

Certification of 3D Model- Based Enterprise Data

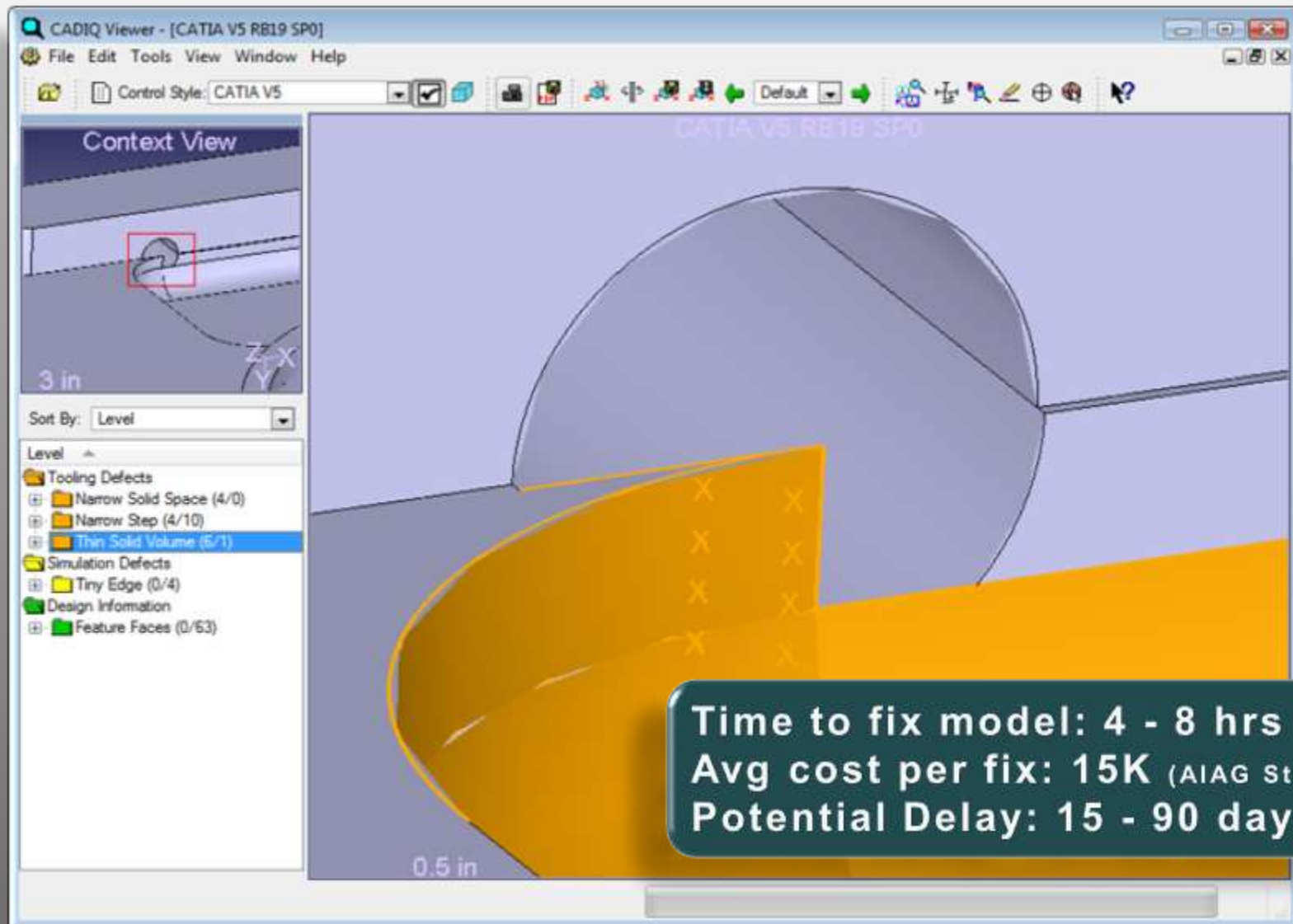
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Problem: Bad Models Cause Delays, Cost a Lot of Money, and Foster a Lack of Trust



Problem: 3D Model-Based Processes Have not Yet Been Accepted for DoD Acquisition

Digital Tolerance

“Model-based definition could spell the end for traditional drawings, but first, there’s an issue of trust to address.”

