Attain Trusted Product Models

GLOBAL PRODUCT DATA
INTEROPERABILITY
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2017

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DOE's Kansas City National Security Campus (KCNSC)
Managed & Operated by Honeywell Federal Manufacturing & Technology

KCNSC's Project to implement MBE is:
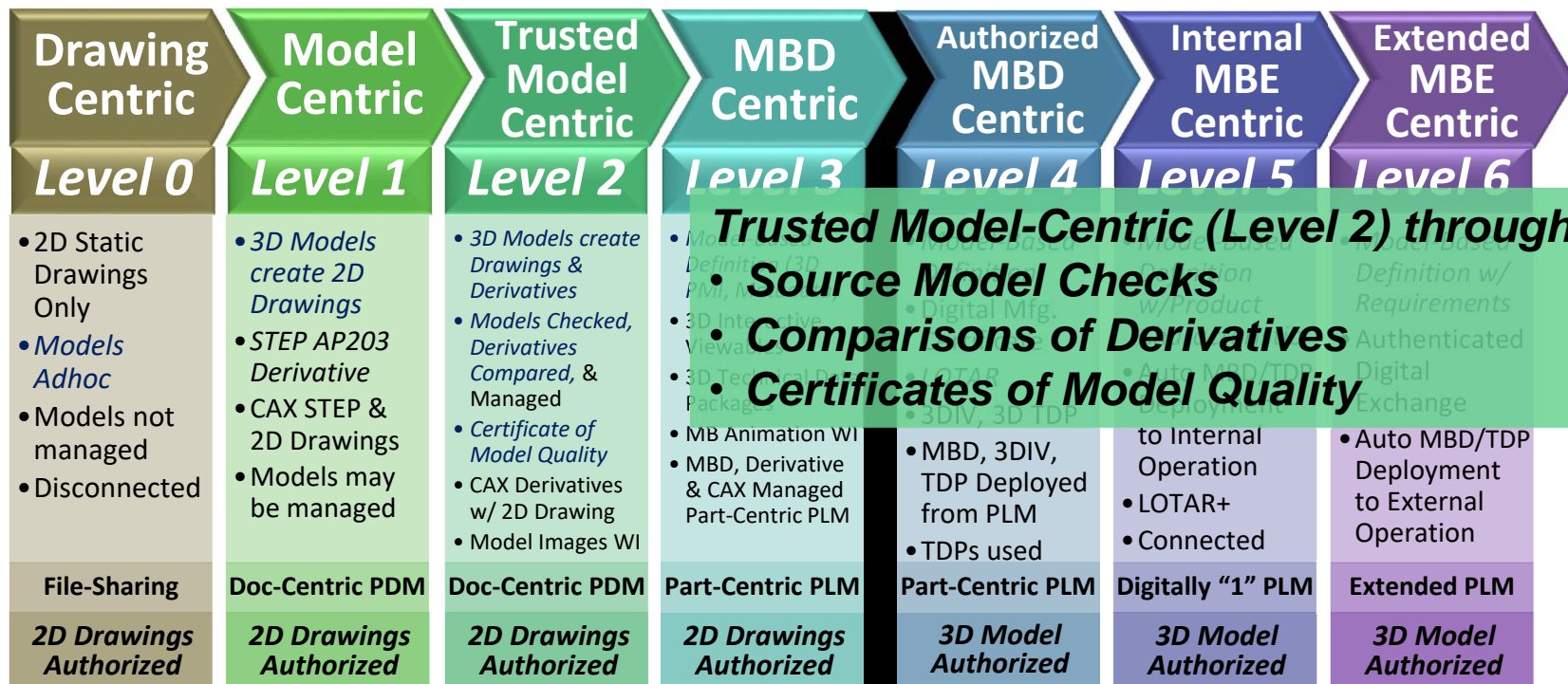**"Digital Product Realization Enterprise" (DPRE)**

DPRE Vision Statement:
"Attain Trusted Product Models, Managed for Confident Reuse, Throughout our Enterprise"

KCNSC's MBE Maturity Index*

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Model-Based Enterprise Maturity Index
Apply the MBE Index for each Maturity Level: **Capability, Readiness, Adoption**

