INCOSE

International Council on Systems Engineering

A better world through a systems approach

Model-Based Systems Engineering for Industrial Systems

- Gauthier FANMUY
- Saulius PAVALKIS
- Adel TAGHIYAR
- Tarik KEBDANI

Ready for Shift?

Gauthier FANMUY

Director CATIA Cyber Systems Industry Process Expert

Helping Industry to understand the value of Virtual Twin Experiences and Model-Based Systems Engineering. Certified OMG UAF Model user.

Saulius PAVALKIS, PhD, ESEP

WW CATIA NO MAGIC - Cyber Industry Consultant Senior Director

Enable model based digital engineering ecosystem

DASSAULT SYSTEMES | Company Overview

Accelerate sustainable innovation with Virtual Twin and 3D UNIVERSES

- **Software Solutions** for Model-based Systems Engineering, 3D Modeling & Simulation, Product Lifecycle Management, Collaboration and Data Science
- Created in **1981**
- 6.2 b€ **revenues** (FY 2024, Non-IFRS)
- 22 500 **Employees** in 130+ countries
- 300 000 **Enterprise Customers**
- 45 million **Users**, 17 000 **Partners** (Technology, Consulting, Sales, Integration & Services)

Deliver software solutions supporting 12 industries

Collaborate with Industry Leaders

...

...and new "market shakers"

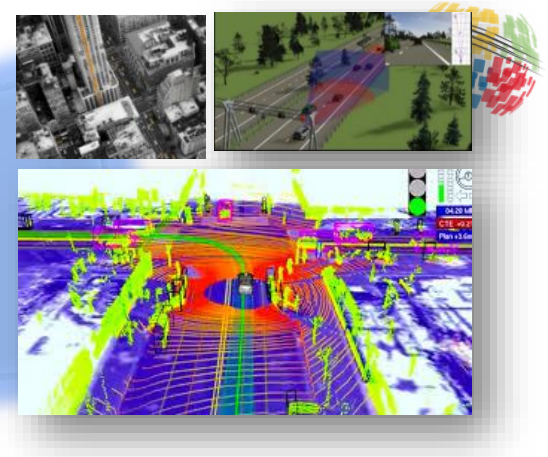
...

Evolution of complexity

Mechanical systems

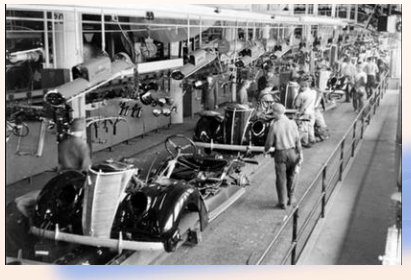
Mechatronics systems

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



System of systems

Populations of software-intensive distributed systems interacting together in an unpredictable world



Industry 2.0

Mass production assembly lines using electrical power

Industry 3.0

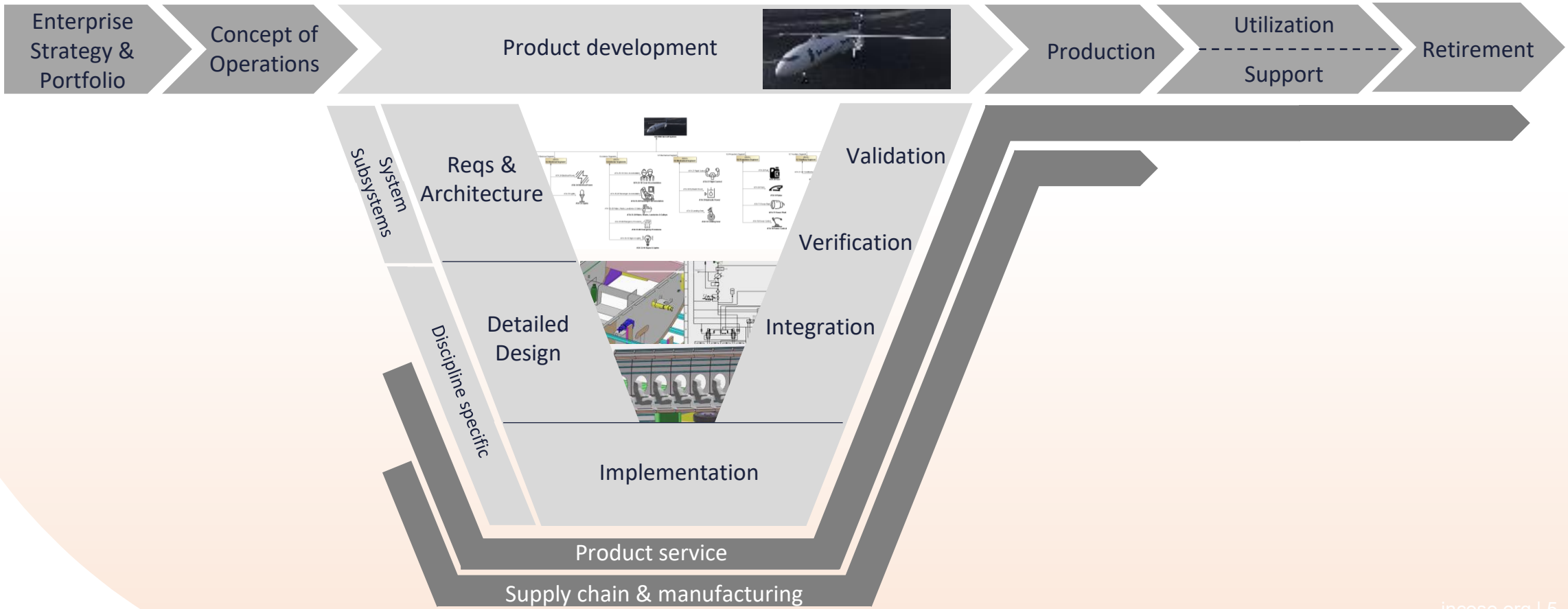
Automated production using electronics, programmable logic controllers (PLC), IT systems and robotics

