 10.1080/13658816.2012.743664.

Primary References

INCOSE. 2015. *Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities*, (4th edition). San Diego, CA, USA: International Council on Systems Engineering (INCOSE), INCOSE-TP-2003-002-04.

Longley, P.A., M.F. Goodchild, D.J. Maguire, and D.W. Rhind. 2015. *Geographic Information Science and Systems*, (4th edition). New York, Chichester, Weinheim: John Wiley & Sons, Inc.

Additional References

None.

[< Previous Article](#) | [Parent Article](#) | [Next Article >](#)

SEBoK v. 2.4, released 19 May 2021

Retrieved from

"https://www.sebokwiki.org/w/index.php?title=Systems_Engineering_and_Geospatial/Geodetic_Engineering&oldid=61902"

Categories:

- [Part 6](#)
- [Knowledge Area](#)
- [Systems Engineering and Geospatial/Geodetic Engineering](#)

Navigation menu

Personal tools

- [Log in](#)

Namespaces

- [Page](#)
- [Discussion](#)



Variants

Views

- [Read](#)
- [View source](#)
- [View history](#)
- [PDF Export](#)



More

Search

Stewards



- Quicklinks
 - [Main Page](#)
 - [Letter from the Editor](#)
 - [Governance and Editorial Boards](#)
 - [SEBoK Sponsors](#)
 - [Acknowledgements and Release History](#)
 - [FAQs](#)
- Outline

- [Table of Contents](#)
- [Part 1: SEBoK Introduction](#)
 - [Introduction to the SEBoK](#)
 - [Scope of the SEBoK](#)
 - [Structure of the SEBoK](#)
 - [Introduction to Systems Engineering](#)
 - [Systems Engineering Overview](#)
 - [Brief History of Systems Engineering](#)
 - [Systems Engineering Principles](#)
 - [Systems Engineering Heuristics](#)
 - [Economic Value of Systems Engineering](#)
 - [Systems Engineering: Historic and Future Challenges](#)
 - [Systems Engineering and Other Disciplines](#)
 - [Systems Engineering Core Concepts](#)
 - [SEBoK Users and Uses](#)
 - [Use Case 0: Systems Engineering Novices](#)
 - [Use Case 1: Practicing Systems Engineers](#)
 - [Use Case 2: Other Engineers](#)
 - [Use Case 3: Customers of Systems Engineering](#)
 - [Use Case 4: Educators and Researchers](#)
 - [Use Case 5: General Managers](#)
- [Part 2: Foundations of Systems Engineering](#)
 - [Systems Fundamentals](#)
 - [Introduction to System Fundamentals](#)
 - [Types of Systems](#)
 - [Complexity](#)
 - [Emergence](#)
 - [Fundamentals for Future Systems Engineering](#)
 - [Systems Approach Applied to Engineered Systems](#)
 - [Overview of Systems Approaches](#)
 - [Engineered System Context](#)
 - [Identifying and Understanding Problems and Opportunities](#)
 - [Synthesizing Possible Solutions](#)
 - [Analysis and Selection between Alternative Solutions](#)
 - [Implementing and Proving a Solution](#)
 - [Deploying, Using, and Sustaining Systems to Solve Problems](#)
 - [Applying the Systems Approach](#)
 - [Systems Science](#)
 - [History of Systems Science](#)
 - [Cycles and the Cyclic Nature of Systems](#)
 - [Systems Approaches](#)
 - [Systems Thinking](#)
 - [What is Systems Thinking?](#)
 - [Concepts of Systems Thinking](#)
 - [Principles of Systems Thinking](#)
 - [Patterns of Systems Thinking](#)
 - [Representing Systems with Models](#)
 - [What is a Model?](#)
 - [Why Model?](#)
 - [Types of Models](#)
 - [System Modeling Concepts](#)