By Jean Thilmany, Associate Editor Mechanical Engineering Magazine



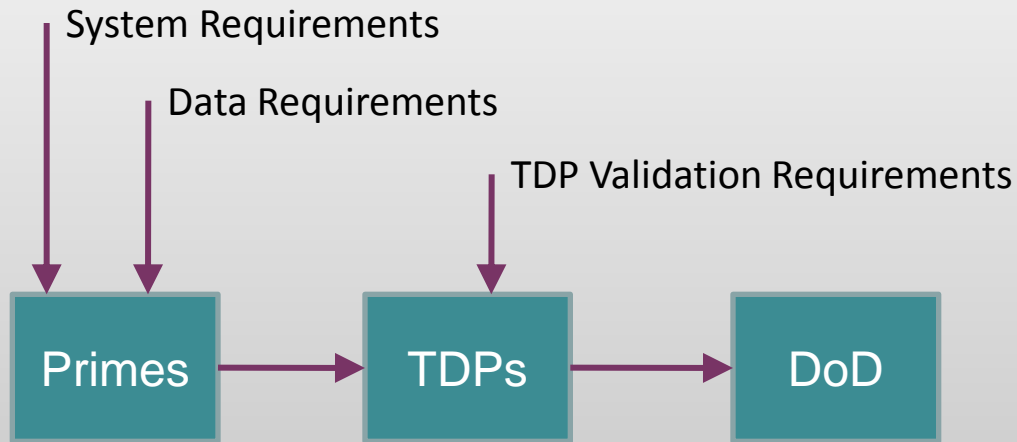
Problem

- Many defense systems are delivered with insufficient, inaccurate, and non-interoperable data that makes sustainment difficult.
- 3D model data is not currently approved within DoD for use as the Official DoD Master product data set.
- No approved processes or guidelines currently exist within DoD for **validating 3D product data** integrity or certifying 3D model data for approval as the master data reference.
- Vendors are often reluctant to quote due to risk involved with questionable models or will quote considerably higher prices to cover risk.