Industry 4.0

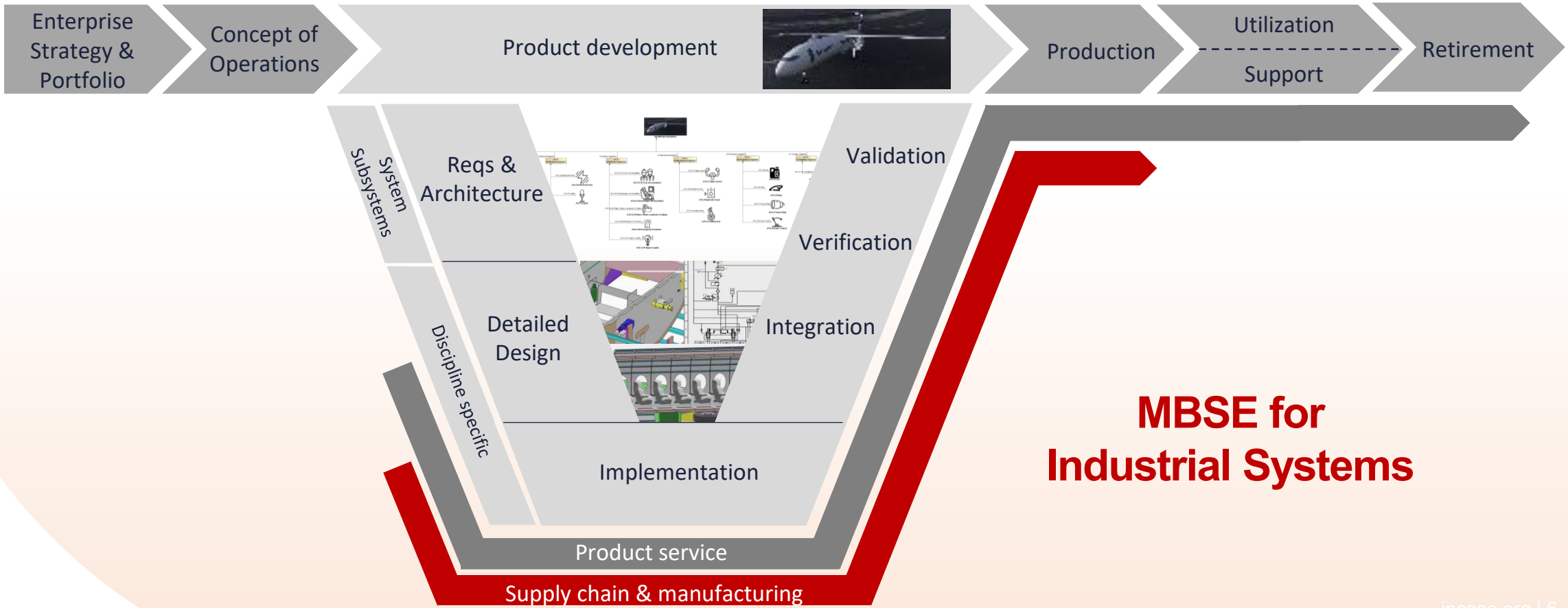
Smart factory. Autonomous decision making, machine learning, big data analysis, interoperability

Emergent Behaviors!

What 'if we change the focus?



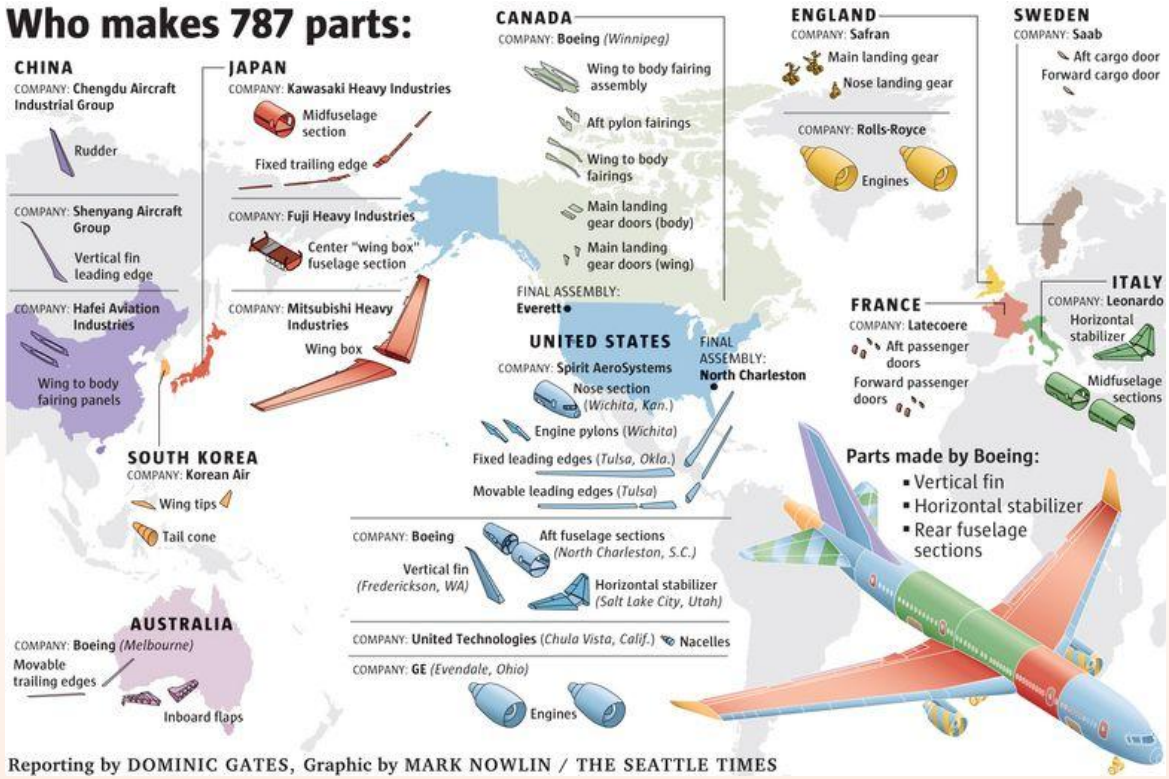
What 'if we change the focus?



