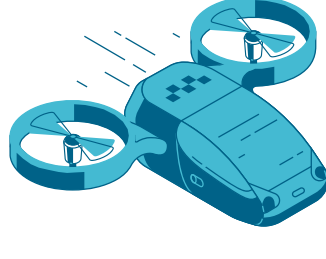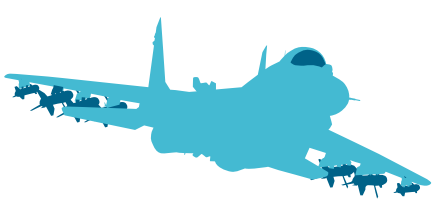# SIEMENS
Ingenuity for Life

Orchestrate your technical program and become more agile and efficient with
Model Based Systems Engineering

Trends

Pressure to Reduce Program Cost and Schedule
Companies are under pressure to reduce program cost and schedule while meeting requirements for new products.

Increasing Program Complexity and Integration
Aerospace and defense products are becoming increasingly complex and highly integrated.
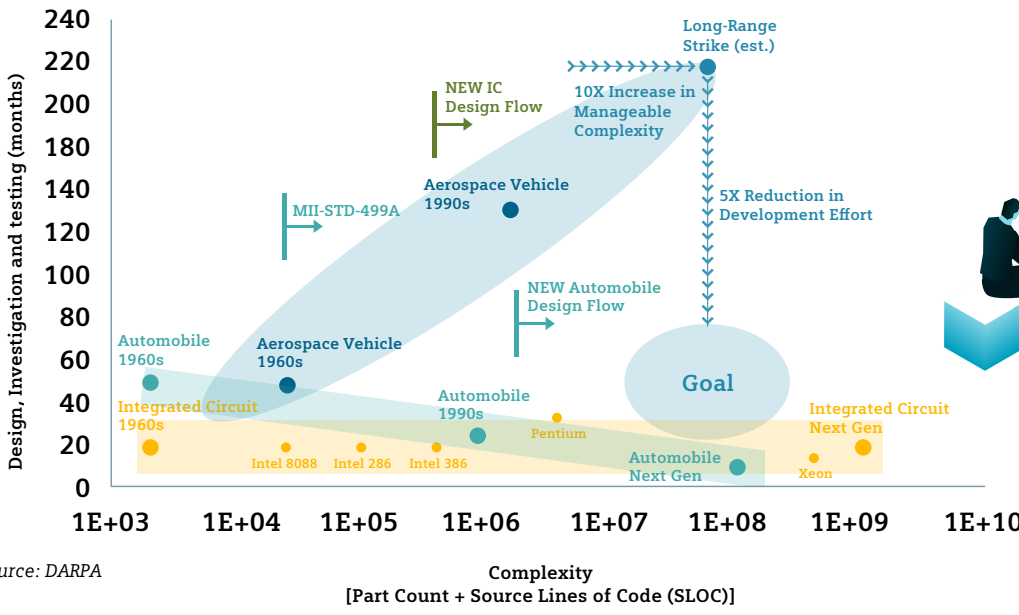
Increased Electrification of Products
Decarbonization, reliability, maintainability and performance of products are driving increased electrification.
