Smart Manufacturing: Enterprise Real-Time, Networked Data, Information & Action

Michael Yost
President, MESA International
NG Manufacturing Summit

AGENDA

• Introduction to MESA International
• Smart Manufacturing
  • What is it?
  • What does it mean to you?
Introduction to MESA International

MESA is...

...building bridges-of-understanding from the Plant to the Enterprise (P2E)

...to drive clarity on the role and value of modern Information Technologies in production operations
Introduction to MESA International
MESA knows…

...there is significant business value for companies who can leverage IT-based solutions in their production operations...

...and, there are more organizational and educational issues than technology issues today
Introduction to MESA International

MESA knows...

...Far too few companies know how to develop and implement a “Manufacturing-Focused IT Strategy”

...and, the speed of change in modern Information Technologies will continue to increase exponentially.
Introduction to MESA International

MESA knows…

…the lack of clarity, both at the plant and enterprise, hurts manufacturers, keeping them from building a competitive advantage for their business through their production operations.
Introduction to MESA International

The power of knowing what MESA KNOWS
Introduction to MESA International

MESA International: Building Bridges-of-Understanding from the Plant to the Enterprise

- Peer-to-Peer
- Points-of-View
- Global Education Program
- Speaking with the Voice of Industry’s Practitioners

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MESA International supports the **Smart Manufacturing Leadership Coalition (SMLC)**, a non-profit organization with origins from a National Science Foundation initiative to define a roadmap for the implementation of advanced process manufacturing technology — or Smart Manufacturing — in the United States.

[https://smartmanufacturingcoalition.org](https://smartmanufacturingcoalition.org)
[http://smartmanufacturing.com](http://smartmanufacturing.com)
Plant-wide connectivity creates “Big Data”

President Obama said, “the U.S. should develop a Smart Manufacturing infrastructure and approaches that let operators make real-time use of ‘Big Data’ from fully-instrumented plants in order to improve productivity, optimize supply chains, and improve energy, water and materials use.”
Smart Manufacturing and Big Data in the Popular Media

“Smart manufacturing. The era of near-perfect computational design and production will unleash as big a change in how we make things as the agricultural revolution did in how we grew things.”

- Julio Ottino and Mark Mills, Wall Street Journal

“The technologies used for the implementation of “smart manufacturing” or “smart production” are referred to as Internet of Things (IoT) technologies, i.e., the combination of a sensing/actuating device with a communication network (wired or wireless) and a software application to move, read and interpret data.”

- Alain Louchez and Dr. Ben Wang, Georgia Institute of Technology, Automation World

“Machines increasingly communicate among themselves and with people. Mobile devices allow round-the-clock interconnectivity. Computers crunch terabytes of data. Such innovations have convinced economists from GE’s Marco Annunziata to Erik Brynjolfsson of MIT that the stage is set for a wave of productivity gains to rival the 10-year Internet boom that began in 1995.”

- Bloomberg News

Source: Smart Manufacturing Leadership Coalition; Used with permission
“Cisco estimates that the Internet of Things as having a potential value of $14 trillion, and that 27%, or nearly $4 trillion, will be found in manufacturing. This is by far the biggest opportunity across the entire Internet of Things landscape.”

- **Keith Nosbusch CEO Rockwell Automation CIO Review Magazine**

“The Internet of Things has already set in motion the idea of a fourth industrial revolution—a new wave of technological changes that will decentralize production control and trigger a paradigm shift in manufacturing.”

- **McKinsey Partner, Dr. Markus Löffler**

“The 21st century, Smart Manufacturing enterprise is fully integrated, knowledge-enabled and model rich. Smart Manufacturing encompasses the comprehensive scope to achieve transformational impact in economic growth, manufacturing innovation, global competitiveness, and environment impact.”

- **Smart Manufacturing Leadership Coalition**
Smart Manufacturing

“Information that drives the next century’s structural shift in manufacturing.”

Smart Manufacturing Leadership Coalition (SMLC) – 501c (6)

Making real-time info available:
• when it is needed,
• where it is needed
• and in the form it is needed throughout the Manufacturing ecosystem

SMLC Partnerships

**Test Beds** - General Dynamics, General Electric, General Mills, General Motors, Praxair, Corning, Pfizer, Owens Corning, Alcoa, Center for Advanced Technology Systems/RPI, Southwest Research Institute

**Design/Manufacturing Platform Providers** – JPL/NASA, UCLA, Rockwell, Honeywell, Emerson, Schneider Electric, OSISoft, Nimbis

**Modeling & Simulation Materials, Design, Manufacturing** – Caltech/JPL, NETL, UCLA, UT Austin, Tulane, NCSU, CMU, Purdue

**Smart Manufacturing/Smart Grid** – EPRI

**Global Metrics/Outreach** – AIChE, ASQ, AMT, ACEEE, NCMS, MESA, MT Connect, Society of Manufacturing Engineers, Sustainable Solutions, Spitzer & Boyes