MBSE for Industrial Systems

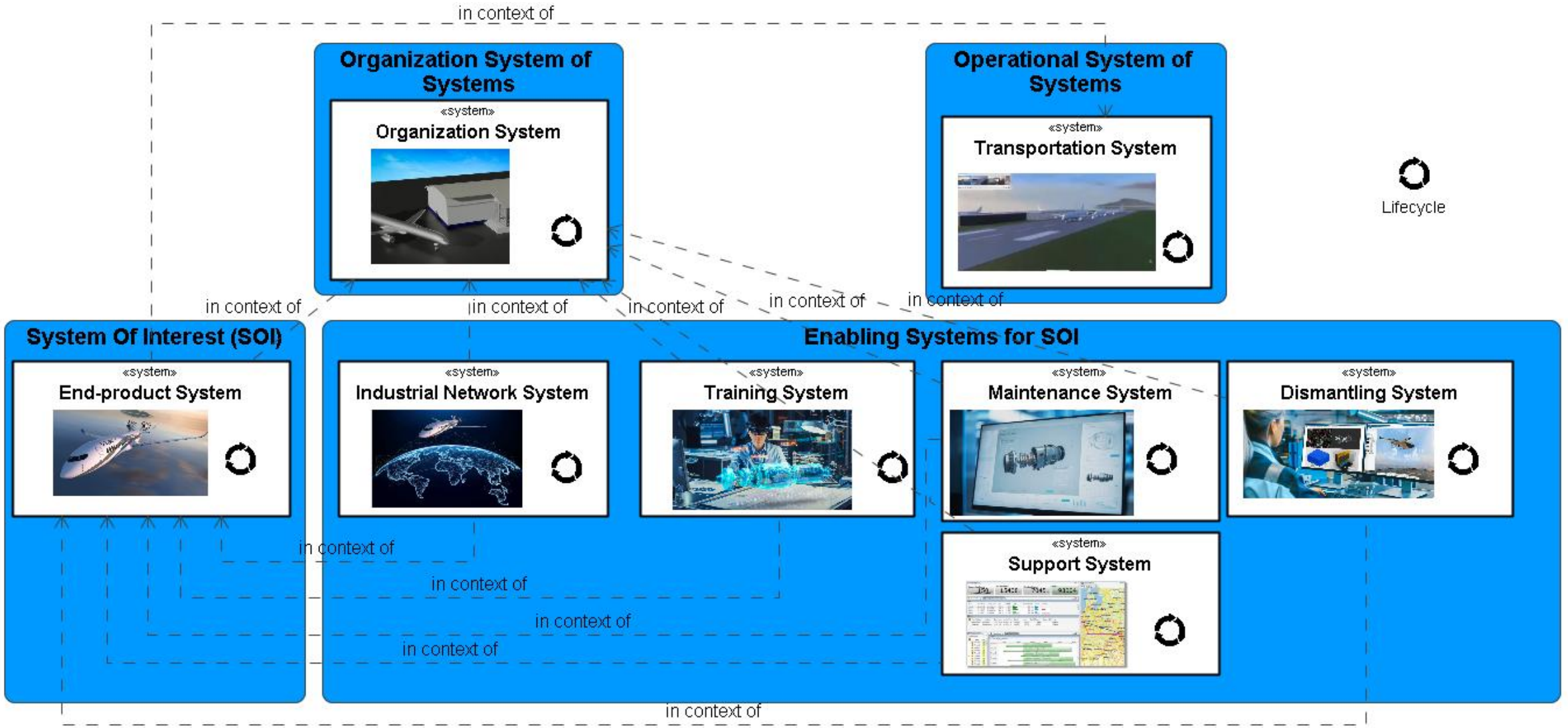
Strategic motivation

- Supply chain disruptions
- Sustainability as a priority
- New technologies integration
- Late product development iterations
- Cybersecurity threats



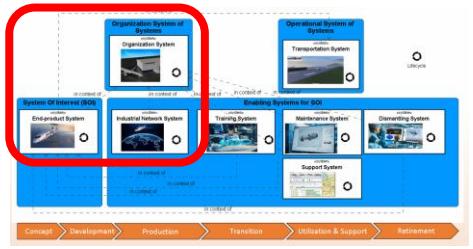
Critical investments: ~70% of a system lifecycle cost

