Exploiting an Electrical System Model to Increase EWIS Manufacturing Profitability

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Integrated Electrical Systems – Solutions Architect, Aerospace & Defense

Global Product Data Interoperability Summit | **2020**

Mission:

- *Serve the A&D Industry*
- *Grow Siemens Offerings & Business*

Background:

- 28 years in the U.S. Aerospace Industry (Aircraft OEMs)
- Engineering, Certification, Customer Support, Manufacturing Support
  - Aircraft Production, Outfitting, Modification, Special Missions
  - New product development
- Direct customer and partner engagement
  - Airlines, Government and private customers, suppliers
  - Regulatory agencies (FAA, EASA)
- Education
  - Bachelor of Science, Engineering Mechanics, University of Wisconsin – Madison

Aerospace harness suppliers are under pressure

How to meet promises for profit, responsiveness, quality and delivery time?

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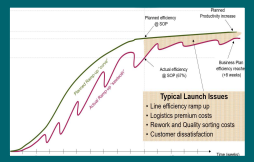
THE SUPPLIER SQUEEZE!

The More Electric Aircraft

Increased System Complexity

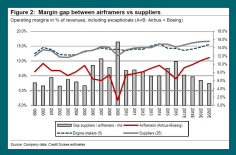
Increased Frequency of Design Changes



More Challenging Program Launches

Global Competition

OEM/Supplier Vertical Integration



Increased Margin Pressure From Customers

Loss of Tribal Knowledge

Aircraft differentiation spurs electrification

Increased electrification: Evidenced by power demand

Magnitude of Impact:

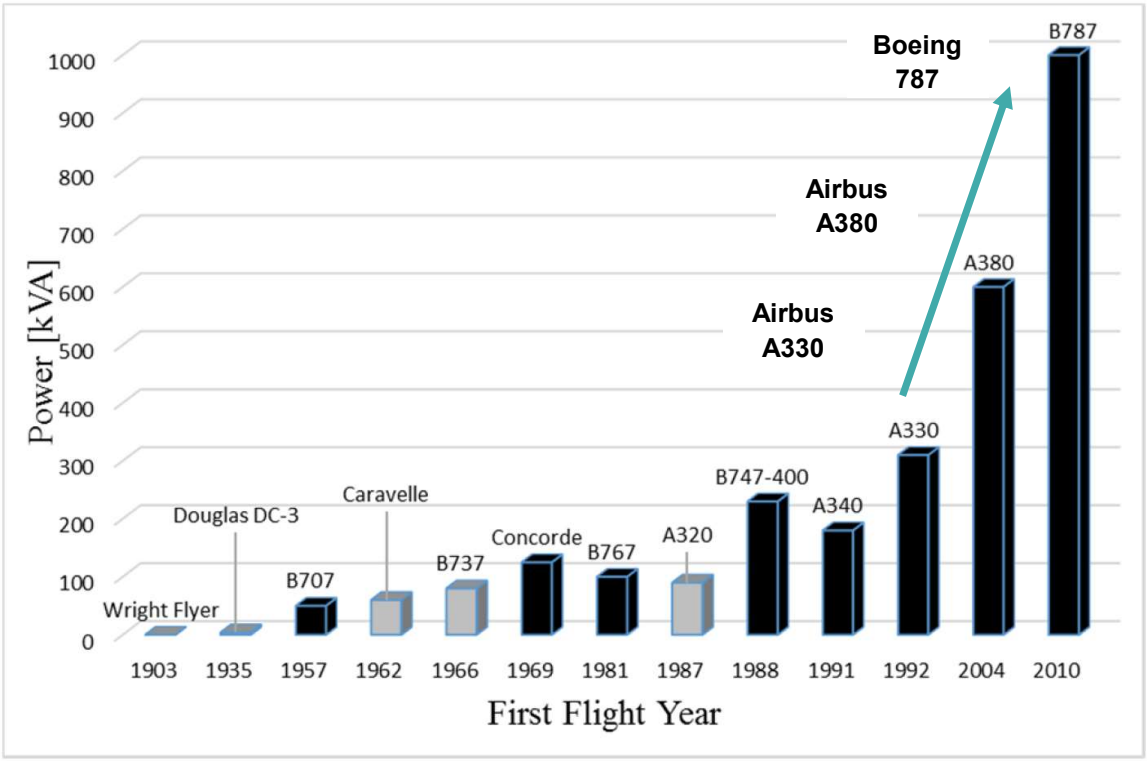
25% EE Content Growth Every 5 Years

10x Power Demand Over 50 years

EWIS now 3% of Aircraft Weight

EWIS Cost Grows Faster than Content

EWIS = Electrical Wiring Interconnection System



Paper: "Electrical Power Generation in Aircraft: review, challenges and opportunities"
http://eprints.nottingham.ac.uk/51652/1/Electrical%20Power%20Generation%20in%20Aircraft.pdf

