Appendix A – Further Reading

As the authors of this book, we hope you have found the material useful and easy to understand. However, this book is merely a beginning. In the following sections, we have listed a number of good books that you can read for more in-depth coverage of SysML and other subjects related to model-based systems engineering.

SysML Books

- **Delligatti, Lenny –** *SysML Distilled: A Brief Guide to the Systems Modeling Language.* Addison-Wesley Professional, 2013

  SysML Distilled is an excellent, compact, all-around text for engineers who want to develop a more thorough understanding of SysML. In fact, this book is Dave's primary "go to" reference when he has questions about the more subtle/advanced details of SysML. Prior to working as a systems engineer, Lenny Delligatti had experience both as a naval officer and as a high school mathematics teacher. This leadership and instructional background come through in his well-organized, and straightforward textbook.

- **Douglass, Bruce Powel –** *Agile Systems Engineering, 1st Edition.* Waltham, MA, USA:Morgan Kaufmann, 2015

  Bruce Powel Douglass was involved in the development of specifications for both UML and SysML and is a prolific author, having written extensively about the use of UML for real-time applications.

  The scope of this book is somewhat broader than the other two, including more guidance on methodology. The treatment of SysML is brief – one chapter, 80 pages. However, that 80 pages includes some important insights, such as his treatment of:

  - role versus type (page 88)
  - the relationship of block definition, internal block definition, and package diagrams (page 94)
  - model organization for a large project (page 104)
  - value properties in blocks, parts, and instances (page 108)

  This book also goes into depth on the development and management of use cases and requirements.

- **Friedenthal, Sanford and Alan Moore, Rick Steiner –** *A Practical Guide to SysML, Third Edition: The Systems Modeling Language.* Morgan Kaufmann, 2014

This book is the authoritative reference on SysML and its authors are key leaders in the ongoing development of the standard. Since the SysML standard itself includes limited explanatory content, this book is helpful as a sort of window into the intent of the leaders of the SysML standard development.

- **Weilkiens, Tim –** *Systems Engineering with SysML/UML: Modeling, Analysis, Design (The MK/OMG Press) 1st Edition.* Morgan Kaufmann, 2008

  This book is one of the early works on SysML. Tim Weilkeins remains a leader in the SysML community and is heavily involved in developing the next version of the language: SysML V2

Systems Engineering Books

While this book shows how to model very simple examples, your success in using *Cameo Systems Modeler* for larger projects will depend heavily on your mastery of some classical systems engineering skills. These books are good sources of information about classical systems engineering activities.

- **Cockburn, Alistair –** *Writing Effective Use Cases.* Addison-Wesley, 2001

  Use cases are used in both software development and systems engineering. Writing effective use cases is not easy. Where do you start? What do you include? How much is too much? This book is regarded by many to be best book ever written on this difficult topic.

- **INCOSE –** *INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, 4th Edition.* Wiley, 2015

  This is the handbook of the International Council on Systems Engineering. As such, it is a handy, compact compendium of standard systems engineering techniques – including, but not limited to model-based systems engineering.

- **Jenney, Joe with Mike Gangl, Rick Kwolek, David Melton, Nancy Ridenour, Martin Coe –** *Modern Methods of Systems Engineering: With an Introduction to Pattern and Model Based Methods, 4th Edition.* CreateSpace Independent Publishing Platform, 2011

  This book gives a solid overview of general systems engineering techniques with an overview of model-based and pattern methods as promised by the title. However, what Dave found most valuable was actually chapter 2 with its brief but fascinating accounts of:

  - The development of the highly innovative Cord 810 in 1935 by a 3-person design team in about six months – including the production of 100 prototype vehicles. This feat would be utterly unimaginable in today's automobile industry.

- The development of World War II aircraft in which the designers had offices on balconies overlooking the line that was producing the first aircraft. This close proximity allowed them to step out and look at the aircraft in seconds, as well as walk down a stairway and touch it within a minute.

This chapter does an excellent job of setting the correct frame of reference: the real problem is neither fancy tools nor abstract modeling grammars; the real problem is the complexity of the human communication. Even though chapter 2 is brief, this chapter alone is worth the purchase price of the book.