Holistic system approach in a digital thread

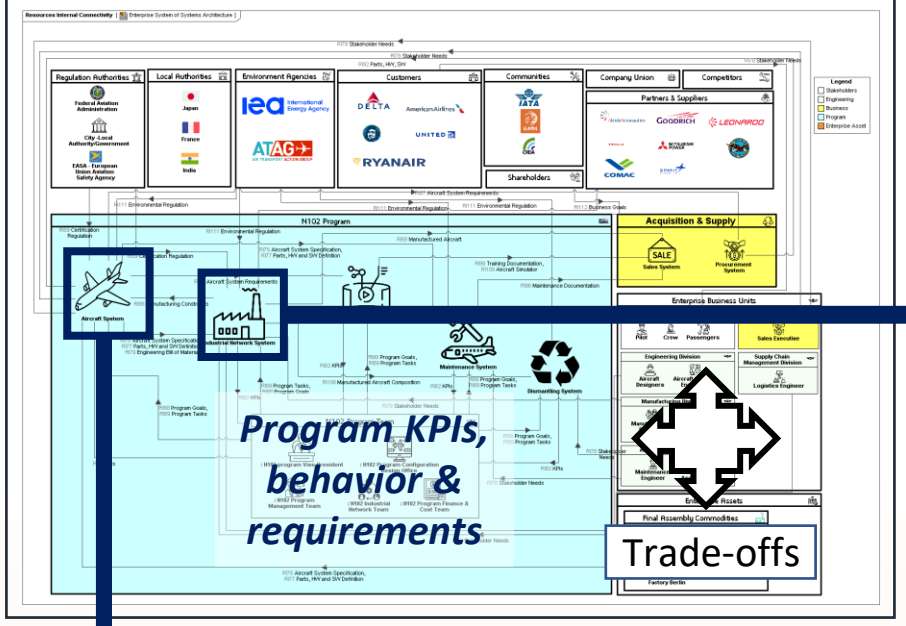


Concept | Development | Production | Transition | Utilization & Support | Retirement