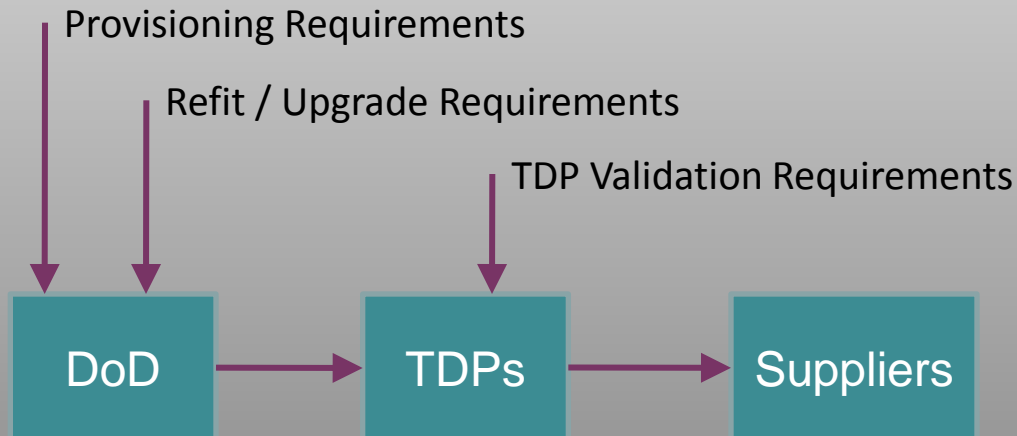


Two TDP Use Cases

1. New Systems: DoD Receives Technical Data Packages



2. Existing Systems: DoD Authors Technical Data Packages



TDP Creation Flow

Design Model Creation

Concurrent Validation

Semi Automated

Product Lifecycle Management Check In

Triggered Validation

Human Approval

Derivative Creation

Triggered Validation

Human Approval

Customer Delivery

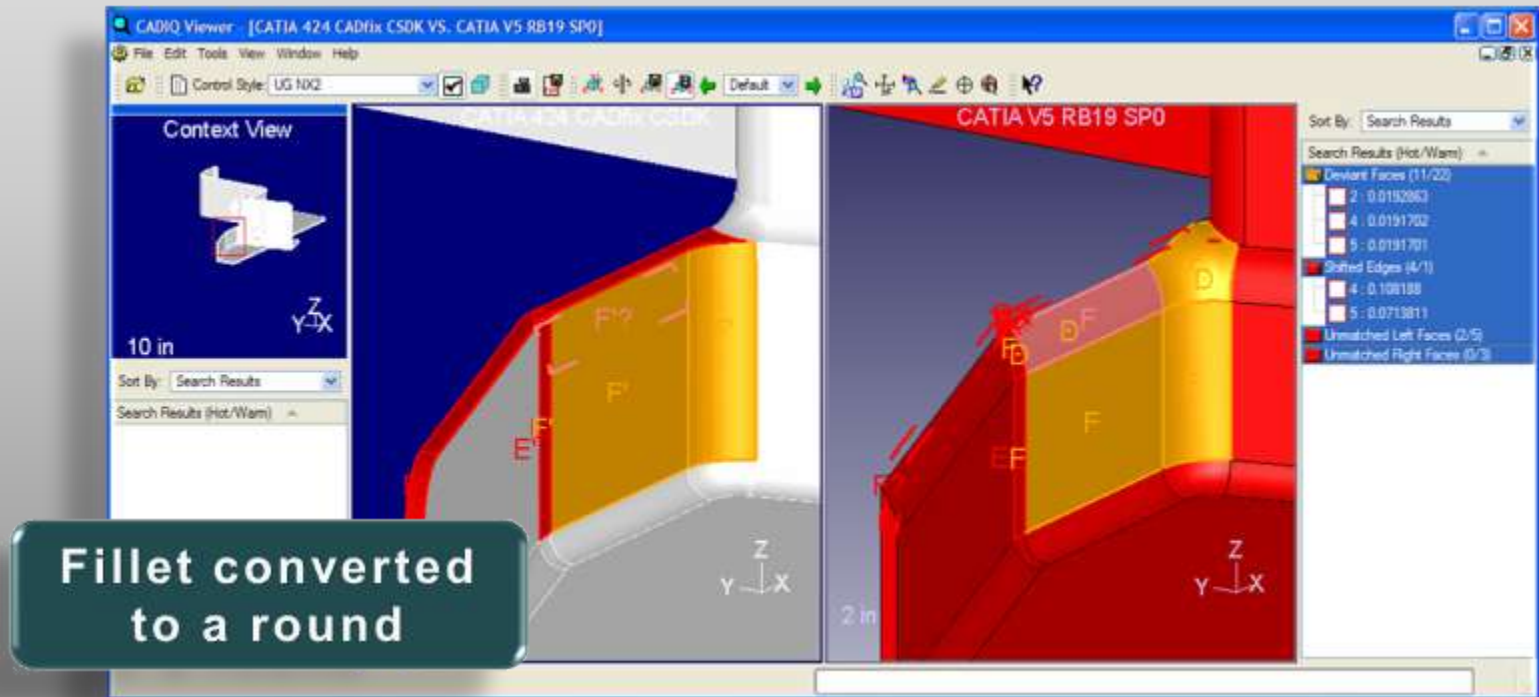
Full TDP Review

Semi Automated

**Validation
Is NOT a
“one-click”
function**

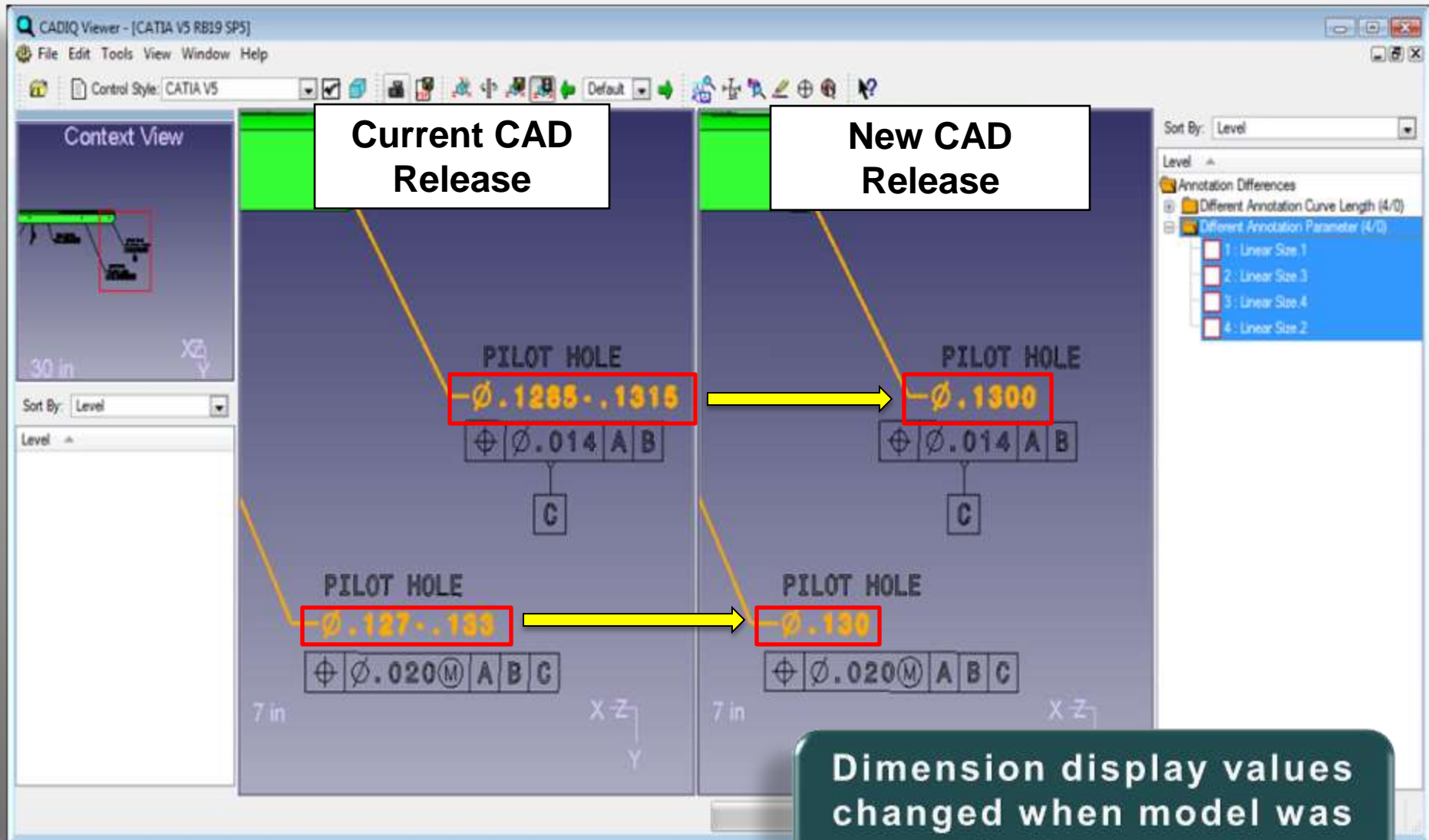
Data Not Validated – Consequences

- Translation and Migration Validation
 - Lost Data?
 - Significant changes introduced?
 - Non-value-added rework
 - Unknown change affects design intent



Source: ITI TranscenData

Data Not Validated – Consequences



What We are Doing

- Developing and demonstrating processes and specifications for validating 3D model data for approval as “master” product data.
- Project scope is limited to an initial set of priority applications.
- Developing data quality requirements, validation techniques, and data validation metrics.
- Developing tools to allow program managers to assess technical data packages for conformance to model quality guidelines.