- [Integrating Supporting Aspects into System Models](#)
 - [Modeling Standards](#)
- [Part 3: SE and Management](#)
 - [Introduction to Life Cycle Processes](#)
 - [Generic Life Cycle Model](#)
 - [Applying Life Cycle Processes](#)
 - [Life Cycle Processes and Enterprise Need](#)
 - [Life Cycle Models](#)
 - [Life Cycle Process Drivers and Choices](#)
 - [Life Cycle Process Models: Vee](#)
 - [Life Cycle Process Models: Iterative](#)
 - [Integration of Process](#)
 - [Lean Engineering](#)
 - [Concept Definition](#)
 - [Business or Mission Analysis](#)
 - [Mission Engineering](#)
 - [Stakeholder Needs and Requirements](#)
 - [System Definition](#)
 - [System Requirements](#)
 - [System Architecture](#)
 - [Logical Architecture Model Development](#)
 - [Physical Architecture Model Development](#)
 - [System Design](#)
 - [System Analysis](#)
 - [System Realization](#)
 - [System Implementation](#)
 - [System Integration](#)
 - [System Verification](#)
 - [System Validation](#)
 - [System Deployment and Use](#)
 - [System Deployment](#)
 - [Operation of the System](#)
 - [System Maintenance](#)
 - [Logistics](#)
 - [Systems Engineering Management](#)
 - [Planning](#)
 - [Assessment and Control](#)
 - [Risk Management](#)
 - [Measurement](#)
 - [Decision Management](#)
 - [Configuration Management](#)
 - [Information Management](#)
 - [Quality Management](#)
 - [Product and Service Life Management](#)
 - [Service Life Extension](#)
 - [Updates, Upgrades, and Modernization](#)
 - [Disposal and Retirement](#)
 - [Systems Engineering Standards](#)
 - [Relevant Standards](#)
 - [Alignment and Comparison](#)
 - [Application](#)

- [Part 4: Applications of Systems Engineering](#)
 - [Product Systems Engineering](#)
 - [Product SE Background](#)
 - [Product as a System Fundamentals](#)
 - [Relate Business Activities](#)
 - [Product SE Key Aspects](#)
 - [Product SE Special Activities](#)
 - [Service Systems Engineering](#)
 - [Service Systems Background](#)
 - [Fundamentals of Services](#)
 - [Properties of Services](#)
 - [Scope of Service Systems Engineering](#)
 - [Value of Service Systems Engineering](#)
 - [Service Systems Engineering Stages](#)
 - [Enterprise Systems Engineering](#)
 - [Enterprise SE Background](#)
 - [The Enterprise as a System](#)
 - [Related Business Activities](#)
 - [Enterprise SE Key Concepts](#)
 - [Enterprise SE Process Activities](#)
 - [Enterprise Capability Management](#)
 - [Systems of Systems \(SoS\)](#)
 - [Architecting Approaches for SoS](#)
 - [Socio-Technical Features of SoS](#)
 - [Capability Engineering](#)
 - [Healthcare Systems Engineering](#)
 - [Overview of the Healthcare Sector](#)
 - [Systems Engineering in Healthcare Delivery](#)
 - [Systems Biology](#)
 - [Lean in Healthcare](#)
- [Part 5: Enabling Systems Engineering](#)
 - [Enabling Businesses and Enterprises](#)
 - [SE Organizational Strategy](#)
 - [Determining Needed Capabilities](#)
 - [Organizing Business to Perform SE](#)
 - [Assessing SE Performance](#)
 - [Developing SE Capabilities](#)
 - [Culture](#)
 - [Enabling Teams](#)
 - [Team Capability](#)
 - [Team Dynamics](#)
 - [Diversity, Equity, and Inclusion](#) ****New Article****
 - [Technical Leadership in SE](#)
 - [Enabling Individuals](#)
 - [Roles and Competencies](#)
 - [Assessing Individuals](#)
 - [Developing Individuals](#)
 - [Ethical Behavior](#)
- [Part 6: Related Disciplines](#)
 - [Systems Engineering and Environmental Engineering](#)
 - [Systems Engineering and Geospatial/Geodetic Engineering](#) ****New Article****

