

Industry Perspective on Manufacturing Data Exchange

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GLOBAL PRODUCT DATA
INTEROPERABILITY
S U M M I T
2019



Agenda

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- 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

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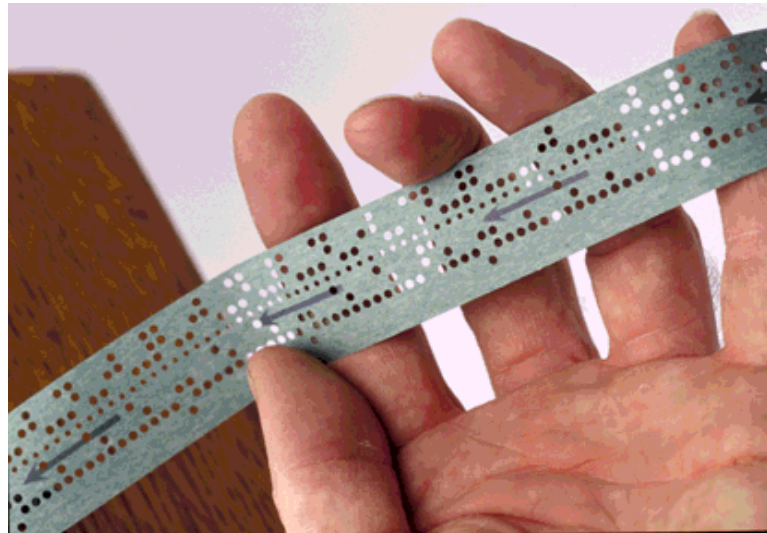
- Around since 1950s
- Ubiquitous in modern manufacturing
- Execute simple process data



Typical CNC Data

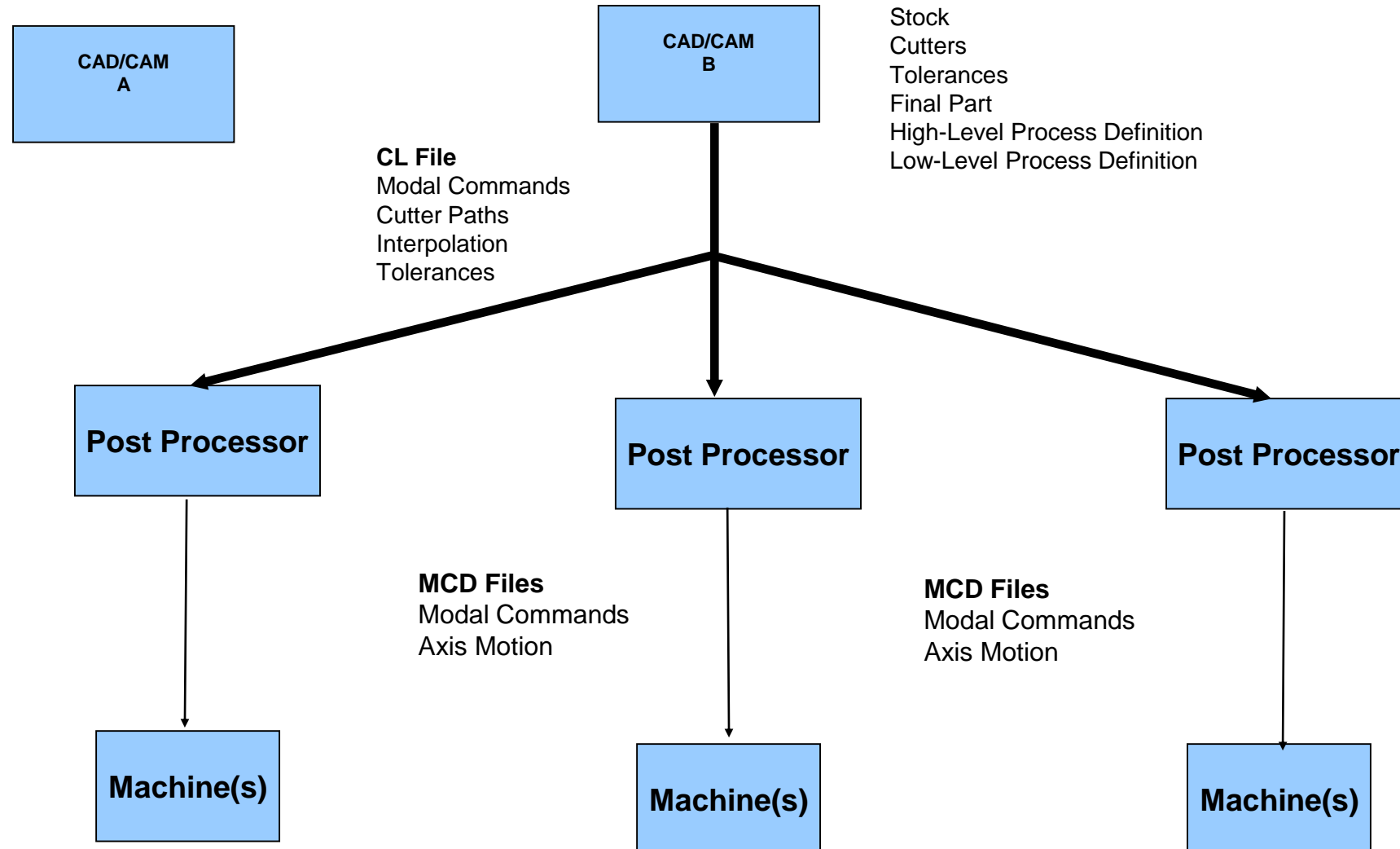
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Traditional CNC/CAM Data Flow