Increased electrical system and wire harness design change

The New Reality: More & Shorter Duration Production Runs

Market Driver

- Variation desired in customer Aircraft configuration
  - Derive competitive advantage through responsiveness

Regulatory Driver

- Keep pace with regulatory evolution
  - Must integrate impact of regulation changes

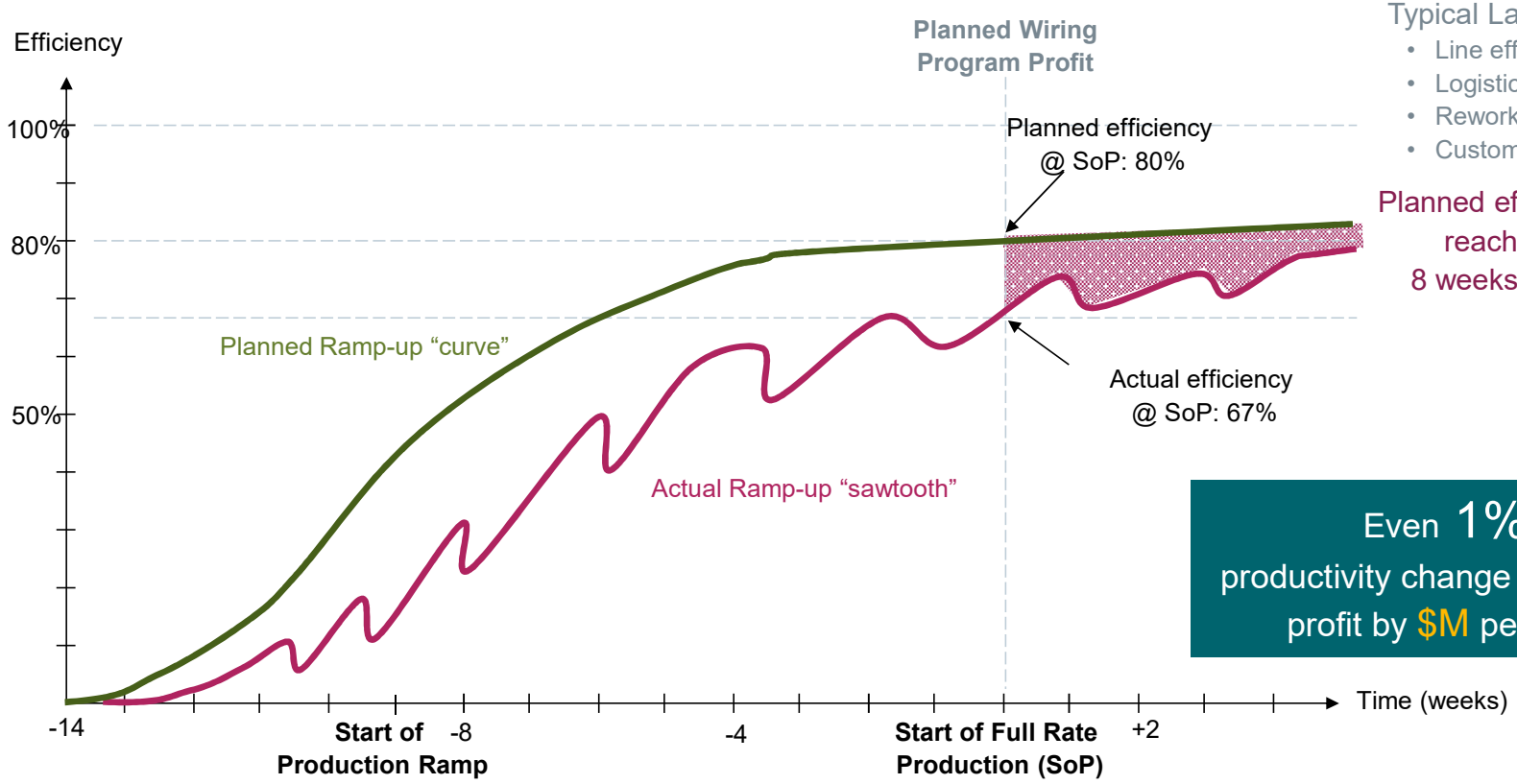
Financial Driver

- Integrate design improvements
  - For cost reduction, producibility, reliability and performance

Address unexpected, late breaking integration problems!

