Industry Perspective on Manufacturing Data Exchange

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Agenda

Global Product Data Interoperability Summit | 2019

- Your Speaker
- About CNC
- Pain Points
- Relevant Standards
- Key Efforts
- Keys to The Future
- The CAM/Supply Chain Track
- Comments/Conversation
Your Speaker

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Boeing

- **1984-1985** Electronics Technician, Rockwell, El Segundo
- **1985-1990** Maintenance Engineer, Rockwell, El Segundo
- **1990-2005** Controls Engineer, Rockwell/Boeing, Tulsa
- **2005-2017** CAD/CAM Development Boeing
- **2018-2019** Production Engineering, Boeing

Industry

- ISO TC184/SC4/WG15 (STEP Manufacturing)
- OMAC Machine Tool Workgroup
CNC Machine Tools

- Around since 1950s
- Ubiquitous in modern manufacturing
- Execute simple process data
Typical CNC Data

;T_9077451_105_MPF
MSG ("114W5414-2 1MF-05 T-9077451 03/18/02 11.23 STATUS=SOLD ")
N2G17G70G40
N38T2
N40G0X-12.Y-3.585
N42Z12.175
N46Z10.305
N48G1G94Z10.205F150.
N50Y-1.835
N52X5.F120.
N106Y-.4683F150.
N174G0X-23.5Y-15.5A0.C0.
N10650G74C0.0
N10656M2
Traditional CNC/CAM Data Flow

- CAD/CAM A
  - CL File
    - Modal Commands
    - Cutter Paths
    - Interpolation
    - Tolerances
  - Post Processor
    - Machine(s)
    - MCD Files
      - Modal Commands
      - Axis Motion
  - Post Processor
    - Machine(s)
  - Post Processor
    - Machine(s)

- CAD/CAM B
  - Stock
  - Cutters
  - Tolerances
  - Final Part
  - High-Level Process Definition
  - Low-Level Process Definition
  - MCD Files
    - Modal Commands
    - Axis Motion
“I want to be able to leverage a global manufacturing supply chain to be more efficient and respond to emergent events. However, unless the suppliers use the same CAD/CAM system, I have no way to digitally share process information. This means different suppliers have to re-invent the manufacturing process”
“I have developed advanced capabilities for my CNCs (tool tip programming, collision prevention, spline toolpaths), but almost nobody is utilizing them. I want to be able to differentiate my advanced CNCs from those that are less capable.”
“I have a tool that creates optimized toolpaths for CNC machining. But, because of all the different/poorly defined data formats, it’s hard to implement. I spend more effort dealing with data conversions than my technology”
“I have a process that involves in-line measurement and closed-loop machining adjustments based on those measurement results. The adjustment algorithms are my “secret sauce” and key to productivity. But my shop uses different CNC machine tools and different CMMs for inspections. Dealing with all the different data formats is a nightmare.”
About STEP (ISO 10303)

- Managed by ISO SC184/SC4

- Different Application Protocols for different applications

- AP-242
  - Replaces AP203 and AP214
  - Includes GD&T and Kinematics
  - Tessellated or Breps
  - Edition 2 to be finalized in 2019

- AP-238
  - “STEP-NC”
  - Includes process planning
  - Includes AP242
  - Edition 2 to be finalized in 2019
Looking at a STEP File
About QIF

- “Quality Information Framework”
- Developed by DMSC (Developers of DMIS) http://www.dmsc-inc.org/
- ANSI standard being harvested by ISO
- Modern, XML based
- Includes Planning, Inspection, Evaluation
- Development kits available: Python, C#, C++, (I converted to Visual Basic)
• **Manufacturing Process Sharing**
  • End users: Boeing, Airbus, Scania
  • Technology Providers: STEP Tools, Okuma, DMG, Hyundai, Sandvik Cormorant, Iscar
Key Efforts/Implementations/Demonstrations

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- Measurement Integration / Closed Loop Machining
  - End users: Boeing, Scania, Pratt and Whitney
  - Technology Providers: STEP Tools, Concepts NREC, KTH, Sandvik Cormorant
• Our ancient culture needs to change
  • The value is in the data, not the format
  • The value is in the tools, not the format
  • Consider the Digital Thread, not just a segment of it
  • Understand the value of Digital Twins

• To make the change
  • Educate
  • Demonstrate
  • Specify
  • Implement!
• Digital Factory Standards Harmonization

• The Importance of Contextual Data for Smart Manufacturing

• Closed-loop Industrial IoT: giving the model-based ecosystem a reality check

• Enabling Machine Learning for Manufacturing Machines

• Integrating Semantic Quality Information with the Digital Thread
CAM/Supply Chain Track

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• Cut Costs and Timelines through Part Reuse and Sourcing Optimization

• Enabling a global distributed supply model for Additive Manufacturing

• Managing a Digital Thread across the Global Supply Chain

• Bringing MBSE to the Design of Aircraft Production Systems

• Panel Discussion (All Presenters)
• Questions / Comments / Conversation