

DEFENSE ARCHIVING ISSUES AND INITIATIVES

**Naval Surface Warfare Center, Carderock Division
Code 2230-Design Tools Branch**

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OVERVIEW

- **Background**
- **Issues**
- **Initiatives**



BACKGROUND

Why Product Model Data?

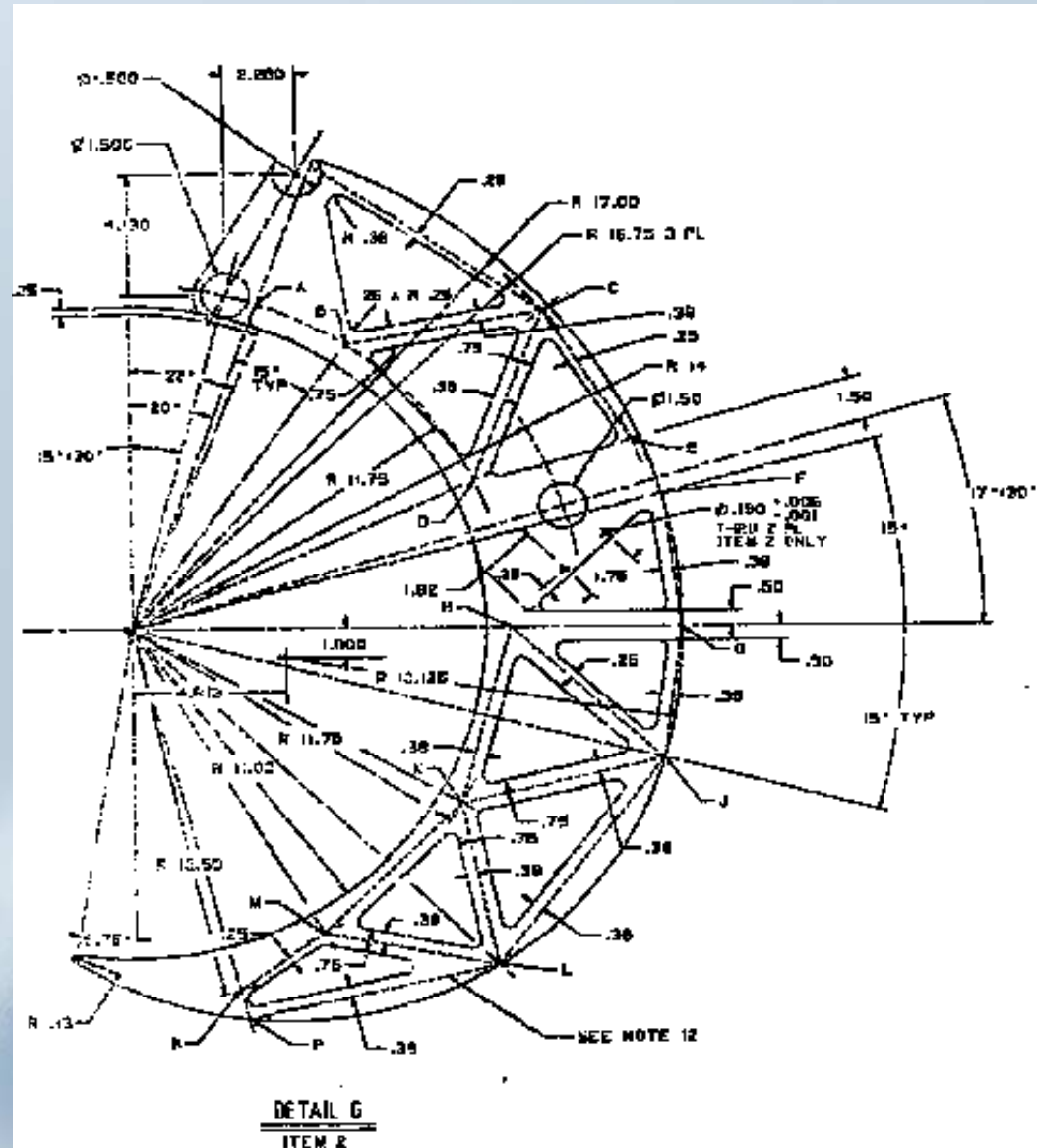
Torpedo retrieval claw test

Would you rather cut metal using:

- the paper drawing or
- by tracing a tool path around the CAD model on a CAM system?