Predictable production ramp essential

Missed productivity expectations can consume profit from ENTIRE run!



Typical Launch Issues

- Line efficiency ramp up
- Logistics premium costs
- Rework and quality sorting costs
- Customer dissatisfaction

Planned efficiency reached 8 weeks late!

Even 1% productivity change can swing profit by $M per year

Predictable & profitable harness manufacture is difficult

Manufacturing engineering methods too slow & expensive to scale

Current methods from a less demanding era:

Manual, slow & disconnected

Onerous and expensive

Issues often found late in the manufacturing cycle

- Forcing ***expensive*** iterations at a ***critical*** phase

Result:

Risks to Delivery Milestones, Profitability & Reputation

Digitalization: Transforming Business Processes

Including the Transition to Production

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…we are shifting toward a dynamic digital engineering ecosystem. This digital engineering transformation is necessary to meet new threats, … and leverage technology advancements.

Kristen Baldwin,

US Acting Deputy Assistant Secretary of Defense for Systems Engineering

…it's a time of unprecedented technological change.

Dr. Will Roper

Assistant Secretary of the Air Force tor Acquisition, Technology and Logistics

Model Based E/E Systems Development

Leveraging the configuration controlled, electrical digital twin.

Connected by a comprehensive DIGITAL THREAD

Digital Twin of the Product

Complex system architecture and design

Digital Twin of Production

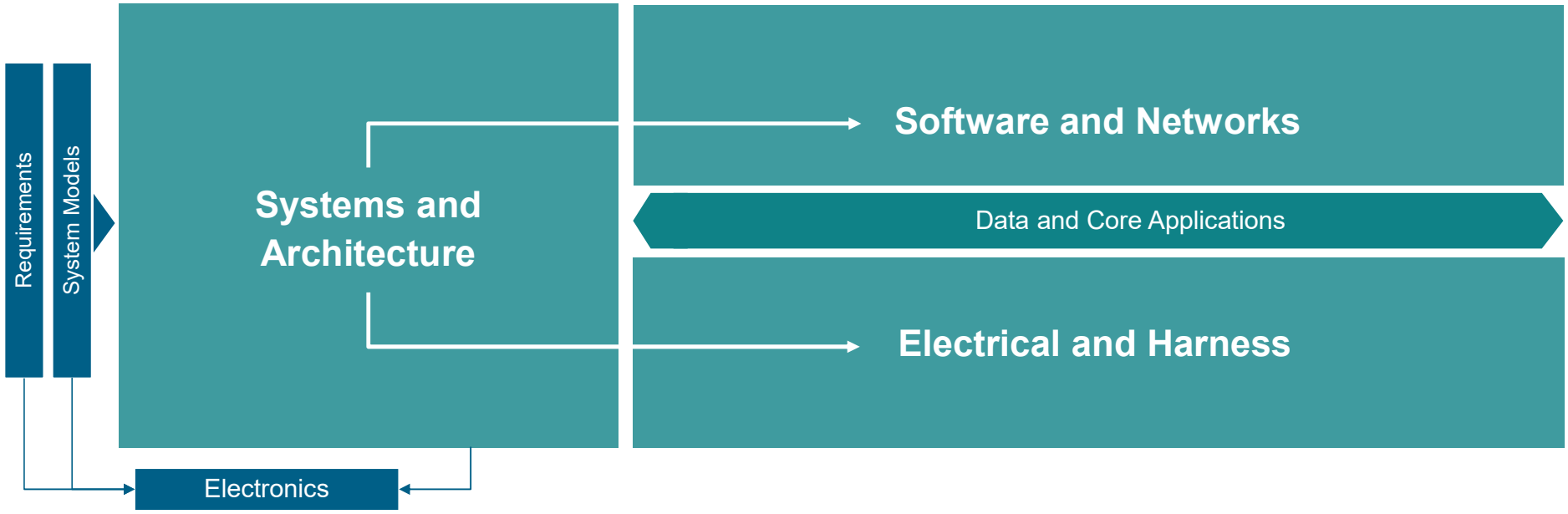
Optimal manufacture of electrical harnesses

