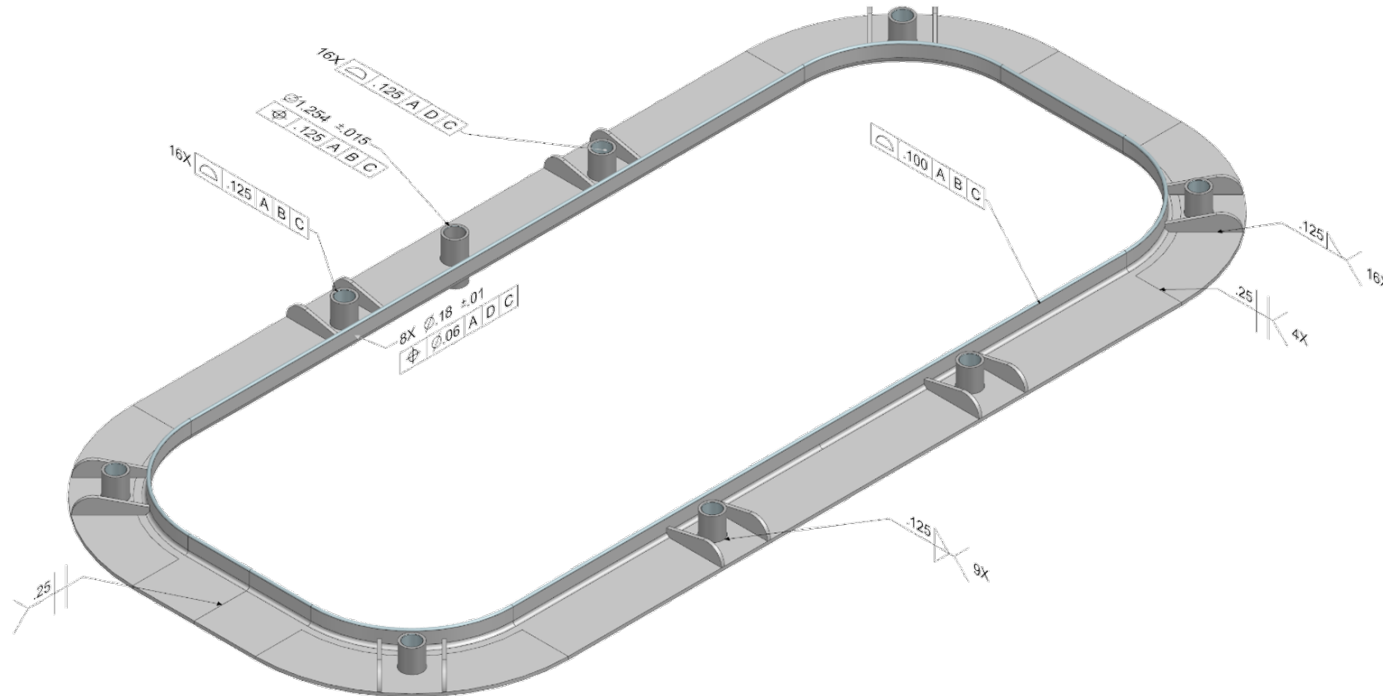


## Minimum Standardized Content to Enable a Navy Digital Enterprise



During Phase 2 of 2

# Agenda

- ❑ Problem & Objectives
- ❑ Project Team
- ❑ Technical Findings
- ❑ Current State of Data Exchange
- ❑ Future State of Data Exchange
- ❑ 3D Data Information Flow Functional Models
- ❑ Use-Cases
- ❑ 3D Artifacts
- ❑ Prototype Architecture and Publishing
- ❑ Ship Door Assembly-Example
- ❑ Minimum Attribute List
- ❑ Applied Standards
- ❑ Conclusions