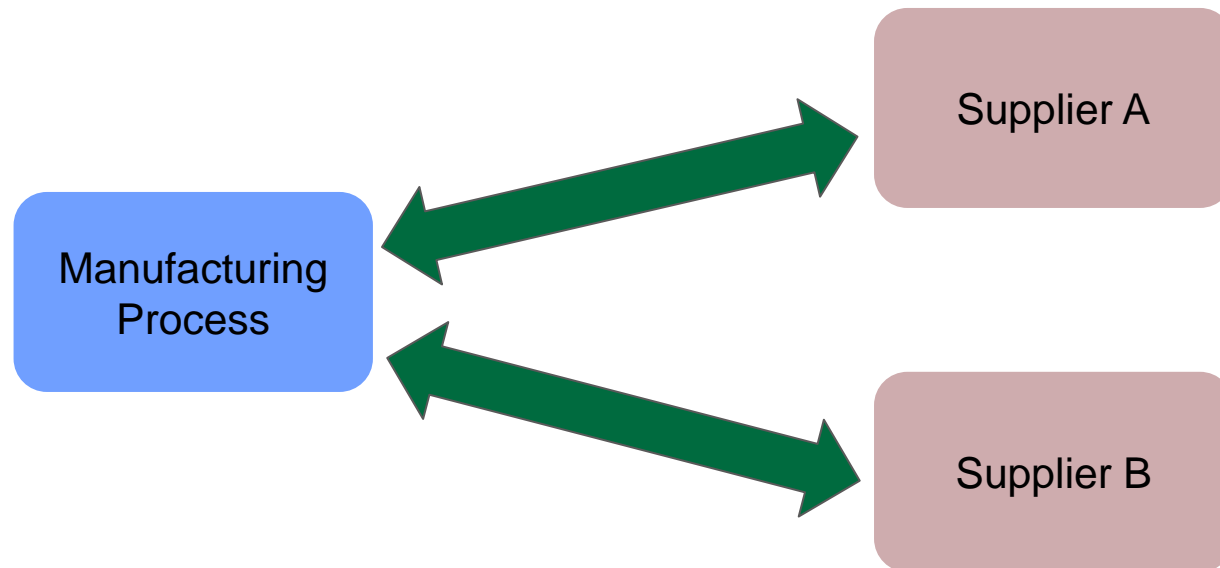
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Pain Point: Manufacturing Process Sharing

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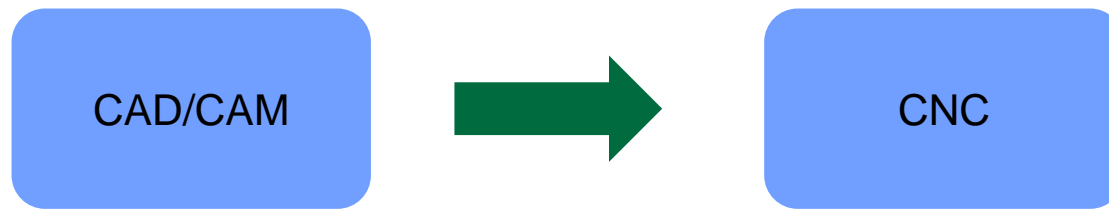
“I want to be able to leverage a global manufacturing supply chain to be more efficient and respond to emergent events. However, unless the suppliers use the same CAD/CAM system, I have no way to digitally share process information. This means different suppliers have to re-invent the manufacturing process”