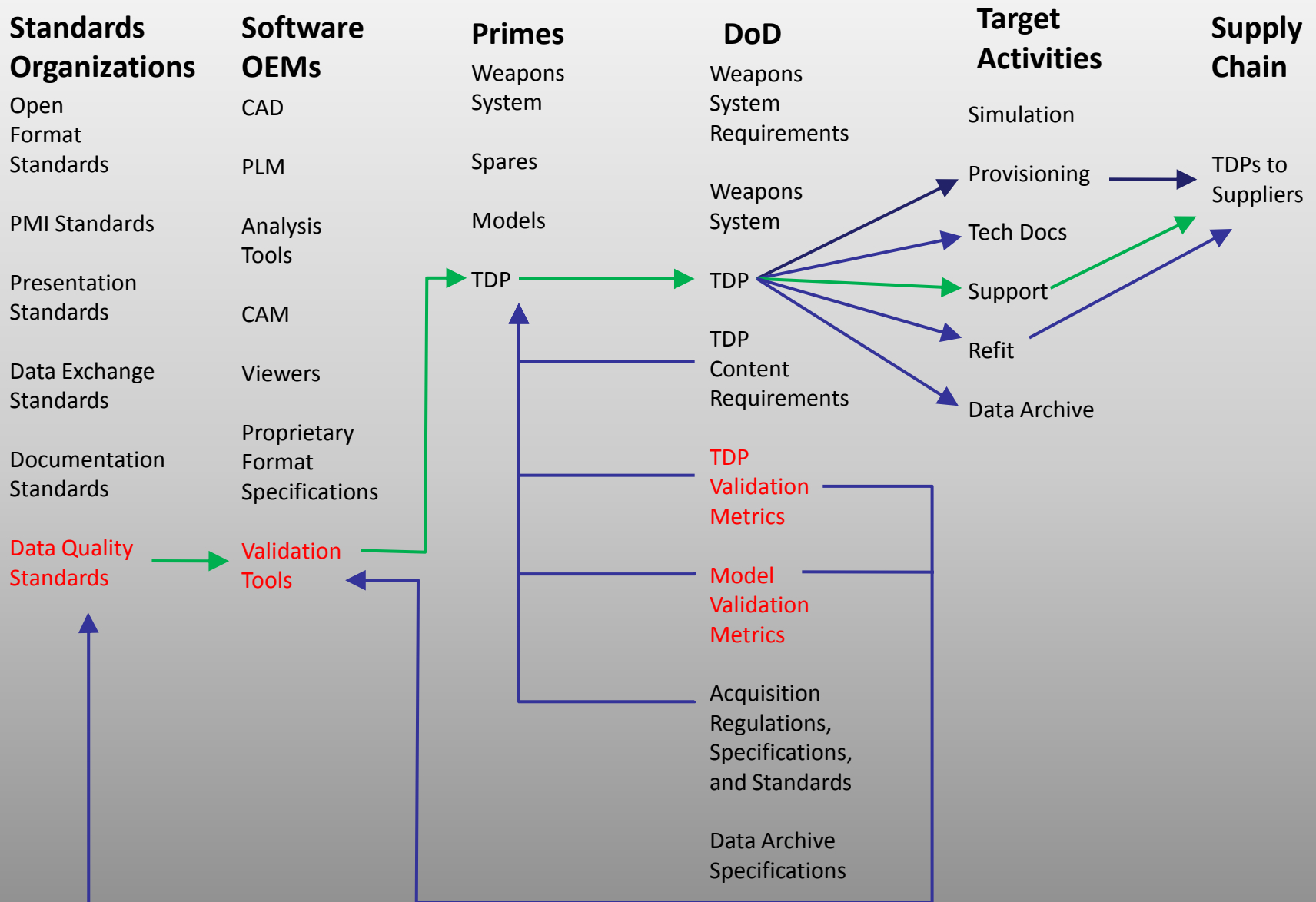


Making this Real

- Working with software vendors to establish requirements and continuously release new validation capabilities as an ongoing activity.
- Working with DoD organic industrial base (depots), prime contractors and technology vendors to set requirements and establish processes and specifications.





