U.S. Army Research, Development and Engineering Command

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

DEDMWG and MIL-STD-31000 Overview and Status of Model Based Definition Efforts

Paul Huang, U.S. Army Research Laboratory
28 Nov. 2011

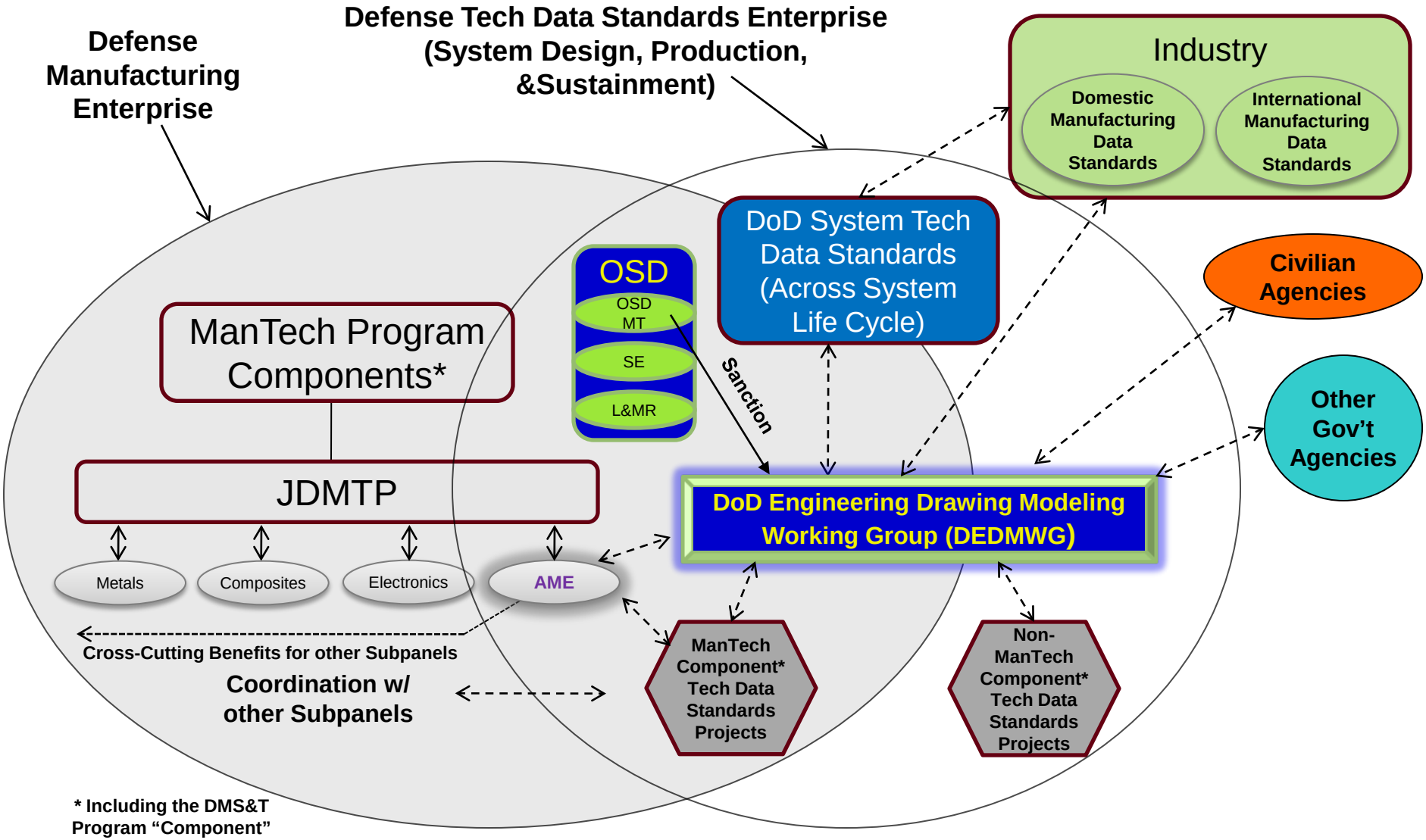
AGENDA

- Overview of DEDMWG History
- DEDMWG relationship within DoD/ManTech Community
- Scope & Objectives
- Current Relevant Projects
- Accomplishments
- Summary and Gaps
- Questions

DEDMWG History

- First Meeting hosted by the Army and Navy in Gaithersburg, MD November 2008.
- DoD Engineering Drawing and Modeling Working Group (DEDMWG) established by the Services and DoD in 2008 to establish a Community of Interest for sharing and leveraging ideas, tools, processes, and to be a unified voice within DoD and to Industry Standard Groups.
- Membership includes all the Services, Coast Guard, DoD and Industry partners. A Workspace is located at the Acquisition Community Connection (ACC).
- First task taken on was the update to MIL-DTL-31000C, which is being converted to a MIL STD. Also looking to update associated Data Item Descriptions (DIDs) Accomplished Nov 2009.
- Charter has been endorsed by OSD ManTech Director 29 June 2010
- Held multiple workshop/summits with SME from all services, NIST, NASA, USCG, Industry, Academia participants. The last meeting was in July 2011 with next meeting on 14-15 Dec.2011.

Leverage Between JDMTP, AME Subpanel & DEDMWG



Scope and Objectives

I. Scope:

DoD Engineering Drawing and Modeling Working Group (DEDMWG) is chartered to lead efforts for technical coordination and policy guidance on weapon systems technical data for acquisition, product design, analysis, simulation, manufacturing, provisioning and other product lifecycle management functions within a Model Based Enterprise (MBE). This includes offering guidance on technical data requirements for computer-aided design, engineering, manufacturing, data repository, data archival/retrieval tools, and related applications for total product lifecycle management.

II. Goals & Objectives:

Establish a group of respected subject matter experts (SMEs) across the DoD technical acquisition communities.

Work with DoD organizations to establish requirements for acquisition defined in the scope.

Investigate state of the art tools and technologies.

Revise current DoD specifications, standards, handbooks and other documents to incorporate requirements and guidance for (acquisition and management of) state-of-the-art model-based technical data.

Partner with government and non-government organizations that develop specifications and standards that are suitable for DoD Acquisition Programs to ensure DoD requirements are being met.

Work with domestic and international partners to access technology and tools to allow the DoD community to effectively perform life cycle support activities related to technical data, and define the terminology and definitions for this activity.

