# Systems Summit II

***From Traditional Systems Engineering to AI-Enabled Model-Based Systems Engineering***



**Dietmar Pilz**
Director of Technology, Engineering and Quality
Head of ESTEC

***27 October 2026,*** *Oude kerk, Delft*

EUROPEAN SPACE AGENCY

ESA UNCLASSIFIED – For ESA Official Use Only

# EUROPEAN SPACE AGENCY

## ELEVATING THE FUTURE OF EUROPE IN SPACE

THROUGH EUROPEAN COOPERATION AND
WITH INTERNATIONAL PARTNERS

**23** MEMBER STATES

4 associate members
**1** cooperating state

**6500** ESA WORKFORCE

IMPLEMENTS
**60%**
OF THE EUROPEAN SPACE BUDGET

**150+**
missions delivered
**30+**
missions upcoming

2026 BUDGET
**€8.26B**

**€16**
per European



# Major Influence in Technology

- Increasing Defence and Commercial Budgets
- Disruption, Industrialisation and Risk Taking
- Space Race (Dual-Use, Security, AI, Exploration..)
- Importance of Space Assets for Geopolitics
- Systems of Systems and Interoperability



# Successful Ministerial 2025

CM25 22,3 Bn € ⟫ ESA Technology 5 Bn€

# Spacecraft MBSE today

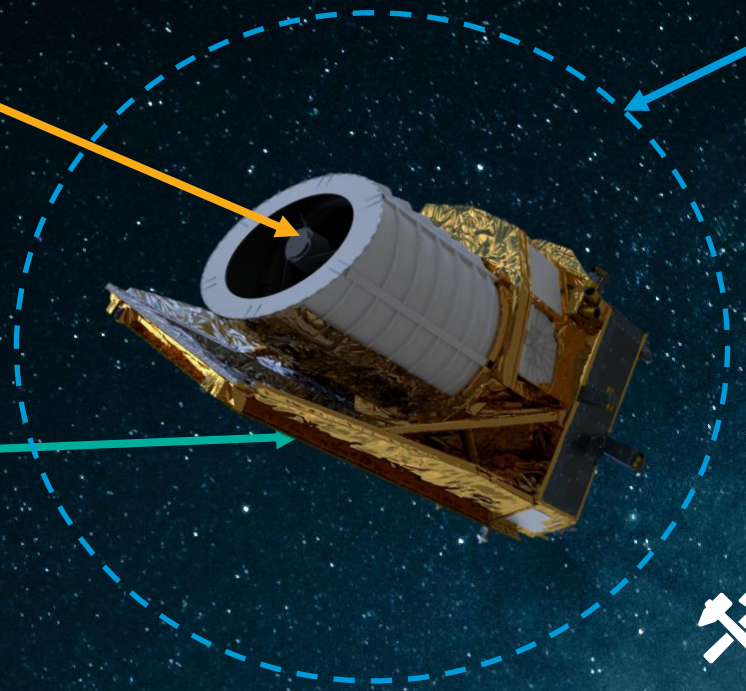
E.g. Optical SpaceCraft

## Payload Performance

- Focal Plan Array
- Optical Bench
- Sensor Thermal properties
- Electromagnetic properties
- …

## Platform

- Interfaces
- Thermal control
- Data handling
- Software
- Processing Power
- Micro-Vibration
- …



## General

- Cost
- Requirements
- Mission Analysis
- Orbital Mechanics
- Supply Chain,
- Manufacturability
- Scientific requirements
- Radiation
- ….

## Supported by:

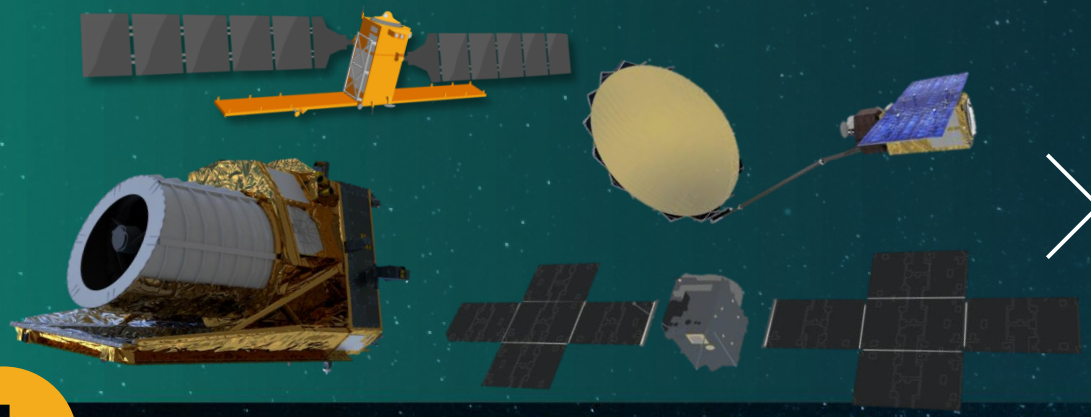
- Simulation tools
- System Architecture tools
- ….