TDP Dependancies

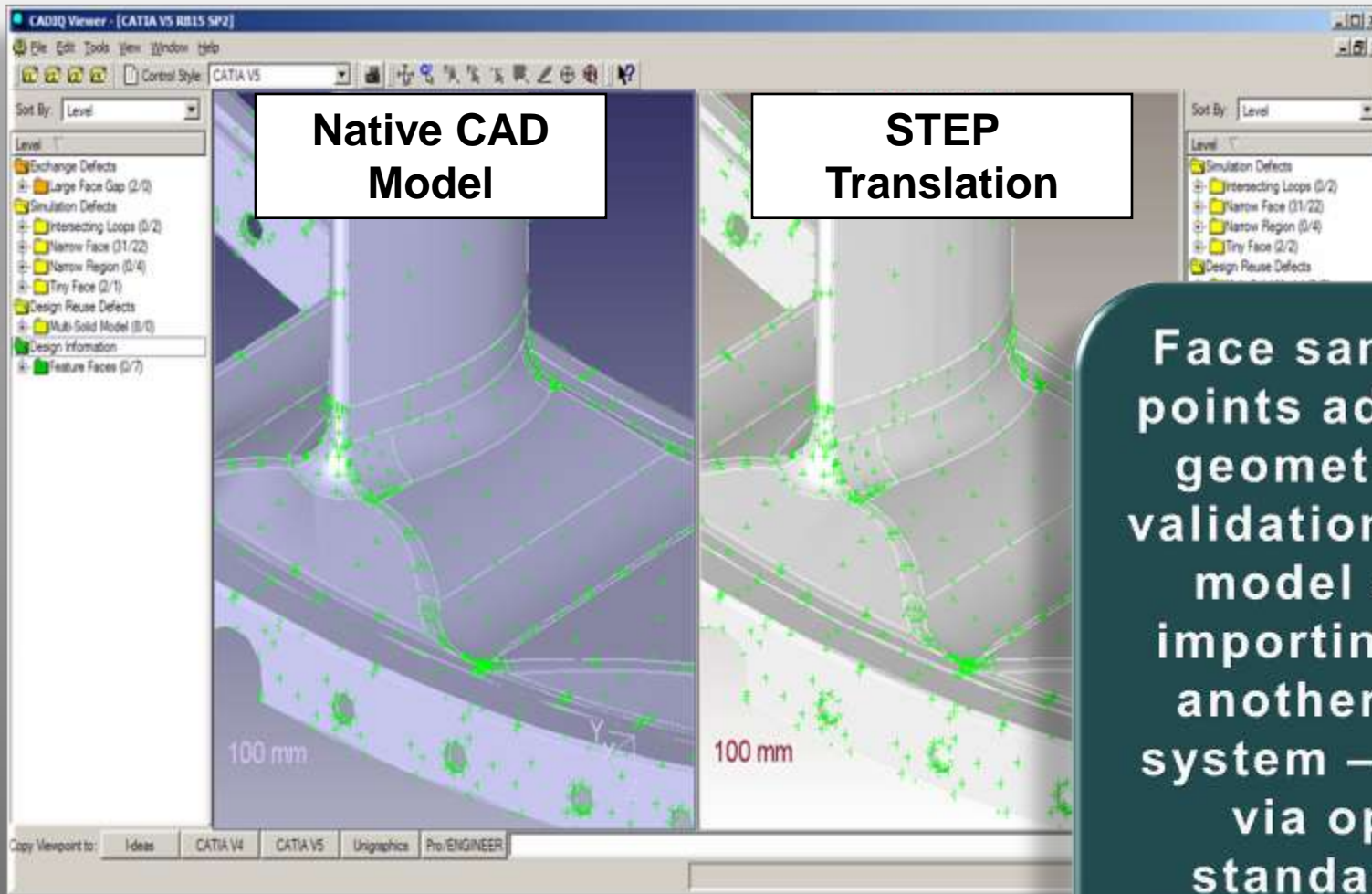


Where we are - Validation Handbook

	Native Model Quality		Derivative Model Equivalence		
Parts and Assemblies	Valid for Data Exchange	Valid for Mfg	STEP Equivalent	Visualization Equivalent	Translation Equivalent
Structure	Green	Green	Green	White	Green
Geometry	Green	Green	Green	Yellow	Green
GD&T	Yellow	White	Yellow	White	Yellow
Other Annotations	Yellow	White	Yellow	White	Yellow
Product data	White	White	White	White	White
	White	White	White	White	White

-  Demonstrated
-  Currently Under Development

Where we are - Validation Methods



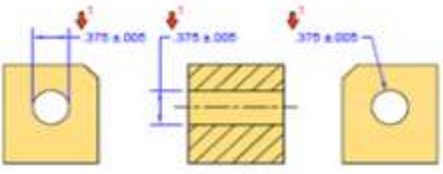
Face sampling points added to geometry for validation of the model after importing into another CAD system – either via open standard or direct translator

Source: ITI TranscenData

Where we are - PMI Validation

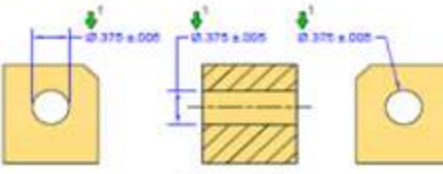
PMI Quality Validation

Errors



Orthographic Views

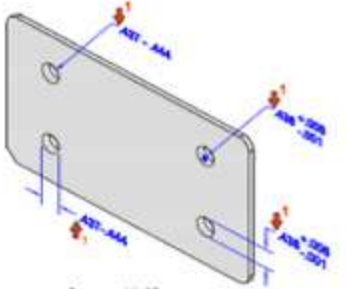
Correct Specifications



Orthographic Views

PMI Quality Validation

Errors



Axonometric View

Correct Specifications

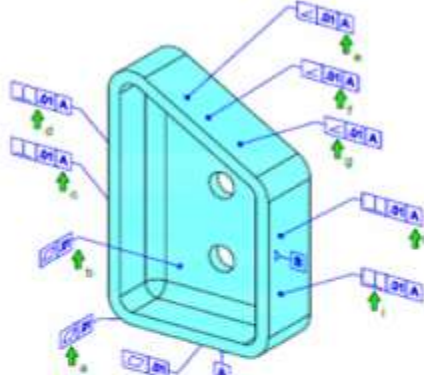


Figure 1-1
PMI Errors: Missing Diameter Symbol in Size Dimension:
Various Examples in Orthographic and Axonometric Views