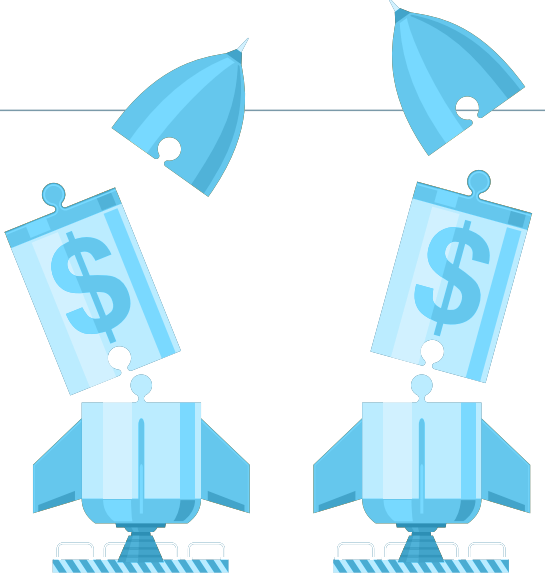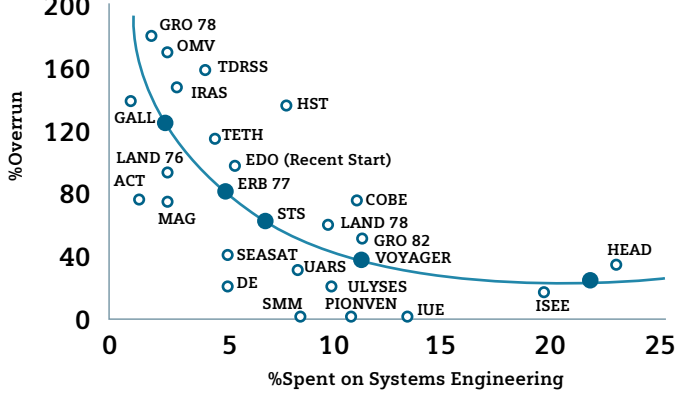
Globalization
Increasing globalization in company supply chains, workforce and the competition is driving changes to how companies collaborate both internally and externally.
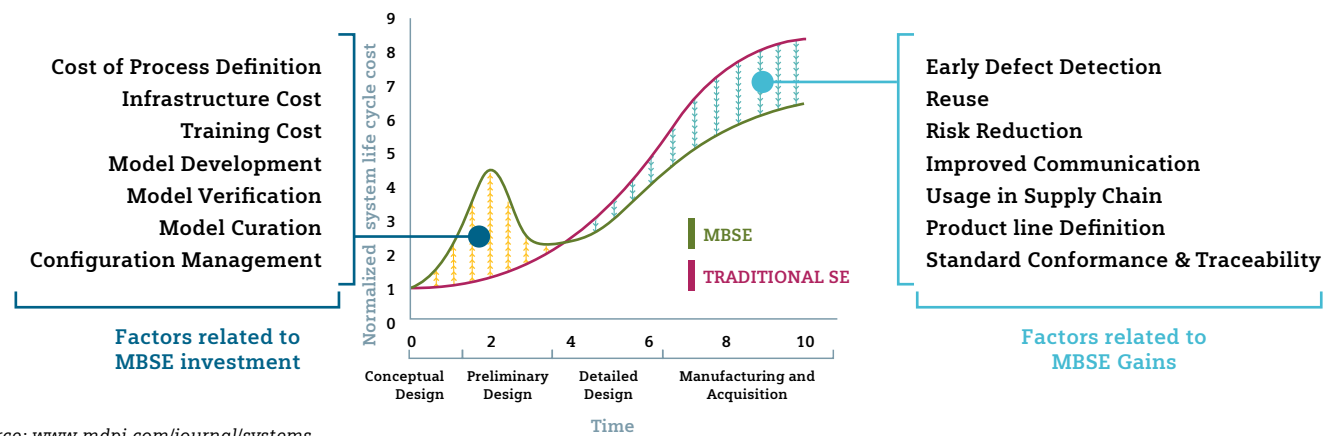
Complexity growth in A&D

Source: DARPA

X-axis: Complexity [Part Count + Source Lines of Code (SLOC)]
Y-axis: Design, Investigation and testing (months)

Long-Range Strike (est.)
10X Increase in Manageable Complexity
5X Reduction in Development Effort
NEW IC Design Flow
Aerospace Vehicle 1990s
MIL-STD-499A 1990s
NEW Automobile Design Flow
Automobile 1960s
Aerospace Vehicle 1960s
Automobile 1990s
Goal
Integrated Circuit 1960s
Automobile Next Gen
Integrated Circuit Next Gen

