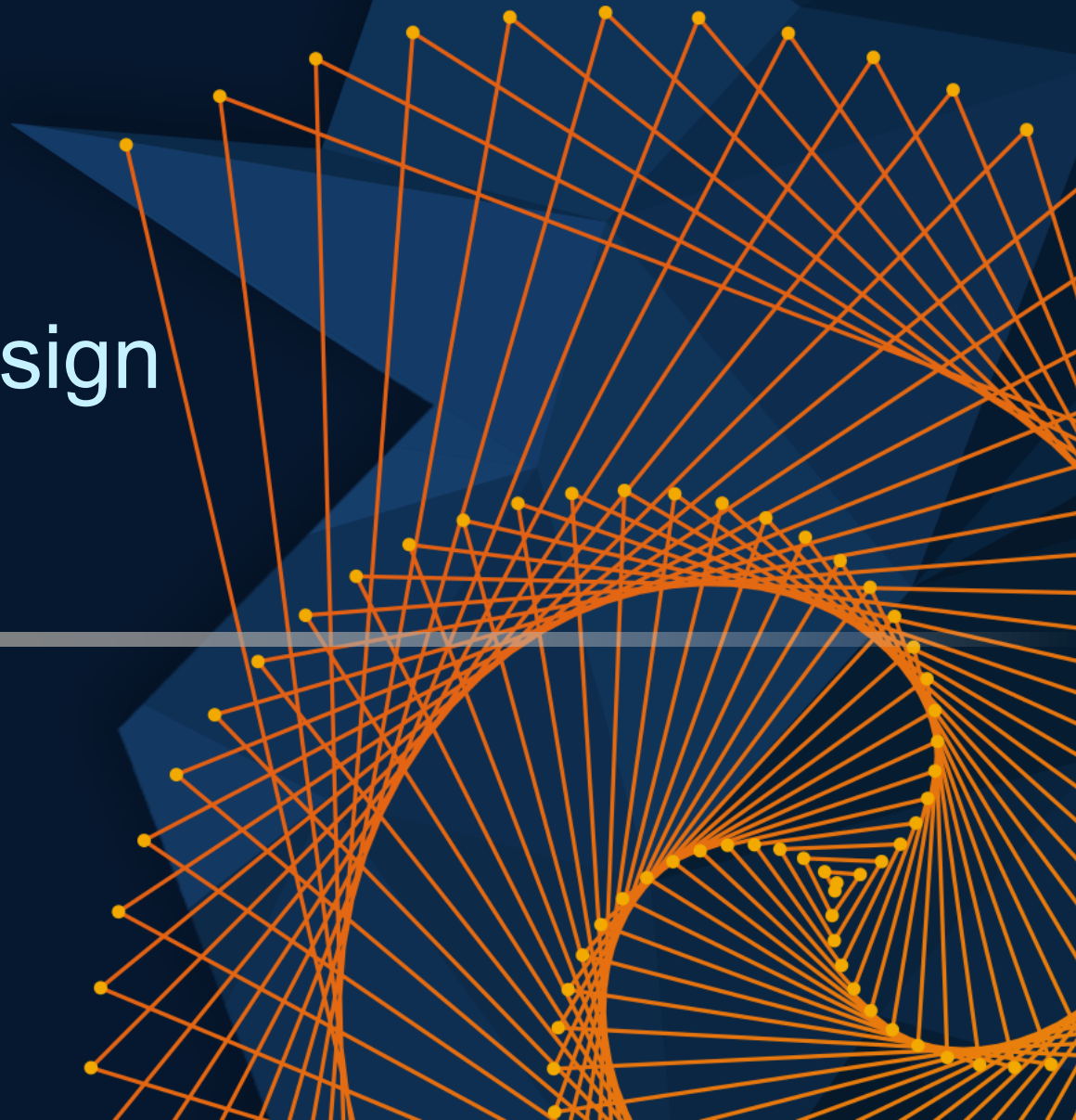
MATLAB EXPO
POLSKA

Embedded Intelligence: The Future of AI in Engineering Design

Massimiliano Campagnoli
Senior Application Engineer
June 11, 2026



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About me

Senior Application Engineer, Aerospace & Defense – MathWorks

Focus areas: MBSE, Certification, Embedded AI

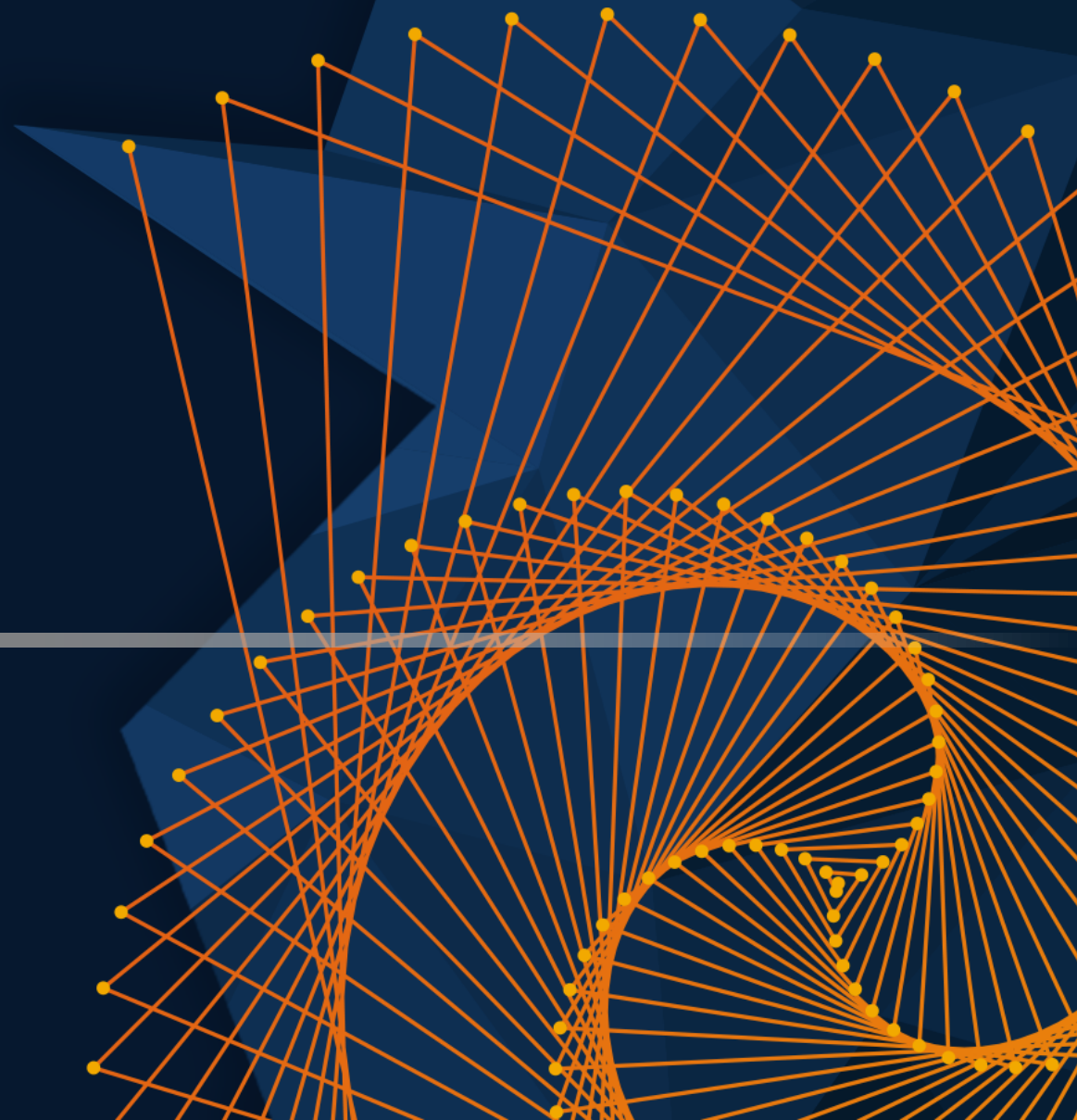
Aerospace Engineering (M.Sc., Politecnico di Milano)

20 years at Leonardo Aircraft: safety-critical software, systems & control, autopilots and autonomous systems

Agenda

- The role of AI in modern engineering workflows across industries
- Overview of AI adoption trends in aerospace, defense, and regulated domains
- Combining models, data, and engineering knowledge with AI-assisted tools
- Human in the loop and agentic AI in open engineering ecosystems

The role of AI in modern engineering workflows across industries



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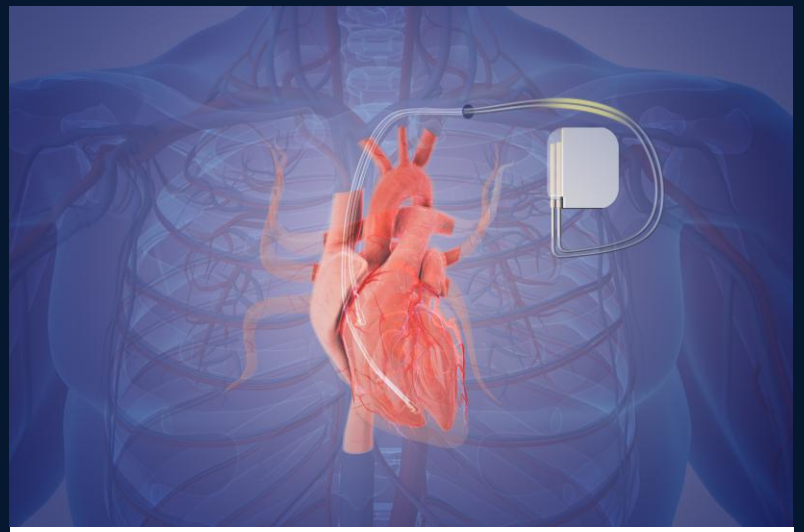
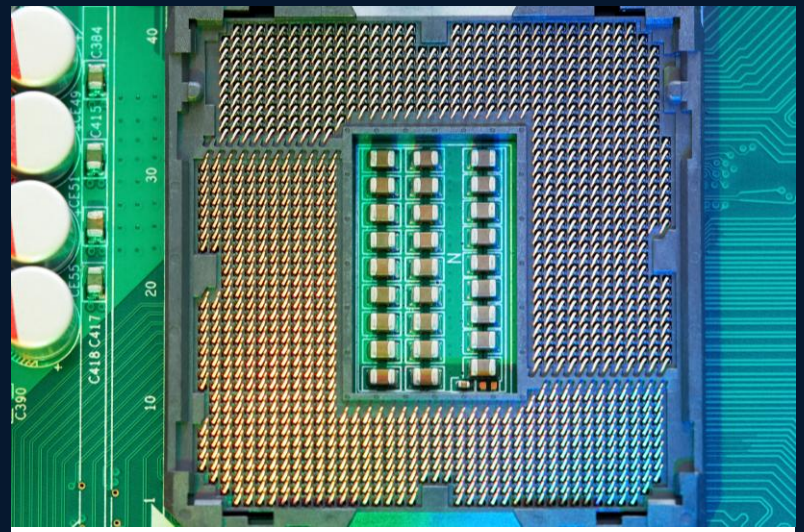
Combining AI and engineering



Medtronic

Detecting heart disorders in implantable cardiac monitors



Princeton University

Creating wireless chip designs

Eaton

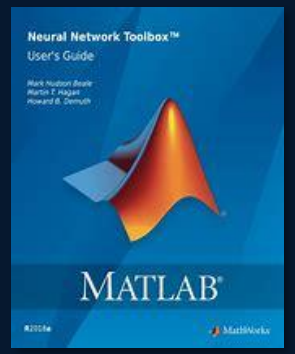
Advancing solar power systems performance