- [Overview of Geospatial/Geodetic Engineering](#) ****New Article****
 - [Relationship between Systems Engineering and Geospatial/Geodetic Engineering](#) ****New Article****
- [Systems Engineering and Industrial Engineering](#)
- [Systems Engineering and Project Management](#)
 - [The Nature of Project Management](#)
 - [An Overview of the PMBOK® Guide](#)
 - [Relationships between Systems Engineering and Project Management](#)
 - [The Influence of Project Structure and Governance on Systems Engineering and Project Management Relationships](#)
 - [Procurement and Acquisition](#)
 - [Portfolio Management](#)
- [Systems Engineering and Software Engineering](#)
 - [Software Engineering in the Systems Engineering Life Cycle](#)
 - [The Nature of Software](#)
 - [An Overview of the SWEBOK Guide](#)
 - [Key Points a Systems Engineer Needs to Know about Software Engineering](#)
 - [Software Engineering Features - Models, Methods, Tools, Standards, and Metrics](#)
- [Systems Engineering and Quality Attributes](#)
 - [Human Systems Integration](#)
 - [Manufacturability and Producibility](#)
 - [System Affordability](#)
 - [System Hardware Assurance](#) ****New Article****
 - [System Reliability, Availability, and Maintainability](#)
 - [System Resilience](#)
 - [System Resistance to Electromagnetic Interference](#)
 - [System Safety](#)
 - [System Security](#)
- [Part 7: SE Implementation Examples](#)
 - [Matrix of Implementation Examples](#)
 - [Implementation Examples](#)
 - Defense System Examples
 - [Submarine Warfare Federated Tactical Systems](#)
 - [Virginia Class Submarine](#)
 - Information System Examples
 - [Complex Adaptive Taxi Service Scheduler](#)
 - [Successful Business Transformation](#)
 - [FBI Virtual Case File System](#)
 - Management System Examples
 - [Project Management for a Complex Adaptive Operating System](#)
 - Medical System Examples
 - [Next Generation Medical Infusion Pump](#)
 - [Medical Radiation](#)
 - [Design for Maintainability](#)
 - Space System Examples
 - [Global Positioning System](#)
 - [Global Positioning System II](#)
 - [Russian Space Agency Project Management Systems](#)
 - [Cassini/Huygens](#)

- [Hubble Space Telescope](#)
 - [Applying MB Approach for 30 Meter Telescope](#)
 - [MSTI Spacecraft](#)
 - [Apollo 1 Disaster](#)
- Transportation System Examples
 - [Denver Baggage Handling](#)
 - [FAA Advanced Automation System](#)
 - [FAA NextGen](#)
 - [UK Route Modernisation](#)
 - [Korean Light Transit System](#)
- Utilities Examples
 - [Northwest Hydro System](#)
 - [Singapore Water Management](#)
- [Part 8: Emerging Knowledge](#)
 - [Emerging Topics](#)
 - [Socio-technical Systems](#) *New Article*
 - [Artificial Intelligence](#) *New Article*
 - [Verification and Validation of Systems in Which AI is a Key Element](#) *New Article*
 - [Transitioning Systems Engineering to a Model-based Discipline](#)
 - [Model-Based Systems Engineering Adoption Trends 2009-2018](#)
 - [Digital Engineering](#)
 - [Set-Based Design](#)
 - [Emerging Research](#)



- Use the SEBoK
 - [How to Read the SEBoK](#)
 - [Download SEBoK PDF](#)
 - [Copyright Information](#)
 - [Cite the SEBoK](#)
 - [About the SEBoK](#)
- Navigation
 - [Knowledge Areas](#)
 - [Topics](#)
 - [Use Cases](#)
 - [Examples](#)
 - [Glossary of Terms](#)
 - [Acronyms](#)
 - [Primary References](#)
- Toolbox
 - [Recent Changes](#)
 - [Random Page](#)
 - [What Links Here](#)
 - [Special Pages](#)

Quicklinks

- [Main Page](#)
- [Note to Reviewers](#)
- [How to Read the SEBoK](#)
- [Acknowledgements](#)
- [Copyright Information](#)
- [About the SEBoK](#)
- [Download SEBoK PDF](#)

Outline

- [Table of Contents](#)
- [Part 1: Introduction](#)
- [Part 2: Systems](#)
- [Part 3: SE and Management](#)
- [Part 4: Applications of SE](#)
- [Part 5: Enabling SE](#)
- [Part 6: Related Disciplines](#)
- [Part 7: Examples](#)

Navigation

- [Knowledge Areas](#)
- [Topics](#)
- [Use Cases](#)
- [Case Studies](#)
- [Vignettes](#)
- [Glossary of Terms](#)
- [Acronyms](#)
- [Primary References](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Browse properties](#)

• This page was last edited on 19 May 2021, at 20:44.

- [Privacy policy](#)
- [About SEBoK](#)
- [Disclaimers](#)

