

# Model-Based Systems Engineering — Basic (SysML/DoDAF) Workshop



**This introduction to Model-Based Systems Engineering familiarizes systems engineers with the basic principles and best practices of SysML and DoDAF modeling. Modeling tool training is optional.**

Although system modeling has been an important part of systems engineering since its inception more than a half-century ago, during the last decade systems engineers have significantly increased their use of model-driven development technologies to **evolve a new discipline of Model-Based Systems Engineering (MBSE)**. MBSE differs from traditional systems engineering, which is sometimes characterized as document centric, in that it **emphasizes a central system model that captures system requirements and the architecture and design decisions that fulfill them**. In addition to serving as a knowledge repository for systems engineering work artifacts, the system model can also be executed to drive system simulations that validate trade studies and design decisions.

**This interactive modeling workshop explains the basic principles and best practices for modeling systems with SysML and DoDAF.** SysML is a dialect of the Unified Modeling Language that is customized for systems engineering applications. DoDAF is the aerospace/defense industry standard framework for organizing system architectures. The hands-on workshop shows you how to construct a well-formed system model with SysML and organize it using DoDAF compliant product views.

## THE PIVOTPOINT TRAINING ADVANTAGE

- **Authored and taught by experts.** All workshops are authored by PivotPoint's founder, Cris Kobryn, an internationally recognized expert in visual modeling languages and model-driven development technologies. (Cris chaired the international standardization teams for UML 1.1, UML 2.0 and SysML 1.0.) In addition, all PivotPoint instructors have 10+ years experience working with Model-Driven Development technologies.
- **Small, intense and interactive.** We limit workshop sizes, usually to a maximum of 12 participants. This ensures that participants get the individual attention that they need to learn quickly. Also, our workshops are intense and highly interactive with frequent work sessions, so you will learn from other participants as well as your instructor.
- **Proven principles and best practices.** Our workshops emphasize proven modeling principles and best practices that will work with all modeling tools that comply with the relevant standards. If you have already chosen a modeling tool, we can integrate optional tool training in your workshop. If you have not yet selected a modeling tool, we can help you select one that best meets your project and team needs.
- **Emphasis on pragmatic problem solving.** Our workshops emphasize the use of modeling technologies to solve tough, practical problems such as those you encounter on your day job. The bigger and more difficult the problem you choose for practice sessions, the more interesting the workshop will be for the participants and the instructor.
- **Flexible choice of venue.** Our workshops are available onsite at Client training facilities, which allow us to customize workshops to meet Client project or team needs, or at PivotPoint training facilities.

## WHAT WILL YOU LEARN?

The following are the key learning objectives of the workshop:

- What is SysML and why do we model systems?
- SysML's basic constructs for modeling requirements, structure, and behavior
- How SysML can specify large, complex systems
- How SysML can specify the full system lifecycle: requirements through testing
- Practical guidelines for specifying correct, clear, concise and consistent SysML models
- The similarities and differences between SysML and UML
- How to draw and execute SysML using a selected SysML tool [optional]
- What is DoDAF and why do we model architectures with frameworks? [optional]
- How SysML can be used as Architecture Description Language for DoDAF [optional]
- Practical guidelines for specifying correct, clear, concise and consistent DoDAF specifications [optional]
- How to learn more about SysML and DoDAF modeling

## WHO SHOULD PARTICIPATE?

System engineers, system architects, project managers, and others who want to learn how to improve how they specify system models and architectures will benefit from this workshop.

## PREREQUISITES

Systems engineering experience in building large, complex systems. No prior knowledge of SysML or DoDAF is required for this workshop.

## WORKSHOP AUTHOR & PRIMARY INSTRUCTOR



**Cris Kobryn** is the CEO and Founder of PivotPoint Technology Corporation, a company that specializes in Model-Driven Engineering Solutions™ for tough business and engineering problems. He is an internationally recognized expert in visual modeling and model-driven development, and has successfully applied these technologies to diverse industries ranging from aerospace-defense and telecom to financial services and manufacturing. Cris has global experience leading high-performance software development teams, and has architected custom applications and commercial products. He formerly held senior technical positions at Telelogic, EDS, MCI Systemhouse, Inference Corporation, and SAIC.