MBSE is limited ensuring a coherent database

# Space Industry: Additional market with new opportunities

The space market is expanding beyond “haute couture” into also the space “prêt à porter”

## Science with Cutting Edge Requirements



Bespoke Prototypes that cannot fail

- Manufacturing
- Conservatism
- Large Verification effort
- Large Entry Barriers

+

## Defense, Navigation, Telecom, Space Data Centers



Huge # of Launches
LEO Constellations

- Serialisation
- Iterative approach
- Products
- Risk possible
- New Players

# AI is connecting engineering tools

AI helps connect distributed engineering information across the lifecycle.

## DISTRIBUTED EVIDENCE

- Mission goals
- Requirements
- Interfaces
- Models
- Design decisions
- Software
- Test reports
- Anomalies
- Operations

## AI-ENABLED ENGINEERING KNOWLEDGE



## WHAT ENGINEERS CAN DO

- TRACE Requirements
- ASSESS IMPACT
- DETECT GAPS
- REUSE KNOWLEDGE

AI can enhance systems engineering but cannot replace systems thinking, engineering judgement and responsibility

# MBSE at ESA



## End-to-End Digital Engineering Thread:

Connecting requirements management, models, analyses, interfaces and verification evidence across engineering tools, disciplines and lifecycle phases (more than 300 tools in D/TEC).



## TEC Engineering Data HUB:

Engineering data backbone, enabling interoperability, traceability and reuse of engineering knowledge.



## AI-enabled MBSE adoption:

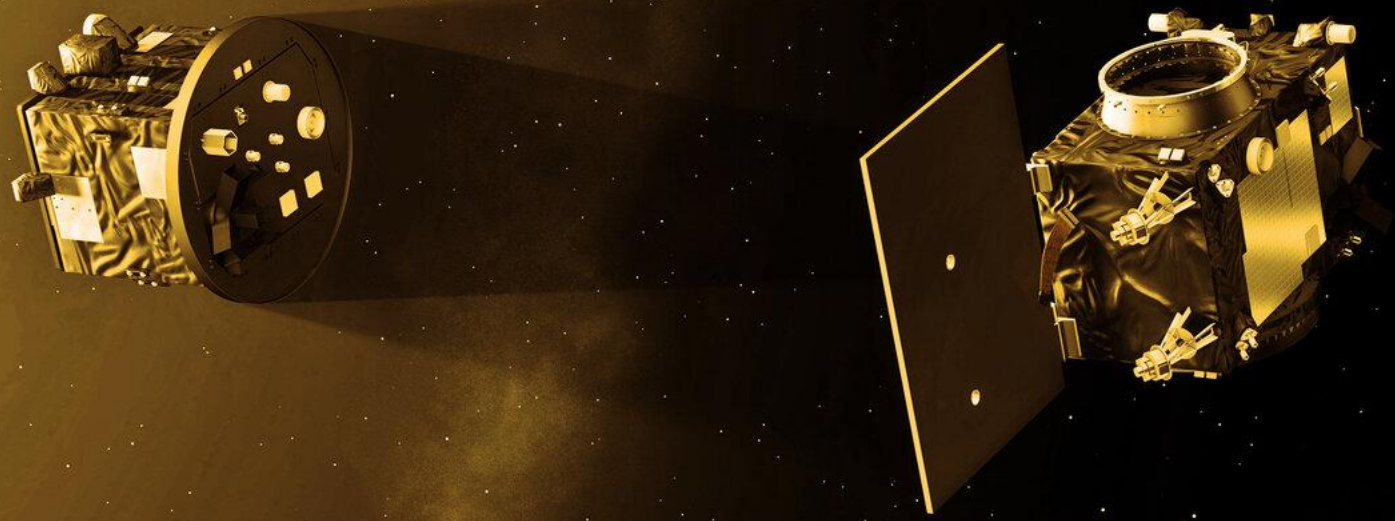
Support projects, design initial system models from existing requirements, documents and engineering data.

**Practical MBSE**

**E**very simulation is not integrated into one model, but connected and traceable engineering environment.

# AI Use-Case : Proba-3

- Software error introduced during requirements flow-down.
- The error remained despite multiple review cycles.
- ESA's AI agentic tool identified the issue in less than 48 hours.



… AI enables thorough analysis of documentation without fatigue.

# Conclusion

***At ESA we are moving from Traditional Systems Engineering to AI-Enabled Model-Based Systems Engineering***



- Complexity is increasing faster than organisations systems are adapting.



- The future is AI-enabled MBSE and digital engineering, but human systems thinking remains indispensable.



- Europe must treat systems competencies as a strategic capability essential for sovereignty, resilience and competitiveness.