Smart Manufacturing: Next Generation IT for Next Generation Manufacturing

Presented by Jim Davis
Vice Provost – IT & CTO, UCLA
CTO, Smart Manufacturing Leadership Coalition (SMLC)
Current SMLC Membership

ACEEE
AMP Socal
Alcoa
AIChE
American Society of Quality
ArcelorMittal
ARC
ASSERTI
CMTC
Carnegie Mellon
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Corning, Inc.
DOE
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MT Connect
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Owens Corning
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RPI
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Schneider Electric
SME
Southwest Research Institute
Sustainable Solutions
Texas A&M
Tulane – PolyRMC
United Technology Research Center (UTRC)
UC Berkeley
UC Irvine
UConn
UCLA
USC - EDC
UT Austin
West Virginia University
**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

**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

**Membership Expansion**
Spin-off parallel activities

**DOE Workshop**
**NSF Workshop**
**AlChE Workshop**
**SMLC Forum Workshop**
**Technical Meetings**

**ACCELERATE DOE FOA**

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What is Smart Manufacturing?

Right Data, Right Time, Right Form
Wherever Needed Throughout the Enterprise
General Dynamics | Scranton, PA

www.smartmanufacturingcoalition.org

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Holcroft Continuous Roller Hearth

http://afc-holcroft.com/products/continuous/roller-hearth
Steam-Methane Reformer Furnace

Temperature Distribution

Average Temperature

Fuel Flow-meters

Tube Temperature (K)

Number of tubes

1 F. Beyer. Steam reforming – 50 years of Development and the Challenges for the next 50 years. 2005
Test Bed: Praxair

Test Bed: General Dynamics

Integrated Line Operations Management

Dynamic Energy Risk Management & Cross Unit Performance

EERE DOE ‘Project Smart Manufacturing’
Development of an Open Architecture, Widely Applicable Smart Manufacturing Platform
Affordable, Accessible, Innovative and Secure
Intelligent, Seamless, and Collaborative
Network-Based, Smart Manufacturing

Connected Supply Chain
- Agile
- Demand Driven
- Raw Material to Finished Product

Business Systems, ERP

Safe Production
- Improved safety
- Fewer incidents
- More user friendly

Sustainable Production
- Higher value products
- Data for decision making
- Product Lifecycle Management

Energy Efficient
- Lower emissions
- Less energy used
- Green manufacturing

Optimization
- Asset Utility/Zero Downtime
- Quality/Zero Defects
- Reliable results

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End-to-End Systems
Advanced Sensing Controls Platforms & Modeling (ASCPM)
• Make multiple vendor applications and infrastructure systems a dominant capability

• Eliminate, simplify and/or automate the overall execution of real-time systems

• Don’t make me deal with security every time I want collaborative business relation or multiple vendor system

Some points reference ARC 2014 Forum, Insider Industrial and Automation by Sandy Vassar, ExxonMobil
What got us here

Won’t get us there
SMLC Defined Technical and Business Challenges to Smart Manufacturing

Challenges Individual Company

• Compartmentalized ROI’s are constrained or prohibitive
  - Incremental investment difficult
  - Need 80% reduction in systems costs
  - Need 10x reduction in the cost of sensors
  - Need radically shortened deployment time

• Business Risk
  - New business model
  - Collaboration vs. transaction
  - Uncertainty technology, security & IP

• Organizational Risk
  - IT capability lacking
  - Workforce skills
  - Collaboration

Challenges Beyond Individual Company

• ROI opportunity comprehensive
  - Multiple systems
  - Integrated performance metrics
  - Depends on other companies - supply chains

• Investment/Return “Chicken & egg” Issues
  - Software innovation
  - Increased revenue
  - Increase in SME’s total market
  - Skilled sustainable jobs

• IT Infrastructure and support needs to be scaled
  - Retrofit $60 B installed IT investment
  - Halve the non-value IT infrastructure costs
What Brings the Coalition Together
The Case for an Open Platform
Smart Manufacturing Value Proposition
Bridging Seams Extending the Real Time Infrastructure Data to Applications

Open-Architecture Infrastructure & Marketplace
- APPs & Toolkits
- Composable Systems
- Cloud Deployment
- Private/Public IaaS

Applications
Context
Mapping
Data

Event Data
Production Models
Calibration & Maintenance
Sensor Data

Real-Time Data

Power Mgmt & Energy Grid
Heating & Forging Line Operations
Suppliers
Distribution
Customers

Sustainability & Safety
SMLC Industry-Defined Open Platform

**Marketplace as a Service**

- **Buyer/Seller Dashboard**
- **Composable apps & libraries**
  - Data tools, viewers, metrics, models
- **Toolkits, App, Interface, Data services, Validated licensed environments**

**Development Deployment Performance Reuse as a Service**

- **Workflow as a Service**
- **Data Configuration management**
- **Mobile Interface**
- **Secure historian & private virtual computation**
- **Secure data connectors**
Manufacturing Health & Sustainability

Open Architecture – Vendor Agnostic
Open Access – low cost & easy to use
Open Market Place – composable software libraries & data
Open Market Place - Innovation Trusted Data Broker

Collective Wisdom
Converting Knowledge to Wisdom
Converting Information to Knowledge
Converting Data to Information

Big Data
Smart

Data Valuation
Collective vs. Proprietary

Practice Valuation
Collective vs. Proprietary

Data Valuation
Collective vs. Proprietary

IoT
## Performance Metrics with Platform

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease First of Kind System</td>
<td>25%</td>
<td>30%</td>
<td>35%</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Accelerated outcomes</td>
<td>2 years to 1 year</td>
<td>+5% faster</td>
<td>+10% faster</td>
<td>+15% faster</td>
<td>+20% faster</td>
</tr>
<tr>
<td>Decrease Replication cost/risk</td>
<td>60% first replication</td>
<td>65% multiple replications</td>
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DOE Funding Opportunity Announcement

Manufacturing Innovation Institute for Smart Manufacturing:

Advance Sensing, Controls, Platforms and Modeling for Manufacturing
A Comprehensive Approach to Manufacturing

...to achieve:

- Connected Supply Chain
- Plantwide Optimization
- Sustainability & Safety
- Increased Productivity
- Effective Risk Management
- High Quality Products
- Innovation
- Great Customer Service
Questions

Please wait for the microphone before asking your questions

State your name & company

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