Metrology Interoperability Perspectives in the Automotive Industry

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Predictions

• Only two of the three North American auto companies will survive
  ➢ 25 mfg plants eliminated by 2008
  ➢ 8 large tier one suppliers are in bankruptcy
  ➢ 200,000 auto workers will lose employment by 2008

• Toyota becomes the world auto leader by 2008
What sets these companies apart?

- Cost
- Quality
- Adaptability
- Flexibility
- Legacy costs

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<th>Consumer Reports Product Reliability</th>
<th>Problems per 100 Vehicles</th>
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<td>TOYOTA</td>
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Consumer Reports 2003
Future Success

- The ability to achieve full utilization of our manufacturing facilities
  - Fast flexible change of product
  - Faster integration & production launch
  - Reduced staffing requirements
  - Ability to leverage technology - doing more with less
Future Success

• The ability to reduce capitol investment
  ➢ Design & development costs drive component sharing on a global basis
  ➢ Top hat programs using existing platforms
  ➢ Lower capitol equipment investments
Future Success

- The ability to achieve high quality products
  - Quality systems need to work in harmony
  - Fast, responsive, intuitive
  - Connects the inspection process to the manufacturing process without gaps
  - Organized data in a format that’s intuitive to quality engineers
Globalization

Exterior Build Objectives

Assembly Plant Database

Hood Asm Checks

Stapning Plant Database

Root Cause Tree

CMDANA Db

Supplier Support

AutoWeb

DCAH

DCS

BSA Audit

Powertrain Assembly Plant Database

Powertrain Component Plant Database

WebAnalysis@DCX.com

Intranet

Intranet
Globalization Challenges

Achieve globalization through standard processes
  • Design, mfg, inspection, reporting
    ➢ Who’s process is considered benchmark?
    ➢ Who’s systems will be considered?
    ➢ How to achieve common dimensional control objectives?

Standards play a key role
  • Use of ANSI or ISO tolerance?
  • DIN, ANSI or ISO inspection standards?

How to preserve legacy systems but gain global connectivity?
  • With minimal cost added
The Role of Standards

• Standards can reduce cost across the extended enterprise
  – Allows for easier integration
  – Reduces cost for users
  – Reduces cost for suppliers

• Enable standard processes to occur
Examples of cost opportunities….

CMM system compatibility issues migrating to Catia V5:

- 1450 CMM’s worldwide
  - V5 direct translator costs = $4,350,000
  - 80% require software upgrades
  - 40% require controller upgrades
New engine program purchases completed designs in Pro-E to reduce design costs:

- $5,000,000 in integration costs
- 30% of geometry required repair
- Tolerance could not translate
Examples of cost opportunities…. 

- Connecting the extended process chain
  - High accuracy CMM purchased for the plant
    - Tool supplier had identical hardware but different software from the same supplier
    - Duplicate set of programs developed to run off tools at supplier
    - Cost penalty $300,000
Examples of cost opportunities....

• Typical vehicle manufacturing plant today
  – 6 major quality systems
    ➢ Each have redundant SPC software
    ➢ Each have a unique database for data storage
    ➢ Each require custom translators
    ➢ Each are disconnected from the user of quality data
Cost of a Poor Quality Process

• Shut down the line
  ➢ Vehicle assembly plant = $25,000,000 / day
  ➢ Power train plant = $2,500,000

• Defects causing warranty issues
  ➢ Recall cost
  ➢ Repair cost
  ➢ Dissatisfied customers / quality perception

• Legal implications of quality problems
  ➢ $1,000,000,000 class action suit
Re-active Quality Process

Local CMM

Corp CMM Database

Corp Quality Database

Local OP 10

Local OP 20

Local OP 30

User
Valve Seat Analysis

• The SPC chart indicates the valve seat operation is running out of control.
  ➢ Engineer receives the static SPC chart via a pdf file displayed on a web browser
  ➢ The engineer cannot dive directly down to investigate the inspection results. Calls inspector for the last 20 files.
  ➢ The results files indicate excessive run out
  ➢ The engineer needs to see the underlying hit points to determine what is the form error but only the last inspection retains this data.
Pro-active Quality Process

Summarize quality problems
Determine process capability
Correlate multiple gage results
Investigate specific data files
Graphical display of feature data

Multiple systems communicating in a common language

Software “A”
Software “B”

DML - All data saved all the time
Dimensional Metrology System:

Component diagram with candidate open & non-proprietary interface standards

Design  Planning  Execution  Analysis

CAD + GD&T  Part geometry and design tolerances  Inspection process planning  Inspection execution

STEP AP203e2, AP219, DML

Measurement results

DML, STEP AP219

CMM control commands and responses

I++ DME

Coordinate measuring machines (CMMs)

Reporting & analysis

Quality device integration

Quality Data

AIAG

Quality

Measurement information