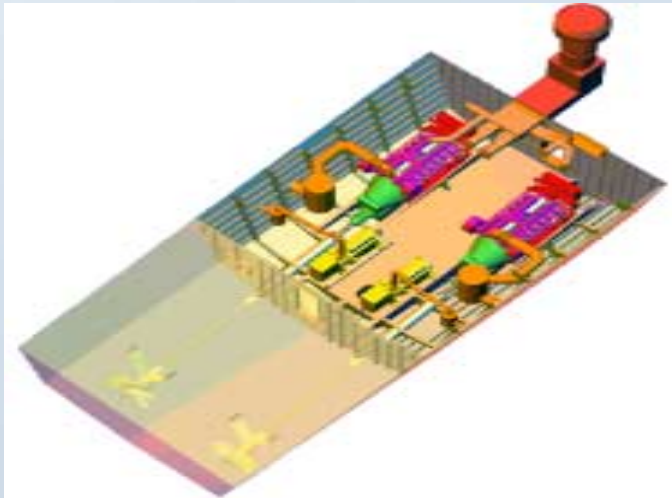
Which one is more likely to be correct?

And the winner was . . .

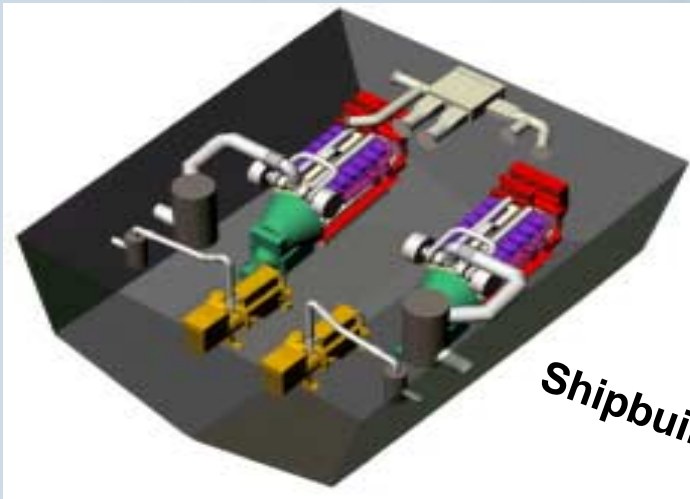


BACKGROUND

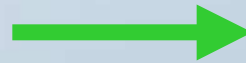
Industry Focus - they want it all but . . .



CAD

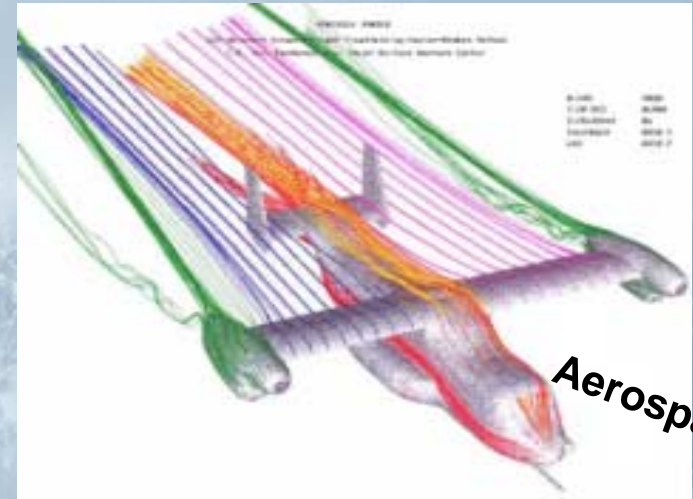


CAD



Automotive

CAM



Aerospace

CAE

Problems

Can't query paper or raster drawings

Missing data

Does not support automated down-stream processes

Unreadable legacy data

Training required for 2-D drawing interpretation

Top-down break-down information

Data rights

Data entry errors on indexing

Technical data errors

Management of common parts/libraries/catalogs



ISO 10303, STandard for the Exchange of Product model data (STEP) TC 184/SC 4/WG 3/T 23 (Ship Team) Standards