MathWorks

1990s

Toolboxes

- Neural Network Toolbox
- Statistics Toolbox



2016

GPU

2017–2019

Toolboxes

- Deep Learning Toolbox
- Text Analytics Toolbox
- Reinforcement Learning
- Predictive Maintenance Toolbox

Code Generation

- GPU Coder
- MATLAB Coder

Apps

- Image Labeler
- Deep Network Designer
- Classification Learner
- Regression Learner
- Video Labeler
- Signal Labeler

Interoperability

- TensorFlow-Keras Importer
- ONNX Support

2020–2022

Compression

- Quantization

Code Generation

- Deep Learning HDL Coder

Apps

- Experiment Manager
- Lidar Labeler
- Reinforcement Learning Designer

Model-Based Design

- Image Classification & Model Prediction
- Recurrent Neural Networks
- Object Detectors

Interoperability

- TensorFlow Model Importer & Exporter
- PyTorch Importer

2023–2025

Compression

- Taylor, Projection Pruning

Code Generation

- TensorFlow Lite

Interoperability

- Co-execution blocks

Verification

- Out of distribution detection
- Robustness

Domain Specific AI

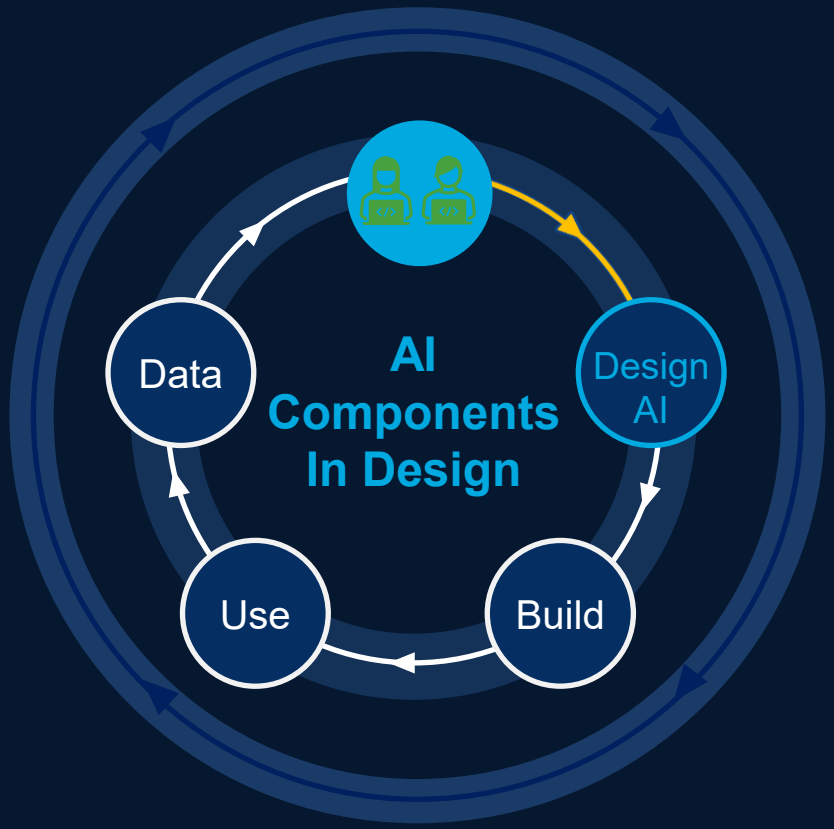
- Medical Imaging
- Automated Visual Inspection

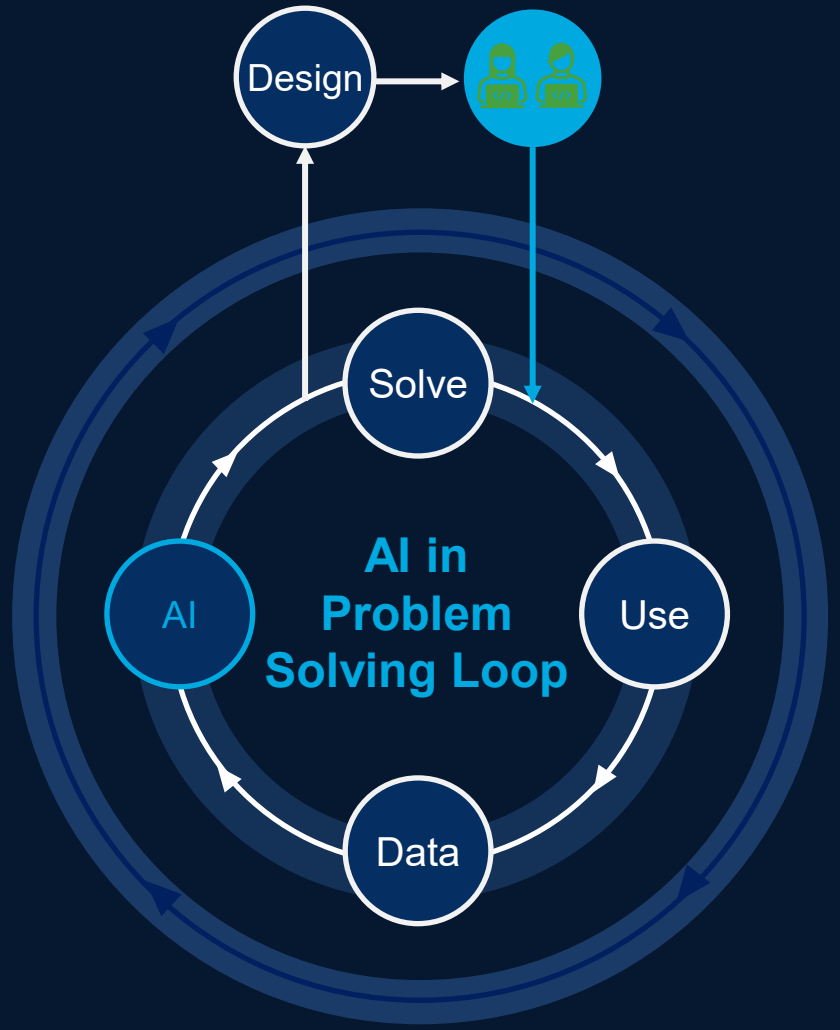
Accessibility

- Deep Learning Model Hub

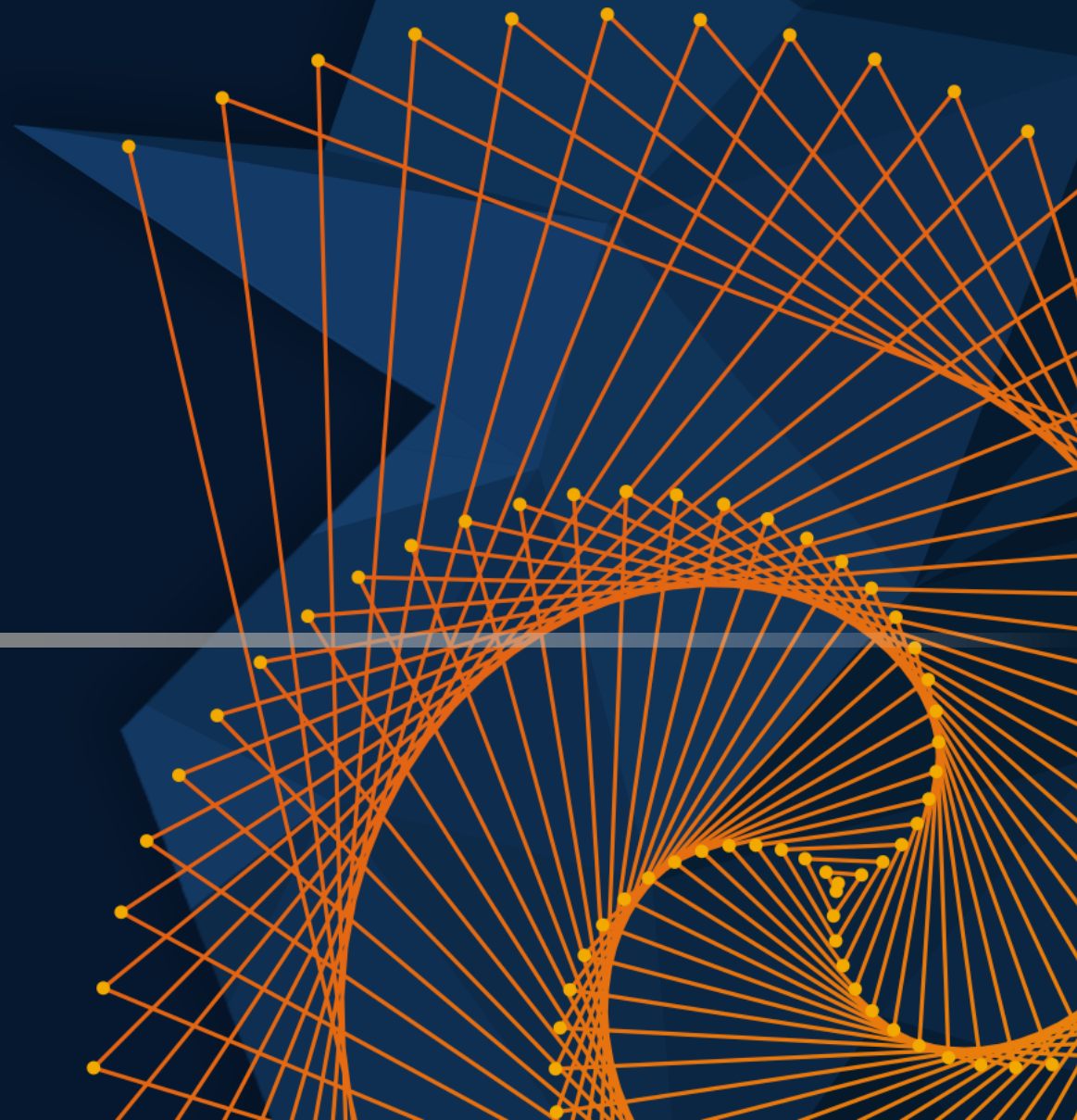
Over 500+ examples

AI in engineering design loops





Overview of AI adoption trends in aerospace, defense, and regulated domains



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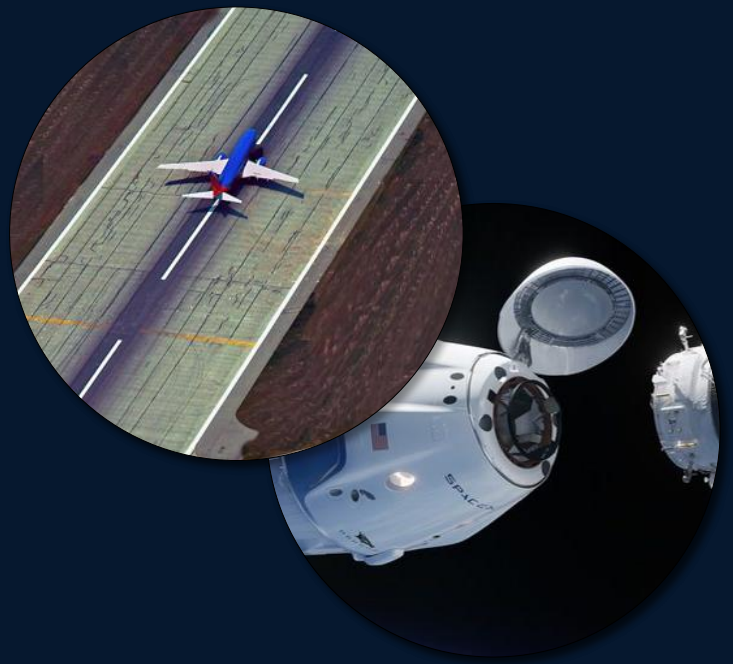
Where embedded AI delivers value in Aerospace & Defense