Relation of SE investments and program cost overruns

Y-axis: %Overrun
X-axis: %Spent on Systems Engineering

Source: www.sebokwiki.org/wiki/Economic_Value_of_Systems_Engineering

MBSE factors related to investment and gains

Factors related to MBSE investment
- Cost of Process Definition
- Infrastructure Cost
- Training Cost
- Model Development
- Model Verification
- Model Curation
- Configuration Management

Factors related to MBSE Gains
- Early Defect Detection
- Reuse
- Risk Reduction
- Improved Communication
- Usage in Supply Chain
- Product line Definition
- Standard Conformance & Traceability

Y-axis: Normalized lifecycle cost
X-axis: Time
MBSE
TRADITIONAL SE
Conceptual Design / Preliminary Design / Detailed Design / Manufacturing and Acquisition

Source: www.mdpi.com/journal/systems

Challenges with certifying and managing programs

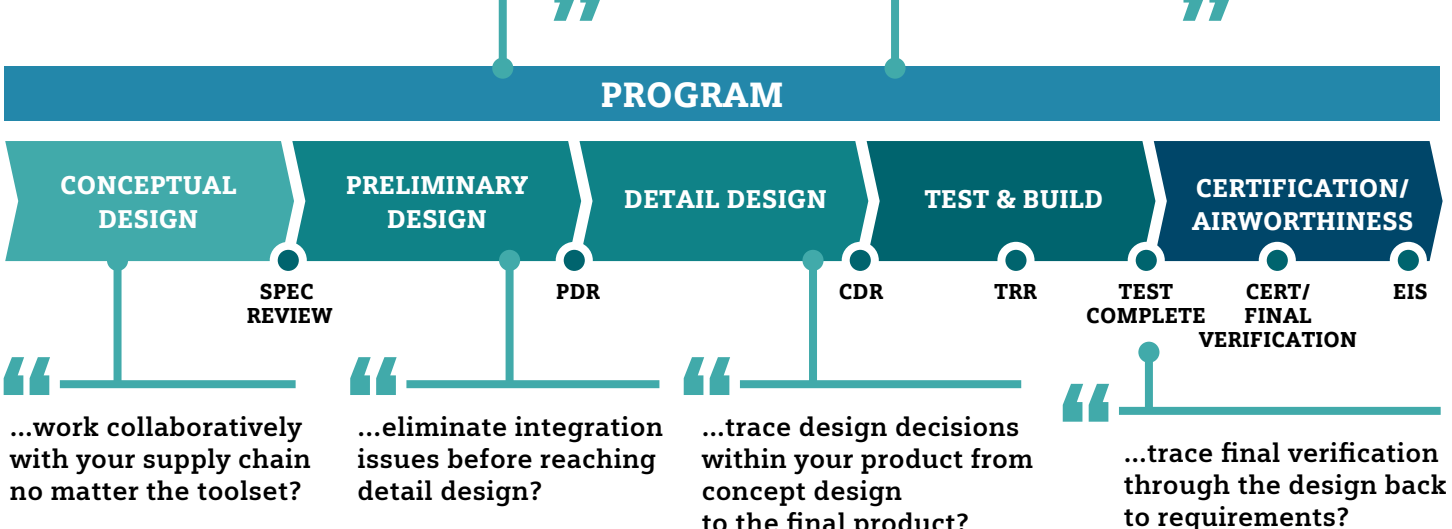**Compliance with regulatory requirements**

Difficult to manage document-centric systems engineering processes

Increased cost and risks due to integration of complex systems and supplier relationships