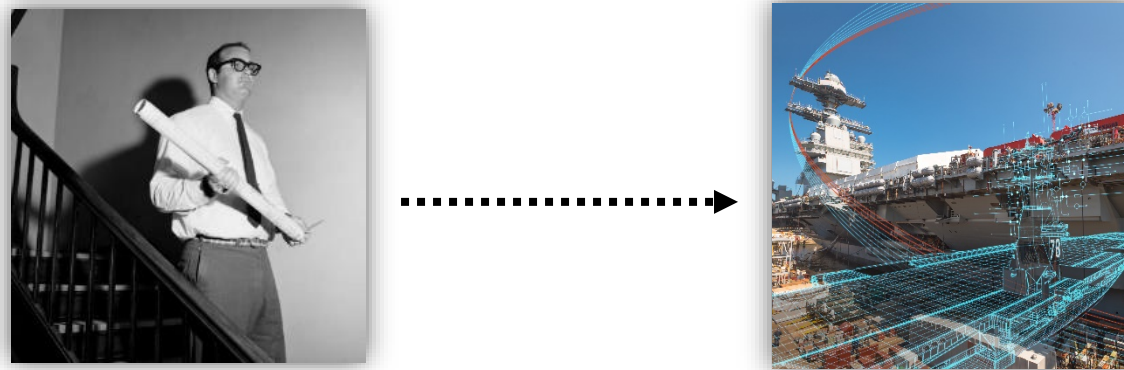
# Problem & Objectives

## PROBLEM TO BE ADDRESSED

The Navy is investing heavily in the Digital Future and is aware that the transition from legacy Shipbuilding “Drawing Centric Processes” to “Digital Data Centric Processes” is considered High Risk.

## PROJECT OBJECTIVE

The objective of this project is to enable Navy advanced data collaboration through the configuration management of content & format that conforms to defined standards and specifications.



# Project Team

GENERAL DYNAMICS  
Bath Iron Works

LMI

Huntington  
Ingalls  
Industries



Newport News  
Shipbuilding



Project Participant	Role and Key Contribution
Action Engineering	Team Member: Action Engineering helps organizations large and small achieve their Model-Based Definition/Enterprise (MBD/MBE) goals by motivating stakeholders, delivering training, and providing business planning and implementation consulting services. AE will develop and test functional standards based models for this project.
HII – Technical Solutions Division (TSD)	Team Member: Fleet Support Group, CVN Logistics requirements, Navy Database Integration, On-Board Ship support, Integration with Navy databases, Cloud-Environment management, standards for data exchange.
LMI	Team Member: Industry experts in the identification and implementation of Standards for military programs. LMI has personnel specifically knowledgeable on Navy Digital Transformation and Standards required for operation documents. LMI is a not-for-profit company.
Bath Iron Works (BIW)	Team Member: Shipyard Project participant with data exchange expertise.
PMS 312	Team Member: Program Executive Officers (PEO) Carriers is responsible for the total life-cycle management of the U.S. Navy's Fleet of 11 nuclear-powered aircraft carriers, from construction to inactivation. GERALD R. FORD (CVN 78), is the lead ship of the first of a new class of carriers in nearly 40 years.
NAVSEA 08	Team Member: Naval Reactors: U.S. government office that has comprehensive responsibility for safe and reliable operation of the United States Navy's nuclear propulsion program.
NAVSEA 03	Team Member: NAVSEA Logistics –developed Navy Model-Based Product Support (MBPS) strategy and requirements for data exchange. Support system architecture and standards definitions.
NAVSEA 05	Team Member: NAVSEA Technical Policies and Standards will support use-case development and standards requirements for the project.
NAVSEA 04	Team Member: Logistics, Maintenance and Industrial Operations (SEA 04) has the important mission of getting ships to sea and keeping them ready. SEA 04 is the preferred integrator of logistics, maintenance, and industrial operations for its Enterprise customers. SEA04 manages four naval shipyards.

# Technical Findings from Phase 1

## Major NAVSEA Technical Data

ISO 10303 – 203	Configuration controlled 3D designs of mechanical parts and assemblies
ISO 10303 – 239	Product Lifecycle Support
ISO 10303 – 242	Managed model based 3D engineering
S1000D	International specification for technical publications using a common source database
S2000M	International specification for Material Management
S3000L	International procedure specification for Logistics Support Analysis
S3000L	International procedure specification for Logistics Support Analysis
NAVSEA 7070-900	Ship Configuration and Logistics Support Information System
EIA 649C	Configuration Management Standard
GEIA-HB-649	Configuration Management Standard Implementation Guide