Marine e-business Standards Association
<http://www.emsa.org>



<http://www.jstra.jp>

Conformity to the concept of a system
System definition data and configuration
Requirements, requirement analysis, and functional allocation
Functional, functional analysis, and functional behaviour
Physical architecture and synthesis

Request, define, justify, approve, schedule and capture feedback on work activities/resources.
Product requirements and configuration as-designed, as-built, as-maintained
Feedback on product properties, operating states, behaviour and usage
Define support opportunity, facilities, personnel, equipment, diagnostics and organizations

AP 233, Systems engineering data representation



<http://kstep.or.kr/>



National Shipbuilding Research Program
<http://www.nsrp.or.kr/>

Ship Structural Envelope

Surface, wireframe and offset point representations
Design, Production and Operations lifecycles

General Characteristics
Main dimensions
Hull form geometry
Major internal surfaces
Hydrostatics
Intact Stability tables

AP216:2003, Ship moulded forms

Compartments
• types
• properties (shape, coatings, adjacency, access...)

Stability
• intact
• damaged

AP215:2004, Ship arrangement

Configuration Management
• Class Approval
• Approval Relationship
• Change Administration
• Promotion Status

Weight Description

Production Design Data

Technical Description

Structural Parts
• Feature
• Plate
• Edge Content
• Opening
• Profile
• Profile Endcut

AP218:2004, Ship structures

Distribution Systems

Pipe Flow Analysis and Sizing
Pipe Stress Analysis

AP227 Edition 2:2005, Plant spatial configuration – piping systems

Connectivity
• assembly
• penetrations
• ports

AP227 Edition 2:2005, Plant spatial configuration - cable trays

Connectivity
• assembly
• penetrations
• ports

AP227 Edition 2:2005, Plant spatial configuration - HVAC systems

Connectivity
• assembly
• penetrations
• ports

AP227 Edition 2:2005, Plant spatial configuration - mechanical systems

Equipment/Subsystems

Virtual simulation of mechanical connection to the device. Shows that the pieces in the context model have the same metadata, answers about the specific instance.

Instance	Value
Equipment_Pump	Pump
Equip	Equipment
Component	Component
Geometry	Geometry
Material	Material
Shape	Shape
Color	Color
Texture	Texture
Mass	Mass
Volume	Volume
Area	Area
Perimeter	Perimeter
Length	Length
Width	Width
Height	Height
Radius	Radius
Diameter	Diameter
Thickness	Thickness
Angle	Angle
Curvature	Curvature
Twist	Twist
Roll	Roll
Yaw	Yaw
Pitch	Pitch
RollRate	RollRate
YawRate	YawRate
PitchRate	PitchRate
RollAcc	RollAcc
YawAcc	YawAcc
PitchAcc	PitchAcc
RollVel	RollVel
YawVel	YawVel
PitchVel	PitchVel
RollAcc	RollAcc
YawAcc	YawAcc
PitchAcc	PitchAcc
RollVel	RollVel
YawVel	YawVel
PitchVel	PitchVel
RollAcc	RollAcc
YawAcc	YawAcc
PitchAcc	PitchAcc
RollVel	RollVel
YawVel	YawVel
PitchVel	PitchVel

ISO 13584 (Parts Library Exchange)

Zone Boundaries
• Controlling Access
• Design Authority
• Cargo Stowage
• Machinery
• Compartments
• Crew Occupancy
• Common Purpose Spaces

Cargoes
• assignment to compartments
• weight,
• centre of gravity

ISO 15926 (Oil and Gas)

• Ship Structural Envelope (hull forms, arrangement, structures)
• Distribution Systems (electrical, piping, HVAC, cable ways, mechanical systems)
• Mission Equipment/Subsystems (library and catalog parts)

Ship Product Model Data Exchange Information
STEP - <http://www.tc184-sc4.org>
USPRO - <https://www.uspro.org>
Ship STEP - <http://www.nsrp.org/t23>

Configuration Management
• Class Approval
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Weight Description

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• Feature
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AP 214:2001, Core data for automotive mechanical design processes