MBE/TDP Team Members & Collaborators

OSD ManTech

Army

Air Force

NIST

Navy/Marine Corps

MBE

Standards Organizations (ASME, AIA, PDES, ISO)

DLA

Industry-DoD Primes

Industry-Technology Developers

Other Govt. Agencies/Services (USCG, DoE/NNSA, NASA)

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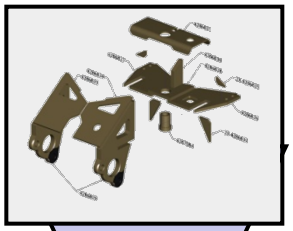
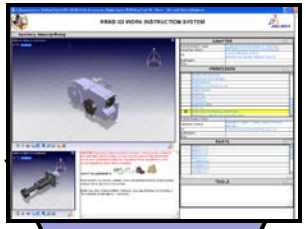
Model Base Definition (MBD)
Model Base Enterprise (MBE)

The Model Based Definition (MBD) is created at the beginning of the lifecycle then reused throughout the enterprise, thus creating the Model Based Enterprise (MBE)

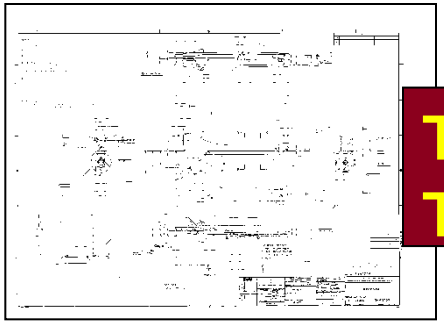
MBE is an integrated and collaborative environment, founded on 3D product definition (MBD) shared across the enterprise, enabling rapid, seamless, and affordable deployment of products from concept to disposal. a





MBD → Concept → Design → Production → Sustainment → End Of Life

From This



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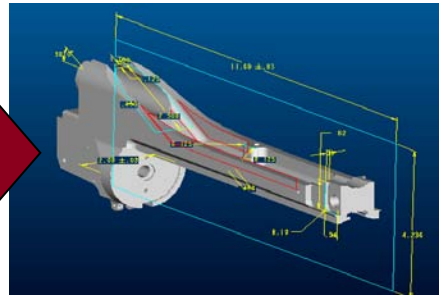

To Improve how we sustain our weapon platforms thru MBD/MBE

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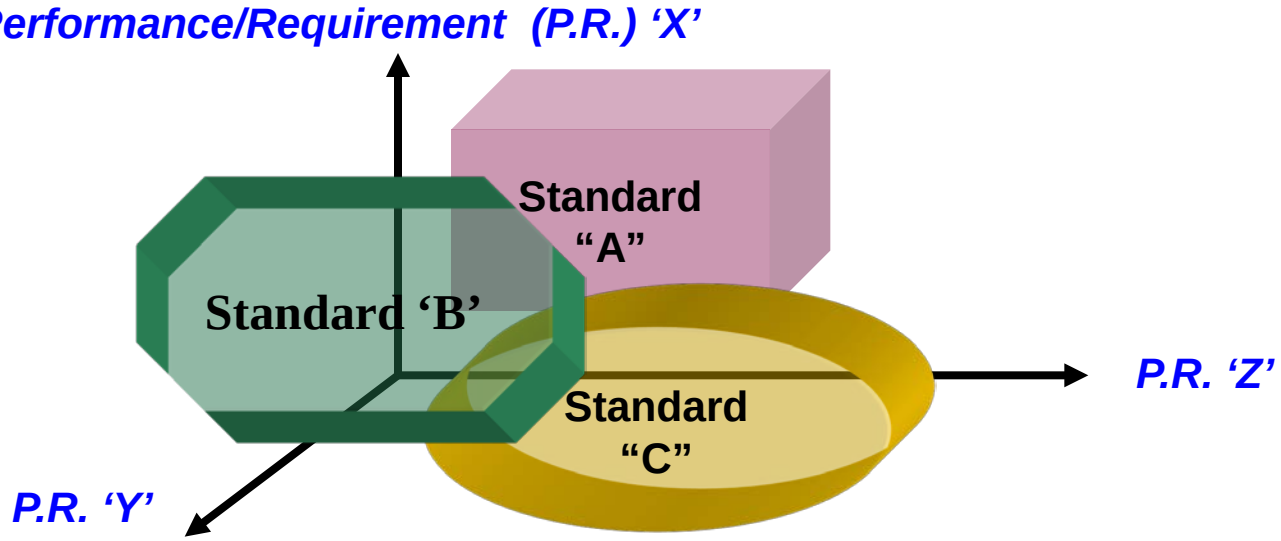
One Standards the Only Solutions?

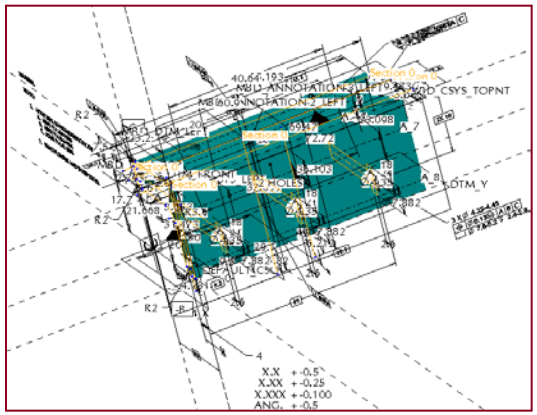
Standards by themselves are not sufficient, but guidance/policy are required for implementation



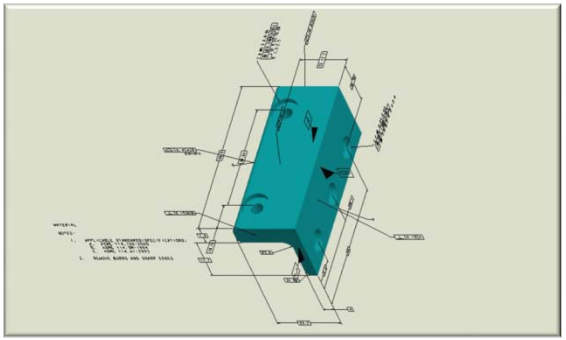
- How do we determine which is the Applicable Standards based on the mission/requirements/performance to put on contracts?
  - Most often not one fits but several from various government/industry/associations, so how do we choose them correctly?
  - As technologies changes standards are usually lagging, how do we link them and speed up development to keep pace, but without overburden our acquisition personnel?