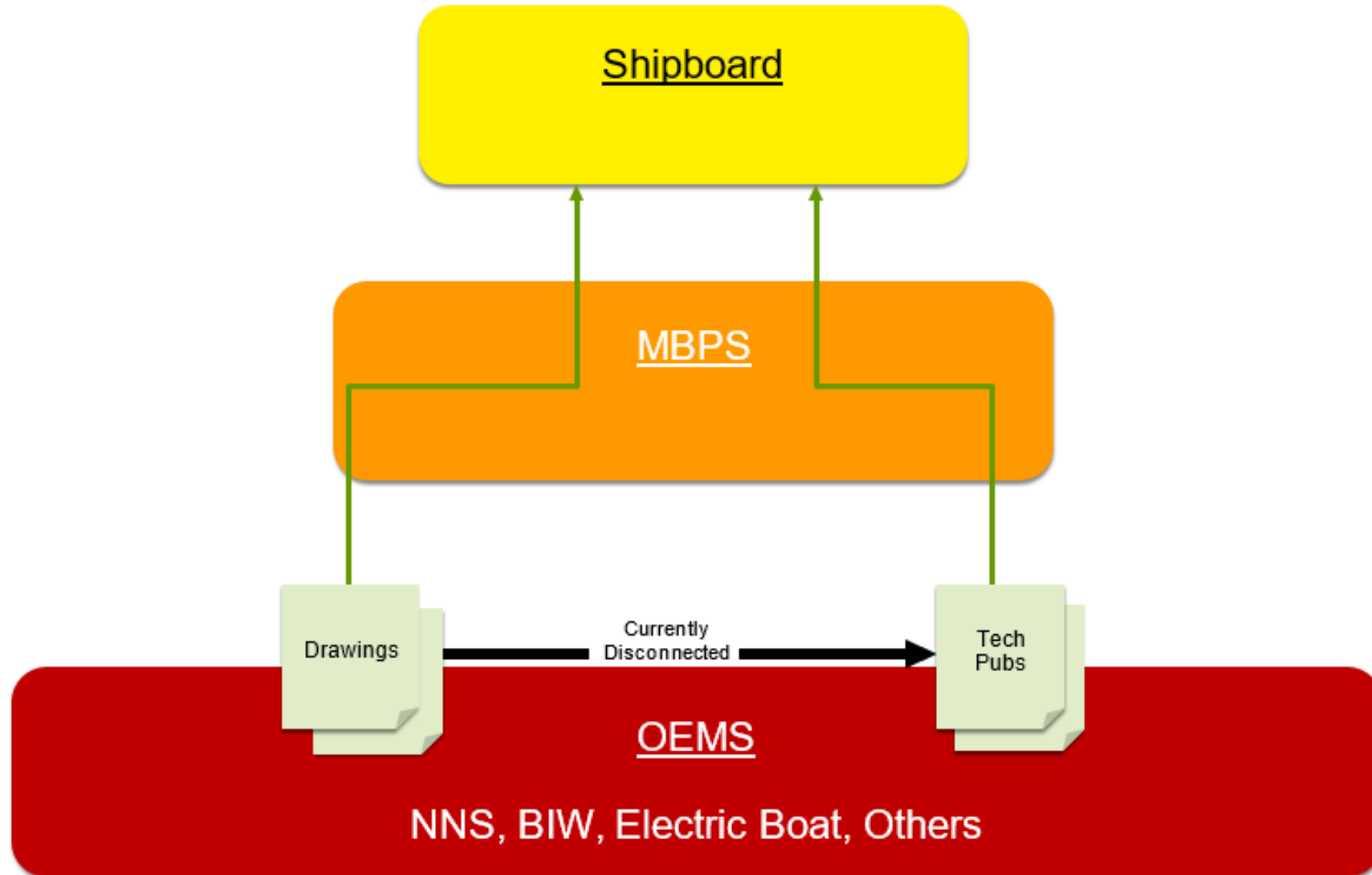
## ASME Y14- Series Standards

ASME Y14.1, Decimal Inch Drawing Sheet Size and Format
ASME Y14.1M, Metric Drawing Sheet Size and Format
ASME Y14.2, Line Conventions and Lettering
ASME Y14.3, Orthographic and Pictorial Views
ASME Y14.5, Dimensioning and Tolerancing
ASME Y14.24, Types and Applications of Engineering Drawings
ASME Y14.34, Associated Lists
ASME Y14.35, Revision of Engineering Drawings and Associated Documents
ASME Y14.36, Surface Texture Symbols
ASME Y14.38, Abbreviations and Acronyms for Use on Drawings and Related Documents
ASME Y14.41, Digital Product Definition Data Practices
ASME Y14.100, Engineering Drawing Practices