Model-Based Engineering Books

These books provide some alternate approaches to and a broader view of the model-based engineering discipline.

- **Aleksandravičienė, Aistė and Aurelijus Morkevičius, PhD –** *MagicGrid® BOOK OF KNOWLEDGE*. Vitae Litera, 2021

  This free e-book lays out the MagicGrid® framework for creating models to define complex systems. The NoMagic team at Dassault Systèmes wrote this e-book in response to customers who asked for a clear and straightforward step-by-step method for creating a model of a system. The book is available on request from .

- **Beatty, Joy and Anthony Chen –** *Visual Models for Software Requirements*. Microsoft Press, 2012

  Joy Beatty and Anthony Chen present an excellent step-by-step method for developing requirements for typical IT end-user applications. The authors present a method for using Microsoft Visio to produce diagrams for clarifying the structure and behavior of the IT application to be developed. Visio is chosen because it is more widely available, less expensive, and easier to learn to use than most SysML tools.

- **Brambilla, Marco and Jordi Cabot, Manuel Wimmer –** *Model-Driven Software Engineering in Practice*. Morgan & Claypool Publishers, 2012

  One challenge in looking into model-driven and model-based engineering methods is that most of the key textbooks were written ten or more years ago. This concise book is an excellent up-to-date review of activity in the field. The book is particularly useful for navigating the blizzard of acronyms and related standards.

  Dave particularly liked Chapter 5 "Integration of MDSE in Your Development Process". Since the initial surge of enthusiasm in the early 2000s, model-driven approaches have suffered a number of setbacks and there are quite a few disillusioned veterans around. [(1)] Chapter 5 covers some of the different sociological

problems that model-driven development can introduce into an organization such as fears about job security. Chapter 5 is a must-read for anyone considering introducing model-driven or model-based engineering techniques to a larger product development organization.

- **Casse, Olivier –** *SysML in Action with Cameo Systems Modeler (Implementation of Model Based System Engineering Set) 1st Edition.* ISTE Press - Elsevier, 2017

  SysML is methodology agnostic. While this attribute of SysML allows it to flexibly adapt to a wide range of methodologies and systems, the lack of clear methodology can be quite confusing for a beginner.

  This book describes, in addition to the SysML notation, a generic approach based on the main principles of SE and relative standards, serving as the basis for a specific MBSE approach to be built.

  This is the first book on SysML by coauthor Olivier Casse. This book is available in English, French, and Simplified Chinese editions.

- **Kelly, Steven and Juha-Pekka Tolvanen –** *Domain-Specific Modeling: Enabling Full Code Generation.* Wiley IEEE Computer Society Press, 2008

  One of the weaknesses of SysML is that its rich descriptive power comes with a significant learning curve. Certain aspects of SysML are inherited from UML and can be confusing to users without a background in computer science. The direction of arrows that show a relationship between two blocks can seem counterintuitive to a mechanical engineer. The ends of a relationship between an engine and a crankshaft may be marked as "target" and "client" by the tool. What does that mean!?

  Domain-Specific Modeling attacks this problem by deliberately sacrificing the idea of a universal, interoperable set of graphics. Instead, DSM tools help small organizations make simple, customized tools that draw the graphical diagrams using any set of icons, shapes, arrows, or other conventions that make sense to that particular organization. In an example mentioned often by the authors at conferences, the diagrams that are intuitive to a team that designs railroad stations might not look anything like the diagrams that are intuitive to a related team that designs the railroad network.

  This book lays out the Domain-Specific Modeling approach and introduces the MetaEdit+ tool for creating such focused end-user modeling tools.

- **Roques, Pascal –** *Systems Architecture Modeling with the Arcadia Method: A Practical Guide to Capella (Implementation of Model Based System Engineering), 1st Edition.* ISTE Press - Elsevier, 2017

[1] Many of these disillusioned modeling experts were key early founders of the Agile movement and now resist documentation in any form, especially any sort of modeling.

Leading independent trainer and consultant Pascal Roques introduces the Arcadia method and the Capella tool. This book is available in English and French editions.

