Smart Manufacturing as a Real-Time Networked Information Enterprise

Open Architecture Infrastructure & Apps Store

- Open-architecture infrastructure for plug & play
- Workflow Based architecture for composability and insertion
- Composable sensor-based SM Systems

- Open source
- IP Security
- Community
- Market-place
GMI’s ECO System of “STUFF”

Value Creation

Core Functions

Business Applications

Core Systems

Data Input
Smart Manufacturing Test Beds

**Design**

**Operations**

**Supply Chain**

Praxair dynamic energy management & cross unit performance

Line and Energy Management
Managing Power from the EPRI & Smart Grid

General Dynamics
Machine Function
Benchmarking & Integrated Management

FORD in-production
Virtual aluminum castings
Multi-Layered Smart Manufacturing Workflow Management

Time Managed as Workflow

Machines – People - Materials Dynamic Manufacturing Ecosystem

Design Data

Prototype

Materials & Process Tech

Product Manufacturing

Qualification

In Service

Focus: 10x Multiple Pass Variability Reduction; Supply Chain Information

Focus: 100x Event Variability/Tradeoff Adjustment; Dynamic Performance Mgmt.; Integrated Metrics

Focus: Insertion, Qualification, ICME, High Fidelity Dynamic Operations

1000s of control loops
Time - minutes

100s of control loops
Time - hours

10s of control loops
Time – days

Macro Layer

Meso Layer

Micro Layer

1000s of control loops
Time - minutes

100s of control loops
Time - hours

10s of control loops
Time – days

Focus: Insertion, Qualification, ICME, High Fidelity Dynamic Operations
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<tr>
<th><strong>SMLC OBJECTIVES</strong></th>
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<tr>
<td><strong>Lower cost barriers</strong> for applying advanced data analysis, modeling, and simulation in core manufacturing processes</td>
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<tr>
<td><strong>Build pre-competitive infrastructure</strong> including network and information technology, interoperability, and shared business data</td>
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<td><strong>Integrate requirements</strong> of small, medium and large enterprises</td>
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<td><strong>Facilitate efforts to secure funding</strong> through public-private and private-private partnerships to address priorities</td>
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<td><strong>Create and provide broad access</strong> to next-generation sensors, including low-cost sensing and sensor fusion technologies</td>
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<td><strong>Develop a standards-based reference architecture</strong> based on industry-driven collaboration with IT suppliers</td>
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<td><strong>Integrate requirements</strong> of small, medium and large enterprises</td>
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<td><strong>Operate industry test beds</strong> for Smart Manufacturing System concepts and make them available to companies of all sizes</td>
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<td><strong>Ensure multi-level cyber security</strong> and protection at a scalable level</td>
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<td><strong>Establish an industry-shared SM Platform</strong> that includes an open architecture software development framework</td>
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What is Smart

**Orchestration** - achieve optimal actions across specific environment at the speed of business

**CONTEXT** - give raw data meaning to do something effective with the information

**DATA** - retrieve related data, communicate to multiple sources, map it for RICH context
Workflow, Data, & Time

Smart Manufacturing
Open Architecture Platform

Data Partnership Workflow Orchestration

Sensor Data

Control & Automation Propriety Optimized Automation Workflows

Decision

Insertion

Data collection, modeling & synchronization defined by workflow

Data collection, modeling & synchronization defined by workflow

Single scale time requirement in workflow

Separate Data & apps
Data to apps paradigm

Composability
Design to manufacturing Workflow libraries

Toolkits
Apps Store

Workflow, Data, & Time
The commitment to comprehensive design-manufacturing life cycle

**THE VISION**

- Higher value products
- Improved quality
- Zero downtime
- Increased equipment life / utilization
- Improved safety
- Reduced energy and emissions
- Highly sustainable
- Higher product availability
- No inventory
- Product lifecycle management

**AGILE DEMAND-DRIVEN SUPPLY CHAINS**

**ENTERPRISE OPTIMIZATION & SUSTAINABLE PRODUCTION**

- Energy, sustainability, EH&S
  - Improved safety
  - Reduced energy and emissions
  - Highly sustainable

**SMART GRID**

**SUPPLIERS**

**ENTERPRISE BUSINESS SYSTEM**

**FACTORY**

**OEM MACHINE BUILDERS**

**DISTRIBUTION CENTER**

**CUSTOMER**

**AGILE, DEMAND-DRIVEN**

**PRODUCTION**

**SUPPLY CHAINS**

**SUSTAINABLE OPTIMIZATION**

**PLANTWIDE**
The infusion of intelligence that transforms the way industries conceptualize, design and operate the manufacturing enterprise.

https://smartmanufacturingcoalition.org
http://smartmanufacturing.com