Model Based Systems Engineering in detail

DS User Conference Hanau, December 5

Gauthier FANMU4
Agenda

Introduction

Development process

Collaborative Model Based Systems Engineering

Systems Engineers journey

Take away
From mechanical Experience twins... to cyber Experience twins

Typical figures in T&M and A&D (one program)

- 2,000 – 5,000 components
- 4,000 – 15,000 functions
- 100,000 interfaces
- 0.5 – 1 M requirements

Projection
Volume & speed

Mechanical system

Mechatronics systems
Multidisciplinary field that includes a combination of mechanical, electrical, control and software

Cyber systems
Populations of software-intensive distributed systems interacting together in an unpredictable world
Why model based is essential

- Rapid system impact assessment of design modifications
- Accelerated collaboration on single source of truth
- Efficiency: eased reuse and configured architecture
- Productivity: documents generation
- Quality: interface mastering & specification consistency
- Improved communication and buy-in
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Take away
Development Process: Automotive example

- **Concept Studies**
  - Style
  - Geometry
  - Systems

- **Preliminary Design**
  - Synthesis
    - Style
    - Product
    - Technique

- **Detailed design**
  - M2

- **Manufacturing & assembly**
  - M6

**Project duration**
Development Process: How

**What to do?**
Processes

Define activities to implement and expected results

**How to do?**
Methods

Defines technics & methodology to implement the activities

**With what?**
Tools

Improve the efficiency of tasks implementation, use of methods
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Take away
Model Based Systems Engineering: Methodology

Solution free

Conceptual

System of Systems

Define Mobility Experience

Integrate Verify and Validate the SoS

Product

Define Needs for Vehicle Project

Integrate Verify and Validate the Vehicle

Functional & Logical

Design Function Project

Manage Change

Design Vehicle Project Architecture

Layers of abstraction

Technical

Solution

Design the Vehicle Project technical solution

Implement the Vehicle Project components

Implement

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Model Based Systems Engineering: Methodology

- Conceptual
- Design Vehicle Project Architecture
- Design the Vehicle Project technical solution
- Implement the Vehicle Project components
- Concept studies
- Preliminary design
- Detail design
- Integrate Verify and Validate the SoS
- Integrate Verify and Validate the Vehicle

Solution free
Technology dependent

Verify = make the product right
Validate = make the right product
Model Based Systems Engineering: Methodology

Verify = make the product right
Validate = make the right product
Model Based Systems Engineering: Roles

- System Architect
- Mobility Architect
- Function Leader
- IVV Engineer
- Project Manager
- Disciplines Architect
- Requirements Manager
- Disciplines Engineers
- Safety Lead

Strongly iterative & collaborative
# Model Based Systems Engineering: Viewpoints

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- **Requirements**
- **Use cases / Behavior**
- **Structure**
- **Safety**
- **Constraints / Decisions**

Objects are displayed in multiple views to ensure consistency and completeness of system definition.

(AudiGrid example)
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Systems Engineers and Designers journey

Take away
Systems Engineers and Designers journey
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Take away
Take away

▶ Why
  ▶ Complexity of Cyber Physical Systems is growing fast
  ▶ Discipline in silos: miscommunication
  ▶ Late discovery of design inconsistencies

▶ How
  ▶ Consistent Process Method & Tools approach
  ▶ Disciplines federation: interfaces mastering
  ▶ Data federation for holistic end-to-end traceability
  ▶ Collaborative Model Based Systems Engineering with the value stream
  ▶ Accurate decision making with continuous validation of system behavior
Thank you for your attention

QUESTIONS?