- **Voirin, Jean-Luc –** *Model-based System and Architecture Engineering with the Arcadia Method, 1st Edition.* ISTE Press - Elsevier, 2017

  This book describes the fundamentals of the Arcadia method and its contribution to engineering issues such as requirements management, product line, system supervision, and integration, verification and validation (IVV). It provides a reference for the modeling language defined by Arcadia. This book is available in English and French editions.

- **Weilkiens, Tim –** *SYSMOD - The Systems Modeling Toolbox: Pragmatic MBSE with SysML.* MBSE4U, 2020

  Although it does include some information about SysML, this book is more about the methodology. SysML is generally agnostic about methodology. Tim does a nice job in this book of laying out a step-by-step methodology for producing SysML models for complex systems.

Requirements Engineering Books

Once you start working on any really large system, especially one with safety-critical components, there will be no way to avoid large sets of text-based requirements. These books introduce the specialized "requirements engineering" field.

- **Hull, Elizabeth and Ken Jackson, Jeremy Dick –** *Requirements Engineering, 3rd Edition.* Springer, 2010

  This is a compact and concise textbook suitable for a university-level introductory course on requirements engineering. For readers with no background in systematic requirements management, this book does a good job of covering basics like requirements elaboration. [(2)]

- **van Lamsweerde, Axel –** *Requirements Engineering, From Systems Goals to UML Models to Software Specifications.* Wiley, 2009

  This is a thoroughly researched book with an emphasis on formal methods. Professor van Lamsweerde is a proponent of formally structured specification languages – a restricted form of English that reads a little bit like a programming language. He is also a recognized authority on goal-oriented requirements engineering. After thoroughly covering the basics of requirements engineering, this book

[(2)] Requirements elaboration is a very basic topic that gets surprisingly little treatment in some of the other larger books on requirements.

uses structured specification languages and goal-orientation to teach a method for developing the UML models for a software application.

- **Leffingwell, Dean –** *Agile Software Requirements: Lean Requirements Practices for Teams, Programs, and the Enterprise.* Pearson Education, Inc., 2011

  Dean Leffingwell's book actually contains little about requirements. On the other hand, his book is a superb distillation and discussion of the various organizational techniques that fall under the umbrella of "Agile" As he points out, project scope/cost, project schedule, and project quality are an iron triangle. You can only control two of these at a time. Any enlightened executive team that is responsible for the purchase and development of a safety-critical system will do well to think carefully about requirements prioritization and the possible application of some modified Agile approaches to get the best possible scope coverage while not compromising on safety or schedule.

- **Pohl, Klaus –** *Requirements Engineering: Fundamentals, Principles, and Techniques.* Springer, 2010

  If you can only afford one formal reference text for requirements engineering, this is the one you should buy. Klaus Pohl's book is the most comprehensive requirements textbook that Dave has encountered so far. It is clear and well-structured. It very helpfully lays out the evolution of key ideas in the field of requirements engineering with meticulous attribution of the original sources.

  Klaus Pohl also addresses some of the messy reality that is glossed over in other more academic treatments of requirements engineering. Dave particularly liked his treatment of the interaction between "What" and "How" in section 2.3.3 on page 27.

Other Simple Series Books

- **Hetherington, David –** *Simple SysML for Beginners: Using Sparx Enterprise Architect, First Edition.* Asatte Press, 2020

  Simple SysML for Beginners: Using Sparx Enterprise Architect, First Edition is the first book in the "Simple for Beginners" series. Like this book, it introduces SysML using the *Sparx Enterprise Architect* tool.

- **Hetherington, David, Frank Braun, and Olivier Casse –** *Simple SysML for Beginners: Using IBM Rhapsody, First Edition.* Asatte Press, 2023 (Planned)

  Simple SysML for Beginners: Using IBM Rhapsody, First Edition is the third book in the "Simple for Beginners" series. Like this book, it introduces SysML using the *IBM Rhapsody* tool.

- **Roques, Pascal, and David Hetherington –** *Simple Arcadia for Beginners: Using Capella, First Edition.* Asatte Press, 2023 (Planned)

  Simple Arcadia for Beginners: Using Capella, First Edition is the fourth book in the "Simple for Beginners" series. Arcadia is a model-based systems engineering methodology that is not SysML although they do have some similarities. This book introduces the Arcadia methodology and the open source Capella tool.