Safety & security



- Runway incursion detection
- Sense and avoid
- Interference detection
- Autonomous docking and rendezvous

Operational efficiency

- Dynamic resource allocation
- Adaptive optimization
- Fuel-efficient trajectory planning
- Predictive maintenance

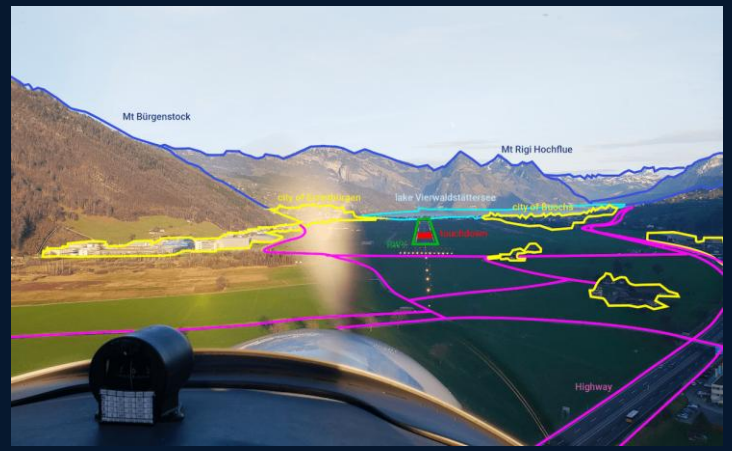
Operator effectiveness

- AI-assisted landing in degraded visibility
- Speech enhancement in noisy environments
- Multi-sensor fusion tracking

AI in AeroDef requires trust, verification, and certification

Civil Aeronautical

- Subject to stringent safety-driven regulation
- Misalignment with existing certification frameworks
- Limited explainability



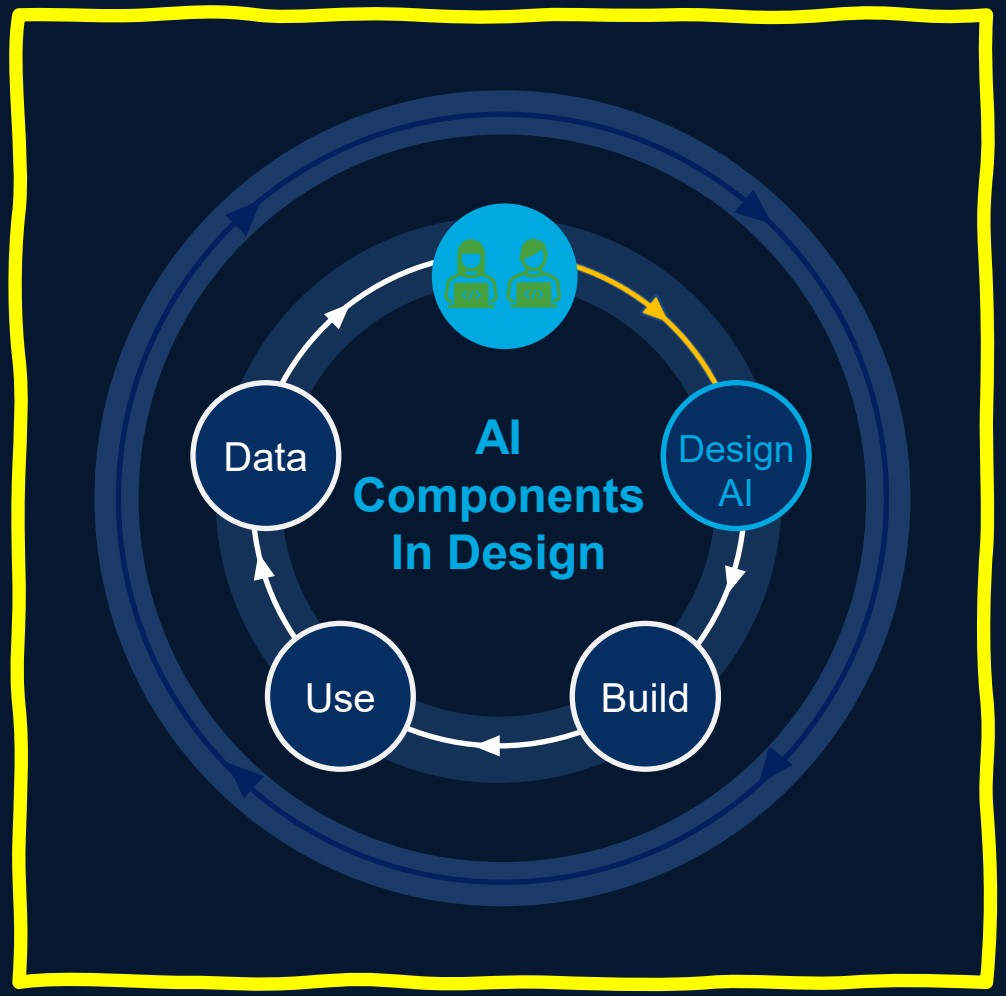
Defence

- Rapidly evolving requirements
- Partial alignment with certification standards
- Strong focus on capability and deployment time

Space

- AI is key to enabling autonomy
- No unified certification approach
- Rapid evolution driven by commercial space actors

AI becomes part of the design



Why is Machine Learning certification a problem?

Existing certification frameworks do not map cleanly to machine learning components

- How can ML be integrated into certifiable airborne and space systems?
- How do we build trust in new ML verification methods?

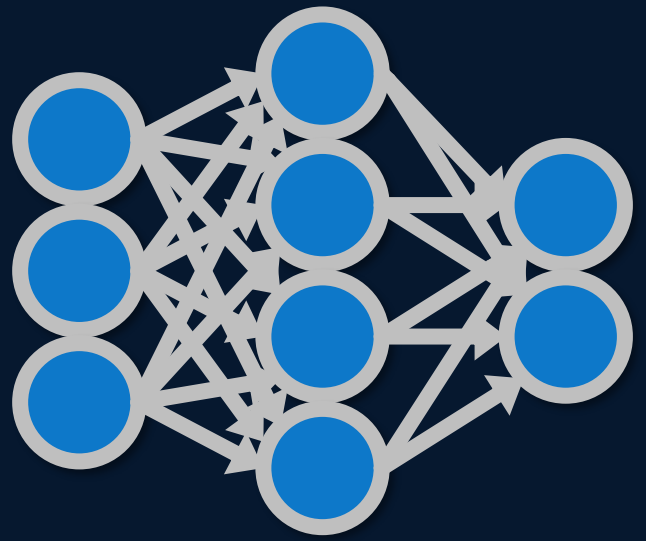
AI is incompatible with the established certification processes

Traditional Software Development (Rule-Based)

```
if (a > b) && (a > c)
    d = a;
end
d = d * 5;
```

Machine Learning Development (Data-Driven)

- ✓ Coverage ✗
- ✓ Traceability ✗
- ✓ Explainability ✗



e.g. DO-178C: 15 out of 71 incompatible objectives*

(*) AIR6988 “Artificial intelligence in aeronautical systems. statement of concerns.” EUROCAE, Tech. Rep., 2021

Aerospace is making real progress toward Machine Learning certification

Sources: easa.europa.eu, eurocae.net, faa.gov

MathWorks actively contributes to emerging standards for AI certification in Aerospace

SAE-G34 / EUROCAE WG-114

- Established in 2019
- Over 750 members
- EASA, FAA, Airbus, Boeing, etc.

ARP6983/ED-324

- Expected release date: 2026

SAE G-34 / EUROCAE WG-114, Artificial Intelligence in Aviation (Joint International Committee)

G-34/WG-114 focuses on implementation and certification related to

ARP6983 - Process Standard for Development and Certification/Approval of Aeronautical Safety-Related Products Implementing AI

WORK IN PROGRESS

This document discusses guidelines for the development of Aircraft Systems leveraging AI capabilities, taking into account the overall aircraft operating environment and functions. This includes validation of requirements and verification of the design implementation for certification and product assurance and guidelines with the assessment of safety. It provides practices for showing compliance with the regulations and serves to assist a company in developing and meeting its own internal standards by considering the guidelines herein.

Standard Details

Issuing Committee: G-34 Artificial Intelligence in Aviation

Publisher: SAE International

Rationale: AI as a technology has become increasingly useful for different software applications. As for today, there are no software approval standards that consider AI for embedded aircraft systems. The intent of this document is to cover gaps and provide guidance for this type of technology.

AI components in engineered systems require care

Example: European Space Agency proposal

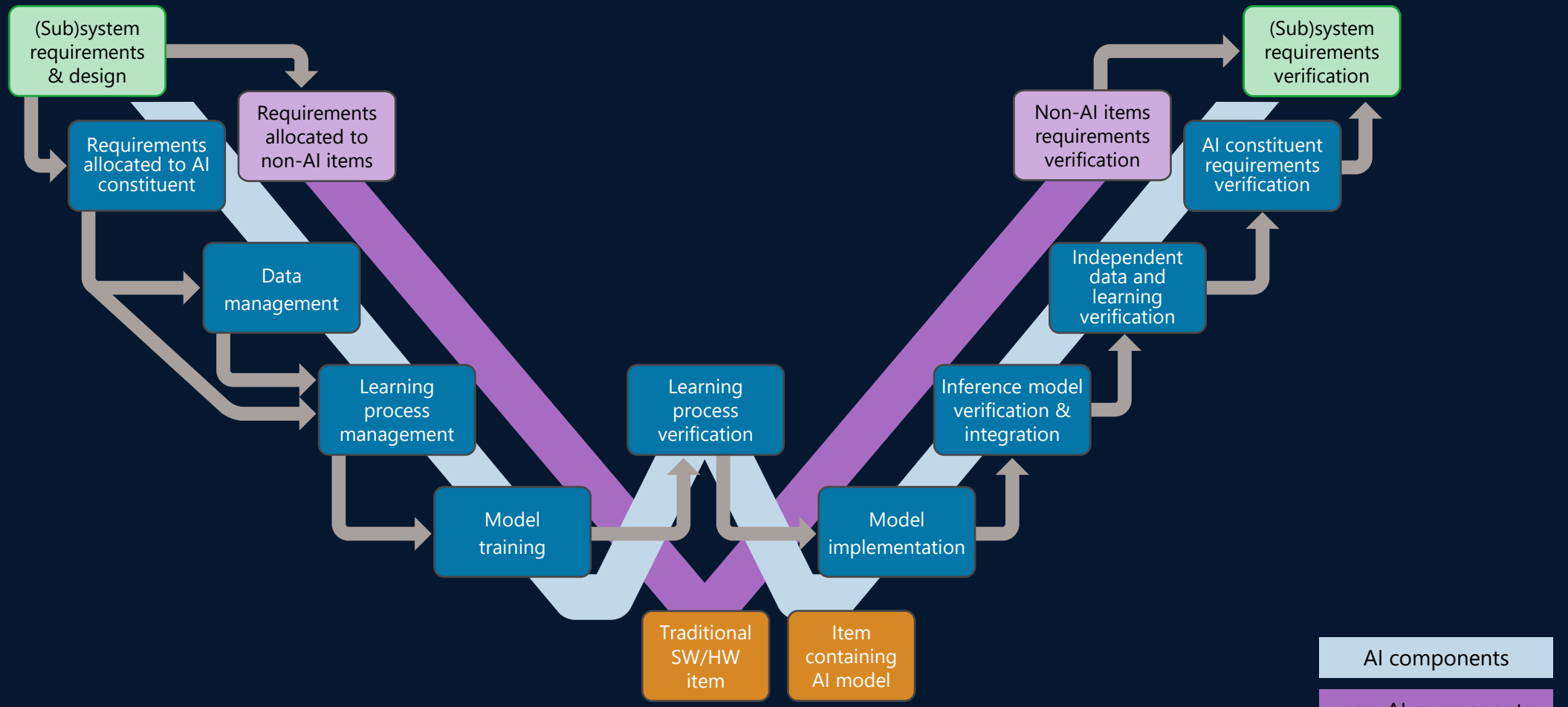


Figure based on an original diagram published by the European Union Aviation Safety Agency (EASA). Used with permission.
Source: EASA Concept Paper Proposed ISSUE 02 'First usable guidance for Level 1&2 machine learning applications'
Credit: EASA