ISO 10303, Standard for the Exchange of Product model data (STEP) Aerospace Product Model Data Exchange Standards



Requirements/Concept

Analysis

Detailed Design/BoM

Manufacturing

Lifecycle Support

Conformity to the concept of a system
System definition data and configuration control
Requirements, requirement analysis, and functional allocation
Functional, functional analysis, and functional behaviour
Physical architecture and synthesis
AP233, Systems engineering data representation

Shape
Associated Finite Element Analysis (FEA)
Analysis results
material properties
AP209:2001, Composite and metal structural analysis and related design

Digital flow field data
Surface data
Analysis and computation
Future Editions
Ground test analysis and results
Flight test analysis and results
AP237, Computational fluid dynamics

Equipment Coverage
• Power-transmission
• Power-distribution
• Power-generation
• Electric Machinery
• Electric Light and Heat
• Control Systems

Electrotechnical Systems
• Buildings
• Plants
• Transportation Systems

Data Supporting and Interfaces
• Functional Decomposition of Product
• 3D Cabling and Harnesses
• Cable Tracks and Mounting Instructions

Electrotechnical Plant
• Plant, e.g., Automobile Unit, e.g., Engine Control System
• Subunit, e.g., Ignition System

AP212:2001, Electrotechnical design and installation

AP 214:2001, Core data for automotive mechanical design processes

Configuration controlled exchanges between Product Data Management (PDM) systems
Links multiple formats
Design Analysis Manufacturing Support
AP232:2002, Technical data packaging: core information and exchange

Physical layout of the circuit card assembly
Description of logical connections among the functional objects
Packaged parts
Physical interconnections
Configuration management
Parameters for parts and functional objects

Edition 2 in process
AP210:2001, Electronic assembly, interconnect, and packaging

Components Assemblies
Administration
Planning
Execution
Archiving

Geometry
Dimensions
Tolerances
Inspection processes

AP219, Dimensional inspection

Component s
Assemblies
Machining features
Assembly information
Explicit geometry
Tolerances

Make or buy
Macro process planning

Edition 3 in process to add gear features
AP224 Ed2:2001, Mechanical product definition data for process planning using machining features

Micro process planning
Automated NC generation

Mechanical parts machining
•milling
•turning
•electro discharge machining
Sheet metal bending
Pipe bending

Geometry Dimensions
Material

AP238, Computer numerical controllers

Components Assemblies
Macro process planning
•machining
•fabrication

Mechanical parts
Structural steel
Sheet metal bending
Pipe bending

Geometry Dimensions
Material

AP240, Process plans for machined products

Work activities and resources
•define
•justify
•approve
•schedule
•feedback

Configuration requirements
•design configuration
•as-built

Operating states Behavior Usage

Support
•facilities
•personnel
•equipment
•diagnostics

AP239, Product lifecycle support

Cross Process Utility

AP203:1994, Configuration controlled 3D designs of mechanical parts and assemblies

ISO TC 184/SC 4 On-Line Information Service for STEP and PLIB –
<http://www.tc184-sc4.org/>

US Product Data Association -
<https://www.uspro.org/>

PDES, Inc. -
<http://pdesinc.aticorp.org/>

ProSTEP iViP Association -
<http://www.prostep.org/en/>

Product Lifecycle Support, Inc. -
<http://www.plcsinc.org/>

BACKGROUND

Technical Data Guidance Referencing ISO 10303

Standard for the Exchange of Product model data (STEP)

DoD

- DoD Information Technology Standards Registry
(<http://disronline.disa.mil/VJTA/index.jsp>)
- DoD Acquisition Guidebook, Section 4.2.3.7.Data Management
(<http://akss.dau.mil/dag>)
- DLA ISO 10303 STEP Application Handbook 2.0, 21 December 2001
(<https://www.uspro.org>)
- MIL-DTL-31000C, Technical Data Packages, 9 July 2004
- MIL-STD-1840C, Automated Interchange of Technical Information, 26 June 1997
- Joint Aeronautical Commanders Group, Strategy for Product Data Throughout the Life Cycle, 8 May 2002 (<https://www.uspro.org>)