## TDP Functional Categories

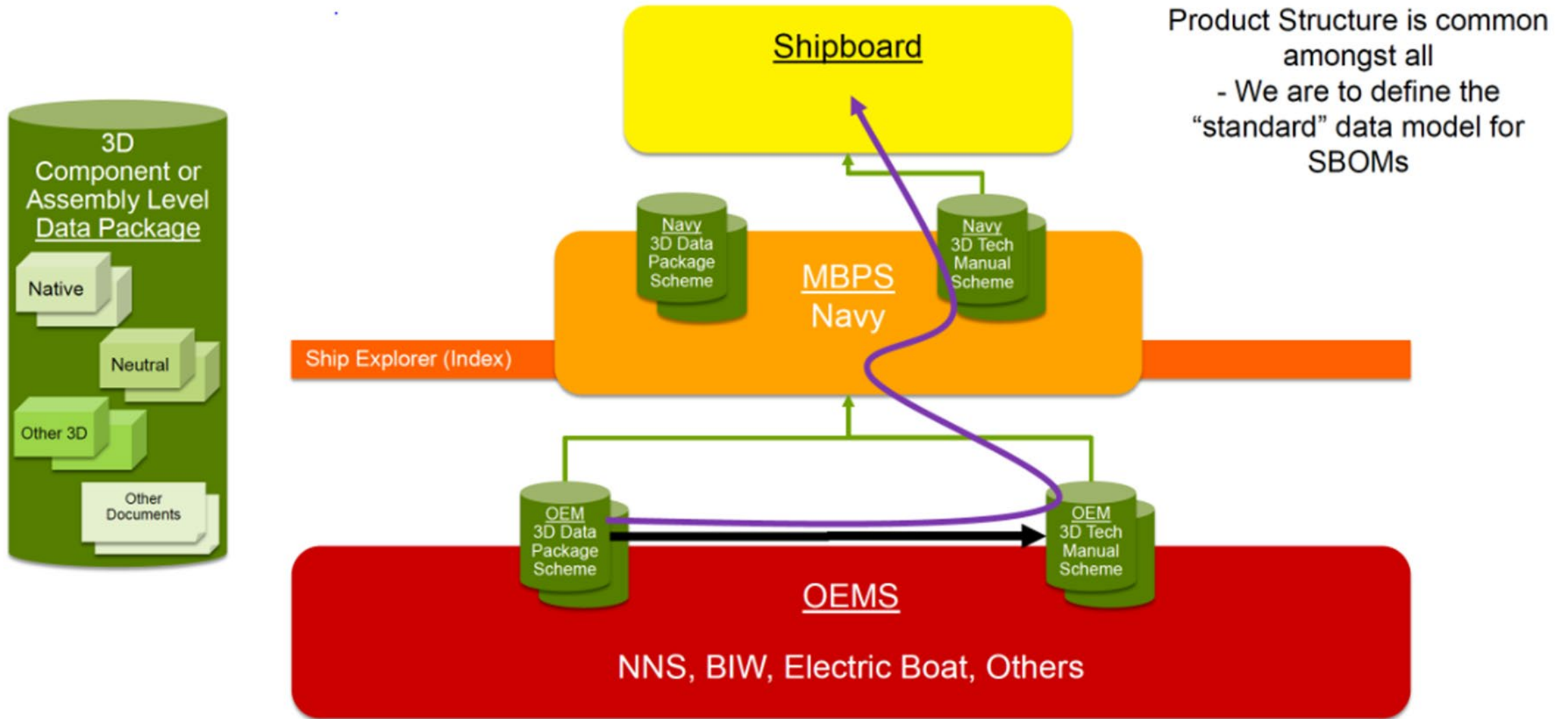
3D Geometry
3D Model-Based Definition
Solid Model Geometry and Basic Dimension
3D Model-Based Product Definition for Manufactured parts
Domain Specific 3D Model-Based Definition
3D Model-Based EARLY STAGE SHIP Product Definition
3D Model-Based Product Definition for molded forms
3D Model-Based Product Definition for Structural Systems
3D Model-Based Product Definition for Arrangements
3D Model-Based Product Definition for Plant Spatial Systems
3D Model-Based Definition for Facilities
Defeatured 3D Model-Based Definition
Alternative 3D Model-Based