Pain Point: Advanced CNC Capabilities

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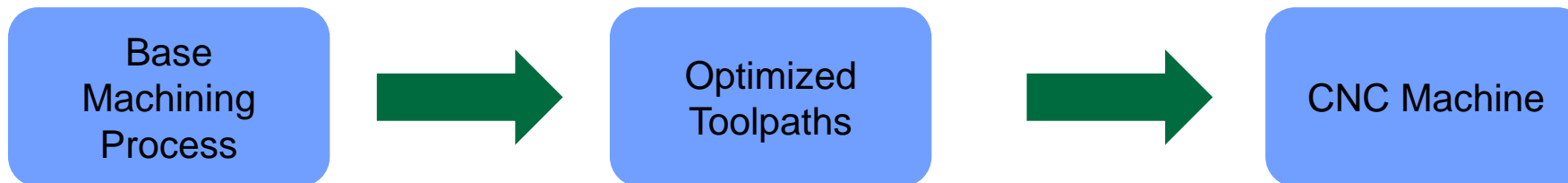
“I have developed advanced capabilities for my CNCs (tool tip programming, collision prevention, spline toolpaths), but almost nobody is utilizing them. I want to be able to differentiate my advanced CNCs from those that are less capable.”



Pain Points: CNC “Add-On” Suppliers

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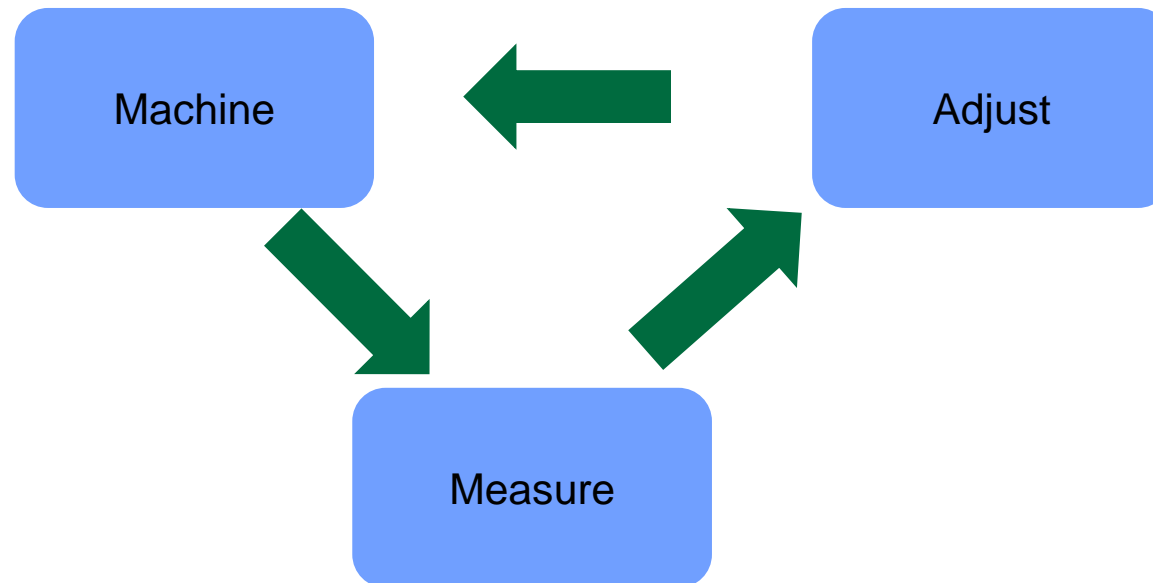
“I have a tool that creates optimized toolpaths for CNC machining. But, because of all the different/poorly defined data formats, it’s hard to implement. I spend more effort dealing with data conversions than my technology”



Pain Point: Closed Loop Manufacturing

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“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.”



