Industry 4.0

The Siemens Digital Factory
Challenges for Industry are growing worldwide

Manufacturing is changing faster than ever before

Increasing competitiveness

1. Increase efficiency
   - Energy and resource efficiency are decisive competitive factors

2. Shorten time-to-market
   - Shorter innovation cycles
   - More complex products
   - Larger data volumes

3. Enhance flexibility
   - Individualized mass production
   - Volatile markets
   - High productivity

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Industry is again seen as a motor of growth and stability

**USA**
"Manufacturing Renaissance"
- Formation of a "National Network for Manufacturing Innovation"
- Use of national shale gas and oil deposits (fracking)

**Great Britain**
"Re-balancing Economy"
- More balanced economic structure – in sector and regional terms
- Boost the share of GDP represented by production
- More active industrial and export promotion policy

**Germany**
Maintain leading industrial position
- Sustainable investment in innovative strength
- High level of exports
- Industry4.0 as new guiding principle

**China**
Higher product quality by use of high-end technology
- Rising wages
- Need for quality driven demand for automation
- Energy efficiency legislation
Aerospace and Defence Segments

- Aircraft Engine
- Aircraft and Airframe
- Space Systems
- Land Systems
- Avionics and Defence Electronics
- Aerospace and Defence Agencies
## Aerospace and Defence Segments

<table>
<thead>
<tr>
<th>Global Competition</th>
<th>Declining Defence &amp; Space Spending</th>
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<tbody>
<tr>
<td>• The entry of new, lower cost and more responsive providers</td>
<td>• Global space &amp; defense spending continues to decline driven by US and Europe and partially offset by</td>
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<td>• Customers demanding lower cost greater innovation and faster delivery from suppliers</td>
<td>increments in China, India and Brazil</td>
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<th>Poor Program Performance</th>
<th>Growing Commercial Aircraft Backlog</th>
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<td>• 40% of US Defence programs +25% over budget and initial operating delay averages 2 years</td>
<td>• OEM programs are driven by supplier performance</td>
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<td>• Commercial programs (Boeing 787, Airbus A380/350) experienced significant overruns and delays</td>
<td>• Suppliers must accelerate development and ramp-up production faster and to record highs</td>
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New Dynamics in Aerospace Spending

- Spending variability by regions
- Shifting sources of opportunity
- Larger but fewer opportunities
- Tighter margins

Global Aerospace & Defense Industry outlook

Expect another record year for commercial aerospace and continued declines in defense

The projected increase in commercial aerospace will be driven by:
- Accelerated replacement cycle of subsonic aircraft with next-generation fuel-efficient aircraft
- Continued increase in passenger travel demand (projected to increase 5 percent over the next 20 years)

Increase in commercial

Over the next decade by 2023, commercial aircraft annual production levels are anticipated to increase significantly by an estimated 25 percent.

2014 will likely bring a high single to double-digit level of growth in the commercial aerospace sub-sector.

Defense spending is increasing in several areas of the globe—namely, the Middle East, India, China, Russia, South Korea, Brazil, and Japan.

“Overall, global Aerospace & Defense sector revenue growth in the 5 percent range is expected for 2014.”

— Tom Cawley, Global Aerospace and Defense Sector Leader, Deloitte Touche Tohmatsu Limited
Possible Solution to These Challenges

- Optimize the product design
- Ensure a smooth transition from development to production
- Successfully take advantage of new materials and technologies
Roadmap towards Industry 4.0
Evolution, not Revolution

Integration and optimisation of the entire product development process

Industry 4.0 – Optimisation of production through cyber-physical systems (CPS)

On the way to Industry 4.0

Introduction of electronics and IT to further automate production

1960  2010  2030
Cyber-physical systems (CPS) contain all information as a digital model.

The digital model is always up-to-date and is extended over the entire lifecycle.

- Physical production facility
- Digital model

Contains all the information on...

- Software / Informatics
- Mechanics
- Electrics, Electronics
- Automation, HMI
- Safety, security
- Maintenance

- Location, identity…
- Status
- SW version
- Interfaces
- …
Real and virtual worlds are converging thanks to the Digital Enterprise Platform.

Design and virtual production

- Production planning
- Product design

PLM
Product Lifecycle Management

TIA
Totally Integrated Automation

Production engineering

Production execution

Real production
Real and virtual worlds are converging thanks to the Digital Enterprise Platform
The automation portfolio for discrete industries

<table>
<thead>
<tr>
<th>Enterprise Level</th>
<th>Management Level</th>
<th>Operator Level</th>
<th>Control Level</th>
<th>Field Level</th>
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<tbody>
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<td>ERP</td>
<td>MES</td>
<td>SCADA</td>
<td>SIMATIC HMI</td>
<td>SIMATIC NET</td>
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<td>PLM</td>
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<td>SIMATIC Controllers</td>
<td>SIMATIC Industrial Communication</td>
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<td>SIMATIC IT Production Suite</td>
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<td>SIMATIC IT Intelligence Suite</td>
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<td>SIMATIC WinCC SCADA System</td>
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<td>SINUMERIK CNC</td>
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<td>SIMOTION Motion Control</td>
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<td>SINAMICS Drive Systems</td>
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<td>SIRIUS Industrial Controls</td>
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<td>SIMATIC IDENT Industrial Identification</td>
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<td>SIMATIC Distributed I/O</td>
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**VW:** Boosting productivity in existing production plant through simulation in machine retrofit project

Press Line Simulation (PLS) for retrofit of a 17-year-old press line

- Control, drive and safety technology from Siemens
- Virtual model simulates all mechanical, electrical and software components for motion control
- Combined use of SIMOTION and PLM software
- Direct data link between PLS and press working line control units
- Performance enhancement and energy savings of up to 40%

Industry software from Siemens can also leverage productivity in legacy systems
Our perspective of Industry4.0
What needs to be done?

**Today: Industry3.x**
- Local controls
- Realtime communication
- Digital "copies" of products and production
- Manufacturing Execution Systems
- Industrial security concepts
- Execution and decision making mainly by humans

**Future: Industry4.0**
- Dynamic network of local controls
- Extended complex communication
- Digital models of the overall process and participants
- Process optimisation in dynamic networks
- Self-configuring security concepts also for temporary requirements
- Humans to define rules and frameworks for decision making

- Rule framework and architecture for dynamic topologies
- Massively extended semantics for M2M communication
- Integrated process simulation
- …
### Right Synchronization
A Model Driven Process

#### 3D Part Model
- Design model
- Create inspection drawings

#### Preparation
- Stage model
- Fixture setup
- Product Manufacturing Information (PMI)

#### Programming
- CAM programming
- CMM programming

#### Production
- Shop floor
- CMM Execution & analysis
Solid Edge ST7
Improved productivity for 2D drawing creation

Improved 2D drawing view placement and handling
• Dynamic display of the drawing views expanded to include all view types (multiple, principal, auxiliary, section & detail views)
• New capability for a user to pull a part or sub-assembly out of a higher level assembly and place drawing views of these components
• Visual highlight and thumbnail images displayed when selection made in parts list

• Easier layout of multiple drawing views
• Improved support for detailing components of assemblies on the assembly drawing

• Google/Bing: Solid Edge Free 2D
Vision of Manufacturing: Industry 4.0

Product development, production and services communicate through software and networks.

Machines and products exchange information and instructions in real time.

Autonomous control and optimisation.