# Current State of Data Exchange

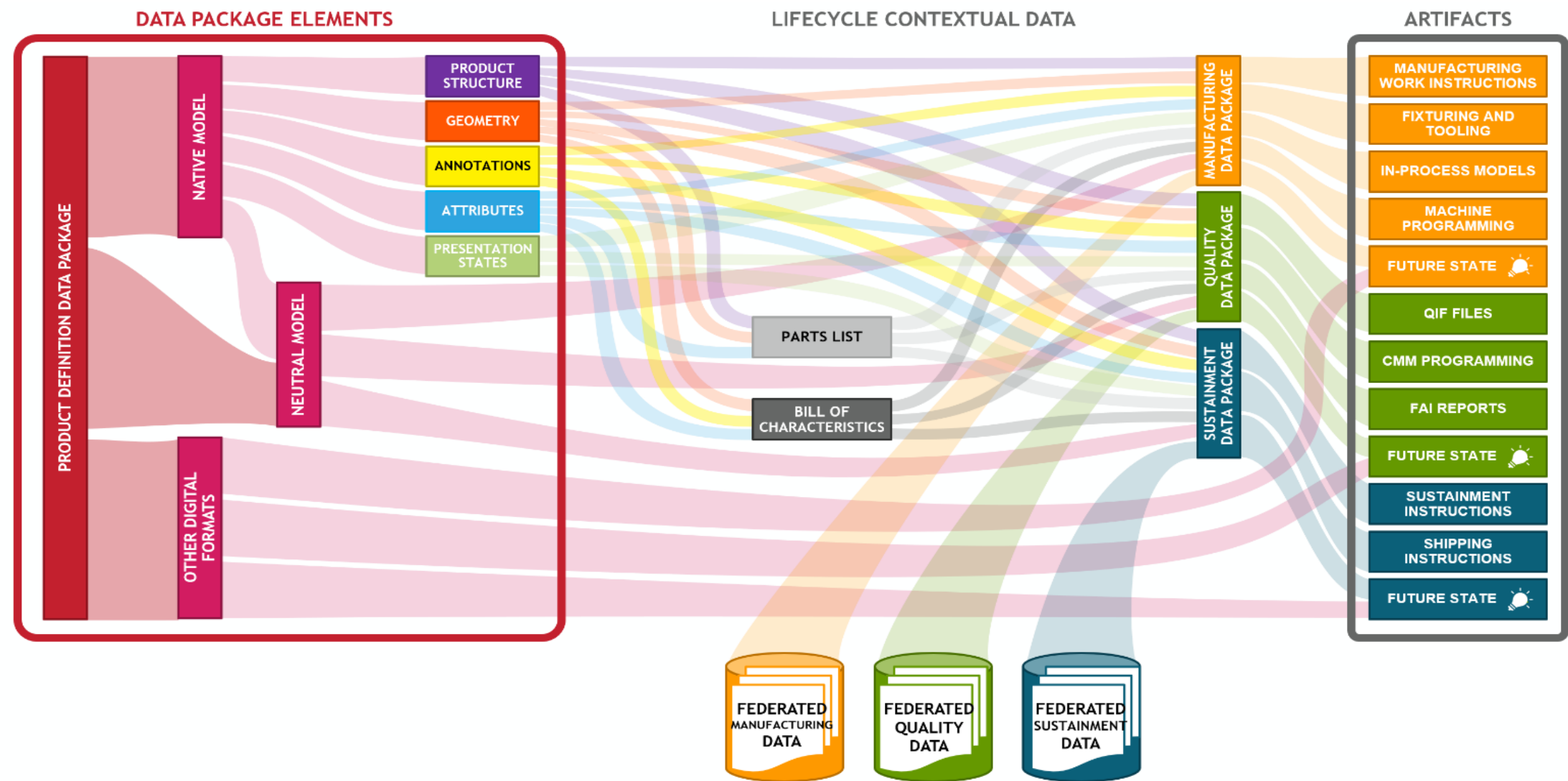




# Future State of Data Exchange



# 3D Data Information Flow



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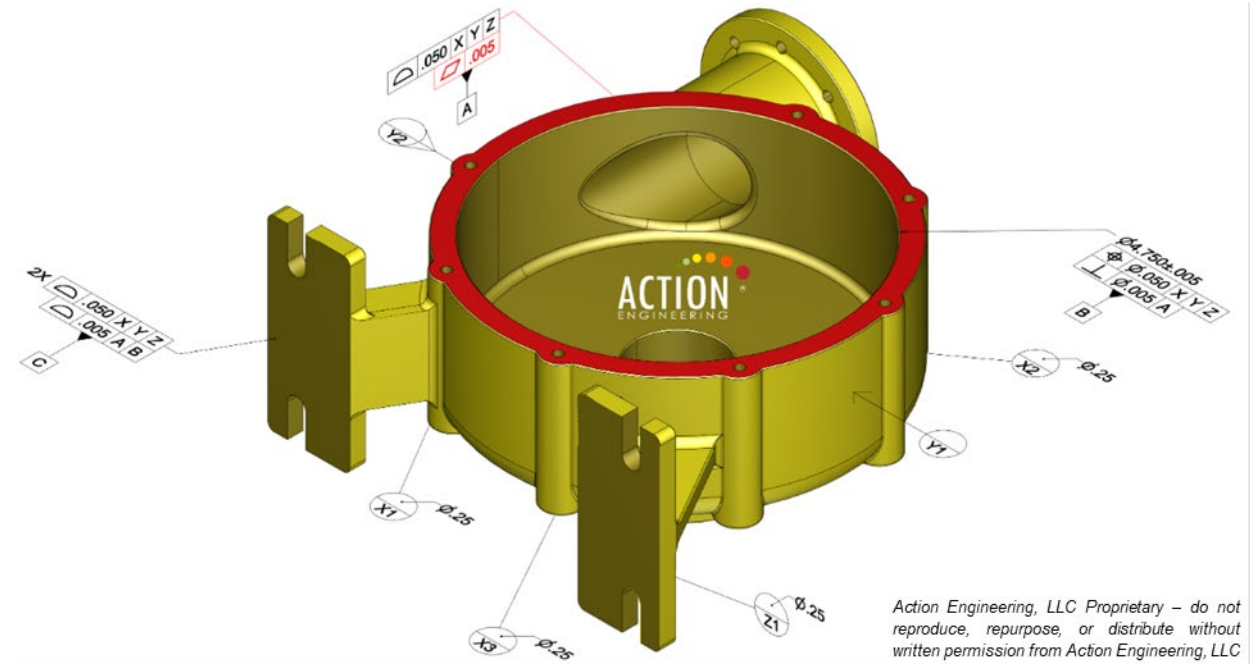


# Functional Models

## Modeling Standards:

➤ Applicable standards for the native model:

- ISO 14306
- ISO 14739-1
- HTML5
- ASME Y14.47
- ASME Y14.41
- ASME Y14.5 & 14.5.1
- X3D
- S1000D
- S2000M
- S3000L
- NAVSEA 9090-700E
- ISO 10303-203, 214, 239, 242



## Phase 2 Model Development:

- Type of model to prototype
- The prototype based on project defined standards





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# Use Cases

## Interview Summary:

- Use case 1, maintenance scenario
  - Who does the routine maintenance?
  - An example of a specific maintenance event and the related information
  - Benefits and concerns be around moving this use case into a 3D Digital platform?
- Use Case 2, casualty incident
  - Who reacts in this situation?
  - What training goes into repair response?
  - An example casualty incident
  - Benefits and concerns be around moving this use case into a 3D Digital platform?
- Use Case 3, general component information for replacement
  - Who would need to access data around a component?
  - Why do they need to access it?
  - How do they get that information today?
  - Benefits and concerns be around moving this use case into a 3D Digital platform

# 3D Artifacts

3D Artifacts		Description
	Product Definition Data Set (PDDS) with Interactive Viewable <i>Includes native, neutral, and other digital formats</i>	The Developer (OEM) creates the PDDS and Interactive Viewable. This artifact captures the engineering design requirements. This data is primarily machine-readable data and some is also human-readable. The interactive viewable enables anyone to rotate, zoom, pan (3D navigation), and read the 3D data, regardless of CAD skill.
	Interactive Parts List	The parts list contains attributes relevant to ship building. Anyone can query the parts list or the component to read the 3D data, regardless of CAD skill. Anyone can search for attribute data (e.g. label plate, name)
	Interactive Technical Manuals	Technical Manuals connected to the Product Definition Data that is 3D navigable, includes an Interactive Parts List, and is searchable
	Interactive Work Instructions	<b>These instructions are compiled from the PDDS and Interactive Technical Manuals to generate the relevant instructions. This data is primarily human-readable and facilitates 3D navigation. The combination of interactive parts lists with the ability to view in 3D enhances user comprehension.</b>