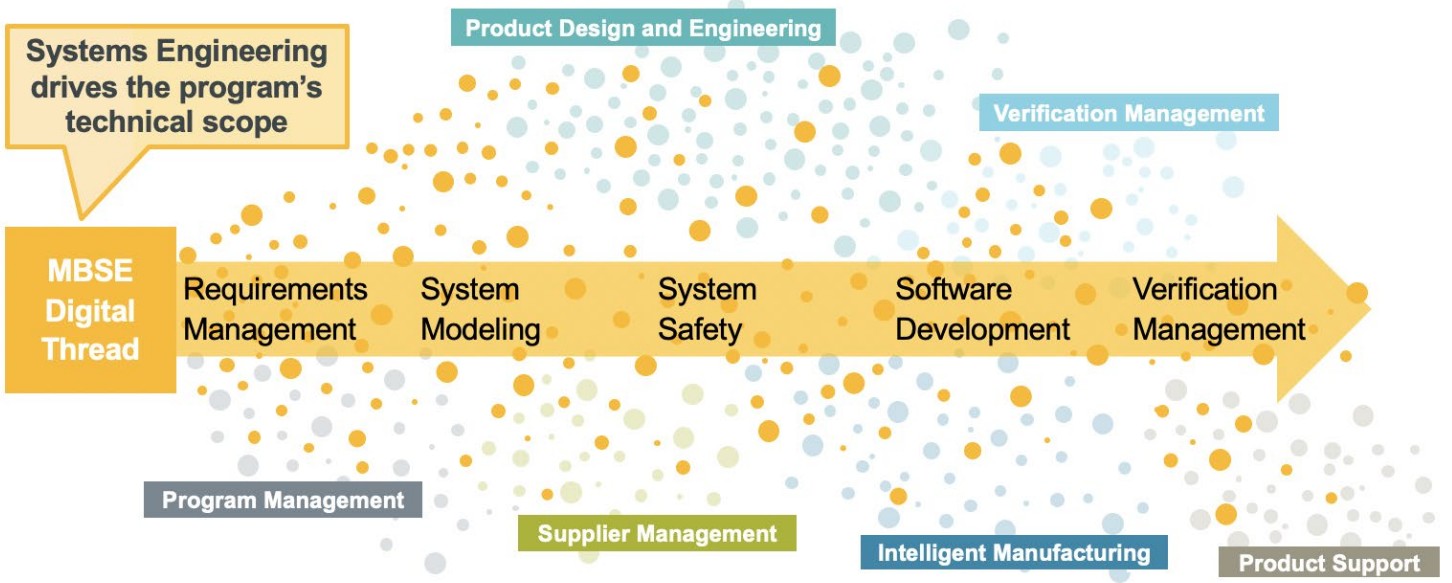## Model Based Systems Engineering... What if you could...?

...orchestrate the technical content and scope of your program throughout the entire lifecycle?

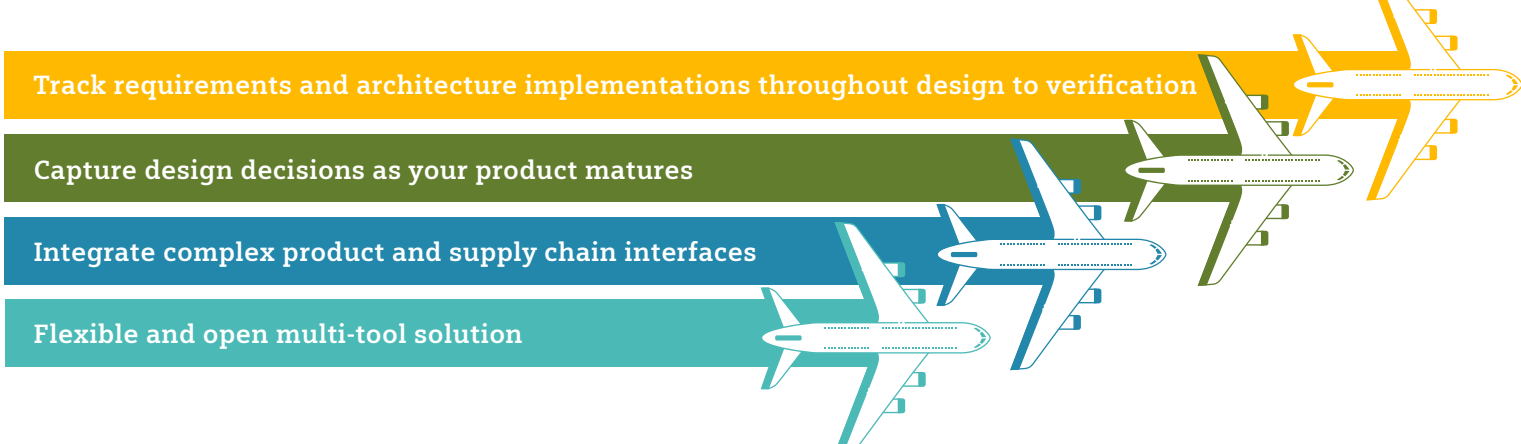...continuously monitor with real-time access to key technical performance indicators?