Combining models, data, and engineering knowledge with AI-assisted tools

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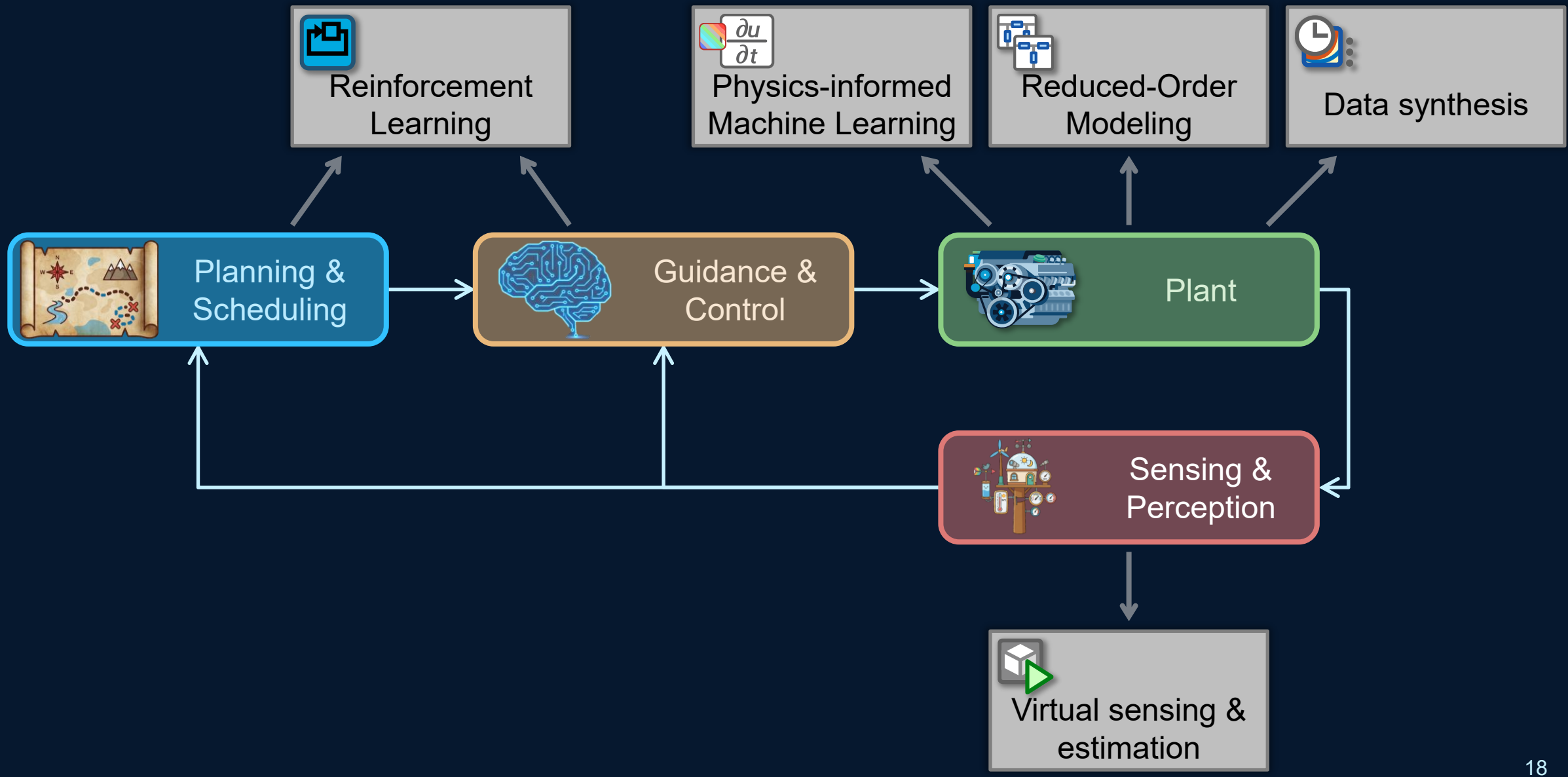
Where AI fits in the engineering workflow



How AI is used in engineering today

Data synthesis

Realistic and representative data generation

Physical modeling

PDE and physical environment modeling

Reduced-order models

Physics-informed learning

Algorithms & Data processing

Virtual sensing and state estimation

Predictive maintenance

Signal processing and data-driven models

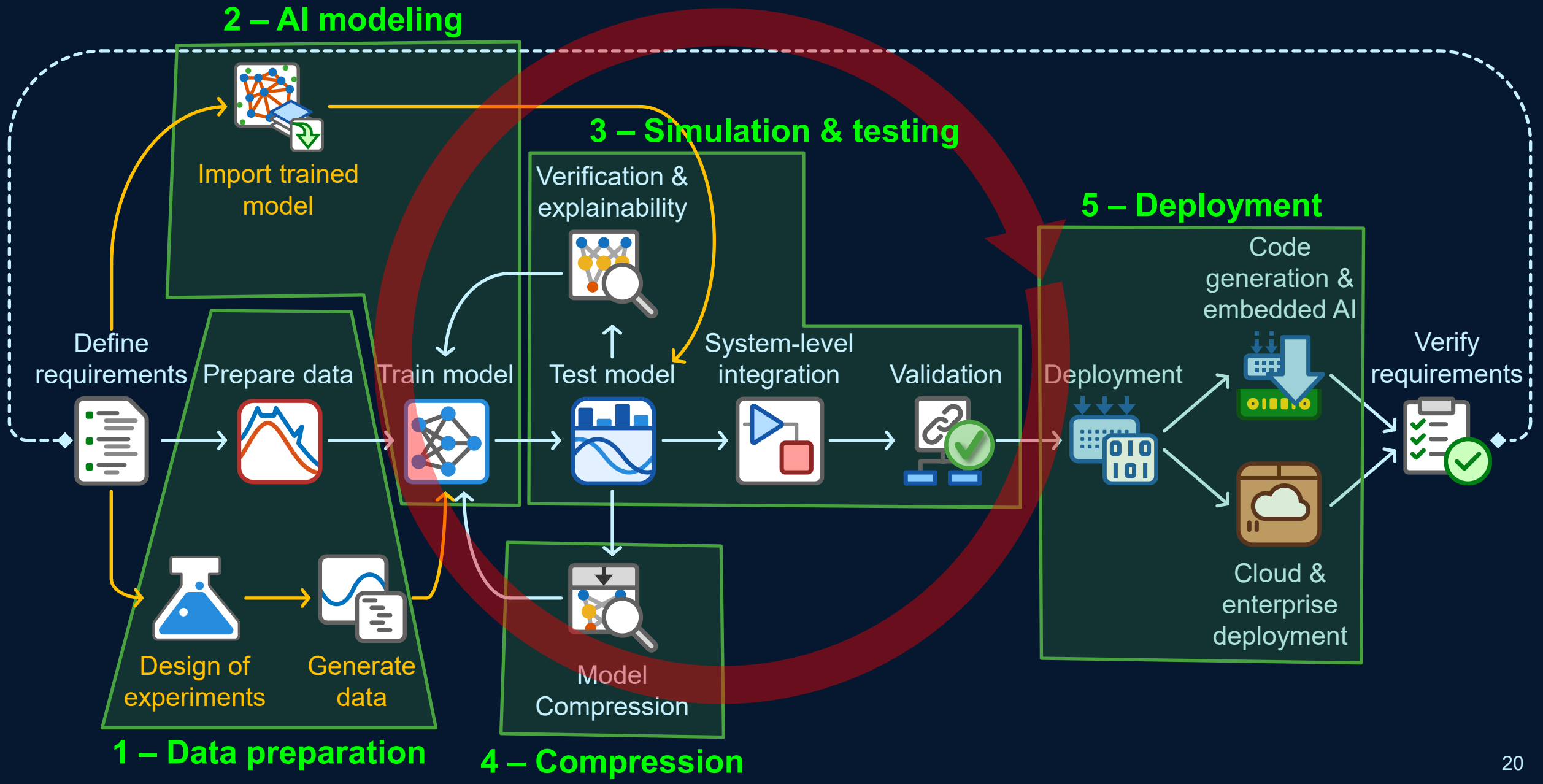
Control & Decision-making

Advanced control and autonomy

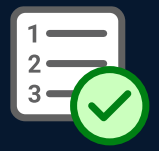
Planning and decision making

System-level design

MATLAB & Simulink: end-to-end AI workflow



Simulink as an AI enabler



Use **simulation** results to inform model selection and use variants to **compare design** options

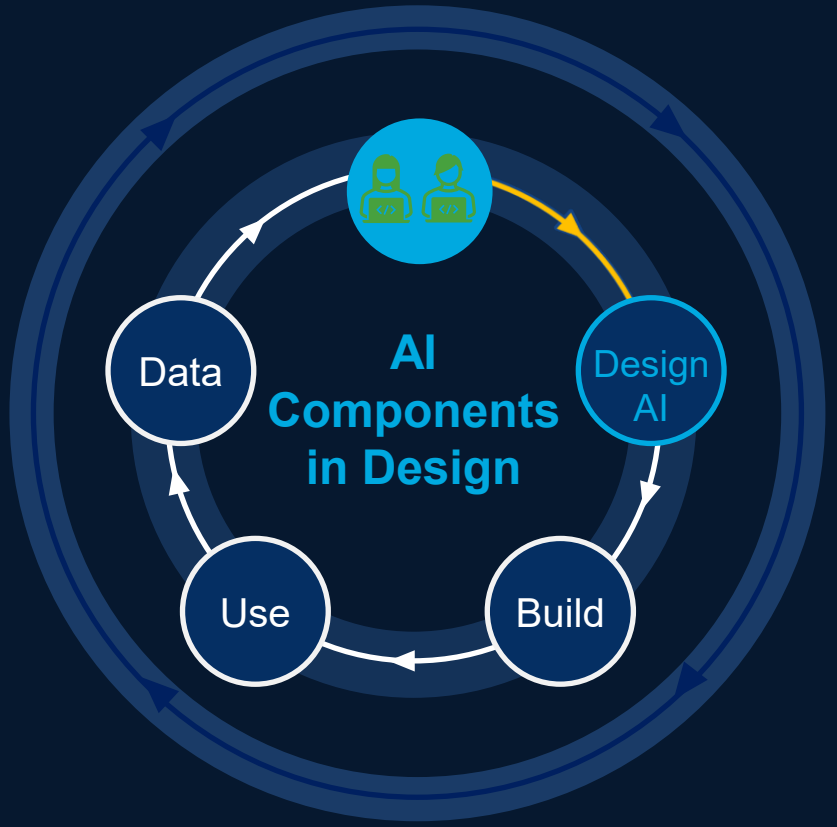
Test scenarios that would be difficult, expensive, or dangerous to run on hardware or in a physical environment

Experiment with multiple AI models and rapidly compare **trade-offs** in accuracy, model size, and on-device performance