Drawing Centric	Model Centric	Trusted Model Centric	MBD Centric	Authorized MBD Centric	Internal MBE Centric	Extended MBE Centric
Level 0	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
• 2D Static Drawings Only • *Models Adhoc* • Models not managed • Disconnected	• *3D Models create 2D Drawings* • STEP AP203 Derivative • CAX STEP & 2D Drawings • Models may be managed	• 3D Models create Drawings & Derivatives • *Models Checked, Derivatives Compared, & Managed* • *Certificate of Model Quality* • CAX Derivatives w/ 2D Drawing • Model Images WI		• MBD, 3DIV, TDP Deployed from PLM • TDPs used	• to Internal Operation • LOTAR+ • Connected	• Auto MBD/TDP Deployment to External Operation
File-Sharing	**Doc-Centric PDM**	**Doc-Centric PDM**	**Part-Centric PLM**	**Part-Centric PLM**	**Digitally "1" PLM**	**Extended PLM**
2D Drawings Authorized	*2D Drawings Authorized*	*2D Drawings Authorized*	*2D Drawings Authorized*	*3D Model Authorized*	*3D Model Authorized*	*3D Model Authorized*

Trusted Model-Centric (Level 2) through:
- **Source Model Checks**
- **Comparisons of Derivatives**
- **Certificates of Model Quality**

**From *Document-Centric, 2D Drawing-Based* to *Part-Centric 3D Model-Based***

* Details are modified from original. Maintains the published MBE Capability Index baseline flavored for MBE at NSE

Digital Product Realization Enterprise

Trusted Product Models . . .

- *Validate Source Models*
  - *Design & Business Checks*
  - *Geometry Checks*
  - *PMI Checks*
- *Certify Model Quality* through Validations
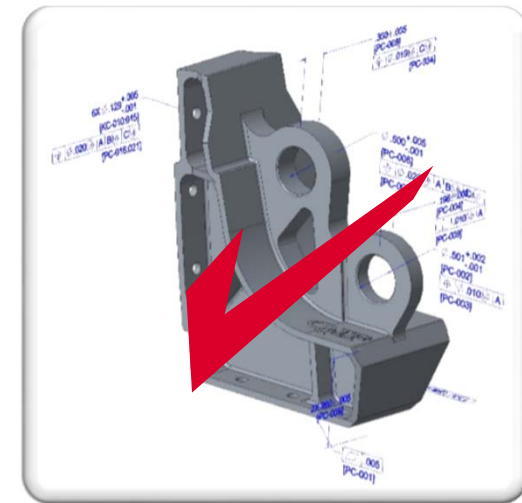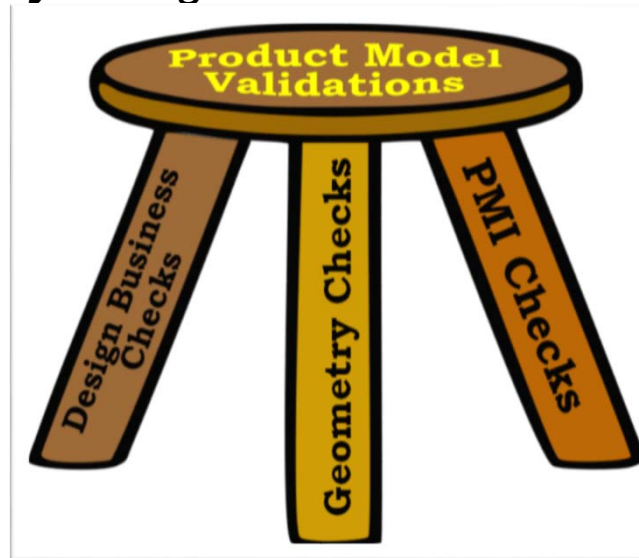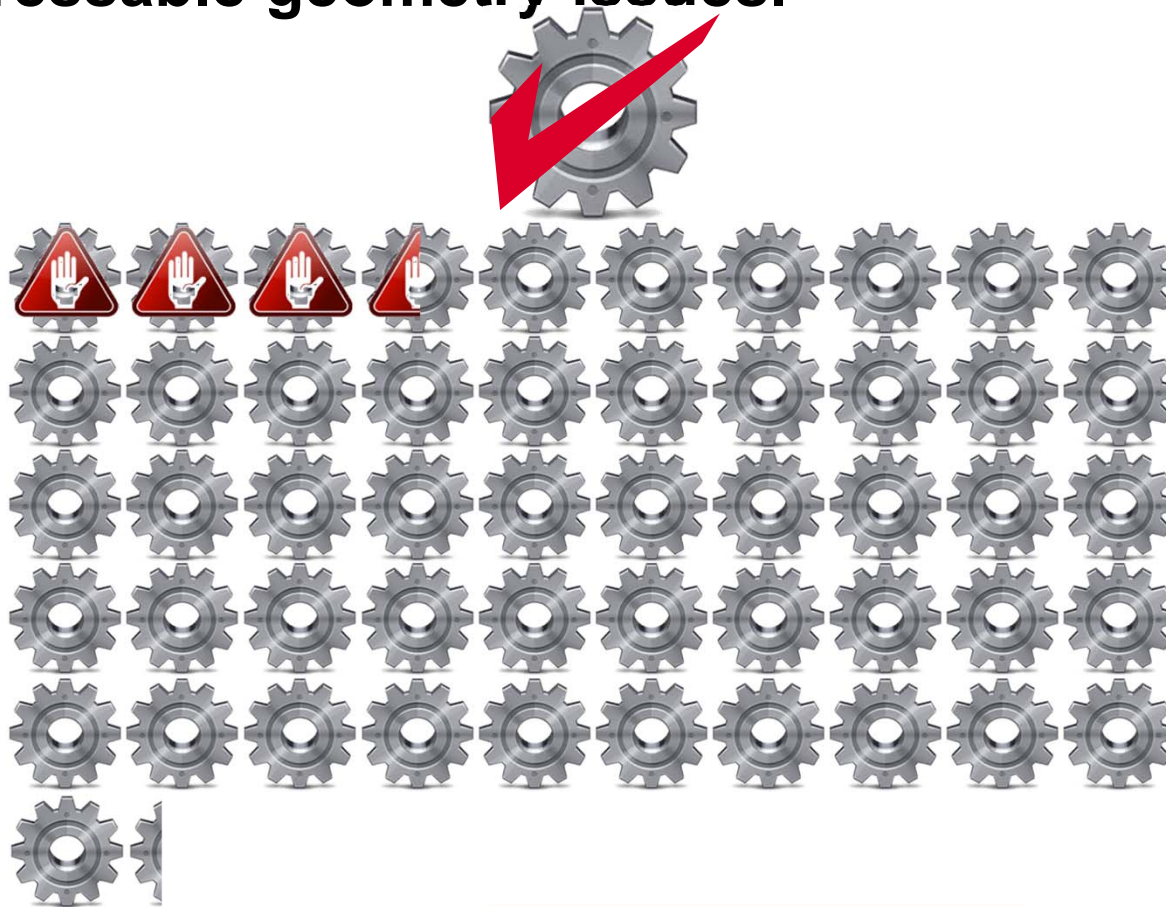
3D Product Models with Associative Annotations