Digital Twin of Utilization

Engineering accurate detail enhances diagnostics

E/E Systems Development

Three Primary Domains Target the Spectrum of Needs



E/E Systems Development

Three Primary Domains Target the Spectrum of Needs

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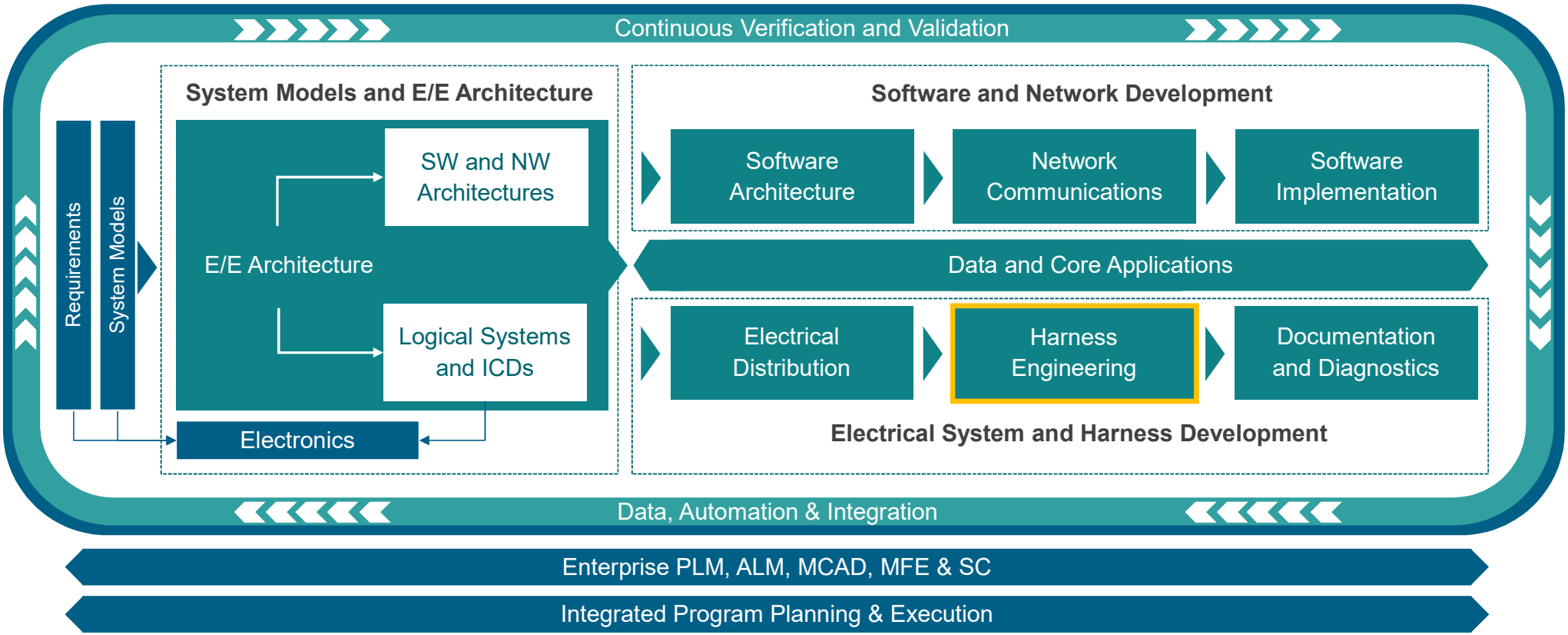