Uncover system **integration issues earlier**

Making high-fidelity models usable in engineering workflows

Enable simulation under real-time and deployment constraints

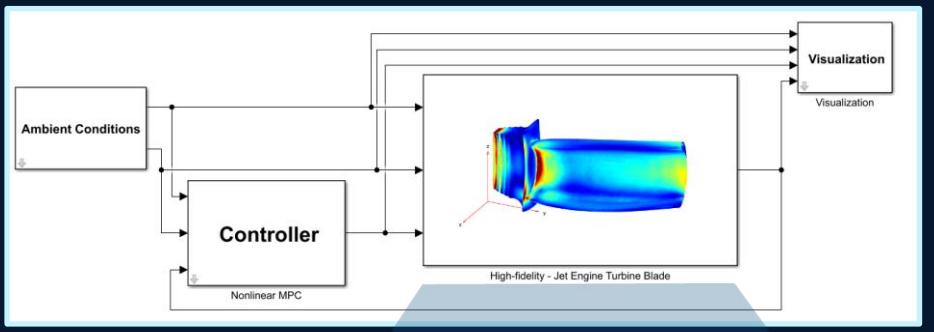


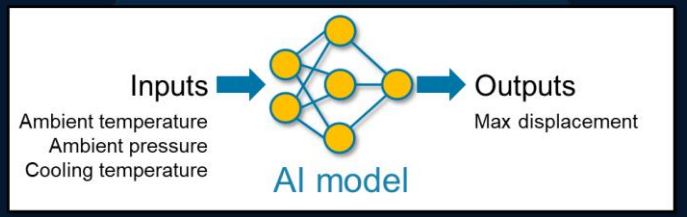
Physics-based model

Design of experiments

Train AI model from synthetic data

Reduced-Order Model

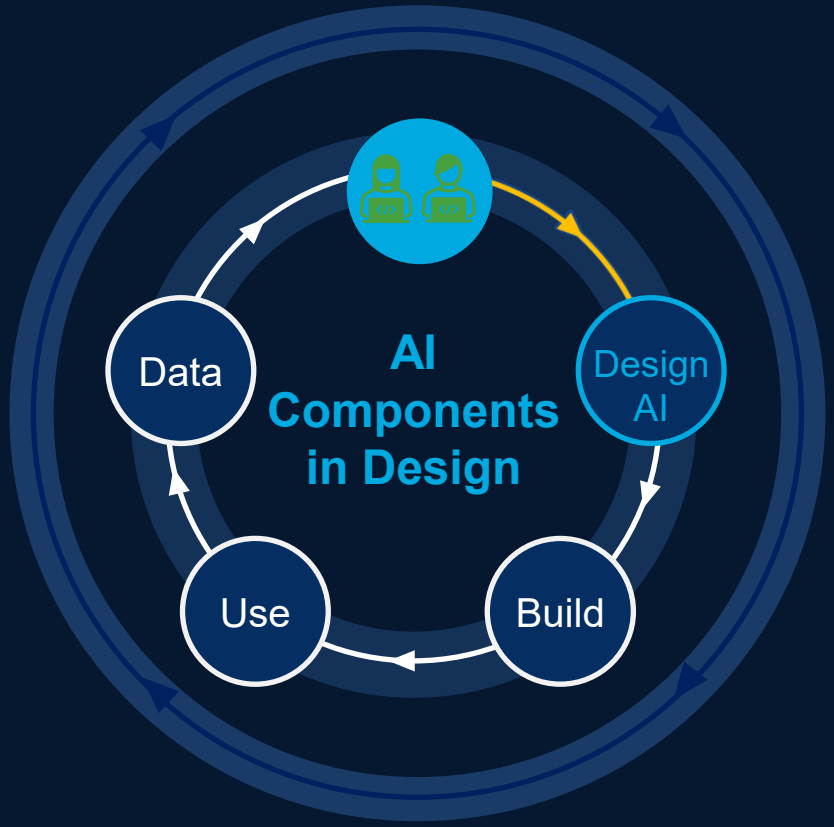


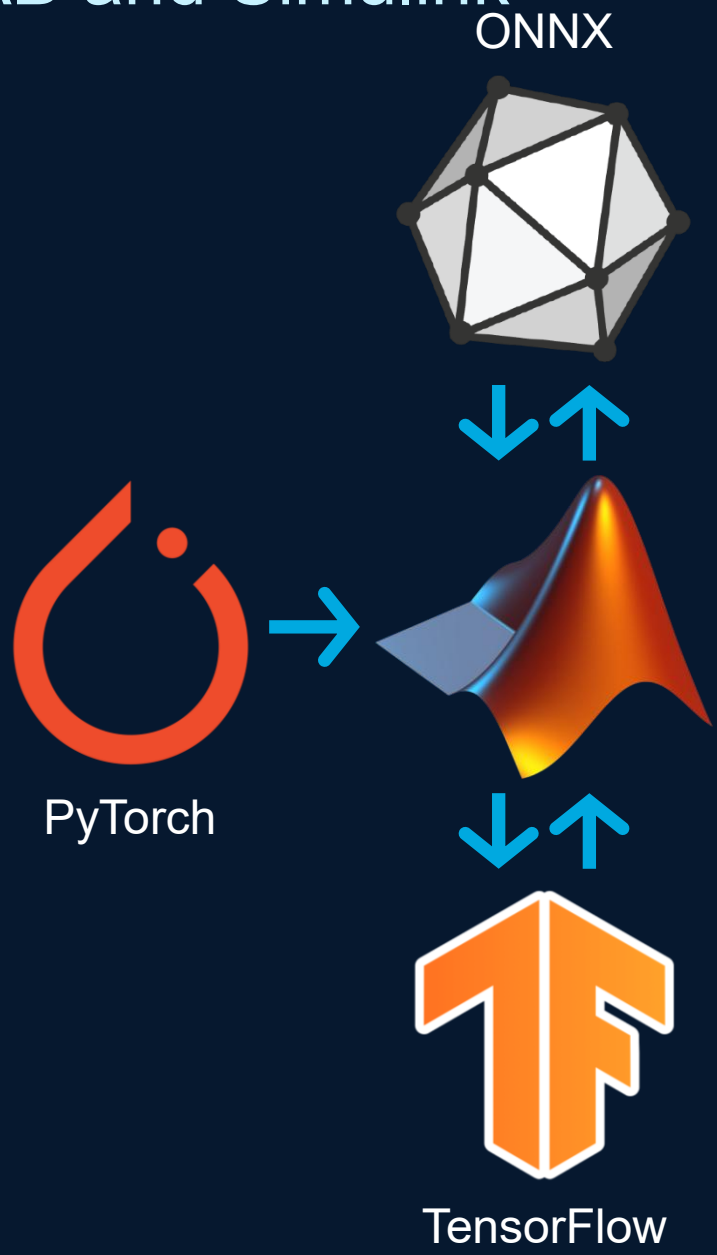


0.028 seconds

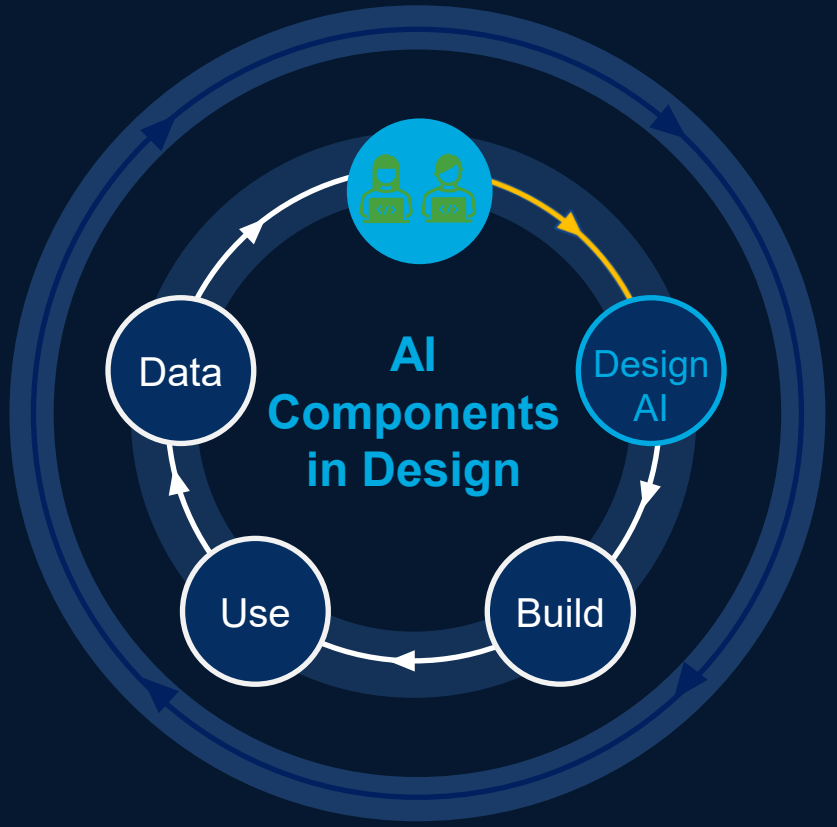
(For <1.5 h simulation)