Example of Challenges:

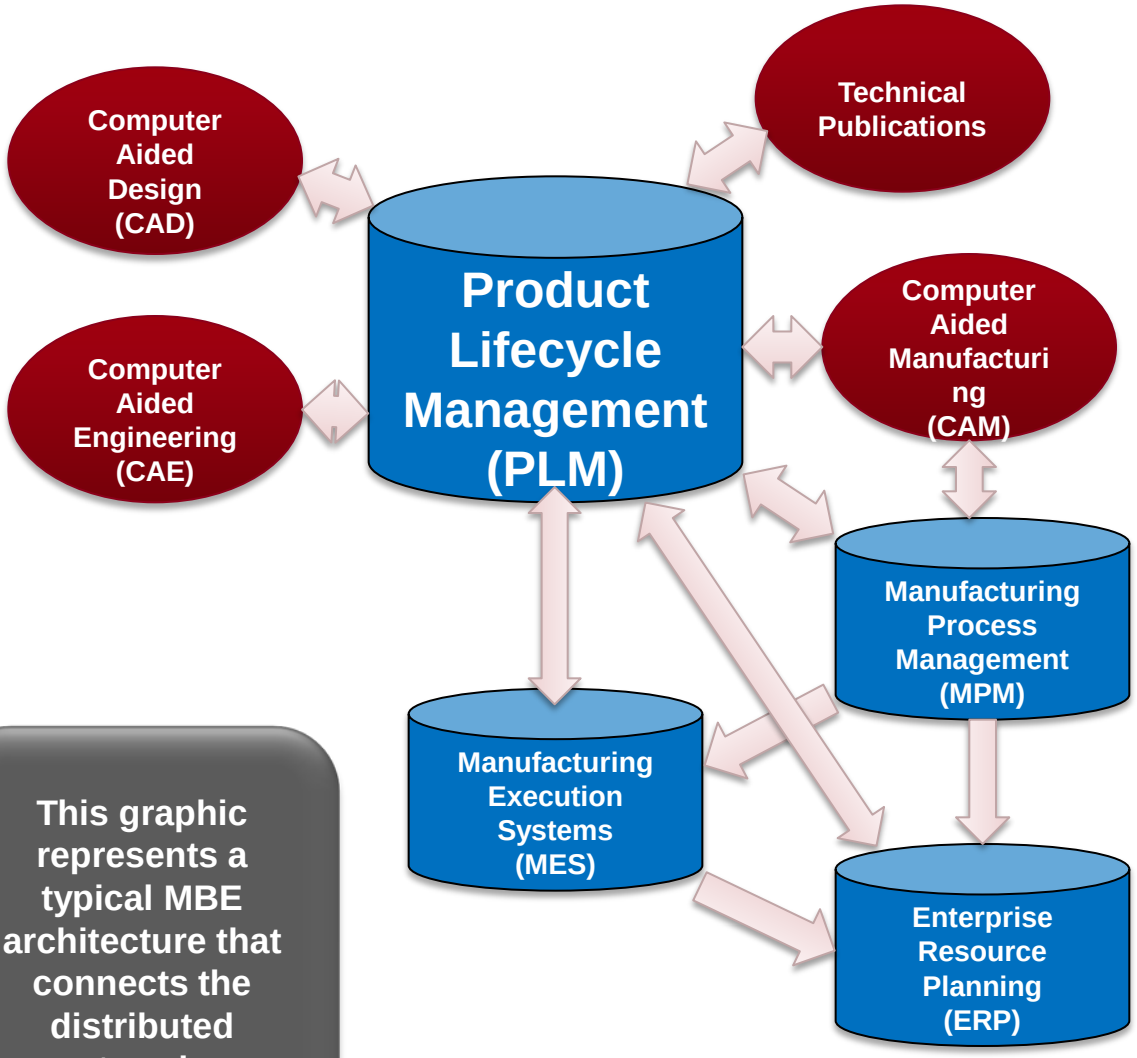
In order to effectively use MBD,CAD file organization methods are required.



CAD File Fur ball



MBD Schema applied to "Tame" the Fur ball



This graphic represents a typical MBE architecture that connects the distributed enterprise

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ISO 10303 AP 242 Harmonization

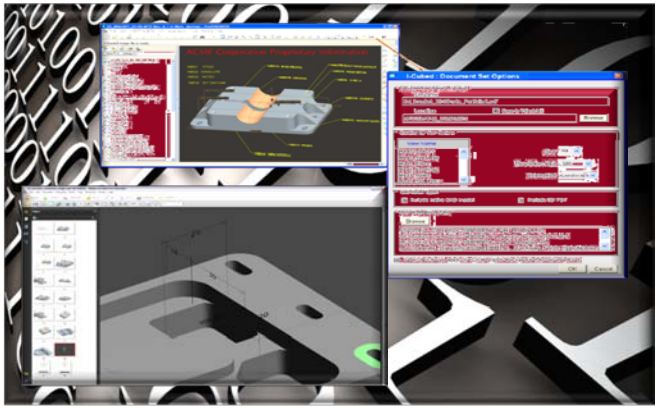
- AP203, Configuration controlled 3D designs of mechanical parts and assemblies.
  - AP203 applies to representations of mechanical parts and assemblies.
  - AP203 files typically contains the boundary representation model, assembly data, and a limited amount of other product information.

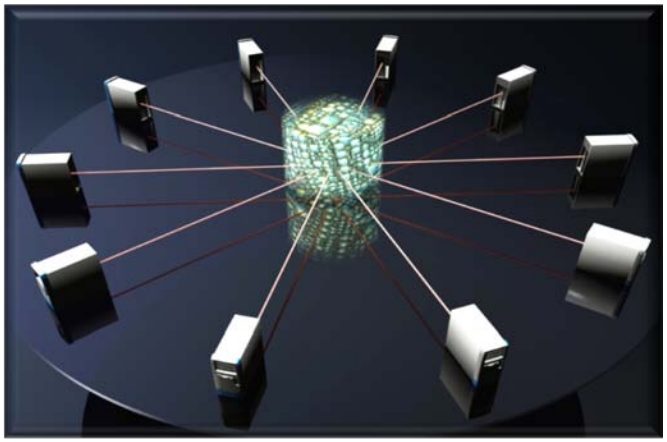
- AP214, Core data for automotive mechanical design processes
  - AP214 applies to representations of data relating to automotive design.
  - AP214 files typically contain colors, layers, and generic resources.

- AP242, Managed model based 3D engineering (under development)
  - New AP combining AP203 and AP214
  - The objective is to develop a common application protocol for the automobile and aerospace industry.
  - Bundling the activities allows reacting faster industrial requirements.
  - Allow for integrating technologies like UML (Unified Modeling Language) and XML (Extensible Markup Language)
  - Lowers the costs for standard maintenance.
  - Envisioned to become the backbone for data exchange, data-sharing, visualization, and long-term archiving.

