Product Lifecycle Management

Diane Ryan – Siemens PLM Software
Discussion Topics

• Challenges in Manufacturing and Lifecycle Maintenance
• Product Lifecycle Management
• Communication and Collaboration
• Standardized Processes and the Capture of Best Practices
• Production Optimization
• Conclusion
Challenges in Manufacturing and Lifecycle Maintenance

• Pressure on Cost and Delivery Time:
  » Design cost and design rework
  » Manufacturing cost and manufacturing rework
  » Procurement cost and information exchange
  » Penalties for delays
  » Penalties for not met requirements
  » Operating costs
Challenges in Manufacturing and Lifecycle Maintenance

• Drivers for OEM’s customers:
  » total lifecycle costs
  » Availability of the asset
  » Costs / time / flexibility for conversions
  » Pressure to improve operating efficiency
  » Regulatory constraints
  » Rapidly changing enabling technology
  » Increased market volatility
  » Tightening of growth opportunities
  » Diminishing size of skilled resources
Discussion Topics

✓ Challenges in Manufacturing and Lifecycle Maintenance

• Product Lifecycle Management
• Communication and Collaboration
• Standardized Processes and the Capture of Best Practices
• Production Optimization
• Summary
“Product lifecycle management is an integrated, information-driven approach to all aspects of a product’s life -- from its design inception through its manufacture, deployment and maintenance, culminating in its removal from service and final disposal.”

University of Michigan PLM Development Consortium
Product Lifecycle Management

• Provide collaborative data environments that manages the intellectual property associated with the evolving engineering, construction, and maintenance definition

• Provide an accurate technical knowledge foundation and detailed history of the configuration throughout the entire lifecycle, from concept to disposal, while continuously coordinating complex interdependent changes initiated by various technical and business stakeholders

• Strong relationships between PLM (Product Lifecycle Management), MES (Manufacturing Execution System), and ERP (Enterprise Resource Planning) offers the ability to build a comprehensive closed loop information system

• PLM is unique from other enterprise software solutions, by providing the application depth and breadth needed to digitally author, validate and manage the detailed product and process data, PLM supports continuous innovation
Product Lifecycle Management

**Manufacture to Order/Stock**
- High Volume
- Low variance
- Electronics, Medical devices...

**Change/configure to Order**
- High/Medium Volume
- Low/Medium variance
- Trucks, Automotive, Machinery...

**Engineer to Order**
- Low Volume - High variance
- E.g. Special Trucks, Large Machinery, A&D, Energy, Ships

1. Master data created in PLM and uploaded to ERP
2. **Master data downloaded** / synchronized from PLM to MES
3. Order issued in ERP downloaded for Execution
4. Completed production order is backflushed from MES to ERP
5. **As built feedback**: Managed in MES, PLM and ERP updated

**Low to moderate frequency of PLM-MES loops**
**Very High frequency of ERP-MES loops**
**Low frequency of PLM-ERP loops**

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1. Master data created in PLM and sent to ERP
2. Product configuration & changes defined in PLM
3. **Configured Process data** (per order) and **master data** downloaded from PLM to MES
4. Order issued in ERP with sequence downloaded for Execution
5. Completed production order is backflushed from MES to ERP
6. **As built feedback triggers workflow in PLM**

**Very high frequency of PLM-MES loops**
**Very high frequency of ERP-PLM loops**
**Very high frequency of ERP-MES loops**

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1. Master data created in PLM and uploaded to ERP
2. Order issued in ERP downloaded for Execution
3. **Order data and master data** downloaded from PLM to MES (for each order)
4. Completed production order is backflushed from MES to ERP
5. **As built feedback triggers workflow in PLM**, resulting in revised process plan for PO

**Very high frequency of PLM-MES loops**
**Low to moderate frequency of ERP-MES loops**
**Low frequency of PLM-ERP loops**
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Communication and Collaboration