Connecting Python AI models with MATLAB and Simulink workflows



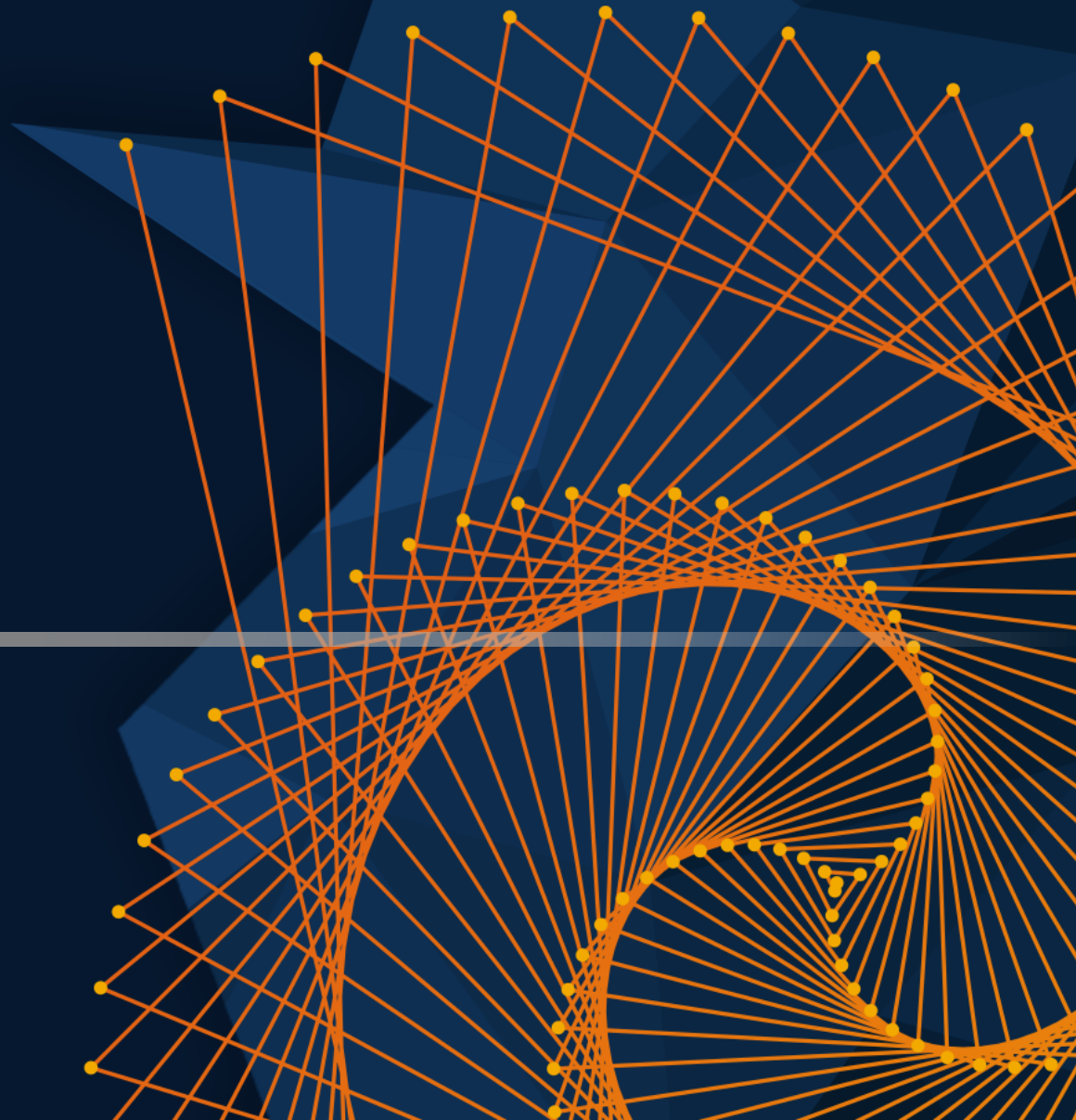


AI enhances the design process



Design loops go **faster-and-faster** with AI

Human in the loop and agentic AI in open engineering ecosystems



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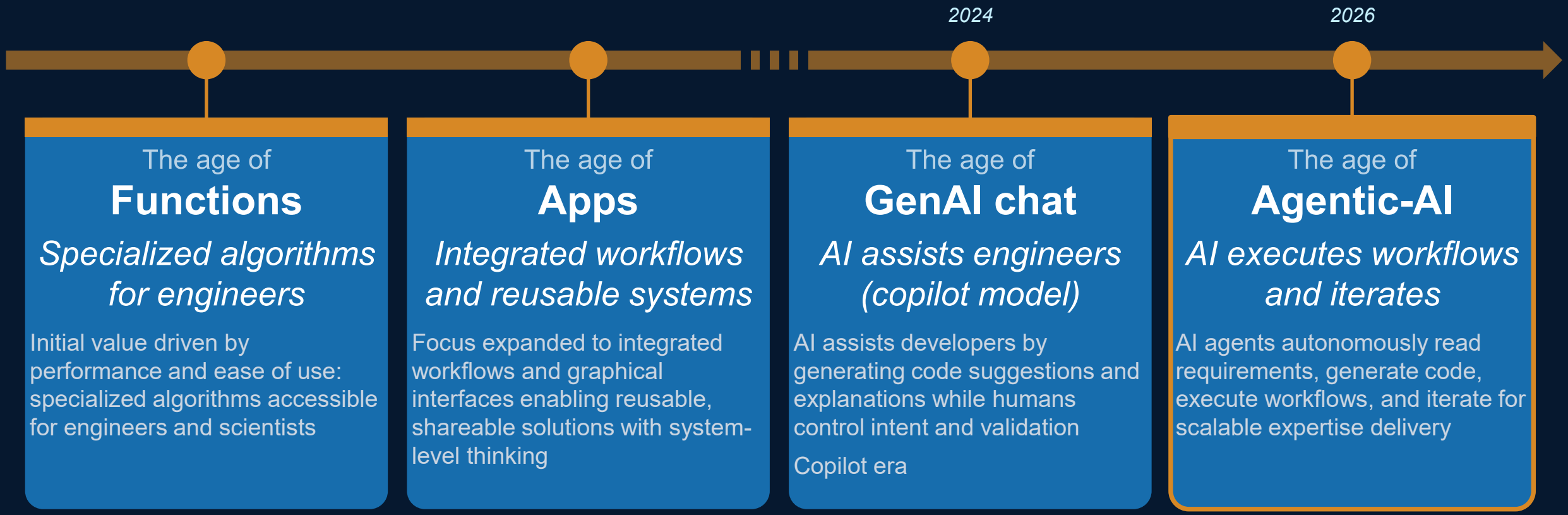
The evolution of computing eras



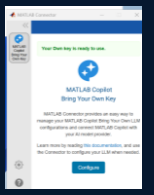
Generative AI innovation in MATLAB and Simulink

May 2025 | Jun | Jul | Aug | Sep | Oct | Nov | Dec | **Jan 2026** | Feb | Mar | Apr | May

MATLAB Copilot

- Generate and modify code
- Eplain code and errors
- Create tests

LLM Model Update

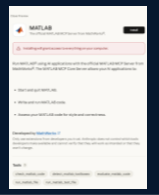


- Bring you own key (OpenAI)

MATLAB MCP Core Server

5 core MCP Tools

- Lazy load of MATLAB
- MATLAB coding guidelines resource



- Easy Install

MATLAB Agentic Toolkit

- Connect LLMs to MATLAB
- Skills turn LLMs into MATLAB experts

Simulink Copilot

Beta program started

LLM Model Update

- Understand models
- Search semantically
- Troubleshoot errors
- Automate predefined tasks

Simulink Agentic Toolkit

- Connect LLMs to Simulink
- Skills turn LLMs into Simulink experts

How MathWorks delivers Generative AI for engineering

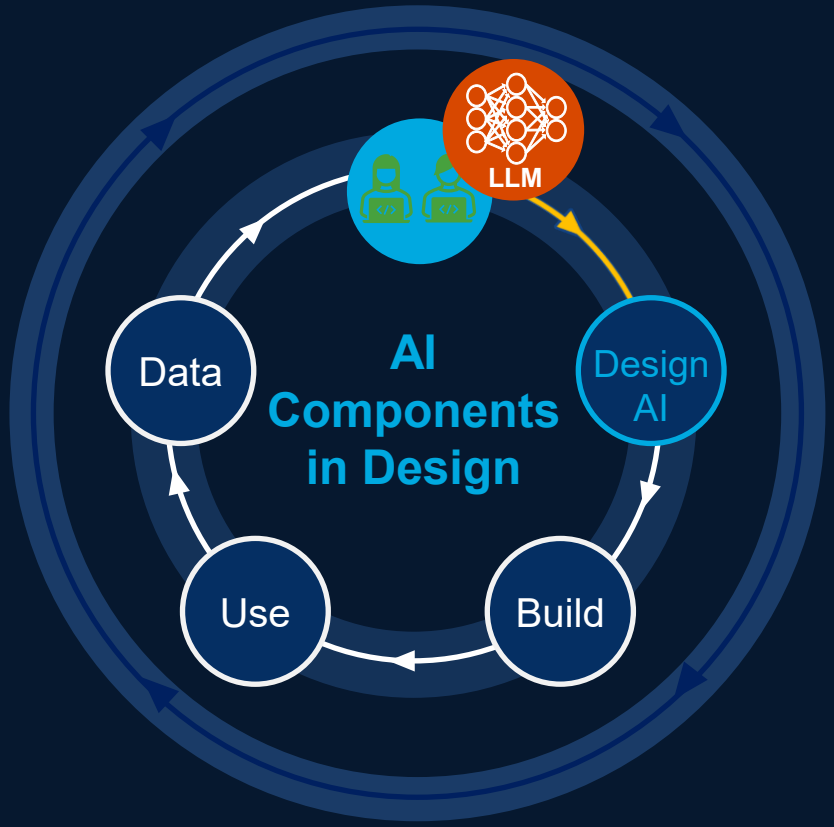
Stable, validated releases for engineering, twice a year

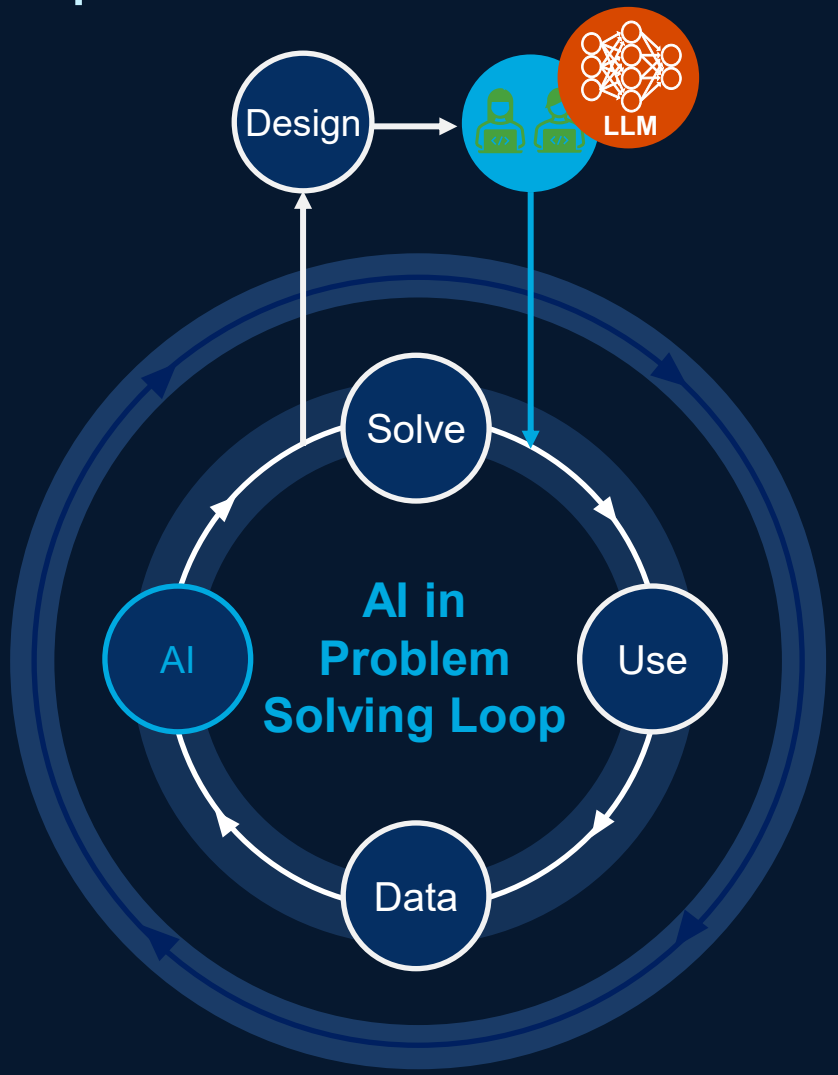
- Maintain engineering-grade reliability
- Provide a validated foundation for AI in regulated workflows

Continuous delivery of new AI capabilities between releases

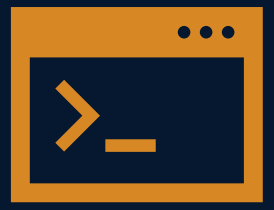
- Address evolving engineering use cases
- Integrate emerging AI technologies safely