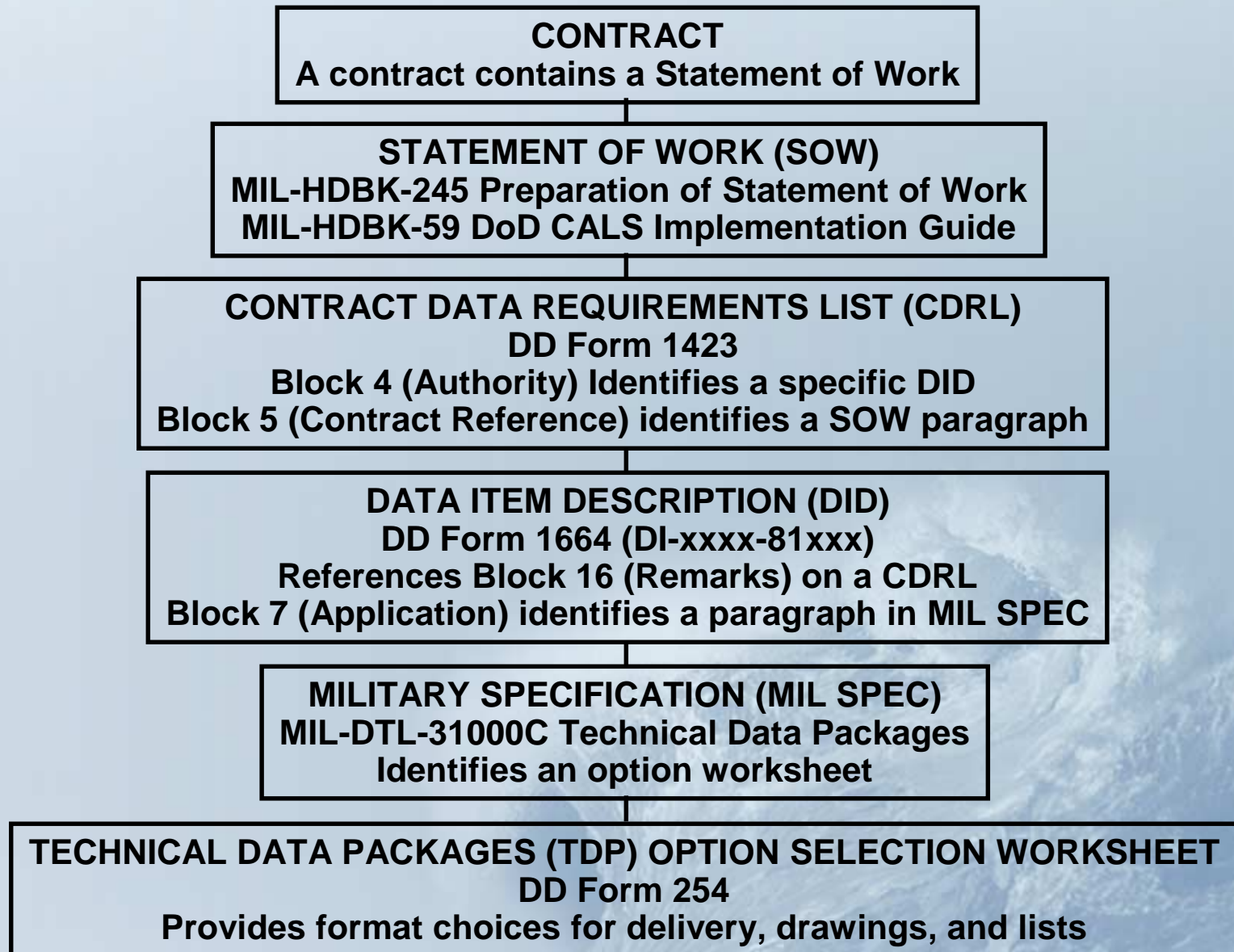
DON

- DON Policy on Digital Product/Technical Data, 23 Oct 2004
(<http://navycals.dt.navy.mil/>)