Systems in a digital thread



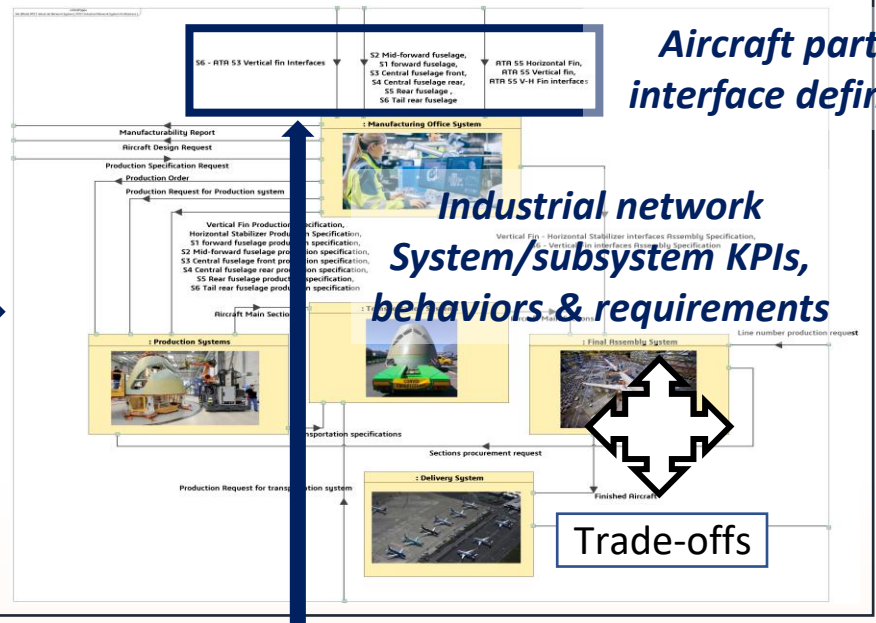
Organization System



Program KPIs, behavior & requirements

Trade-offs

Industrial Network System

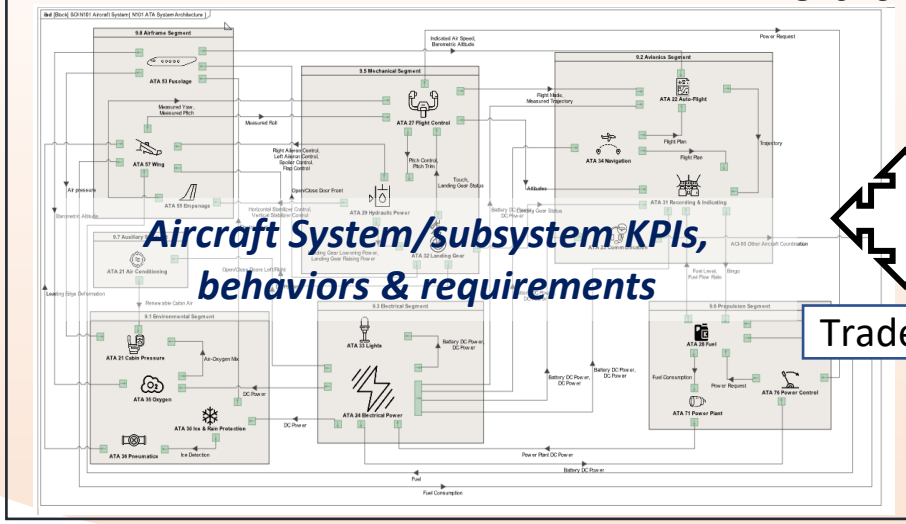


Aircraft parts & interface definition

Industrial network System/subsystem KPIs, behaviors & requirements

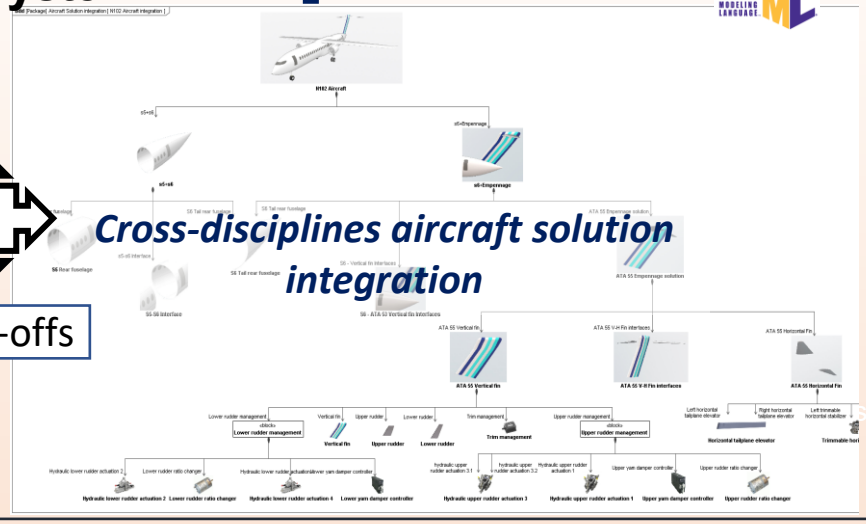
Trade-offs

Aircraft System



Aircraft System/subsystem KPIs, behaviors & requirements

Trade-offs



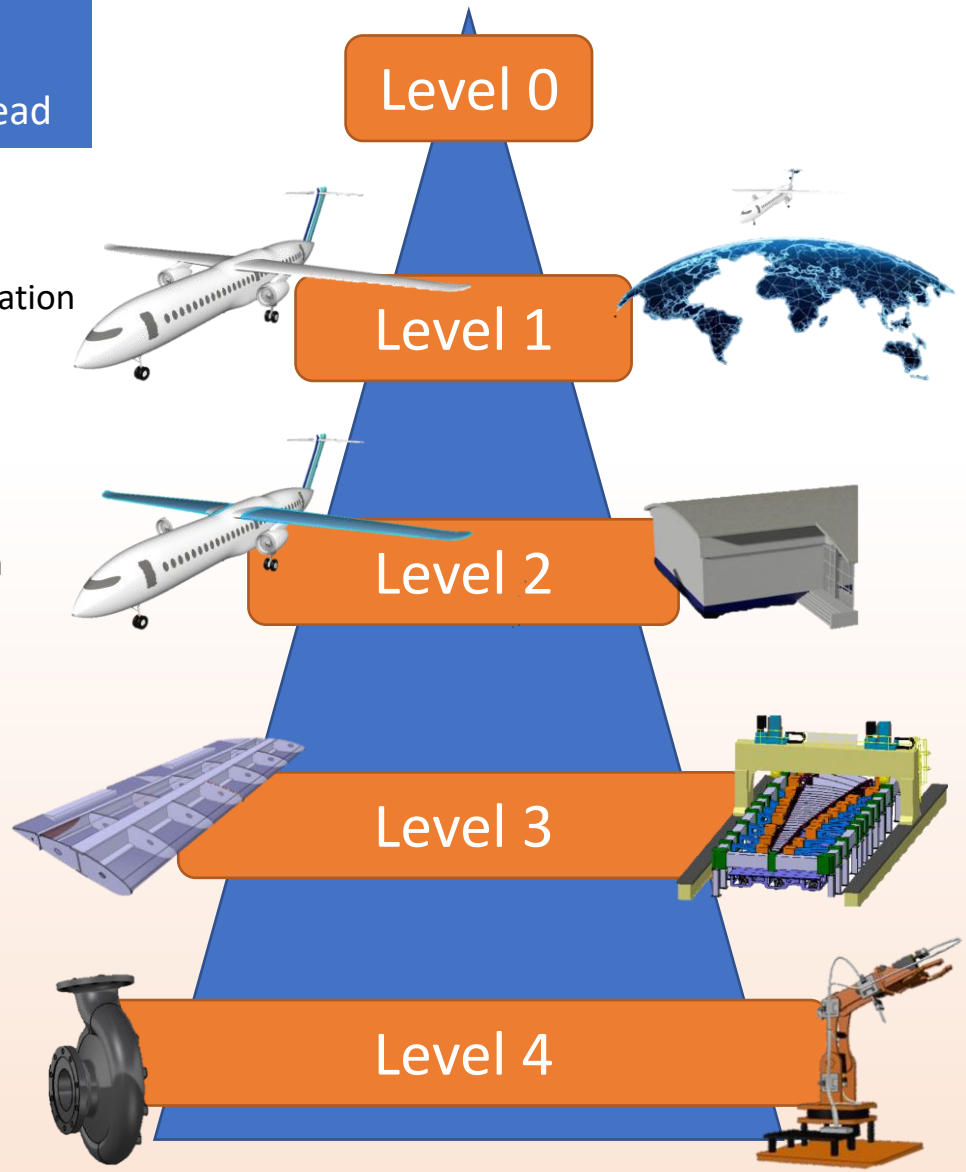
Cross-disciplines aircraft solution integration

Industrial Systems MBSE Co-engineering & Trade-offs

Multiple trade-offs impacts across systems require concurrent & iterative engineering in a digital thread

Organization/Program

Decision for program performance, cost & delay



Aircraft SOI

Decision for cross-disciplines solution optimization

Aircraft ATA

Decision for subsystem solution optimization

Section

Decision for section design optimization

Component

Decision for component design optimization

Industrial Network

Decision for Manufacturing sites and logistics strategy

Factory

Decision for assembly lines strategy

Assembly line

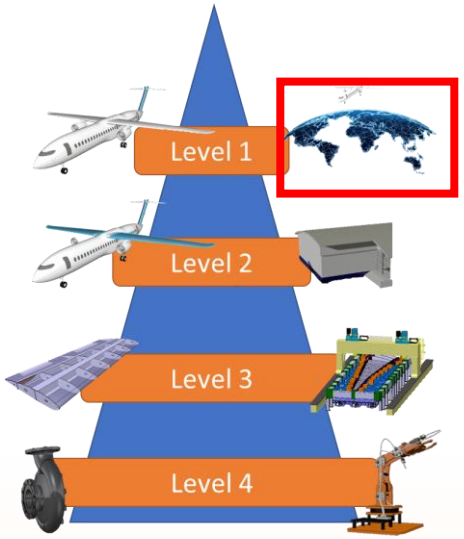
Decision for assembly station processes optimization

