“Empowering the Digital Transformation via Digitalization within the Integrated Lifecycle”
MBE Summit 2018
Topics of Discussion

- Introductions
- The Changing World Around Us
- Digitalization
- Program Execution Excellence
Complexity is Skyrocketing! - The Internet of Everything

Growth of internet of things

- **Connected products**
- **Connected plants and machines**

**Growth of internet of things**

- 1988: 1 M
- 1992: IoT INCEPTION
- 2020: 50.1 B

**Billions of devices**

- 1988: 1 M
- 1992: IoT INCEPTION
- 2020: 50.1 B
The Enterprise Focus

How is my product performing?

How is my plant performing?

How is my supply chain performing?

How do I Gain Product (Profitability) Intelligence?
Profitability is difficult to achieve in a global value chain

Product 1

Product 2

Product N

Design
Manufacturing
Distribution & Customers
Data across the Enterprise is at the Root of Success

**Data sources**

- **Orders**
  - Configuration options
  - What was ordered
  - Initial order timing
  - Initial delivery

- **Suppliers**
  - Shipping data
  - Testing data
  - Configuration data
  - Verification data

- **Factories**
  - Supplier data
  - Testing data
  - As-built configurations
  - Process data

- **Field**
  - Performance data
  - Repair data
  - Crash data
  - General field data

**Data types**

- Orders:
  - Configuration options
  - What was ordered
  - Initial order timing
  - Initial delivery

- Suppliers:
  - Shipping data
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- Field:
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**Users**

- Design
- Engineering
- Manufacturing
- Procurement
- Quality
- Brand
- Support
- Field

**Steps**

- Extract
- Transform
- Load
- Clean
- Correlate
Engineering Automation
Value through digitalization with Horizontal and Vertical integration

Totally Integrated Automation

From Virtual To Real

Digital Thread
In **SIEMENS** Amberg 1 million products a month are delivered with 24h lead time and 10dpm and 9 times increase in efficiency
“To survive disruption and thrive in the digital era, incumbents need to become digital enterprises, rethinking every element of their business.”

Source: 2016 World Economic Forum
Digitalization changes everything –
Digital disruption is our opportunity

The reality is that the challenges facing global and high-growth innovation manufacturing enterprises are not trivial

- Complex products or processes
- Rapid innovation cycles
- Detailed traceability requirements
- Regulatory requirements
- Complex genealogy
- Massive documentation requirements

The solutions for the enterprise that wins in this environment require a fundamentally new approach, with new technology architected to meet these demands

"The IoT is being called the fourth industrial revolution, and is expected to have a value of over 10 trillion dollars by 2025."

McKinsey Global Institute

"Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000."

Pierre Nanterme, CEO Accenture
Digitalization is supported by a Model Based Strategy

Digitalization – is the act of **TRANSFORMING** a paper based processes and artifacts into the Digital and connected world. Unlike digitization, digitalization is the actual ‘process’ of the technologically-induced change within these industries. This process has enabled much of the phenomena today known as the Internet of Things, Industrial Internet, Industry 4.0, Big data, machine to machine communication, blockchain, cryptocurrencies etc.

Digital Transformation - is described as "the total and overall EFFECT of digitalization". Digitization has enabled the process of digitalization, which resulted in stronger opportunities to transform and change existing business models, socio-economic structures, legal and policy measures, organizational patterns, cultural barriers, etc.

Digitization (the conversion), Digitalization (the process) and the Digital Transformation (the effect).

Digitalization makes the digital thread a **proactive** agent to drive new business opportunity.
Re-thinking the product Development Process Towards “Model-Driven Development”
How Digitalization affects Trends in Product Development

Changing the way *systems* come to life

- **GENERATIVE DESIGN**
- **INTELLIGENT MODELS**
- **SYSTEMS OF SYSTEMS**

Changing the way *systems* are realized

- **MACHINE LEARNING**
- **ADDITIVE MANUFACTURING**
- **ADVANCED ROBOTICS**

Changing the way *systems* evolve

- **CLOUD TECHNOLOGY**
- **KNOWLEDGE AUTOMATION**
- **BIG DATA ANALYTICS**
Comprehensive and precise Digital Twin
Model Based Approaches can have a Positive Impact on Digital Transformation Challenges from Tip to Tail

The Digital Enterprise Suite: Powering Digital Transformation

**IDEATION**
- Use Modeling and Simulation to capture Design Intent and achieve foresight using the Virtual World

**REALIZATION**
- Seamlessly coordinate and control the extended resources in the real world

**UTILIZATION**
- Use Big Data Analytics to gain insight and drive continuous improvement

**Model Based Enterprise**
- Model Based Systems Engineering and Definition
- Model Based Manufacturing, Compliance, Quality…
A Leading Practice is to Enable Excellent Performance on Every Program

Critical Success Factors

- Fully support a Model Based Enterprise, Digital Twin – Digital Thread to better meet cost, technical and schedule program goals
- Provide pre-configured technology to focus on the automation of specific Mfg value streams to provide a potential competitive advantage
- Leverage the smart innovation Portfolio to enable product knowledge & definition to be shared to improve performance in production, support and future bids
The Digital Enterprise Value Chain
System Driven Product Development
ALM/PLM integration bring an integrated framework that helps you manage requirements at all levels.