ISSUES - Policy

- *Identify which ISO 10303 STEP Application Protocols (APs) and their Conformance Classes (CCs) will support DoD life cycle business processes for mechanical parts - DLA.*
- *Identify and analyze STEP mechanical viewers. - DLA*
- *Develop a Request For Interest (RFI) for OEM, suppliers, and software vendors to provide certified STEP data and viewers that will enable personnel to examine the digital technical data for mechanical AP CCs that are of DoD interest – DLA.*
- *MIL-DTL-31000C (Technical Data Packages, General Specification for) update to include digital product model data in TDPs.- JEDMICS funded comments by Navy.*
- *Develop test data for ISO 10303 AP products so that software tools can be certified by USPRO for creation, editing and viewing of STEP conforming data - NSRP.*
- *Evaluate how to index and process 3-D data for large systems – DLA/JEDMICS PMO/NARA.*
- **Develop product model Data Item Description (DIDs) for APs chosen for use on contracts need to be forwarded for DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), to ensure that new digital product data TDP DID's can be referenced in MIL-DTL-31000D and cited on the DD Form 1423.
<http://assist.daps.dla.mil/online/start/>**
- **Performance specs for ISO 10303 similar to MIL-PERF 28000B Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols**
- **Develop DFAR contract clause words for acquisition efforts.**
- **Identify who will create and certify data (ISEA/CFA) for legacy systems.**
- **Ensure compatibility with future processes (NMCI, Task Force Web, JEDMICS, ICP tools, etc.)**
- **Incorporate stakeholder input on the viewer requirements into an RFP for site licenses for Inventory Control Point (ICP) users and others.**
- **Identify demonstration system/parts we can and should acquire 3-D STEP data for.**
- **Provide tools and training to logisticians to view 3-D data.**
- **Acquire parts and do cost analysis of savings/quality of 3-D procurement processes.**
- **How do we buy access to data using web based tools for new systems.**
- **Digital Signatures**

ISSUES - Acquisition Documentation



ISSUES – Overlapping Standards

- **GEIA-927 Common Data Schema for Complex Systems**
- **ISO/PAS 16739 Industry Foundation Classes (IFCs)**

INITIATIVES - Technology

Look at the requirements and issues involved with the:

- transition to 3-D product model data,
- aggregation of product models and related data from individual components to complete weapons systems, and
- long-term accessibility and interpretability of the archived digital data by future generations.
 - Leading Edge Architecture for Prototyping Systems (LEAPS-NAVSEA)
 - Joint Engineering Data Management Information Control System (JEDMICS-Navy and DLA)
 - Product Life Cycle Support (PLCS-Services and DLA)
 - Long Term Data Retention of Weapon System Information (National Archive and Records Administration, NAVSEA, NAVAIR, DLA)

Product Model Data Solutions

Can query product model data

Automated QA of incoming data for missing or out-of-range data

Supports automated down-stream processes

Training not required for 3-D models

Top-down break-down information contained in assemblies

Data entry errors on indexing eliminated

Product Model Data Does Not Solve

Unreadable legacy data

Data rights

Technical data errors

Management of common parts/libraries/catalogs



Product Model Data Creates New Issues

Policy on how and what to buy

Transmission and storage of many large data files

Storage of redundant data (3-D product model data, 2-D drawings, native CAD, pictures, video, manuals)

Reintegration of separate domain files for complete system descriptions

Bad CAD data created in conversion processes

Rich data lost data during conversion to neutral data formats that support core industry data exchange/archiving requirements

Future interpretation of native file formats

Implementation agreements (will pump be exchanged in piping, electrical, or structural connection files, must be accessible through all views in the integrated model)

Data availability on shop floor (portable viewing hardware/software or paper drawing generation on the fly)

Viewers are needed for logisticians and others

For Additional Information

SC 4 On-Line Information Service for STEP ISO 10303 and PLIB ISO 13584

<http://www.tc184-sc4.com/>

US PRO Product Model Data Standards

<https://www.uspro.org/>

ISO TC 184/SC 4/WG 3/T 23 Ship team

<http://www.nsrp.org/t23/>

National Shipbuilding Research Program

<http://www.nsrp.org/>

PDES, Inc.

<http://pdesinc.aticorp.org>

American National Standards Institute

<http://web.ansi.org/>

International Organization for Standardization (ISO)

<http://www.iso.ch/>

International Electrotechnical Commission (IEC)

<http://www.iec.ch/>