Current & Recent Army & OSD ManTech Projects

- **3D Tech Data Package (TDP) Definition**
  - **Revision of MIL-STD-31000**
  - **Influencing other standards**
  - **Defining processes**
- **3D Validation**
  - **Defining a certified 3D Model**
  - **Validation processes for the Model and the TDP**
- **Supply Chain**
  - **MBD Summits to raise MBE Literacy**
- **Reuse of 3D TDP in Techpubs**
  - **Influencing Standards**
  - **Proof of concept**





Accomplishments to Date

- Converted and updated MIL-DTL-31000C to MIL-STD-31000 (Nov. 2009)
- Held multiple workshops at NIST where over 60 SMEs participated in revision to MIL-STD-31000
- In process to seek to reactivate MIL-STD-973 Configuration Management
- Close coordination with ASME Y14.41 and AIA NAS3500
- Joined PDES Inc. to collaborate in various STEP AP development and to monitor LOTAR.
- Coordinating with NIST, NASA, USCG and DoE
- Refining annotations and delivery schemas, and validation guidebook into MIL-STD-31000

- Next MBE/TDP Summit will be held 12-15 Dec. 2011 at NIST

DEDMWG Workspace

https://acc.dau.mil/dedmwg

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Summary & Gaps

- **The DoD has made a commitment to adopting MBE**
- **The team has made great progress towards creating a standard 3D TDP process, and demos.**
- **A process for validating 3D TDP quality is nearing completion of phase I**
- **We are committed to raising the MBE literacy throughout the supply chain and the DoD**
- **Still a long road to fully implement MBE and adoption within DoD**

Questions?

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BACK UP SLIDES

The Journey

Drawing Based

Master 2D Drawing

Model Centric

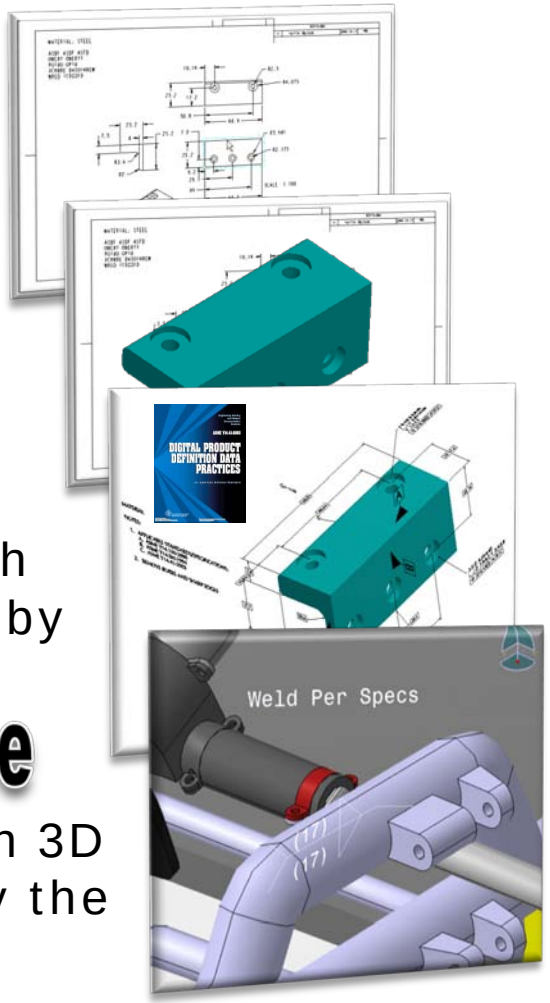
3D CAD Model with Master 2D Drawing

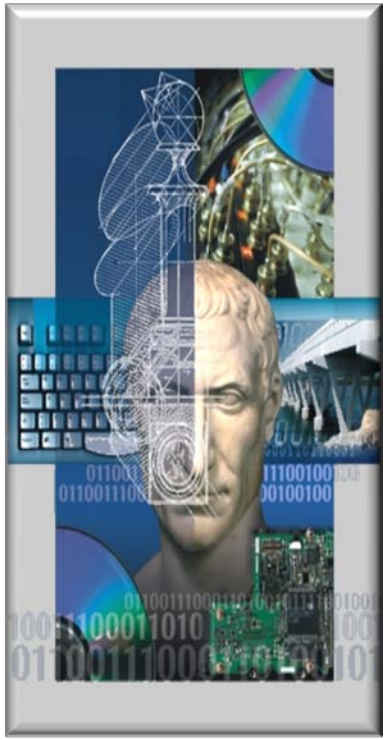
Model Based Definition

Master 3D CAD Model with 3D Drawing, 2D Drawings by exception

Model Based Enterprise

Master 3D CAD Model with 3D Drawing fully leveraged by the Supply Chain





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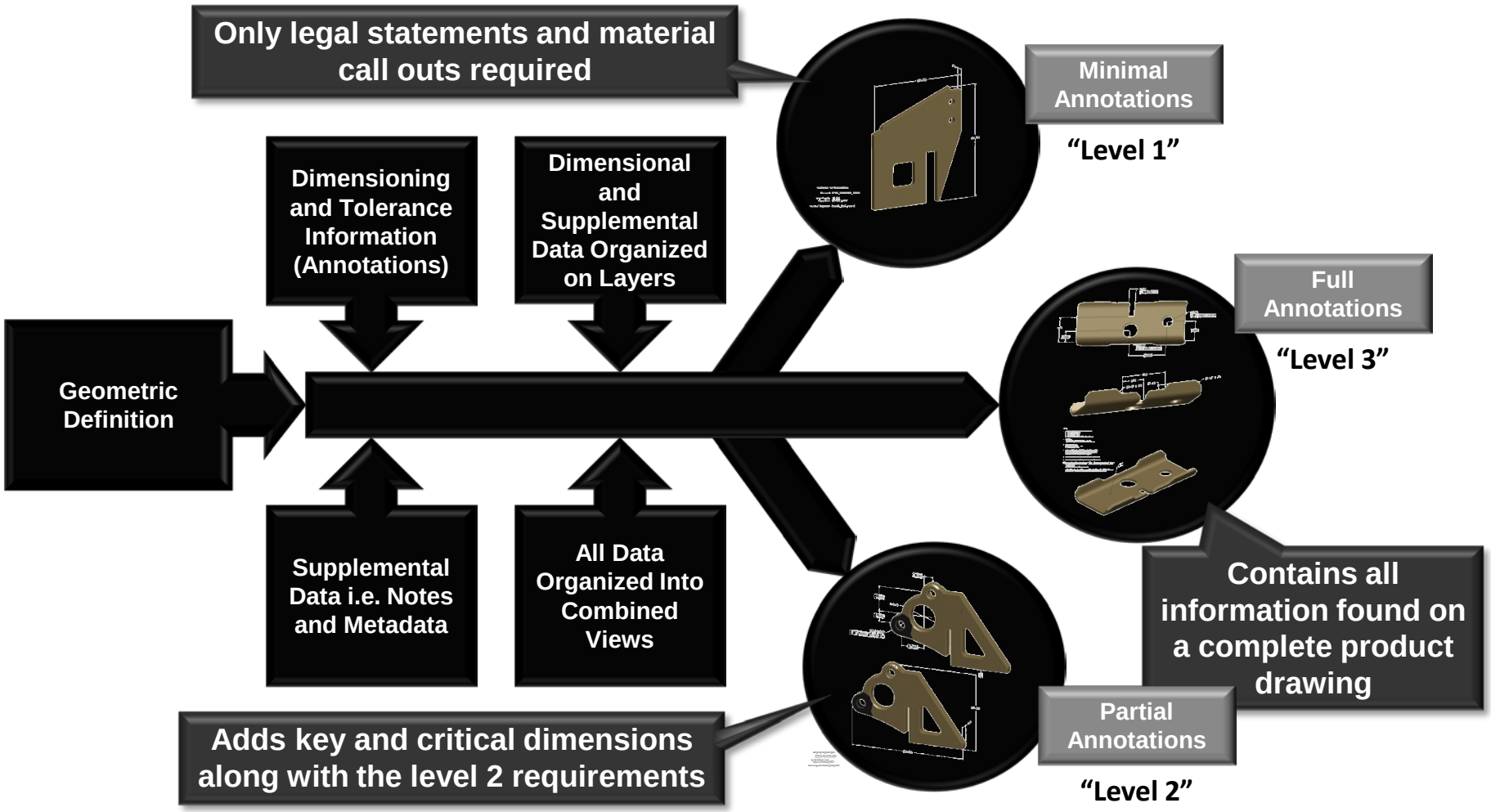
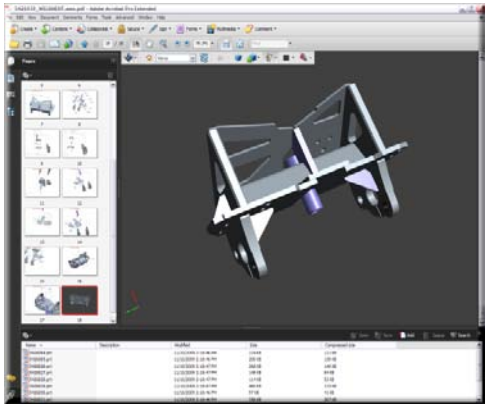
The Framework