• Removing the Silos of Communication
  – Information silos separate an organization along departmental boundaries, creating challenges when integrating work
    • Managing continuous changes
    • Working in parallel vs. sequential
  – Silos inhibit integrated decision making, affecting budget and on-time delivery of the vessel
Communication and Collaboration

• Defining the “as-is” business state
  – Diagram current business processes
  – Analyze to determine those that are value added and non-value added
  – Use of technology to automate non-value added processes and ensure better communication throughout the organization
  – Leveraging industry expertise to support analysing and mapping business processes
Communication and Collaboration

• Managing Intellectual Property
  – Creating a single source of truth
    • PLM collaboration technology streamlines the ability to securely share technical data amongst groups of people
    • Provide transparency to who is doing what, when, where, and how, to the configuration and technical documentation throughout the entire lifecycle
  – OptiCAM Project
Communication and Collaboration

• Integrating Enterprise Solutions
  – Understanding the value and function of key technologies and how they interface

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<tr>
<th>ERP</th>
<th>The main focus areas for ERP are:</th>
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<tbody>
<tr>
<td></td>
<td>• The Finance, HR and Procurement</td>
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<td></td>
<td>• Order Management processes</td>
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<td></td>
<td>• Forecasting and planning process</td>
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<td>• Logistics and Inventory Management</td>
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<th>PLM</th>
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<tr>
<td></td>
<td>• The innovation and product development process</td>
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<td></td>
<td>• Portfolio Management process</td>
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<td></td>
<td>• Manufacturing processes and digital manufacturing</td>
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<tr>
<td></td>
<td>• Products information and configuration throughout its life</td>
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<tr>
<th>MES</th>
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<td></td>
<td>• Real-time Data Collection, Contextualization and Analysis</td>
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<tr>
<td></td>
<td>• Genealogy, Track &amp; Trace</td>
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<tr>
<td></td>
<td>• Quality Management, In-Process-Testing</td>
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<tr>
<td></td>
<td>• Detailed Production Scheduling, Dispatching, and Execution</td>
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Trans-action driven*  
Data driven*  
Event driven
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Standardized Processes and the Capture of Best Practices

- Capturing Tribal Knowledge
  (the experience and expertise that have been passed down from one generation of workers to the next)

- Create a Library of Re-usable Processes
  - Continuous analysis of best practices and process improvements
  - Configuration controlled to support traceability and visibility to what was done where, when, by whom and with what resources
Standardized Processes and the Capture of Best Practices

• Process Validation
  – Simulate the assembly sequence to ensure fit, form and function
  – Perform ergonomic studies to ensure worker safety and feasibility

• Manufacturing Validation
  – Validate NC programming code prior to machining a part
  – Store code in association with the relevant machines for future re-use
Standardized Processes and the Capture of Best Practices

• Work Package Generation
  – PLM provides a single source of truth of intellectual property, thus production planners have work packages that contain all necessary information including but not limited to:
    • Bill of material information
    • Electronically validated process steps
    • Associated resources
    • Equipment list
Standardized Processes and the Capture of Best Practices

- Maximize efficiency and throughput by leveraging the relationship and data flow between PLM, MES and ERP
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Production Optimization

• Having a top down view allows industrial engineers and production planners the ability to capture what is happening at any given time and explore options for future projects or improvement to existing production.

• Key Elements to Managing Production
  – Layout of facility
  – Material flow
  – Scheduling of production
  – Inventory control
Production Optimization

• Drivers for the use of software technology to optimize the facility layout can range from:
  – Determining scenarios for yard expansion
  – Modernizing existing facilities
  – Re-architecting where various equipment and inventory are stored
  – Incorporation of additional programs into an existing production schedule
  – Resource demand and utilization
  – Equipment demand and utilization
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Summary

• Implementing enterprise information systems enables industry to develop more efficient facilities and adopt new, innovative ways to capture and execute manufacturing and maintenance contracts
  – PLM provides a comprehensive collaboration foundation
  – Closed loop PLM-MES-ERP
  – Adoption of technology to support an integrated business approach to communicating within the enterprise