Cris chaired large international teams of vendors and users to specify the Unified Modeling Language (UML) 1.1 and 2.0 standards for software engineering, and the Systems Modeling Language (SysML) for systems engineering. In recognition of Cris's contributions to the UML the Object Management Group (OMG) presented him with its Distinguished Service Award, and in acknowledgement of his contributions to the SysML the International Council on Systems Engineering (INCOSE) presented him with its Outstanding Service Award. Cris is a contributing editor for *Software and Systems Modeling* journal, and a member of IEEE, INCOSE, ACM, and AAAI.

## WORKSHOP SYLLABUS

The workshop syllabus, in a menu form that can be customized to meet your needs, is described at the end of this handout. NOTE: This workshop description and syllabus are subject to revision. Check [www.PTCorp.com/training.htm](http://www.PTCorp.com/training.htm) for updates.

## WORKSHOP SIZE

The number of workshop participants is restricted to maximize interactions with the instructor, especially during modeling lab sessions. Most workshops are restricted to 12 or fewer participants. Exceptions must be approved by the instructor.

## COST, AVAILABILITY, AND FURTHER INFORMATION

This workshop is available at client sites, PivotPoint instructional facilities, or by web conferencing. Costs depend upon your choice of venue, duration, and the number of participants. For further information regarding the contents, availability, and cost of the workshop please email [workshops@PTCorp.com](mailto:workshops@PTCorp.com) or call +1-760-728-9747.

# WORKSHOP MENU

All PivotPoint workshops include both structured presentations and interactive hands-on work sessions to reinforce learning principles and best practices. In addition, workshops can be customized for different project and team requirements.

- **3 day workshop** includes: *SysML – Basic*, *SysML – Intermediate*, and either *DoDAF – Basic* or *SysML – Basic Modeling Tool*.
- **4 day workshop** includes: *SysML – Basic*, *SysML – Intermediate*, and both *DoDAF – Basic* and *SysML – Basic Modeling Tool*.
- **5 day workshop** includes: All workshop modules in the 4 day workshop plus *Project Practicum – Basic*.

<p style="text-align: center;"><b>SYSML – BASIC</b> [Module# LS101]</p> <p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Model-Based Systems Engineering</li> <li>• Basic Concepts</li> <li>• Principles and best practices</li> </ul> <p><b>SysML Quick Tour</b></p> <ul style="list-style-type: none"> <li>• Language overview</li> <li>• Diagram walkthrough</li> </ul> <p><b>Diagram Techniques</b></p> <ul style="list-style-type: none"> <li>• Use Case diagrams</li> <li>• Requirement diagrams</li> <li>• Activity diagrams</li> <li>• Block Definition diagrams</li> </ul> <p><b>Lifecycle Phases</b></p> <ul style="list-style-type: none"> <li>• Requirements</li> <li>• Analysis</li> </ul>	<p style="text-align: center;"><b>Goals</b></p> <ul style="list-style-type: none"> <li>• Understand the advantages of a Model-Based Systems Engineering approach</li> <li>• Comprehend the differences among architectural models, frameworks, processes and tools</li> <li>• Understand the similarities and differences between SysML and UML</li> <li>• Learn the basic concepts and principles for modeling complex systems with SysML</li> <li>• Understand how to specify a correct, complete, concise, and consistent model</li> </ul>
<p style="text-align: center;"><b>SYSML - INTERMEDIATE</b> [Module# LS102]</p> <p><i>Prerequisites: SysML – Basic or equivalent.</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• Architecture description languages, patterns and frameworks</li> <li>• Interface-based design and Service-Oriented Architectures (SOA)</li> <li>• Verification &amp; Validation (V&amp;V) techniques</li> </ul> <p><b>Diagram Techniques</b></p> <ul style="list-style-type: none"> <li>• Internal Block diagrams</li> <li>• Sequence diagrams</li> <li>• State Machine diagrams</li> <li>• Parametric diagrams</li> <li>• Package diagrams</li> <li>• Allocation tables</li> </ul> <p><b>Lifecycle Phases</b></p> <ul style="list-style-type: none"> <li>• Design</li> <li>• Construction</li> <li>• Testing</li> </ul>	<p style="text-align: center;"><b>Goals</b></p> <ul style="list-style-type: none"> <li>• Understand how to use SysML as an architecture description language</li> <li>• Learn how to make your models more scaleable</li> <li>• Understand how to improve the integrity and quality of your models</li> <li>• Learn how to apply SysML modeling techniques to the full system development life cycle</li> <li>• Understand how to verify and validate your models</li> </ul>