AI is becoming part of the engineering loop





Engineering is moving from using tools to delegating tasks to AI



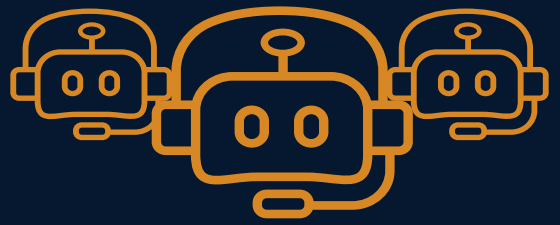
Generates code and models

Uses engineering tools

Operates across domains and workflows

From AI **tools** to AI **agents**

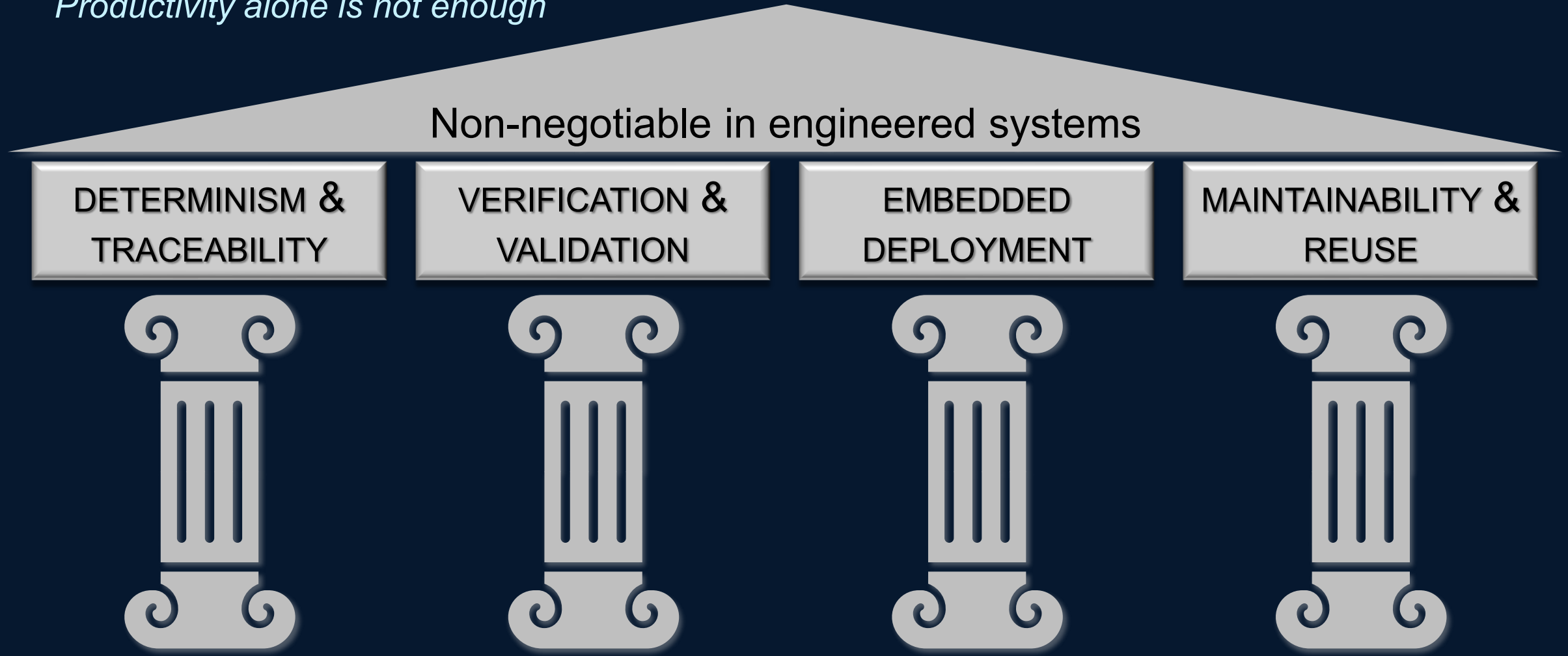
Chatbots answer questions



Agents execute workflows

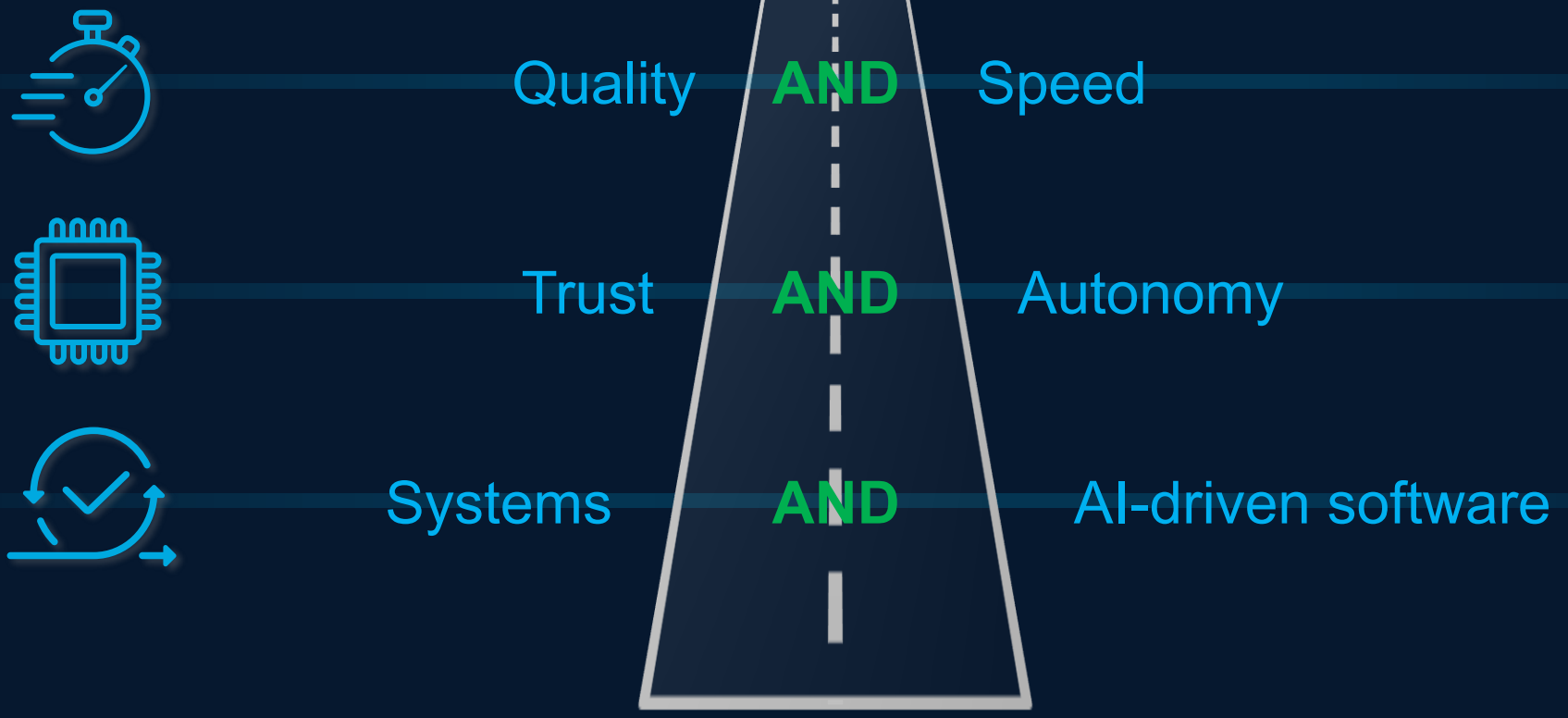
Generative AI must fit engineering constraints