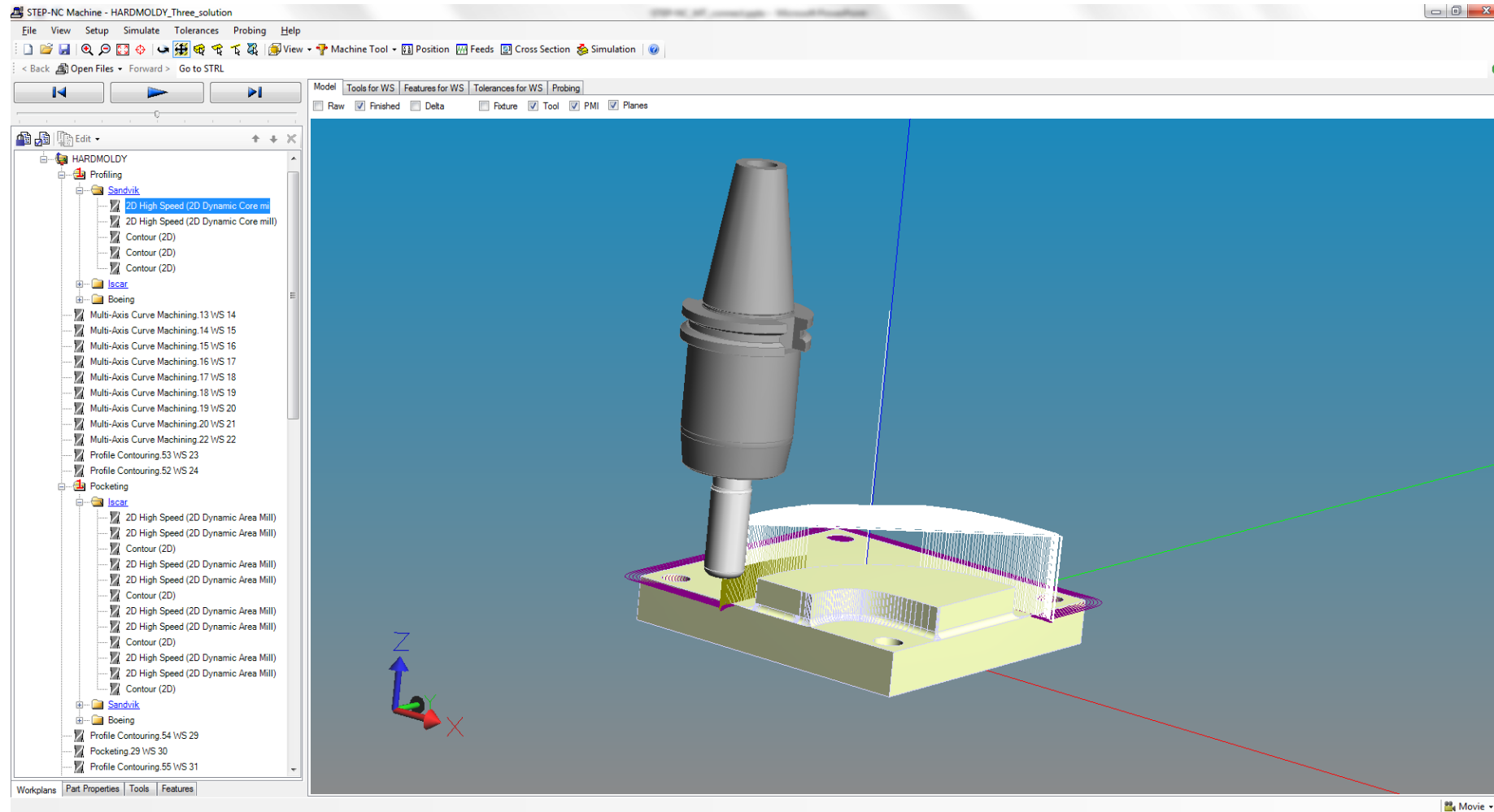
About STEP (ISO 10303)

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- 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