Automating Harness Engineering & Manufacture

Generation of Cost Estimates, Bill of Process & Manufacturing Aids

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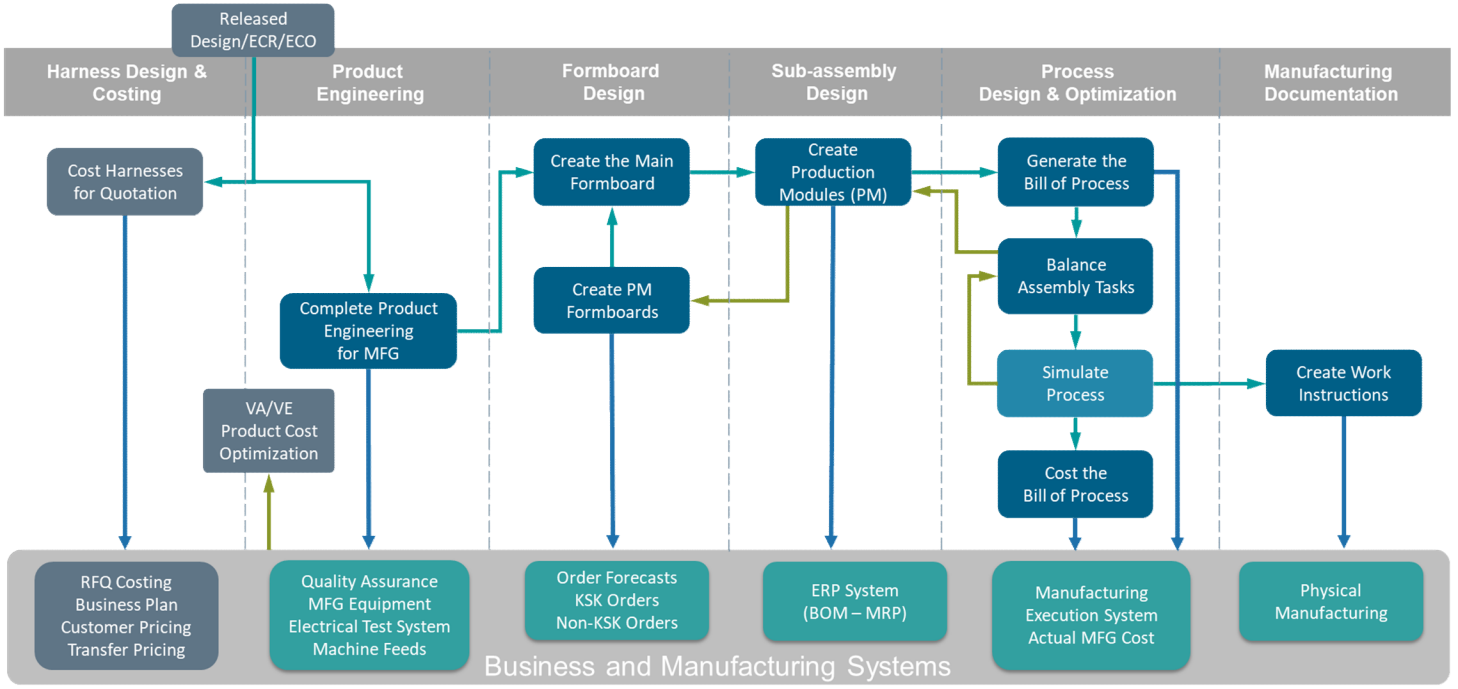
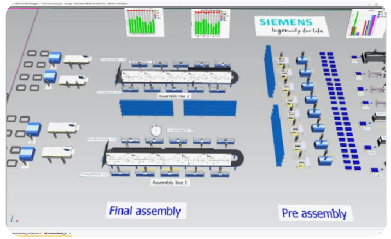
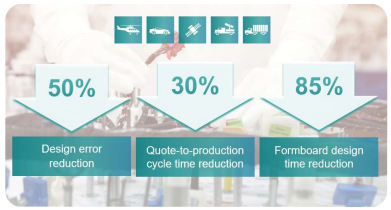






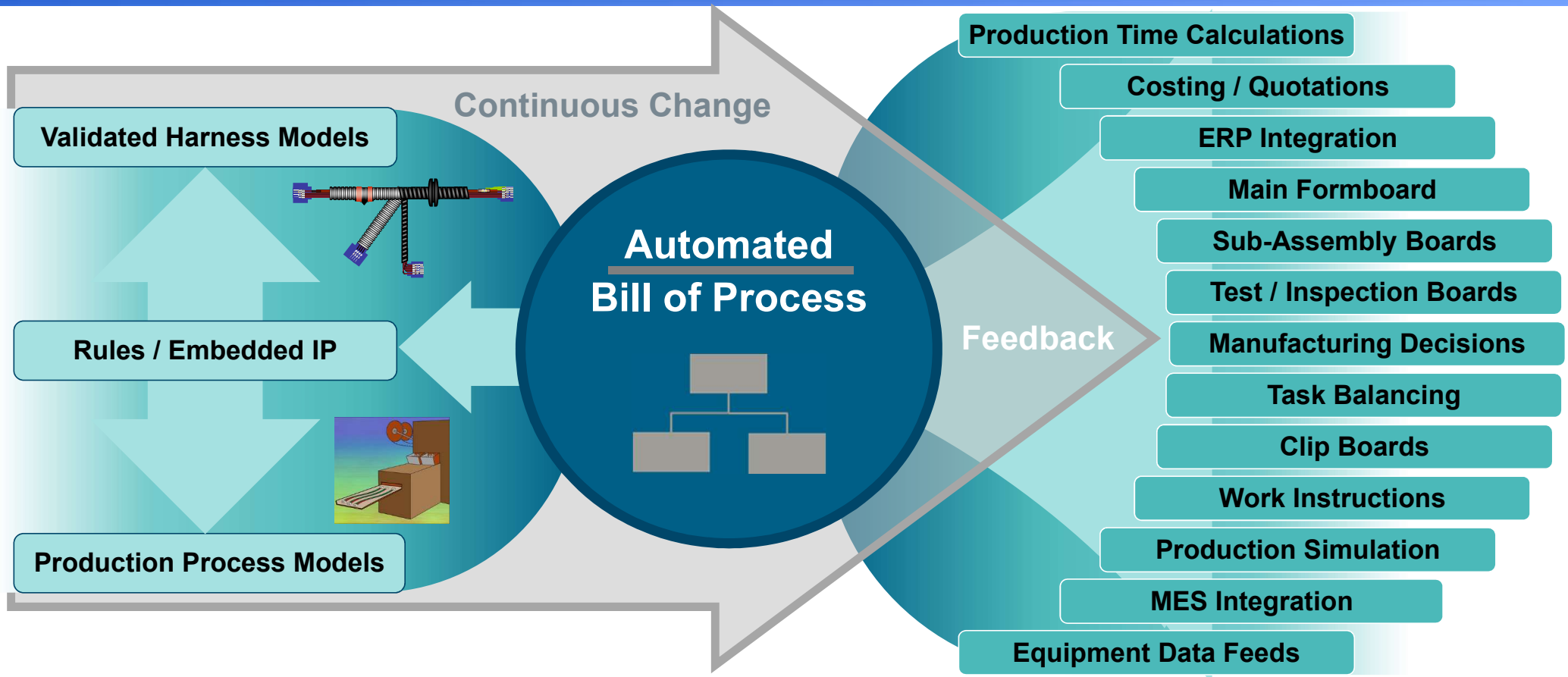
Video clip: From product through process in 2 minutes