Productivity alone is not enough

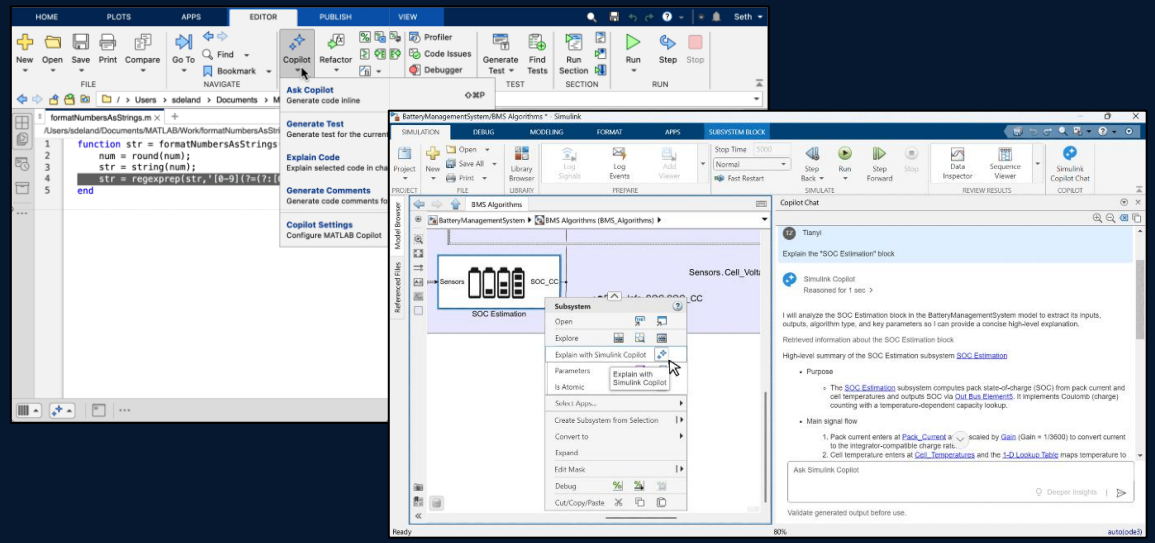


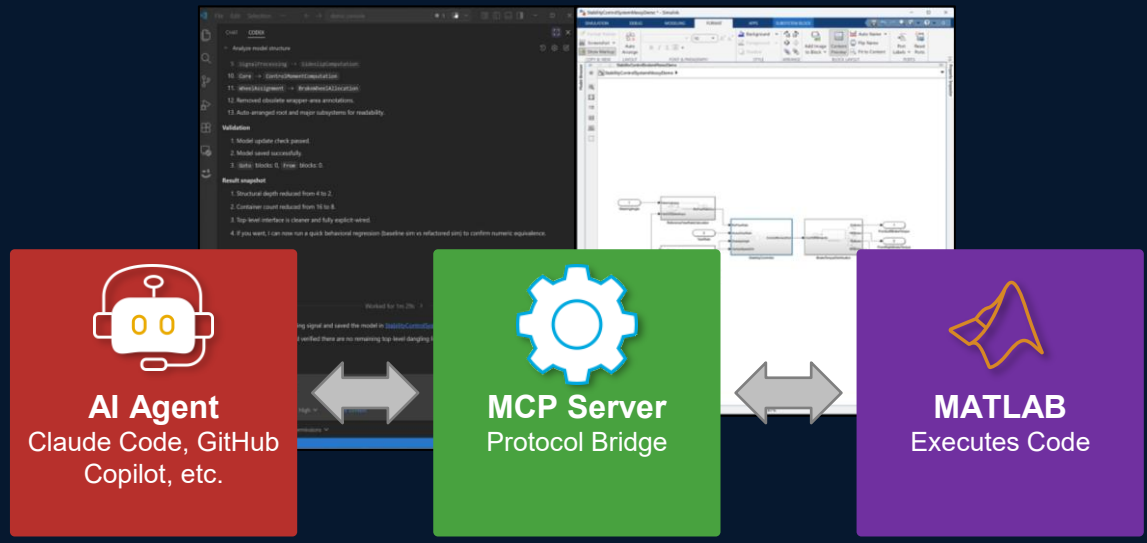
Engineering with GenAI: our approach

Trusted engineering tools + **GenAI**



Integrating Model-Based Design and Generative AI





Integrated AI

Connected AI

MathWorks Copilots

Integrated in MATLAB, Simulink and Polyspace workflows

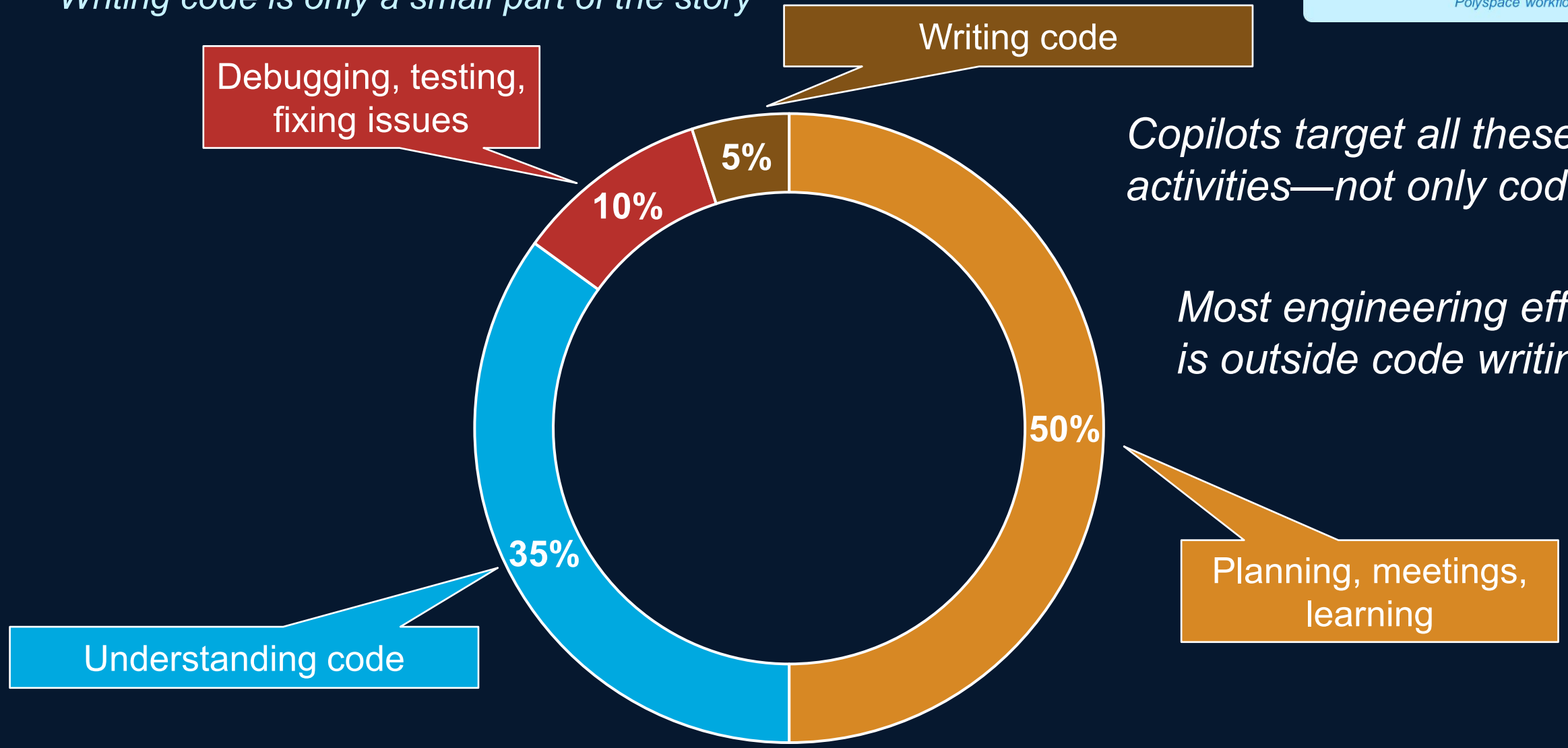
External AI Agents

Use MATLAB/Simulink within agent-based workflows via MCP

MATLAB Copilot

Writing code is only a small part of the story

MathWorks Copilots
Integrated in MATLAB, Simulink and Polyspace workflows



Copilots target all these activities—not only coding

Most engineering effort is outside code writing

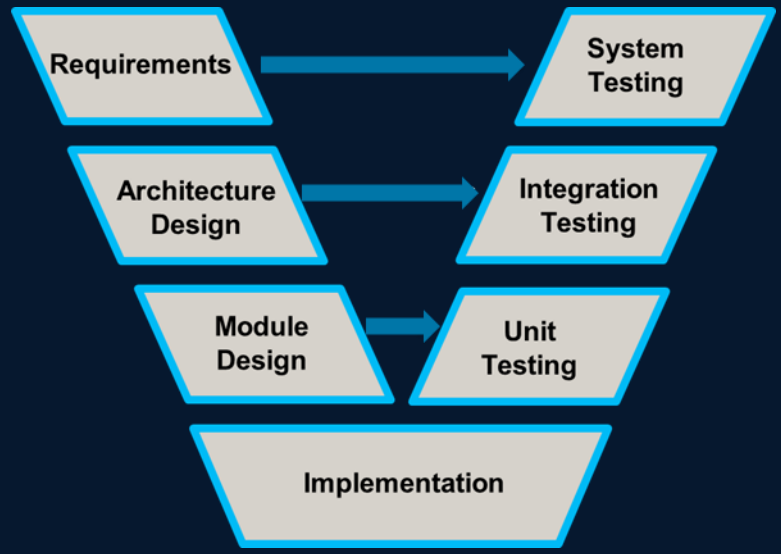
Based on Povarov, Nikita (2022, May 20) *AI for Software Developers: a Future or a New Reality?*. InfoQ. https://www.infoq.com/articles/ai-for-software-developers/

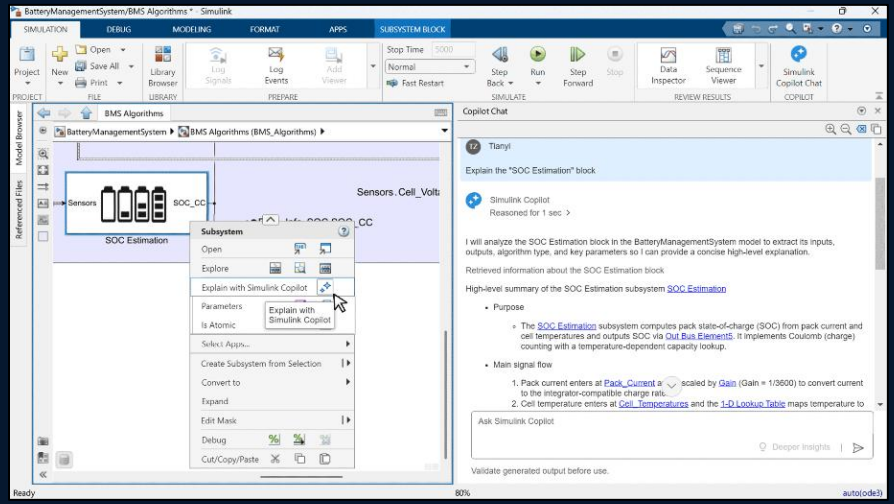
Simulink Copilot

AI support across Model-Based Design activities

MathWorks Copilots
Integrated in MATLAB, Simulink and Polyspace workflows

- Extend Copilot support beyond coding, to Model-Based Design activities
- Support modeling, analysis, and refinement
- Integrated directly in the Simulink environment
- First capabilities available in R2026a
  - More capabilities to come in next releases





Connecting external AI to MATLAB

External AI Agents
Use MATLAB/Simulink within agent-based workflows via MCP

External AI Agent

- Orchestrates workflows across tools

MCP

connection layer

- Standard interface to MATLAB
- Enables integration with different agents

MATLAB

- Executes engineering tasks
- Uses models and domain knowledge

Decouples agent from execution environment

Agentic AI in engineering

External AI Agents
Use MATLAB/Simulink within agent-based workflows via MCP

- **Execution**
  AI executes engineering tasks, not just suggestions
- **Orchestration**
  Workflows become structured, repeatable, and scalable
- **Iteration**
  Systems evolve through continuous iteration

AI becomes part of the engineering loop

Generative AI vs Agentic AI

Generative AI

- Accelerates coding, modeling, and analysis
- Supports engineering workflows end-to-end
- Must be grounded in models, data, and context

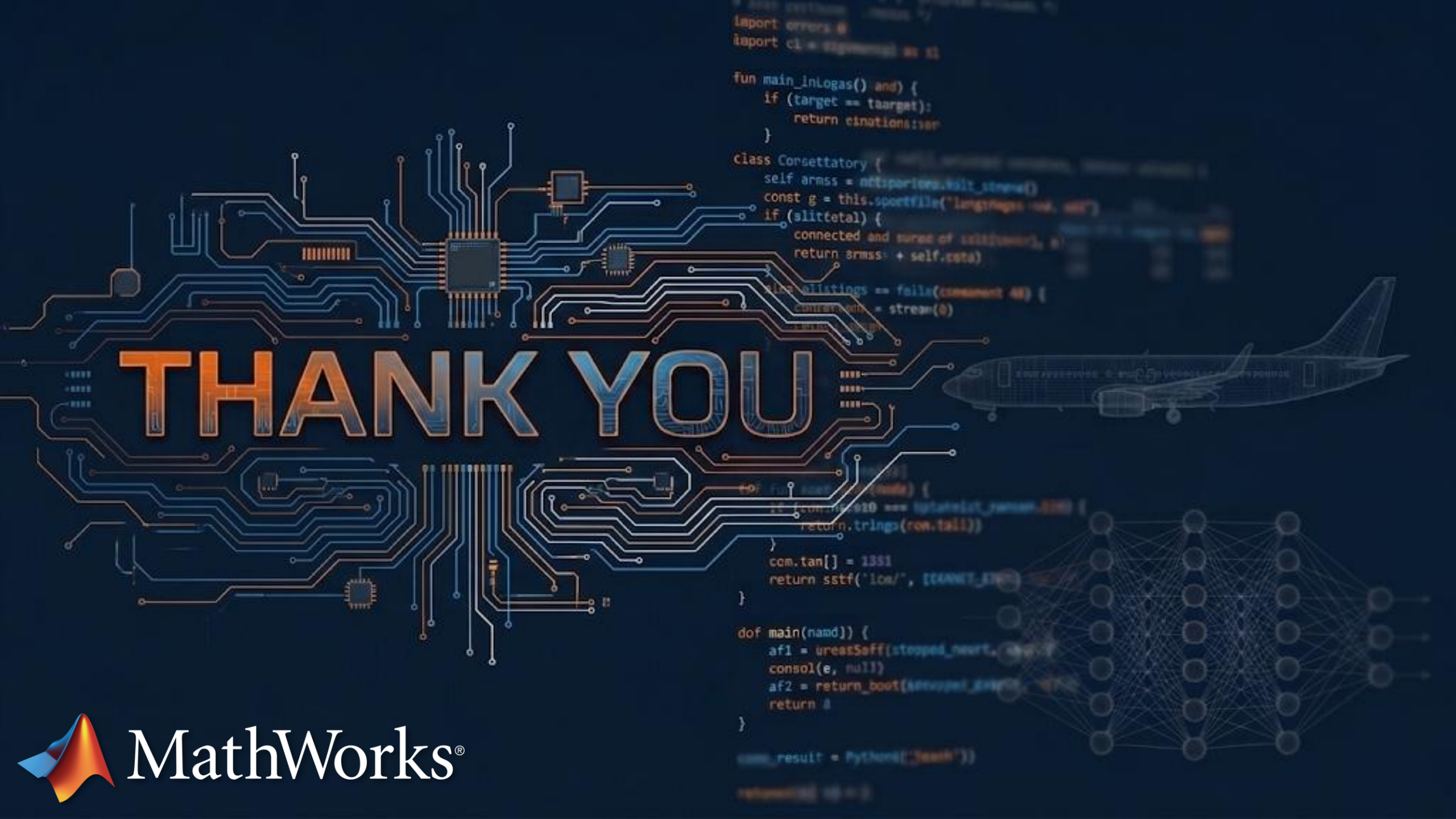
Agentic AI

- Orchestrates multi-step engineering workflows
- Executes tasks across tools and domains
- Still requires human supervision and validation

Human expertise remains central

Key takeaways

- Start from engineering problems, not from AI technology
- Integrate AI into existing Model-Based workflows
- Combine simulation data with real-world measurements
- Use GenAI to accelerate engineering tasks, not to replace engineering judgment
- Leverage agentic AI for workflow automation, under defined processes and controls
- Keep validation, testing, and traceability central
- Focus on scalable solutions across programs and teams



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