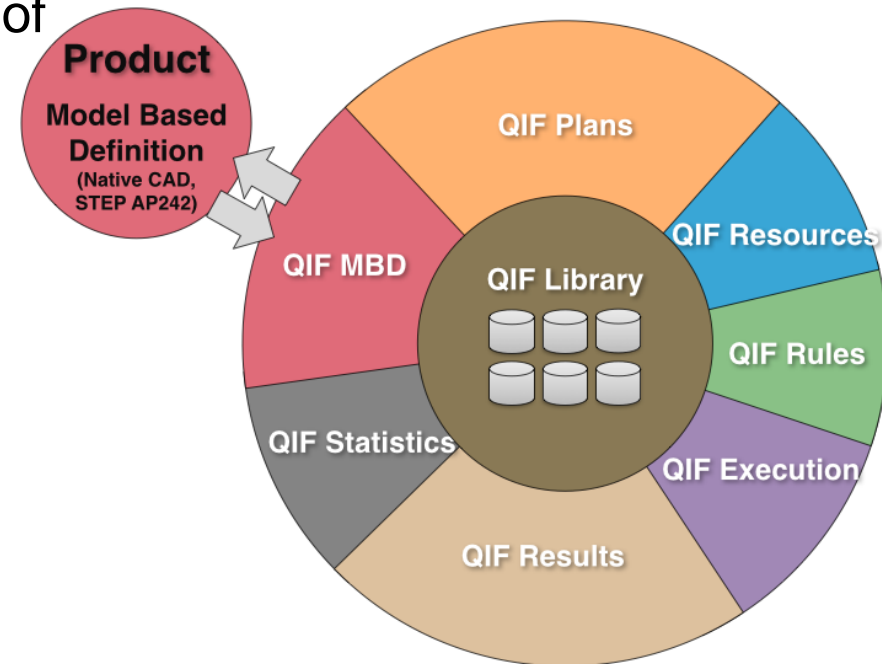
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About QIF

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- “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)