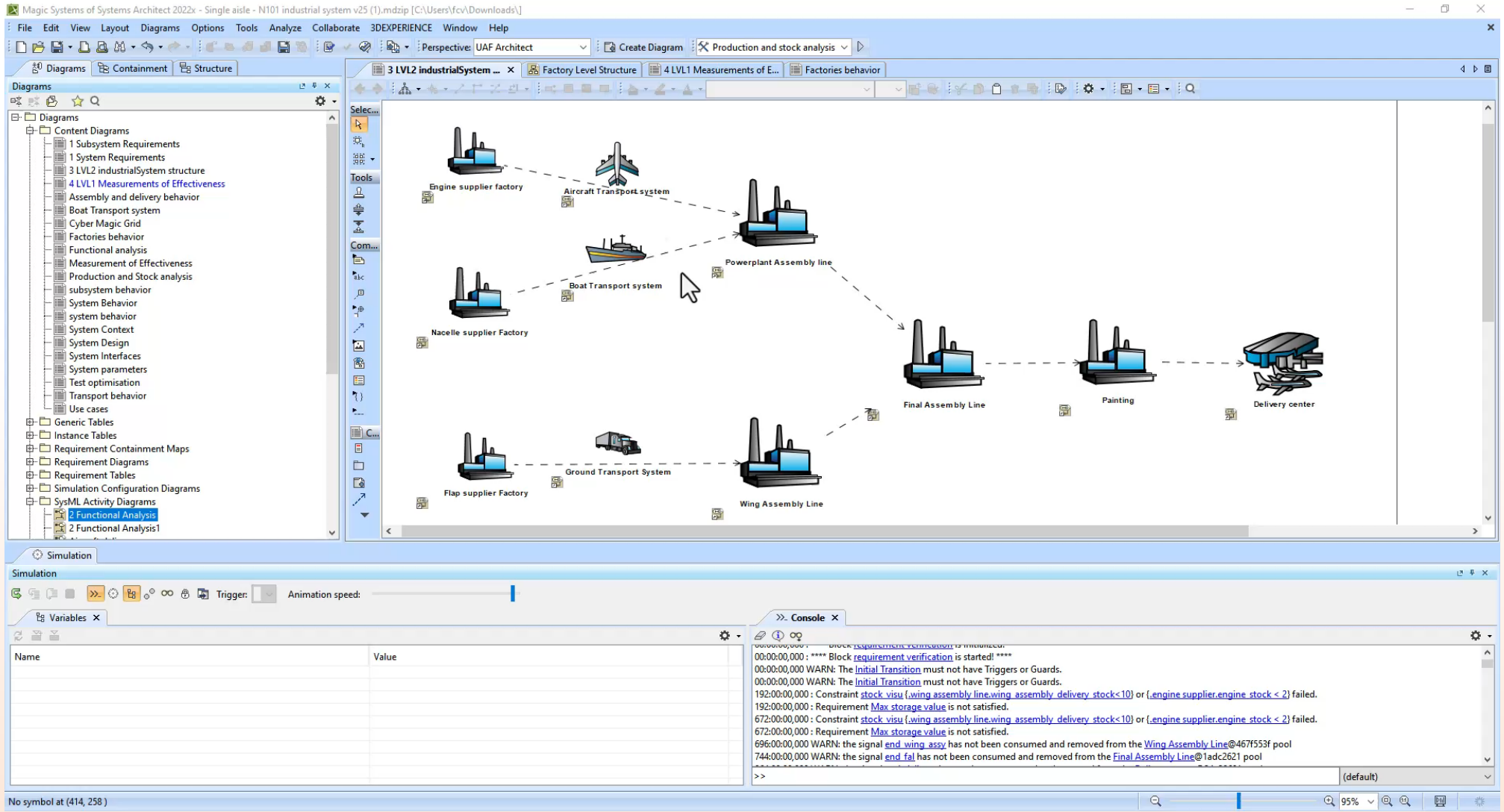
Machine

Decision for system design optimization and V&V

Industrial Network System

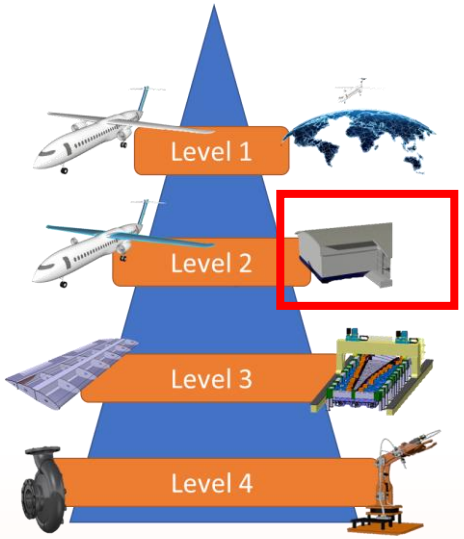
Decision for Manufacturing sites and logistics strategy