**Agency partners** – DOE, NIST, NSF

**Regional Partners** – California Network for Manufacturing Innovation (CNMI), Wisconsin Manufacturing Institute, Association of State Energy Research & Technology Transfer Institutions (ASERTTI), National Association of State Energy Officials (NASEO), AMP SoCal

Source: Smart Manufacturing Leadership Coalition; Used with permission

The power of knowing what MESAKNOWS
The commitment to comprehensive design-manufacturing life cycle

**THE VISION**

**ENTERPRISE OPTIMIZATION & SUSTAINABLE PRODUCTION**
- Higher value products
- Improved quality
- Zero downtime
- Increased equipment life / utilization

**ENERGY, SUSTAINABILITY, EH&S**
- Improved safety
- Reduced energy and emissions
- Highly sustainable

**AGILE DEMAND-DRIVEN SUPPLY CHAINS**
- Higher product availability
- No inventory
- Product lifecycle management

Source: Smart Manufacturing Leadership Coalition; Used with permission
SMLC’s Industry-Driven Strategy

**Roadmap:** Operations & Technology for SM systems

**Action Plan:** Implementing 21st Century Smart Manufacturing

**Implementation Plan:** Review & Refine Collaboration Roles & Alignment

**Establish Work Groups:** Identify & Drive Priority areas
- Test Bed
- Platform
- People
- Business

**Membership Expansion**

**Infrastructure Specification:** Increasing SM Platform Definition & Development

**SMLC Incorporates as 501c6:** Building Capacity & Resources; Leveraging Resources; Advocacy for SM

**DOE, NSF, NIST Awards:** $13 million in Project Work to develop SM Platform Prototype

**AMTech ACCELERATE**

**Source:** Smart Manufacturing Leadership Coalition; Used with permission
Smart Manufacturing – What Is It?

Smart Manufacturing (SM) is the sophisticated practice of generating and orchestrating the use of data-driven Manufacturing Intelligence across the entire factory and supply chain that takes the form of:

– a much deeper behavioral understanding of the manufacturing process through modeling and analysis,
– new capacity to observe and take action on integrated patterns of operation through networked data, information, analytics, and metrics,
– new insights for manufacturing innovation through a broader base of innovators, and
– a significantly greater ability to reuse and repurpose integrated practices through shared infrastructure.

Source: Smart Manufacturing Leadership Coalition; Used with permission
“Making real-time information available when it is needed, where it is needed, and in the form it is needed throughout the Manufacturing ecosystem.”

- Shared, scaled, open architecture infrastructure
- Manufacturing apps store
- Knowledge-enabled, model rich enterprises & supply chains
- Real-time, networked, sensor-based modeling & simulation

Source: Smart Manufacturing Leadership Coalition; Used with permission
GMI’s ECO System of “STUFF”

Value Creation
- Demand Driven Supply Chain
- Green Light to Convert
- Green Light to Ship
- Optimized Inventory
- Allergen/Micro Workflow
- eCOA
- Supplier Managed Inventory
- Line Supply
- Bin Mgmt
- Overusage
- Trace/Recall
- BOM Validation
- Yard Mgmt
- Directed Work

Business Applications
- Production History
- Plant Floor Inventory
- Direct Consumption
- WorkFlow
- Demand Plan
- Production Order
- Line Schedule
- Lot Tracking
- Optimization Engine
- Raw Mat/Inventory
- Finished Product Inventory

Core Functions
- Master Data (BOM, Specs, Vendor, Ingredients, FP)
  - MQIS
  - MES
  - SAP ERP
  - SAP MRP
  - SAP APO
  - SAP PLM
  - Red Prairie

Data Input
- Courtesy of General Mills

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Industry-Academic-Government Collaboration Model

SMC Collaboration Model

Source: Smart Manufacturing Leadership Coalition; Used with permission
Real-Time Data Analysis Cloud Architecture
SMLC Position on Open Architecture

Source: Smart Manufacturing Leadership Coalition; Used with permission
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SM – What Does It Mean to You?

Define Smart Manufacturing

Is Your Company Pursuing Smart Manufacturing?

What Parts Are You Doing?

What Level – plant, enterprise, m/c, all?

Who Is Driving?

Why Are They Driving It?

How Many People Are Involved?

Any Quantified Gains? Challenges? Lessons Learned?
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Do you know MESA?
SMLC’s Industry-Driven Strategy

SMLC Work Groups

Business
- Apps store functionality
- Support service structure
- Certification, Validation Requirements
- Marketplace definition
- Service layers definition
- Market research study
- Problem definition
- SME outreach
- Marketing
- Communications
- Advocacy
- Strategic Planning

Platform
- Smart factory reference architecture
- Standards requirements
- Design & ICME
- Prototype platform
- Technical service structure and functionality
- Certification & validation
- Interoperability
- Cyber security
- Open architecture requirements

Test Bed
- SME requirements and outreach
- National/regional deployment strategy
- Education and training
- Advocacy
- Human interface
- Address workforce
- Leverage existing efforts

Source: Smart Manufacturing Leadership Coalition; Used with permission