PROGRAM

CONCEPTUAL DESIGN	PRELIMINARY DESIGN	DETAIL DESIGN	TEST & BUILD	CERTIFICATION/ AIRWORTHINESS
SPEC REVIEW	PDR	CDR / TRR	TEST COMPLETE	CERT/ FINAL VERIFICATION / EIS

...work collaboratively with your supply chain no matter the toolset?

...eliminate integration issues before reaching detail design?

...trace design decisions within your product from concept design to the final product?

...trace final verification through the design back to requirements?

MBSE Digital Thread to orchestrate your technical program

One thread to connect and guide all domains

Systems Engineering drives the program's technical scope

Product Design and Engineering
Verification Management

MBSE Digital Thread
Requirements Management → System Modeling → System Safety → Software Development → Verification Management

Program Management
Supplier Management
Intelligent Manufacturing
Product Support

Drive scope by moving from system modeling to the comprehensive MBSE digital thread

- Track requirements and architecture implementations throughout design to verification
- Capture design decisions as your product matures
- Integrate complex product and supply chain interfaces
- Flexible and open multi-tool solution

Accelerate your new product development and become more agile

- Get your design right the first time through up-front systems engineering
- Manage complex product and supply chain integration
- Full lifecycle solution to deliver safe, reliable products faster – and within budget

Reduce risk
Speed to market
Ensure compliance
Beat the competition
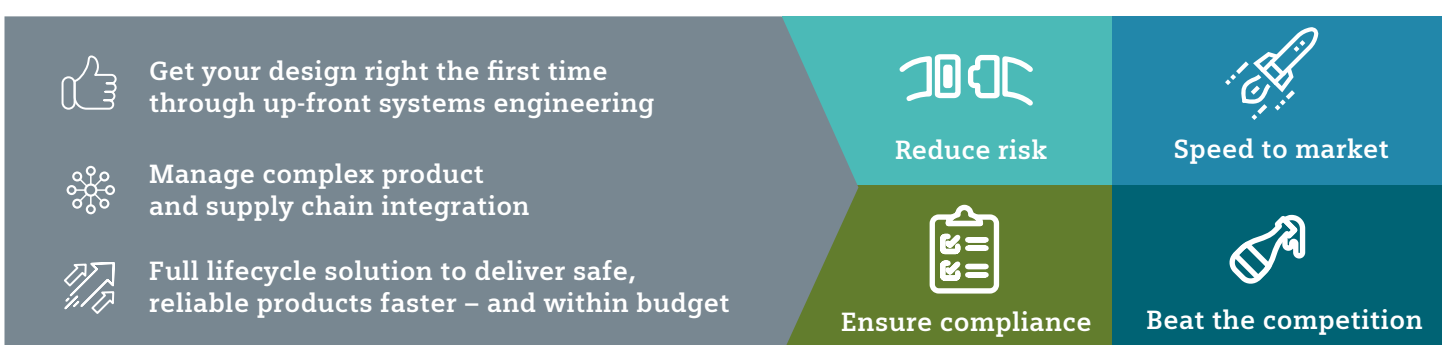
For more information, visit:
siemens.com/polarion