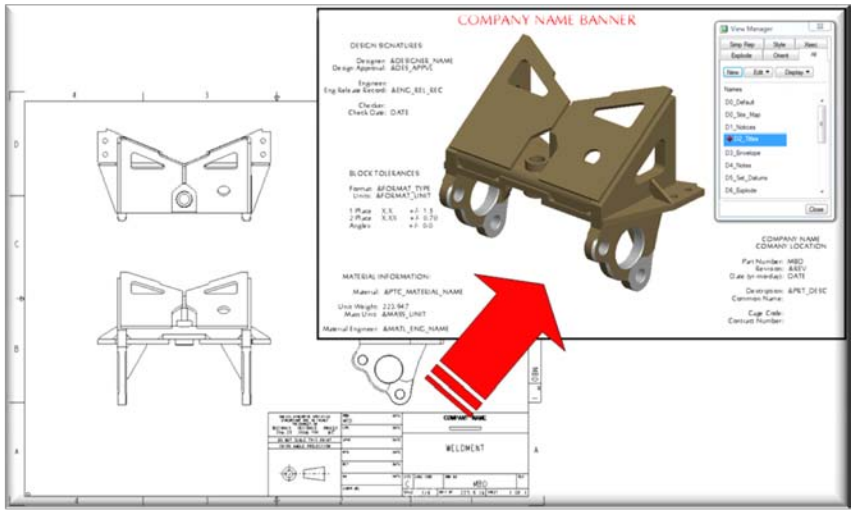


The Purpose of the Schema

- **In order for all the downstream users to consume the annotated model in place of a drawing it must be organized in a consistent and intuitive manner**



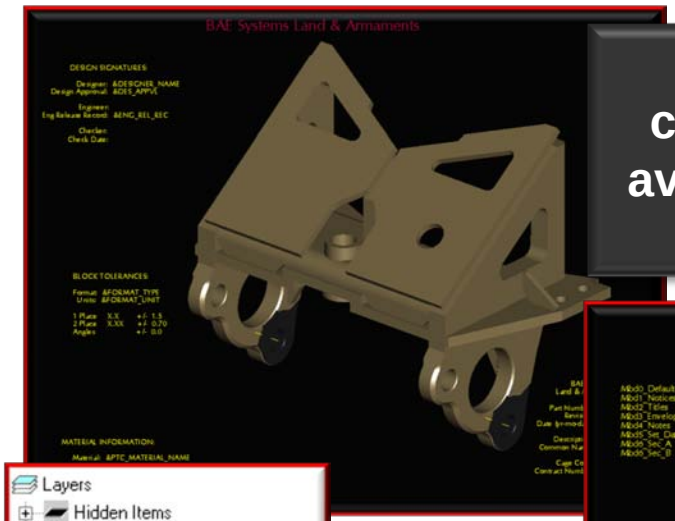
- **The Annotation Schema provides this consistency**

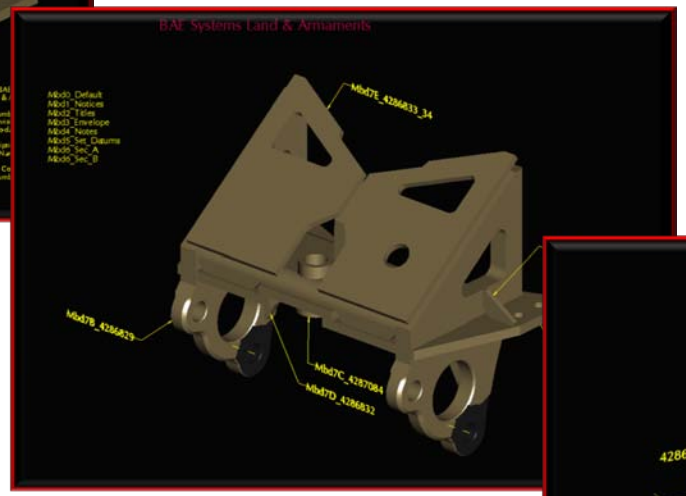


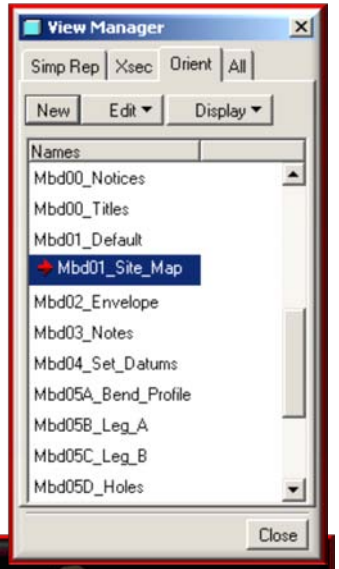
- **Also, it enables much of the information to be programmatically extracted**