Multiple Checks for Multiple Purposes, all to gain a Certified Product Model

Status: 7% of the 513 model geometry checks had addressable geometry issues.

Part Tolerance Definition Checking w/ **Feature-Based Tolerancing (FBTol) Advisor**
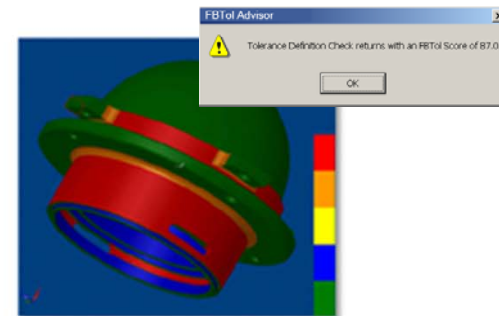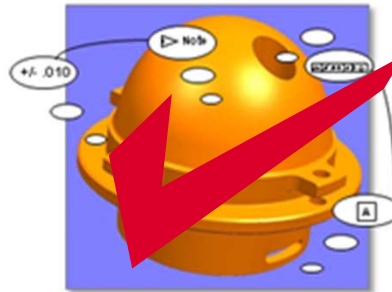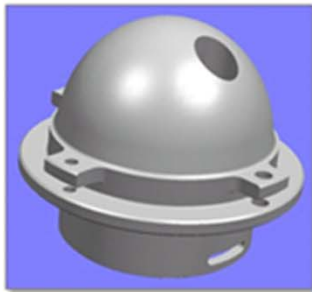
Documented FBTol Tolerance Definition Analysis from

- FBTol Averages (low-high)
  - 78.2% FBTol Score (30% - 99.76%)
  - 24.1 Issues Identified (1 – 75)
- Tolerance Definition Complexity Average (low-high)
  - 83.7 Product Characteristics (5 - 1199)

Is your part's tolerance definition complete and correct? Most likely not.