Requirements need to be closely integrated to facilitate continuous verification at all levels.

Government Regulatory Requirements
NHTSA, FDA, FAA, EPA, etc.

Product Requirements
Attributes and targets, system requirements, engineering standards & guidelines, etc.

Domain Requirements

- Software Requirements
- Electrical/Electronics Requirements
- Hardware Requirements
- Manufacturing Requirements

Cross-domain integration

Architecture & System Engineering

- Product Engineering
- Embedded Engineering
- Software Engineering

ALM-PLM integrated solution needs

Integrated ALM + PLM

ALM-PLM integrated needs

ALM Only

Development timeline

Cascade and Decomposition
Additive Manufacturing Focus Includes:

**Design (CAD)**
- Mesh modeling functionality
- Design of light weight / lattice struct.
- Surface Textures
- Additive Mfg design rules
- Multi-material design

**Analysis (CAE)**
- Topology optimization tools
- Structural and Thermal analysis
- Laser power regulation
- Layer based process analysis

**Manufacturing (CAM)**
- Powder Bed Fusion (PBF)
- Multi-Axis (ME & DED)
  - ME - Material Extrusion
  - DED - Direct Energy Deposition
- Hybrid Manufacturing

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Data Management and Shop Floor Connectivity

Siemens Production Software and MES Systems
Model Based Design for Manufacturing – enabling …

- Turning
- 2 ½ axis milling
- 3 axis milling
- 5 axis milling
- Turbo machinery milling
- Mill turn
- Wire EDM 2 & 4 axis
- Hole making
- Feature based machining
- High speed milling
- Tool libraries
- Shop floor documents
- On machine probing
- Machine tool simulation
- Post processing
Industrializing Additive Manufacturing requires a change in mindset and digitalization
Reimagined products and system

AM Thinking:
Vast improvement opportunities in every area of design, manufacturing and business

Product:
- Simplified, standardized mounting assembly
- Reduced size
- Reduced mounting effort

Manufacturing:
- Reduced lead time, faster assembly
- Reduced parts by over 50%
- Reduced welds by approx. 50%
- Reduced assembly complexity, steps

Business:
- Accelerated speed to market
- Adjustable design for customer-specific combustion requirements
- Simplified repair
Reshaping the business of power generation

Conventional thinking vs. Additive Manufacturing thinking:

- **13 → 1 parts**
  - System simplification
- **26 → 3 weeks**
  - Lead time reduction
- **22%**
  - Weight reduction

In serial production:
- **Function & performance improvement**
- **Designed in NX**

Combustion System:
- Burner
- Swirl/Nozzle/Filter/Mixer
Utilization Strategy
Create a disruptive dominance in the industry

COMPRESS THE NPI PROCESS

DIGITAL ENTERPRISE

DIGITAL THREAD

DIGITAL TWIN

Ability to change
Cost of change
Investment

SHIFT LEFT

REUSE
• Concepts & Designs
• Simulation – Virtual Garage
• Test – Virtual vs Field
• Shape Search – Commonality
• Cross-BU Digital Thread

ACCELERATE
• Data access
• Production readiness

SHORTEN
• Decision making process
• Analytics throughput
• Time to Value

PRODUCTION FOUNDATION
• Electronic Work instructions
• PMI / Control plans

PRODUCTION PLANNING
• Virtual Capacity planning
• Material planning
• Virtual Build
• Order management setup

MANUFACTURING
• Production virtual validation
• PFMEA
• Process validation
• Supplier validation
• Quality

SERVICES
• IoT field support digital twin/thread on demand
• IoT MRO / Supply chain - Logistics support
• Digital telematics Cloud/based monitoring
We think there is one more thing to remember!

Its not just the problems we face today but the Challenges and Decisions we make and face for our children and beyond.
One view - Leverage Data Strategically to Transform the Business

Descriptive
What happened?

Diagnostic
Why did it happen?

Predictive
What happens next and when?

Prescriptive
When this happens, take these steps.
The Digital Enterprise provides a holistic approach improving all processes along the entire value chain.
Use Simulation to achieve foresight in the Virtual World

1. Product design
2. Production planning
3. Production engineering
4. Production execution
5. Services

Seamlessly coordinate and control resources in the real world

Use Big Data Analytics to gain insight and drive continuous improvement

Restricted © Siemens AG 2018
At recent launch of Dell XPS13, a LCD was flickering on 2 of 6 demo units. The problem was isolated and identified:

In 3 hours versus 3 days

“Analytics at the Speed of Thought”
Helping our customers solve their Product Development Challenges

The Digital Enterprise Suite: Powering Digital Transformation

IDEATION

Use Simulation to achieve foresight in the Virtual World

- Design
- Innovate
- Analyze

UTILIZATION

- Program
- Plan
- Execute
- Engineer
- Automate

- Service

Seamlessly coordinate and control resources in the real world

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Collaboration platform: Teamcenter
Thank You