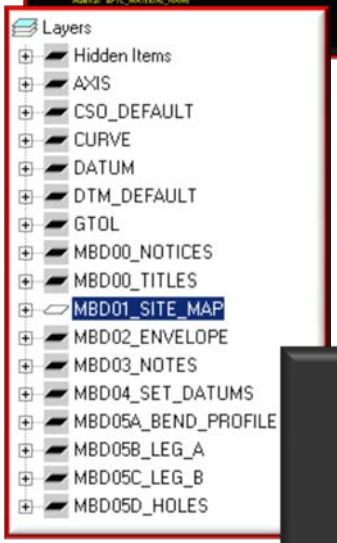
Annotated Models

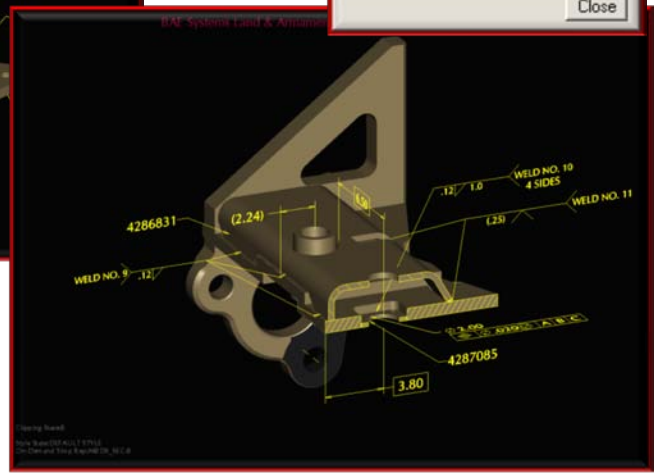
All data that is normally contained in a drawing is now available in a readable format in the Pro/E Model











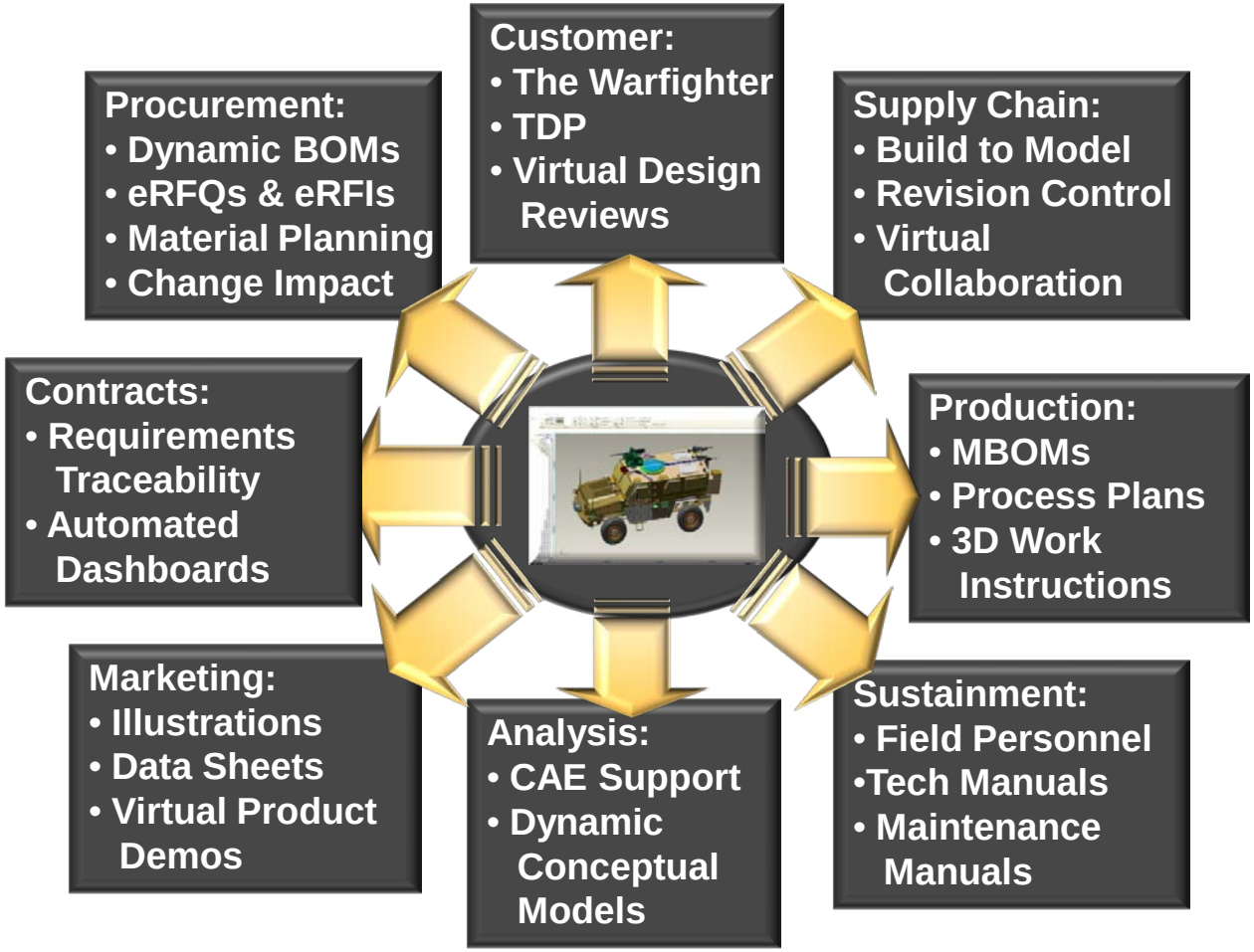
Pro/E Wildfire provides increased organizational abilities through combined views and layers

Why Are We Doing This?

