

# Systems Engineering and Geospatial/Geodetic Engineering

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Geographic Information Systems (GIS) and geospatial applications and infrastructures are widely used and widely integrated into other systems. Among the most well-known such 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. Where it is often claimed that 80% of all data may be geospatially referenced, research by Hahmann and Burghardt (2013) indicates that about 60% of all data have a spatial reference; i.e. the data can be related to a physical coordinate in a spatial reference system, or identified by a geographic identifier. 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. 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); GIS; spatial reference systems; processing, analysis and visualization (portrayal) of geographic data. It briefly analyzes to what extent the Systems Engineering Specialty Activities listed in the INCOSE Systems Engineering Handbook (2015) and modeling and simulation may be supported by related subject matter expertise. As a consequence it concludes that GGE activities could be considered as dedicated Specialty Engineering activities themselves within Systems Engineering.



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## **Topics**

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This Knowledge Area includes three topic articles:

- Overview of Geospatial/Geodetic Engineering
- Relationship between Systems Engineering and Geospatial/Geodetic Engineering
- Further Insights into Geospatial/Geodetic Engineering

## **References**

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### **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.

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