



## CRaG Systems Modelling Training and Consultancy

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# MBSE with SysML and Enterprise Architect Hands-On Workshop Training Course - 4 Days

This training course teaches the Model-Based approach to Systems Engineering (MBSE) using the SysML modelling language and Sparx Systems Enterprise Architect modelling tool. It is aimed at systems engineers, mechanical engineers, system architects and developers who want to produce a detailed model of the structure and behaviour of real world systems sufficient to form the detailed specification, architecture and design of equipment for industrial, automotive, nuclear, military and aerospace applications. The industry best practice model-based systems engineering (MBSE) techniques are based on the Systems Modelling Language SysML v1.4 and are taught within the context of systems engineering disciplines including specification, analysis, architecture, design, validation, verification and testing.

Students produce a model of their own system, or one from within their own domain, using the Sparx Systems Enterprise Architect SysML modelling tool in interactive modelling sessions guided by the instructor.

The models produced are sufficiently detailed to form the basis for the design of systems using a mixture of mechanical, hydraulic, electrical, electronic, firmware and software, real-time and embedded systems architectures. Each technique is taught to the level required for competence on a real project.

### Delegates will learn:

- The basics and the necessary detail of the Systems Modelling Language SysML
- The basics and the necessary detail of the use of Sparx Systems Enterprise Architect
- How to create and maintain a diagram of hierarchical and interdependent written requirements
- How to create and maintain traceability between requirements and parts of the model
- How to create an overview of the external functional requirements of a system with actors and use cases on a use case diagram
- How to write an effective use case description in a way that satisfies both non-technical and technical stakeholders
- How to model high-level system structure and decomposition using block definition diagrams, blocks, ports and relationships
- How to model the detailed internal structure of blocks on internal block diagrams using parts, ports, connectors and flows
- How to define structural and functional parameters and constraints using constraint blocks, parametric diagrams and constraint properties
- How to model simple, hierarchical and concurrent behaviour using activities, actions, control and object flows on activity diagrams
- How to model timing, interaction and messaging between actors, blocks and parts using synchronous and asynchronous messages on sequence diagrams
- How to model state dependant behaviour using states, transitions, events and actions on state machine diagrams
- How to generate and maintain documents from the different parts of the model
- How to link the model with externally maintained documents and data
- How to use the tool in a multi-user environment integrated with a version control system or using the internal baselining capabilities
- How to use the project management capabilities available within Enterprise Architect

## Suitable for:



Systems Engineers, Mechanical Engineers, Requirements Gatherers, System Architects, Analysts and Developers with at least 2 years experience. This workshop is not suitable for those seeking certification as a step towards a qualification. See the Certification Policy for a detailed discussion.

## Project Materials Preparation:



The client is advised to provide adequate documentation regarding the overall project goals and functionality of the project to be modelled, under non-disclosure if necessary, at least 2 weeks prior to the start of the training, if possible. If no project documentation is available, then a stakeholder with a suitable knowledge of the problem domain should be available to take part in the workshop sessions. Stakeholder involvement in problem domain modelling sessions is always encouraged.

## On-Site Workshop Training Course Logistics:



Workshop training courses are delivered at the clients' site and attendance is normally limited to 12 students. Workshops normally start at 9.30am on the first day and 9.00am on subsequent days with an hour for lunch and a 15 minute break in the morning and again the afternoon. Workshops normally finish at 5.00pm each day. The client is expected to provide an appropriate venue, equipment and refreshments. Required equipment includes an XGA/WXGA projector and screen, whiteboard or flipchart and at least one computer per two students loaded with either the evaluation version of Enterprise Architect or a recent licenced copy. For a full discussion of on-site workshop issues please see On-Site Course and Workshop Logistics. Printed course manuals for each student with copies of all presentations, exercises and solutions are provided.

## Pricing:



On-site (in-house) workshop pricing is available from the On-Site Workshop Price Calculator page For consultancy pricing please see the On-Site Consultancy Price Calculator.

## Training Course Outline

Day 1	Day 2
<p><b>Introduction</b></p> <p>People - Course Structure - Modelling - Systems Engineering - System Modelling Language SysML</p> <p><b>Requirements Modelling</b></p> <p>Requirements Diagrams, Requirements and Hierarchy - Derived, Copy, Satisfy and Trace Dependencies - Test Cases - Problems, Rationale, Allocations and Callouts - Generating Documents - Managing Traceability - Repositories</p> <p><b>Requirements Modelling Workshop</b></p> <p><b>Specifying Functional Requirements with Use Cases</b></p> <p>System Use Cases and Actors - Primitive Use Cases and the Basic Course - Writing Effective Use Case Descriptions - Writing Sub-flows and Alternate Flows - 'Include' and 'Extend' Relationships - Modelling Timing Constraints</p> <p><b>System Use Case Workshop</b></p>	<p><b>Block Definition Diagrams</b></p> <p>Blocks - Block Definition Diagrams - Namespace and Structure Compartments - Value Types, QuantityKind, Units - Enumerations - Stereotypes - Instance Specifications - Dependency - Reference Associations, Part and Shared Associations - Containment - Generalization</p> <p><b>Block Definition Diagrams Workshop</b></p> <p><b>Internal Block Diagrams</b></p> <p>Parts and Properties - Internal Block Diagrams - Connectors and Item Flows - Ports, Connectors and Item Flows - Blocks and Value Types to Specify Ports and Item Flows - Interface Blocks and Blocks as Function and Data Types - Proxy and Full Ports - Signals to Specify Events and Messages</p> <p><b>Internal Block Diagrams Workshop</b></p>

## Day 3

### **Parametric Modelling**

Constraint Blocks - Parametric Diagrams - Constraint Properties

#### ***Parametric Modelling Workshop***

### **Modelling Behaviour as Activity**

Activity Diagrams - Activities, Activity Parameters, Parameter Sets - Actions, Action Pins, Control and Stream Pins - Objects - Control and Object Flows - Events, Signals and Interruptible Regions - Control Operator, Call Behavior Action - Control Nodes: Initial, Final, Decision, Merge, Fork and Join - Partition and Allocation - Hierarchy with Structured Activities

#### ***Activity Modelling Workshop***

## Day 4

### **Modelling Interaction and Messaging**

Interactions, Messages, Operations and Methods - Sequence Diagrams - Diagram Links - Synchronous and Asynchronous Messages - Selection and Iteration - Execution Specification - Creation and Destruction - Timing Constraints

#### ***Interaction Modelling Workshop***

### **Modelling State Dependant Behaviour**

The Meaning of the State Model - State Machine Diagrams - States and Transitions - Events and Conditions - Actions and Activities - Hierarchy and Concurrency - Actions on a State - Consistency with Other Diagrams - Direct Implementation

#### ***State Modelling Workshop***

Should the content of the available SysML courses not fit your exact requirements, then CRaG Systems can create a custom course for you. Please either email or call us to discuss your particular needs.

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