The main purpose of the 3D TDP is to provide all Downstream users a 3D data set that they can reuse with out re-mastering the data

For suppliers this means they will have the ability to drive their CAM software straight from the model along with numerous other process

All of this reduces the time to mission for the Warfighter

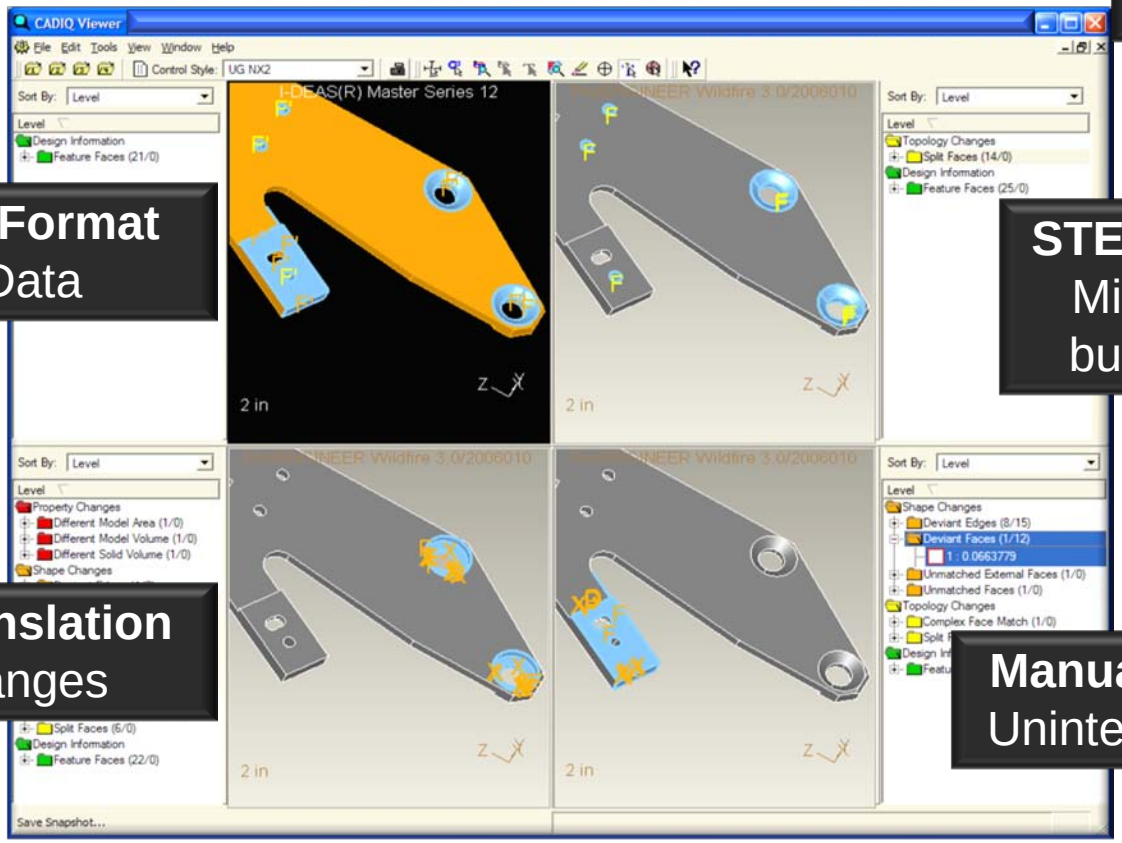


Translations Can be Validated

Original Model Data

Is the Result Valid?

Current Viewing System



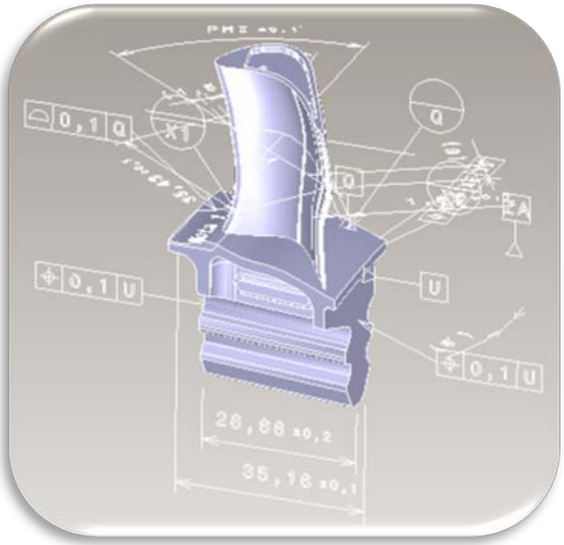
Native File Format
Master Data

STEP Translation
Minor changes
but no features

Feature Translation
Major changes

Manual Remastering
Unintentional changes

Scope of Validation



Specialized Data

Geometry Graphics

Annotations (GD&T, PMI)