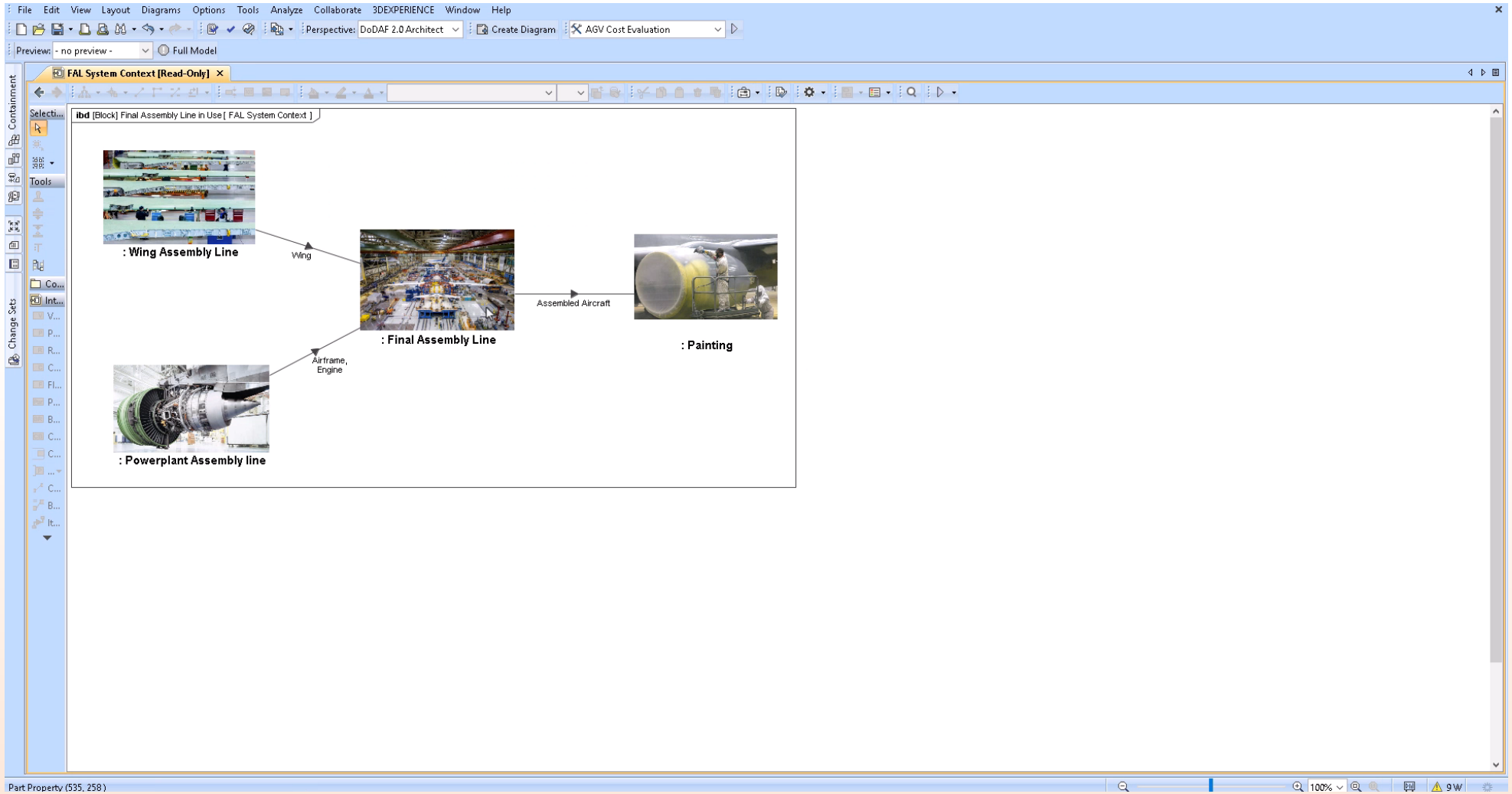




Final Assembly Line System

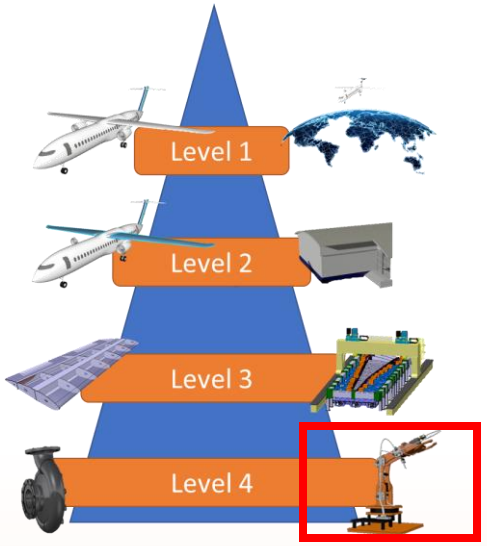
Decision for assembly lines strategy

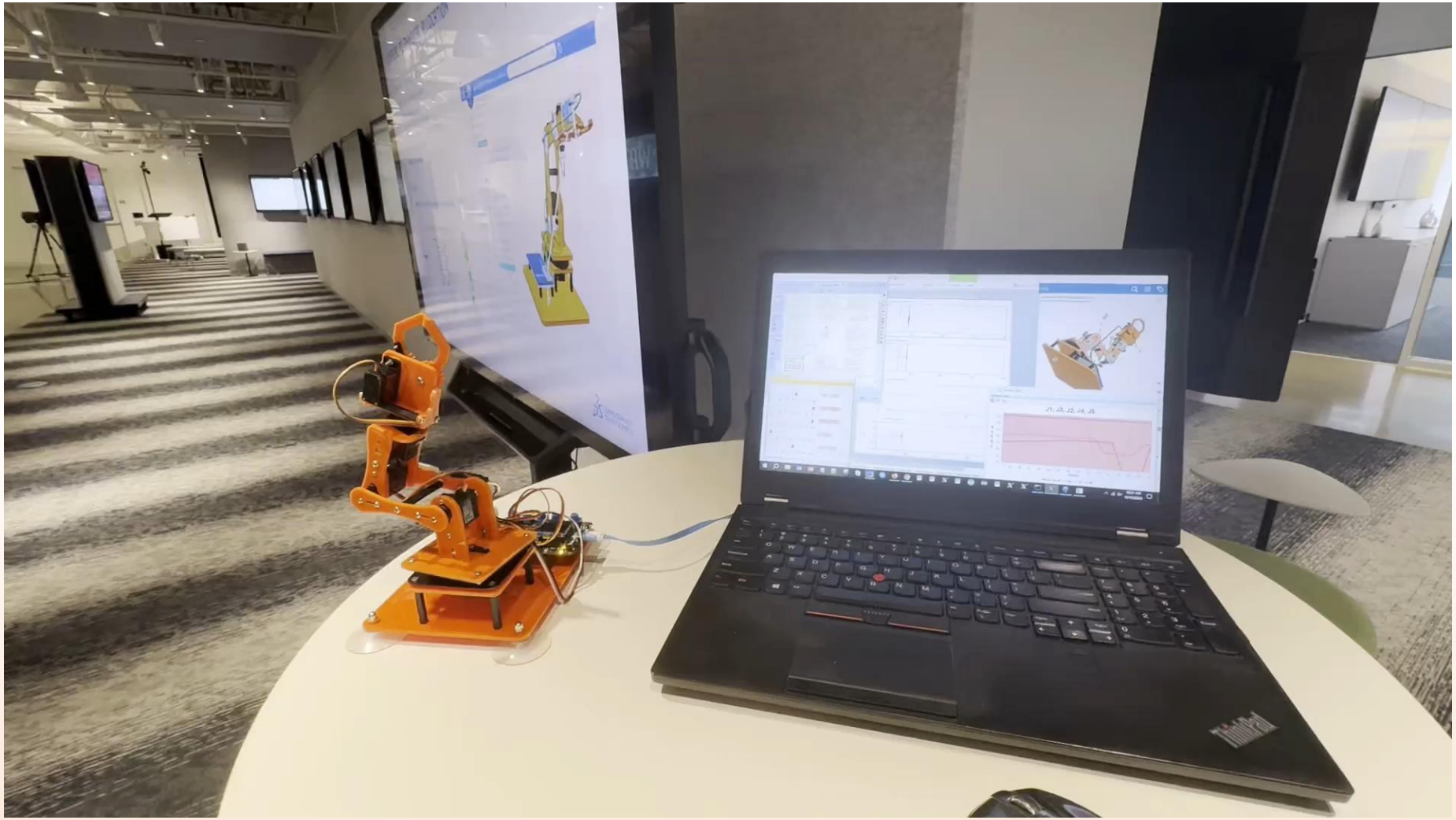




Robot System

Decision for system design optimization and V&V

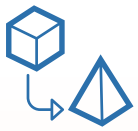




Take aways

Integrated Industrial Systems MBSE approach in a digital thread Product Systems

Early-stage simulation-driven trade-off analysis

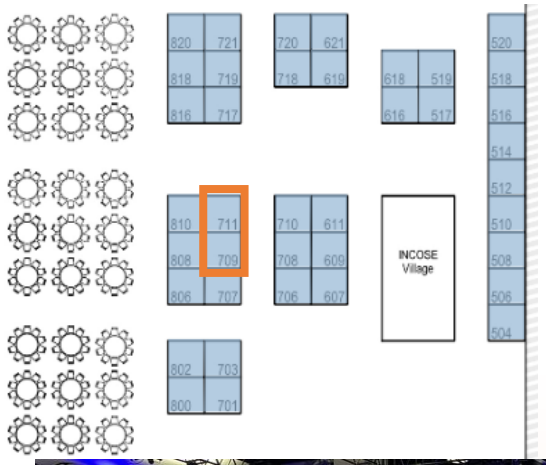


Informed decision-making and impact analysis regarding change from product systems to industrial systems and vice-versa

Set the right requirements for suppliers from the beginning

Progressive industrial systems validation in parallel with product systems maturity increase

Meet Dassault Systemes Team at IS2025!



DASSAULT SYSTEMES

Booth 709-711

Track	Day	Start	End	Type	Title
1.1.1	**Mon**	10:00	10:40	Presentation	Case Studies for Querying the Model - **SysML V2**
1.1.3	**Mon**	11:30	12:10	Paper 185	Exploring the Use of **SysMLv2** for Solution Architecture Development with the MagicGrid Framework
2.4.1	**Mon**	13:30	14:10	Paper 340	**Systems Engineering with Attitude**
2.4.2	**Mon**	14:15	14:55	Presentation	Taming the Beast: Best Practices of Extending **SysML V2**
5.3.1	**Tue**	13:30	13:55	Paper 26	**Systematic Risk Analysis**: FMEA and FTA Approaches for Multi-Level System Architectures