- **Manual Electronic Certificate**
- **Digital Manufacturing Certificate**
- An Extension within Model File
  - A Digital Signature on Model file with Metadata
    – NIST DMC Toolkit
  - **Digital Certificate of Model Quality (CoQ)**
    – **Certificate of Model Quality**
      – **Source Models: Check Quality**
      – **Derivative Models: Functionally Equivalent w.r.t. Source**
  - Digital Certificate of Authorization for Reuse (CoR)
  - Digital Certificate of Authenticity (CoA)
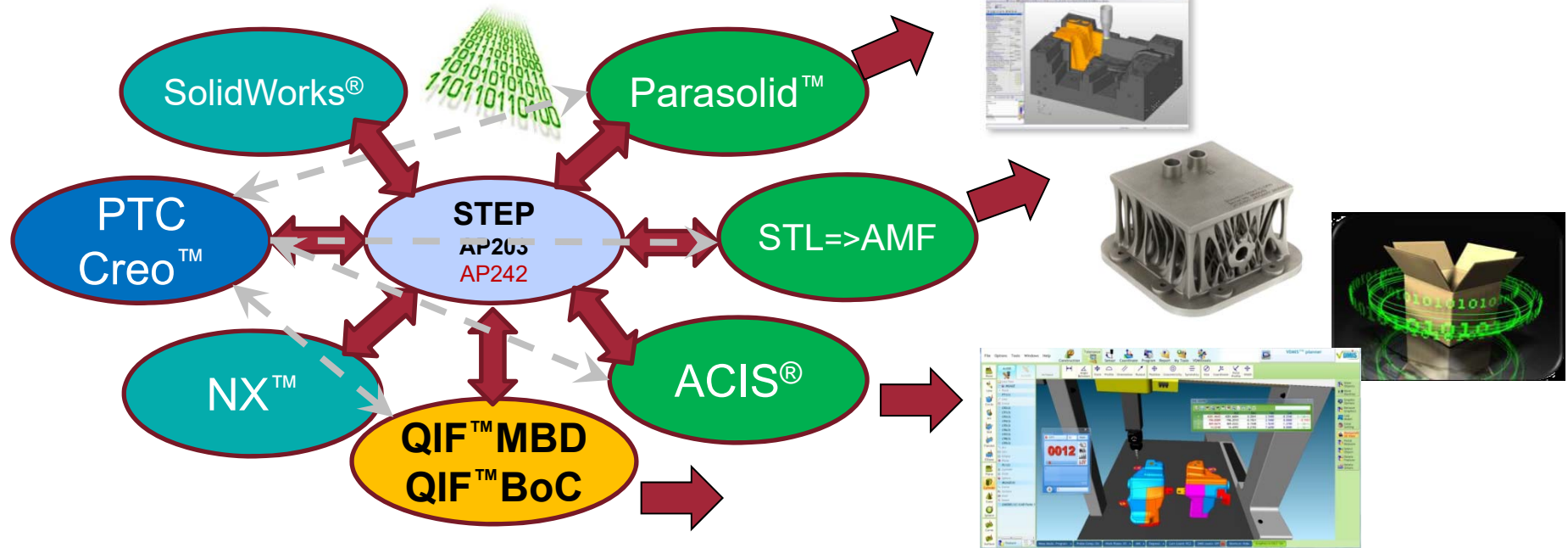   – Genuine, it is still what it is.

Indicates that the model is legitimate and verified, and **then make it known.**

Interoperability with Derivatives

- **Derivative Models Certified as Functionally Equivalent to Source Model**
- **STEP is always an _Intermediary_ Derivative Model**
- **Generate and Compare End Derivative Models**
- **Consider Quality Information Framework (QIF) Std.**

Downstream Applications are Enabled by Derivatives

If your enterprise relies on 3D Models

then they must be reliable models

AND then make it known.

CAD Validation at Honeywell Aerospace

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Marco Vaquera

- **Manual validation is cumbersome, impractical, and often impossible**
  - Results are subjective and inconsistent; depend on:
    - Department
    - Person
    - Mood
  - Often overlooked
- **Need a standardized assessment criteria to enable true interoperability**
- **Having an accepted Pass/Fail assessment acknowledged by different design authorities = major win toward implementation of validation strategy.**

Types of Validation at Honeywell

- **Derivative Validation**
  - Shape changes for translated models
  - Pass/fail assessment based on pre-set validation criteria
- **X to STEP Validation**
  - Allows customizing the validation configuration specifically for STEP paths according to downstream use
  - Pass/fail assessment based on pre-set validation criteria

- **Design Revision Documentation**
  - Identifies and highlights shape changes
    - Intended and unintended
    - Ensures conformance to ECO
  - No pass/fail assessment
- **Quality (PDQ) changes after CAD operation**
  - Assess how particular operations change validation; helps designers understand how feature changes of data exchange affect model quality

Benefits of CAD Validation Implementation

- **Enables data exchange traceability**
- **Improves confidence in data exchange operations**
- **Helps meet customer and government requirements**
- **Standardization of validation recipes**
  - **Results are consistent throughout company**
- **Facilitate translator recipe enhancements**
  - **Identifying limitations**

- "Using our experience with different CAD solutions, we recognized that feeding the validation CAD files into a validation software is essentially a translation into the software modeling kernel, and only as good as its ability to faithfully represent this information. So we set up a QFD process to validate the offering that could better read a set of challenging CAD use cases we had identified as common in our data sets. We choose the solution that scored higher on the QFD."

--Marco Vaquera, Honeywell Aerospace

Example Validation Report