Model Structure

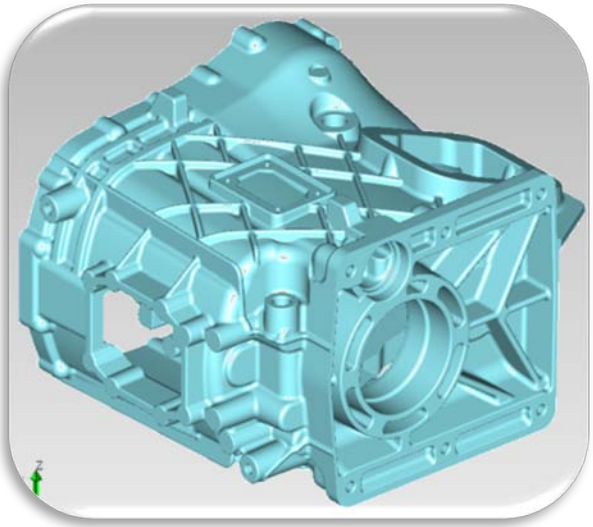
Model Attributes

Geometry Attributes

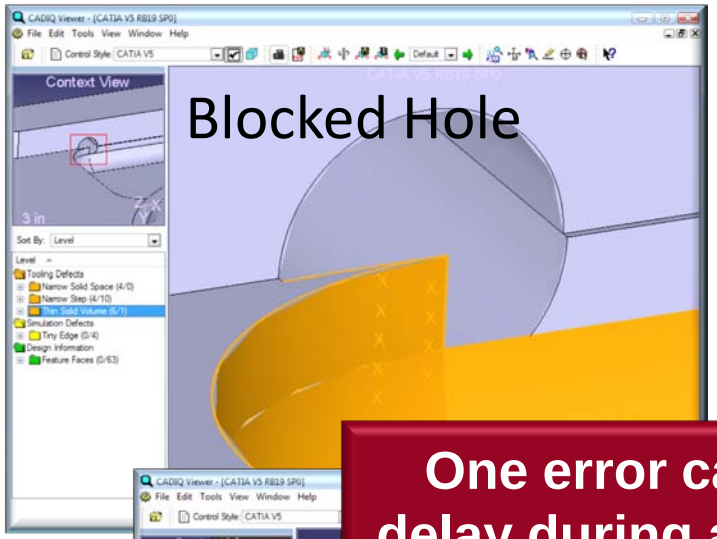
Wireframe Geometry

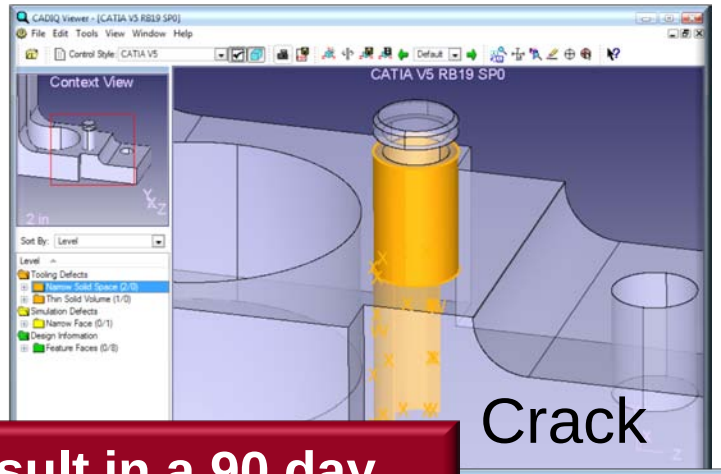
Solid & Surface Geometry

Metadata

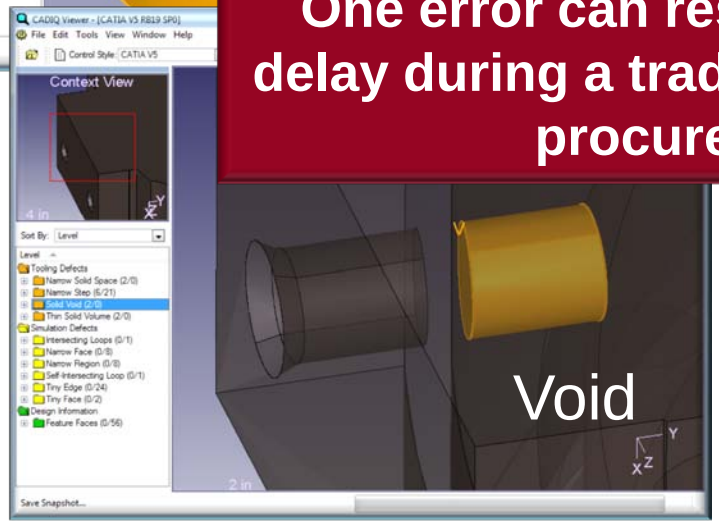


Examples of Bad Quality





One error can result in a 90 day delay during a traditional DoD MFG procurement



Supplier Summit

- Conducted 1st summit at DLA – DLIS Battlecreek, MI with over 80 attendees
- Conducted 2nd summit at Letterkenny Army Depot, PA with over 100 attendees
- Conducted 3rd summit at Huntsville, AL in coordination with NASA with over 80 attendees

- Consisted of a full day of technical and business presentations intended to raise their MBE literacy

- Participants completed a survey whose results will be used to modify the content of the next summit

- The surveys also indicated that the summits were a success by the attendees responses

Letterkenny Army Depot
"Center of Industrial and Technical Excellence for Air Defense and Tactical Missile Systems"

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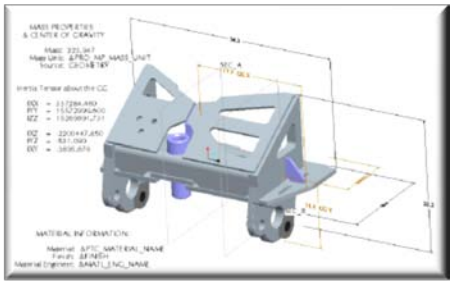
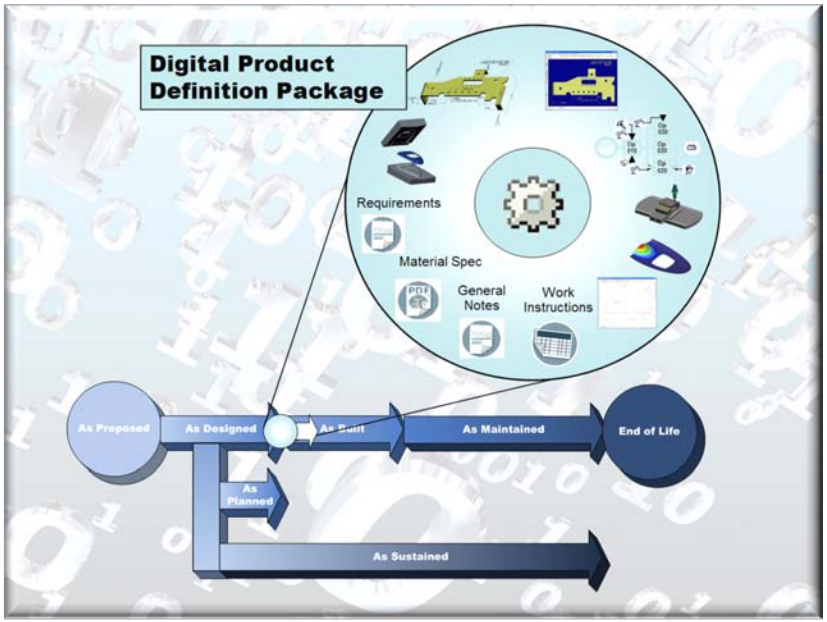
MBE Focus Areas

- CAD Interoperability
  - Working with CAD providers and users to define and communicate translation requirements
  - Working with translation software providers to define and communicate requirements
  - Developing translation validation process
- Manufacturing Process Definition
  - Working closely with CAD/CAM providers to define and communicating requirements
  - Sub-contracting the develop of productivity scripts
  - Developing and deploying 3D interactive Work Instructions

MBD Focus Areas (Continued)



- Product Definition within the CAD model
  - Methods for organizing the PMI contained within the model (CAD Model Schema)
  - Developing requirements for enabling annotated models within the light weight viewers
  - PLM Schema for storing and delivering a 3D TDP



MBE Capability Index

Level 0	•Model Centric Drawings for Design and Manufacturing •Primary Deliverable: 2D Drawing
Level 1	•Model Based Manufacturing •Primary Deliverable: 2D Drawing and Neutral CAD Model
Level 2	•Native CAD Based Manufacturing •Primary Deliverable: 2D drawing and Native CAD Model
Level 3	•Model Based Definition •Primary Deliverable: 3D Annotated Model and Light Weight viewable
Level 4	•Model Based Definition With Data Management •Primary Deliverable: 3D Annotated Model and Light Weight viewable via PLM
Level 5	•Model Based Definition With Automated Technical Data Package •Primary Deliverable: Digital Product Definition Package and TDP
Level 6	•MBD With Automated TDP and On Demand Enterprise Access •Primary Deliverable: Digital Product Definition Package and TDP via the web

There is a comprehensive spreadsheet associated with the Index