1. Type Error - Dimension Missing Diameter Symbol in Size Dimension

Figure 2-6
PMI Errors: Various Geometric Tolerancing Errors

- a. Tolerance Application Error - Form tolerance (Circularity) applied to inapplicable feature type
- b. Unauthorized Datum Feature Reference Error - Form tolerance includes a datum feature reference
- c. Unspecified Datum Feature Error - Geometric tolerance references undefined Datum Feature
- d. Tolerance Zone Shape Error - Diametral tolerance zone specified inappropriately
- e. Missing Datum Feature Reference Error - Orientation tolerance must Reference a Datum Feature

Figure 2-6
Correct Specifications

- f. Material Condition Modifier Error - Modifier applied inappropriately to feature without size (Orientation tolerances may only be specified with MMC modifier if toleranced feature is a feature of size)
- g. Tolerance Application Error - Inappropriate orientation tolerance (Perpendicularity) applied where a different tolerance should be specified (Angularity)
- h. Self-Referential Datum Feature Reference Error - Datum Feature B tolerated to Datum B
- i. Tolerance Application Error - Orientation tolerance (Parallelism) applied where a different tolerance should be specified (Perpendicularity)

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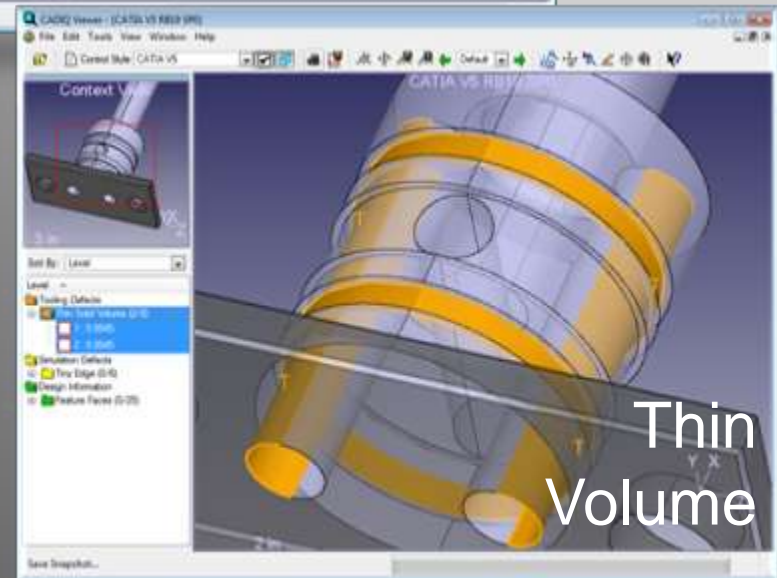
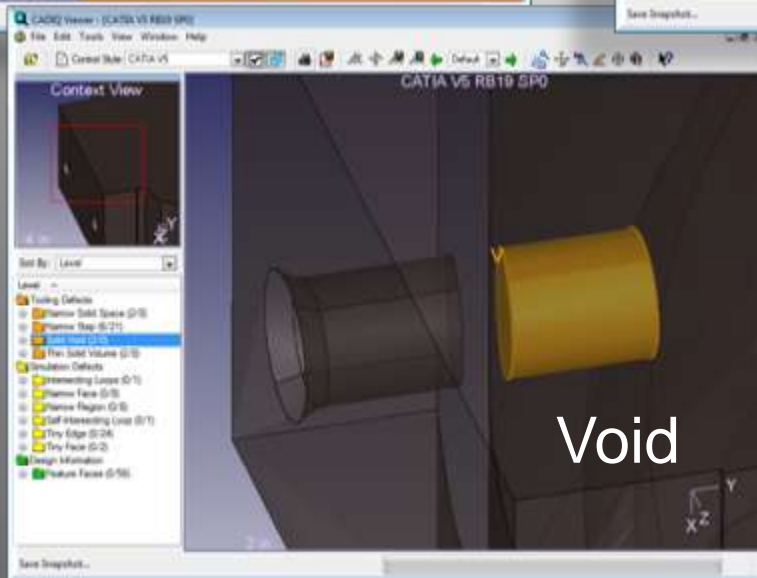
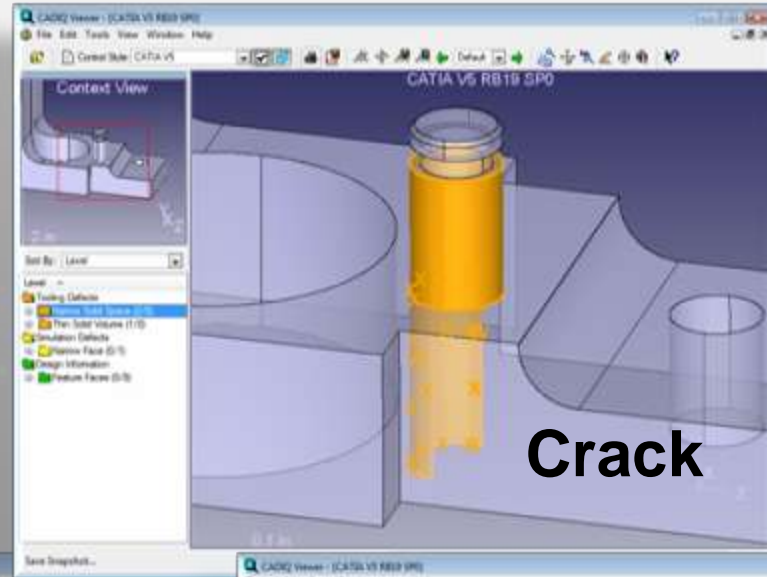
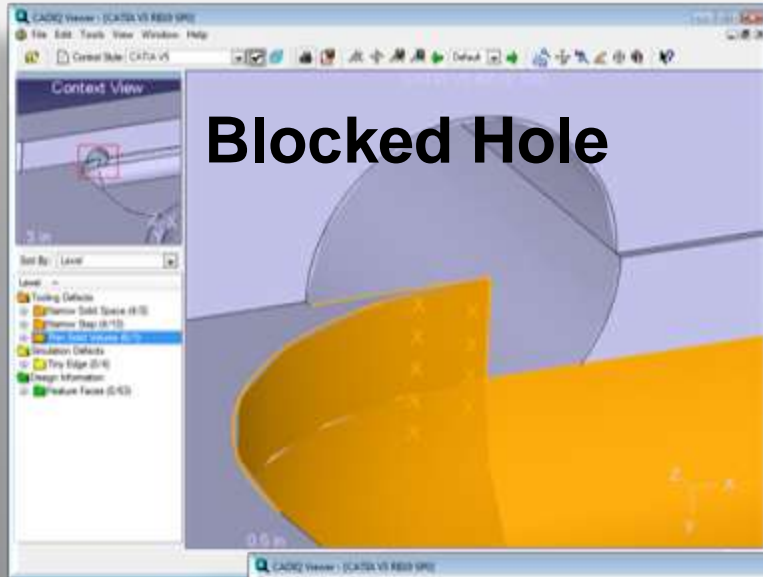
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Validation Pilots