Product | Process

... | Product Design | Product Engineering | Formboard | Sub-Assemblies | BoP & Costing | Line Balancing | Work Instructions | ...

Automatically generated Bill of Process

…generating manufacturing essentials



Tooling Improvement -- Formboard Design

Freeing Up Production Space, Reducing Storage & Increasing Productivity

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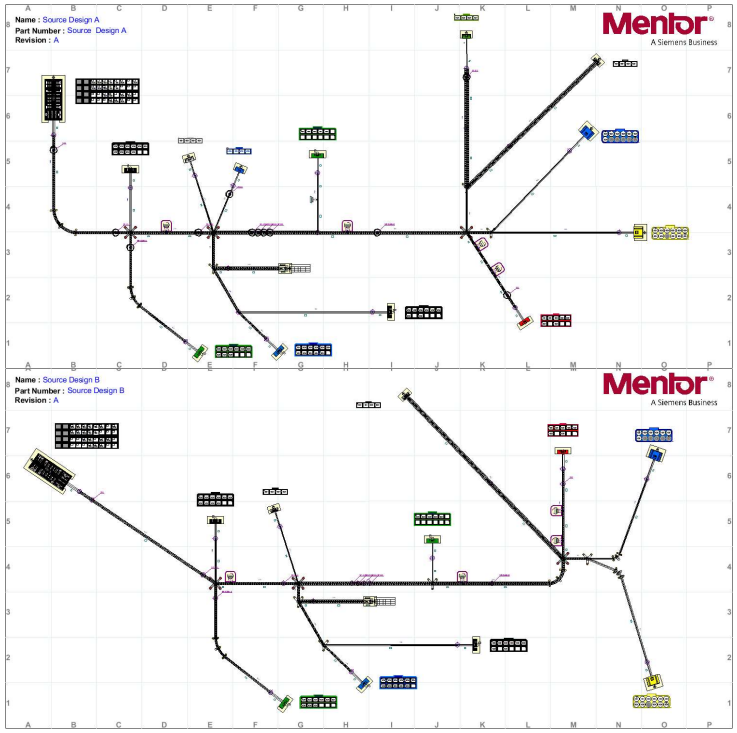
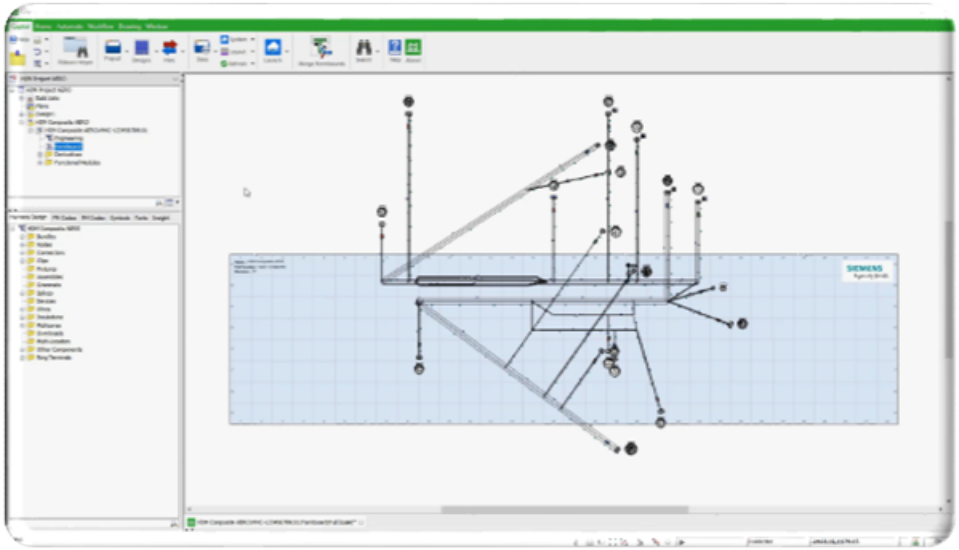
Merge Formboards