5.3.2	**Tue**	14:00	14:25	Paper 270	SysML4Sec – Methodology for **Security modeling** in the context of large-scale product development with multiple design levels
5.3.3	**Tue**	14:30	14:55	Paper 147	A System-of-Systems Modeling, Simulation and Data Analytics Framework for Resilient **Sustainment and Support Readiness** Strategies
6.5.3	**Tue**	16:30	16:55	Paper 128	Model-Based Systems Engineering **for Industrial Systems**
7.2.1	**Wed**	10:00	10:40	Paper 361	A Transformative Process for **Model-Based Design Reviews**
8.1	**Wed**	13:30	2:55	Panel	Bridging the Divide: **Linking Architectural Specification and Verification** by System Simulation
9.1	**Wed**	15:30	16:55	Panel	Cost Impacts of **Generative AI** in Systems Engineering Processes
9.5.2	**Wed**	16:00	16:25	Paper 30	Navigating Innovation: **MBSE Adoption** at Turkish Aerospace Industries
9.5.3	**Wed**	16:30	16:55	Presentation	**Configuration Management** Challenges in Multi-Team Collaboration Using Linked Models
11.5.3	**Thu**	14:00	14:25	Paper 108	Integration of MBSE and **Agile** Development by Seamlessly Creating **Test Plans from Model Simulations in SDV Development**
N/A	**Wed**			Virtual Presentation	Exploration of **MBSE Methodologies** for Modeling Pre-Existing Systems
N/A				Poster	**Enterprise Transformation** Planning with UAF

https://www.3ds.com/products/catia/systems-engineering

35th Annual INCOSE international symposium

hybrid event

Ottawa, Canada
July 26 - 31, 2025