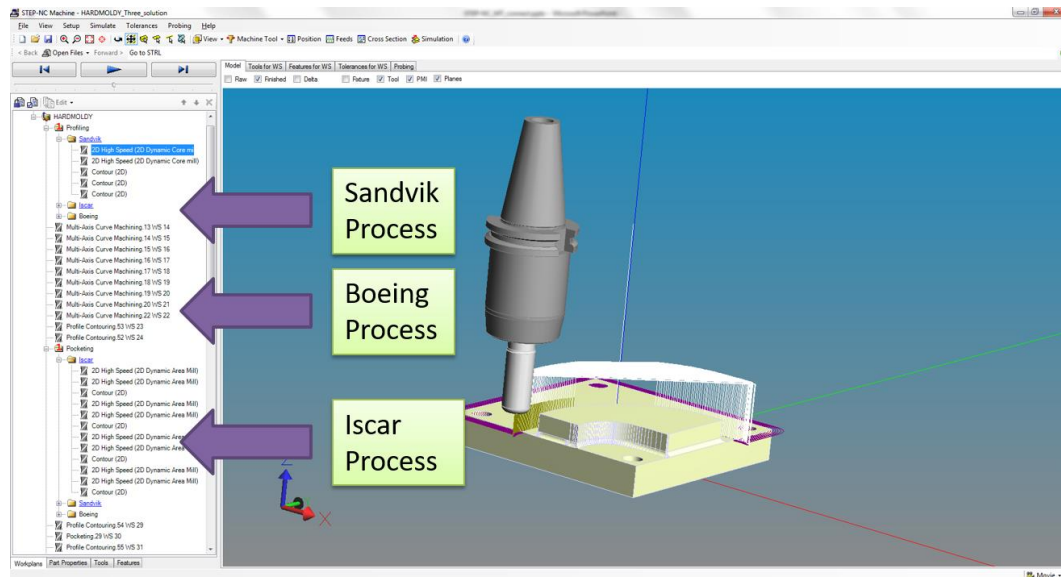


Key Efforts/Implementations/Demonstrations

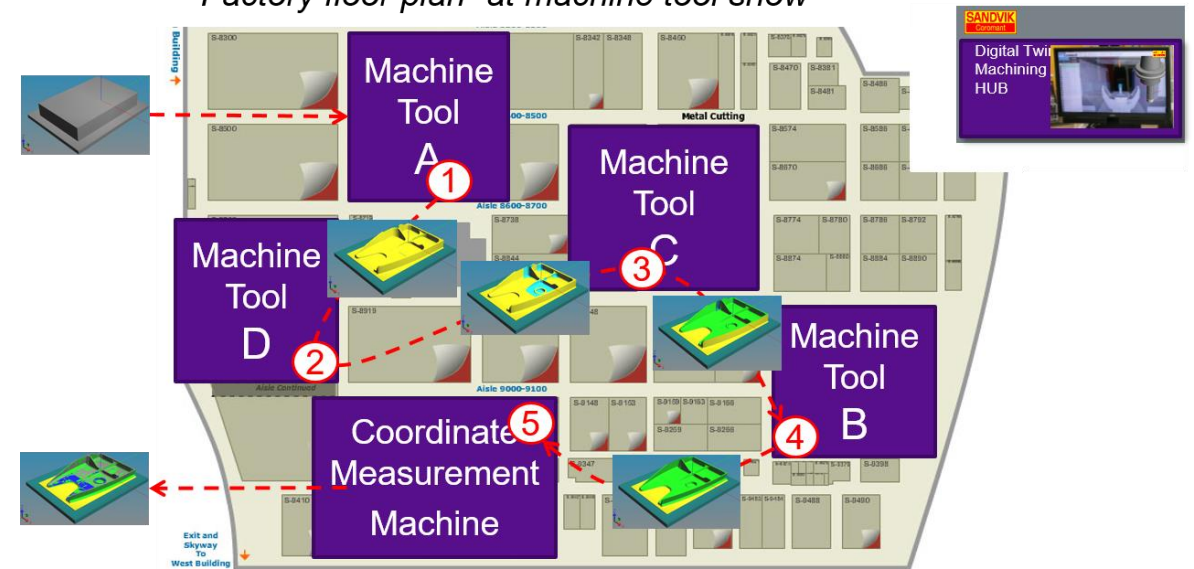
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- **Manufacturing Process Sharing**

- End users: Boeing, Airbus, Scania
- Technology Providers: STEP Tools, Okuma, DMG, Hyundai, Sandvik Cormorant, Iscar



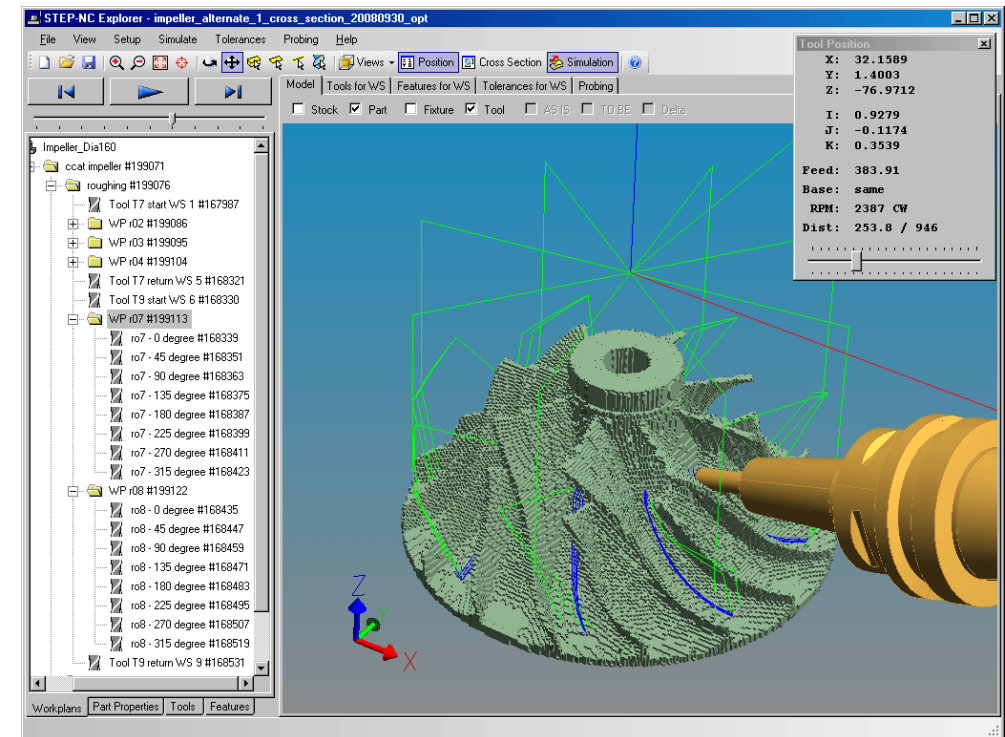
"Factory floor plan" at machine tool show



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



Keys to the Future

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- **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**

- **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**

