



## SYSTEMS ENGINEERING: APPLICATION AND DEVELOPMENT (IS-001)

### Course Overview

*What does Systems Engineering mean? Why is it important to understand this discipline and to implement it in a project? How can a proper Systems Engineering plan be implemented to each project? All these questions and further will be answered in this course.*

### Summary of contents

#### **Module 1: Systems Engineering and its relationship with other areas of a project**

*The first part of the course will be dedicated to introduce the Systems Engineering discipline and to explain the importance of implementing it in a project, with the aim of finishing the project within specifications and complying with the assigned budget and schedule. This module will also describe the Project Phases and the interfaces of the Systems Engineering with other project disciplines.*

#### **Module 2: Systems Engineering Activities**

*The second part will be focused on identifying and detailing the different areas that make up the Systems Engineering discipline. Each area is composed of several activities that will be defined and analyzed with the aid of practical examples.*

#### **Module 3: Development of a Systems Engineering Plan**

*The third module will explain how to implement a Systems Engineering Plan in a project. We will produce an example of a Systems Engineering Plan and will identify the activities that need to be performed at each project phase, the documentation that has to be generated and the reviews to be successfully passed before starting the next phase.*



## SYSTEMS ENGINEERING: APPLICATION AND DEVELOPMENT (IS-001)

### Module 1: Systems Engineering and its relationship with other project areas

#### Module 1.1. Systems Engineering definition

- ❖ What is Systems Engineering?
- ❖ Why should Systems Engineering be implemented in a project?

#### Module 1.2. System definition

- ❖ Configuration element, component and part
- ❖ System, subsystem and Product Tree

#### Module 1.3. Project Phases

- ❖ System Needs Identification
- ❖ Conceptual Design
- ❖ Preliminary Design
- ❖ Detailed Design
- ❖ Manufacturing, implementation, acquisition and/or production
- ❖ Operation
- ❖ Disposal

#### Module 1.4. Systems Engineering Organization within a project

#### Module 1.5. Different organizations for different project types and sizes

#### Module 1.6. Systems Engineering process and activities

- ❖ Systems Engineering process
- ❖ Systems Engineering activities
  - System Control and Integration
  - Requirements
  - Analysis
  - Configuration and Design
  - Verification

#### Module 1.7. Interfaces of Systems Engineering with the rest of project areas

- ❖ Project Management
- ❖ Quality
- ❖ Production
- ❖ Operation and RAMS

#### Module 1.8. Systems Engineering Implementation

- ❖ Systems Engineering Plan development and execution

#### Module 1.9. Introduction to MBSE/SysML

- ❖ Introduction to Model Base System Engineer (MBSE) and to SysML



## Module 2: Systems Engineering Activities

### Module 2.1. Requirement Engineering

- ❖ Requirement engineering process
- ❖ Functional and technical requirements
- ❖ Concept of Operation
- ❖ What is a requirement?
- ❖ How do requirements be defined?
- ❖ Requirement documents
- ❖ Requirement management tools

### Module 2.2. Analysis

- ❖ Functional analysis
- ❖ Requirement allocation analysis
- ❖ Simulations models
- ❖ RAMS
- ❖ Trade-offs
- ❖ System analysis
- ❖ Analysis documentation

### Module 2.3. Design and Configuration

- ❖ Reference lines
- ❖ Design and configuration process
- ❖ Product Tree
- ❖ Interfaces
- ❖ System errors and technical budgets
- ❖ Engineering tools

### Module 2.4. Verification

- ❖ Verification process
- ❖ Verification methods
- ❖ Verification tools
- ❖ Verification process documentation and control

### Module 2.5. System Control and Integration

- ❖ Systems Engineering plan development and evaluation
- ❖ Coordinate systems, units and standards
- ❖ Technology matrix
- ❖ Configuration management
  - Configuration changes
  - Non-conformity
  - Anomalies
- ❖ Risk management
- ❖ Engineering data management



## Module 3: Development of a Systems Engineering Plan

### Module 3.1. System Needs Identification

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ Project Definition Review

### Module 3.2. Conceptual Design

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ Preliminary Requirements Review

### Module 3.3. Preliminary Design

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ Preliminary Design Review (PDR)

### Module 3.4. Detail Design

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ Critical Design Review (CDR)

### Module 3.5. Implementation, Acquisition and/or Production

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ System Acceptance Review (SAR)

### Module 3.6. Operation

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ End-Life Review

### Module 3.7. Disposal

- ❖ Objectives and data flow
- ❖ Activities description and output documents
- ❖ Mission Final Review (MFR)