"For optimal use of factory space and available resources, we sometimes build different, but very similar, harnesses on the same formboard. We call this a merged formboard."



Ergonomic Design

"To maximize assembler comfort and productivity, we design our formboards to maximize the amount of harness assembly conducted in the primary ergonomic zone."



Creating Ergonomic Formboard

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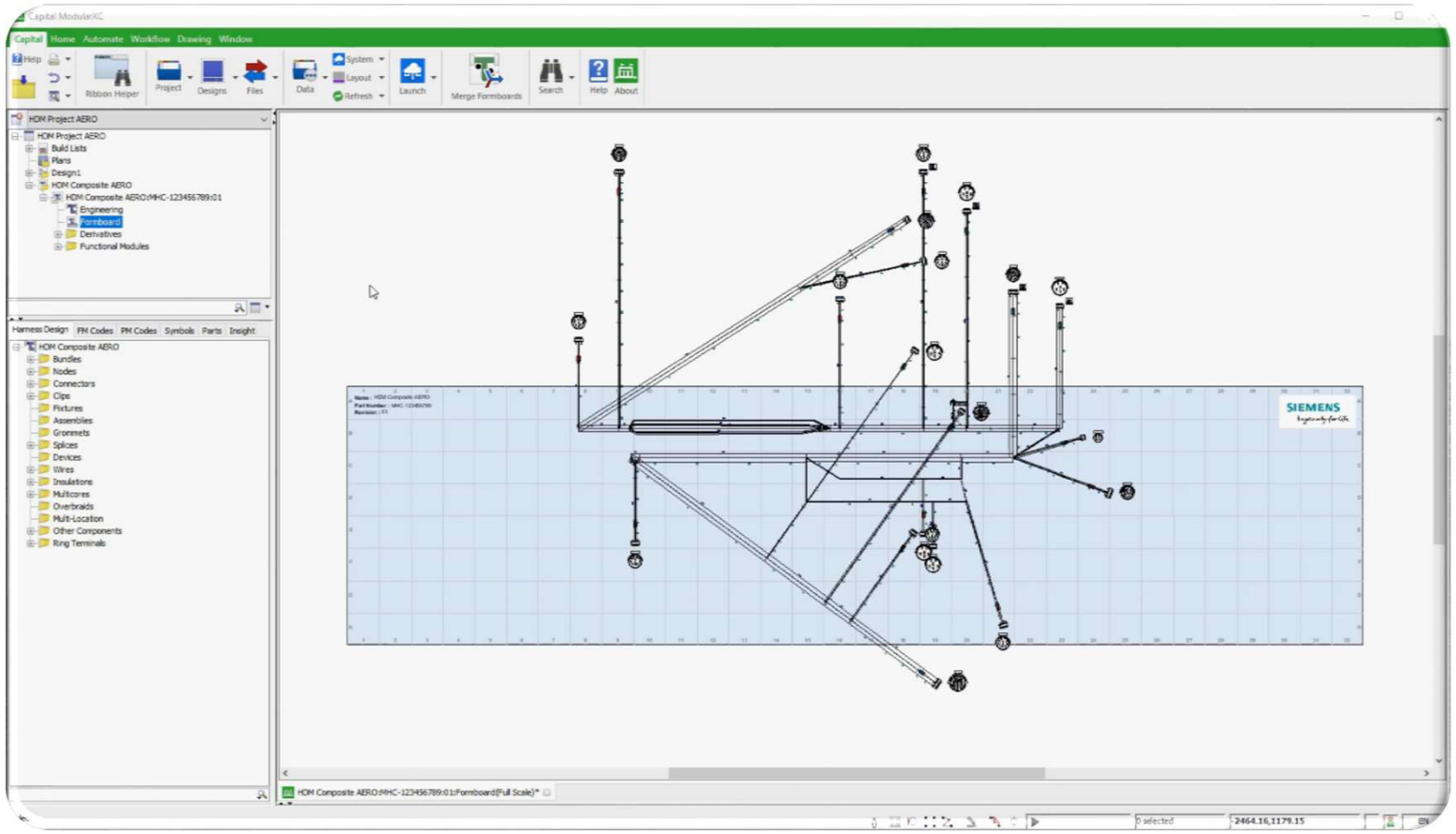
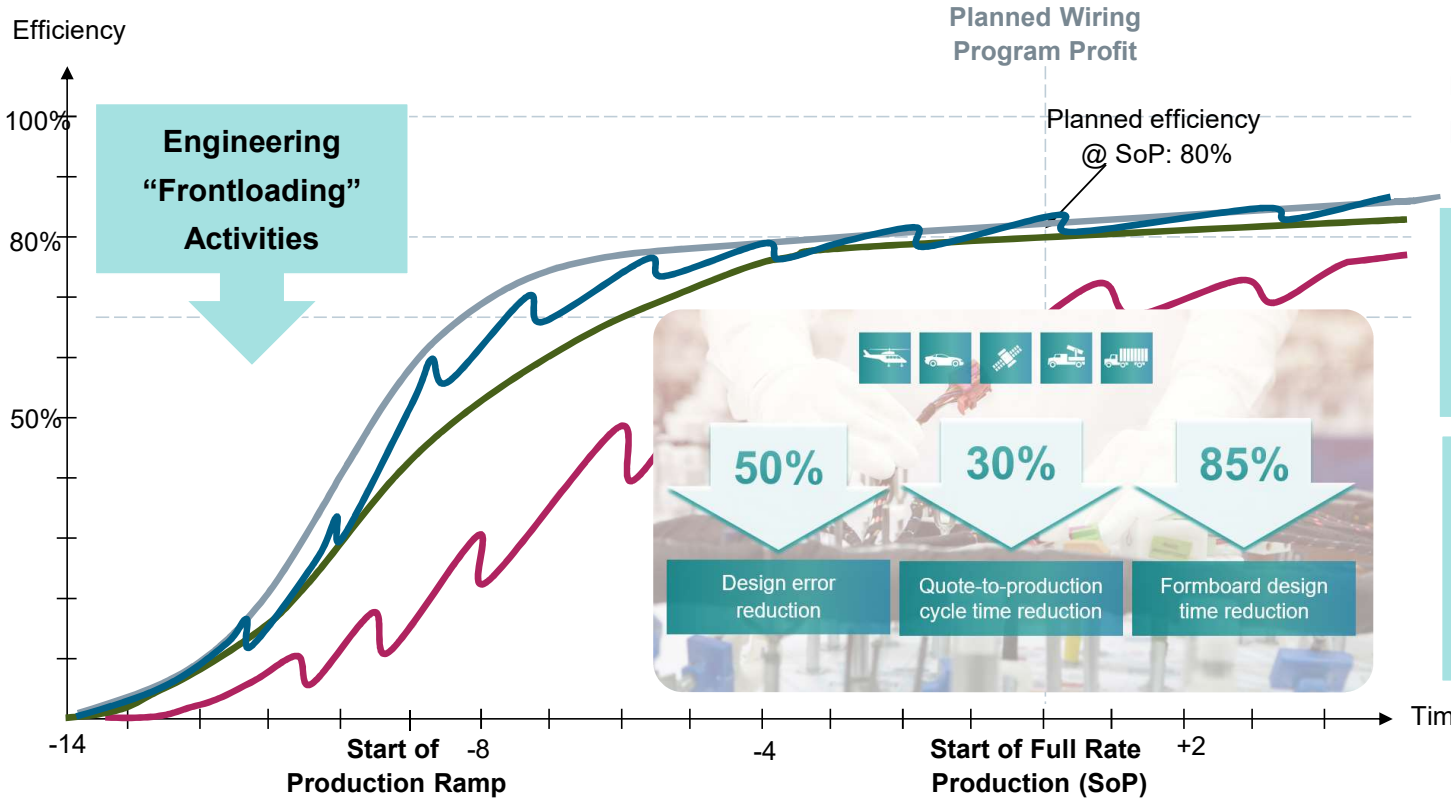


Predictable Production Ramp Essential

Engineering digital thread improves performance to plan



Improved Planned Ramp-up "curve"

Improved Actual Ramp-up "sawtooth"

Correct-by-Construction Design & Product Engineering

- Libraries
- DRCs & Validation

Virtual Manufacturing Process modeling

- Simulate
- Analyze
- Optimize
- Validate

Protect your harness manufacturing profitability

…by applying the electrical model-based enterprise

Thank you

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