- Successfully completed pilot validation effort of M2 50 cal. models and Bradley transmission models.
 - The pilot included fully M2 models created by ARDEC and Bradley transmission models.
 - The models were validated against the MBE schema and model validation requirements. ITI and Elysium software applications were used to validate the models.
 - The Bradley transmission models were then translated from CATIA 4 to Pro/E Wildfire 4 format and re-validated.
 - 21% of the Bradley transmission models contained errors
- Plan to continue M2 pilot and extend to supply chain.



Technical Progress: Bradley Transmission Pilot



PLM Validation

- Model validation is only the first type of validation needed
- Future TDP deliveries to and from the DoD will most likely deal with Product Lifecycle Management data and tools
 - These tools provide configuration management for the entire TDP not just the part model
 - Once delivered, there needs to be assurance that what was received is exactly what was sent
- We are currently starting an initial pilot
 - The primary scope of this is to identify gap and problem areas



Where we are going - Composites Information

Composites Data Sets

- Level I – Basic definitions
 - Ply orientations, materials, lay ups, ply boundaries, tool surface
- Level II – Analysis capability
 - True fiber orientations, zone definitions
- Level III – Manufacturing data
 - Flat patterns, fiber placement data, deposition start locations, layup strategy

**All three data sets must be delivered to
support target DoD activities
(MRO, supply chain, depot service, etc.)**