<p style="text-align: center;"><b>DoDAF – BASIC (SysML)</b> [Module# FD101-S]</p> <p><i>Prerequisites: SysML – Intermediate or equivalent.</i></p> <p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Architectural frameworks</li> <li>• Basic concepts</li> <li>• Principles and best practices</li> </ul> <p><b>DoDAF Quick Tour</b></p> <ul style="list-style-type: none"> <li>• Framework overview</li> <li>• View and product walkthrough</li> </ul> <p><b>SysML Quick Tour</b> <i>[If SysML crash course or refresher required]</i></p> <p><b>Selected Operational View Products</b></p> <ul style="list-style-type: none"> <li>• OV-1 High Level Operational Concept Graphic (Use Case/Block diagram)</li> <li>• OV-2 Operational Node Connectivity Description (Block diagram)</li> <li>• OV-4 Organizational Relationships Chart (Block diagram)</li> <li>• OV-5 Operational Activity Model (Activity diagram)</li> <li>• OV-6b Operational State Transition Description (State Machine diagram)</li> <li>• OV-6c Operational Event Trace Description (Sequence diagram)</li> <li>• OV-7 Logical Data Model (Block diagram)</li> </ul>	<p style="text-align: center;"><b>Goals</b></p> <ul style="list-style-type: none"> <li>• Understand the advantages of an architecture framework approach</li> <li>• Learn how to define DoDAF Operational Views using SysML as an architecture description language</li> <li>• Understand how to specify a correct, complete, concise, and consistent DoDAF compliant system model</li> </ul>
<p style="text-align: center;"><b>SysML – BASIC MODELING TOOL</b> [Module# LS111]</p> <p><i>Prerequisite: SysML – Intermediate or equivalent.</i></p> <p><i>[We support several leading SysML modeling tools. See <a href="http://www.ptcorp.com/training.htm">www.ptcorp.com/training.htm</a> for modeling tools currently supported. Client can select or we will recommend one.]</i></p> <p style="text-align: center;"><b>Selected Modeling Tool Tour</b></p> <ul style="list-style-type: none"> <li>• Projects and diagrams</li> <li>• Generating documentation</li> <li>• Roundtrip engineering</li> <li>• Importing/exporting models</li> <li>• Model validation and metrics</li> </ul> <p style="text-align: center;"><b>Diagram Techniques</b></p> <ul style="list-style-type: none"> <li>• Requirement diagrams</li> <li>• Activity diagrams</li> <li>• Block Definition diagrams</li> <li>• Internal Block diagrams</li> <li>• Parametric diagrams</li> <li>• Sequence diagrams</li> <li>• State Machine diagrams</li> <li>• Package diagrams</li> <li>• Use Case diagrams</li> <li>• Allocation tables</li> </ul>	<p style="text-align: center;"><b>Goals</b></p> <ul style="list-style-type: none"> <li>• Gain familiarity with the user interface and basic features of selected SysML modeling tool</li> <li>• Learn how to model most common SysML diagram types using selected tool</li> <li>• Understand the strengths and weaknesses of selected tool</li> <li>• Assess SysML and XMI standards compliance for selected tool</li> </ul>

## PROJECT PRACTICUM – BASIC

[Module# MB121]

*Prerequisites: SysML – Intermediate and DoDAF – Basic or equivalent.*

*[This practicum provides an opportunity to apply modeling principles and best practices to solve a practical problem in a creative and supervised workshop environment. Participants can identify a problem in advance, or Instructor will work with participants to identify a practical problem.]*

### Topics

- Specifying an Analysis model view
- Specifying a Design model view
- Specifying DoDAF Operational View (OV) products (optional)

### Modeling Techniques

- Intermediate SysML modeling techniques [see Module# LS102]
- Basic DoDAF modeling techniques [see Module# FD101-S]

### Putting It All Together

- Analysis/Design model peer review
- Next steps

### Goals

- Identify the MBSE principles and best practices that are most important to your team and your project
- Apply basic MBSE modeling techniques to a practical problem that you choose