Persona	Activity	PDDS & Interactive Viewable	Interactive Parts List	Interactive Technical Manuals	Interactive Work Instructions
<b>Olivia</b> Ops Team Member 	<b>Initiate</b> <i>Olivia initiates a repair by calling into the repair team. Operations can do many repairs themselves, so the call signifies a more significant repair.</i>				
<b>Shawn</b> Repair Officer 	<b>Route</b> <i>Shawn receives the request and sends it to the appropriate team lead.</i>				
<b>Aaron</b> Repair Team Lead 	<b>Prepare</b> <i>Aaron assesses the repair information he has and assigns it to the team if it can be done shipboard. He orders any parts needed.</i>				
<b>Ethan</b> Repair Team Member 	<b>Conduct</b> <i>Ethan uses his manual to work through the repair procedure.</i>				
<b>Amy</b> Quality Officer 	<b>Inspect</b> <i>Amy uses her inspection checklist to review Ethan's repair.</i>				

# Prototype Architecture and Publishing

## Development Operating System:

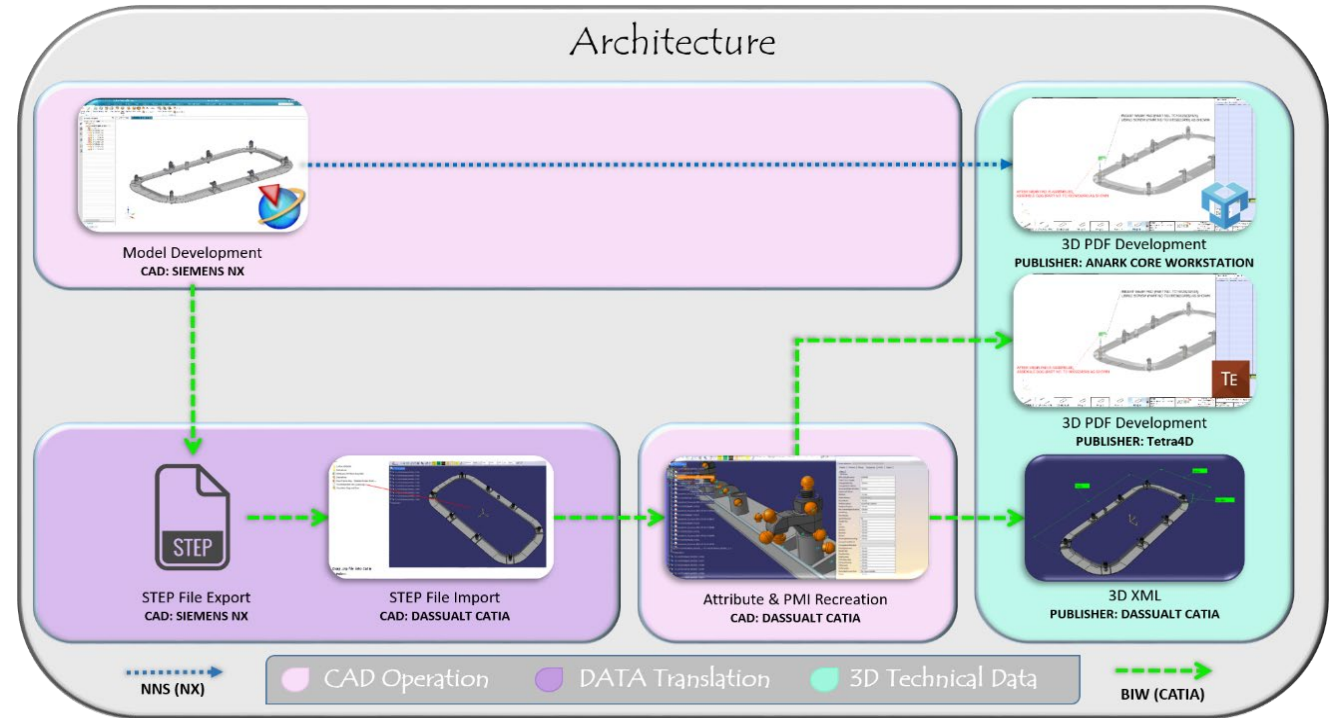
- Windows 10 (latest updates as of June 11, 2021)

## Development Application:

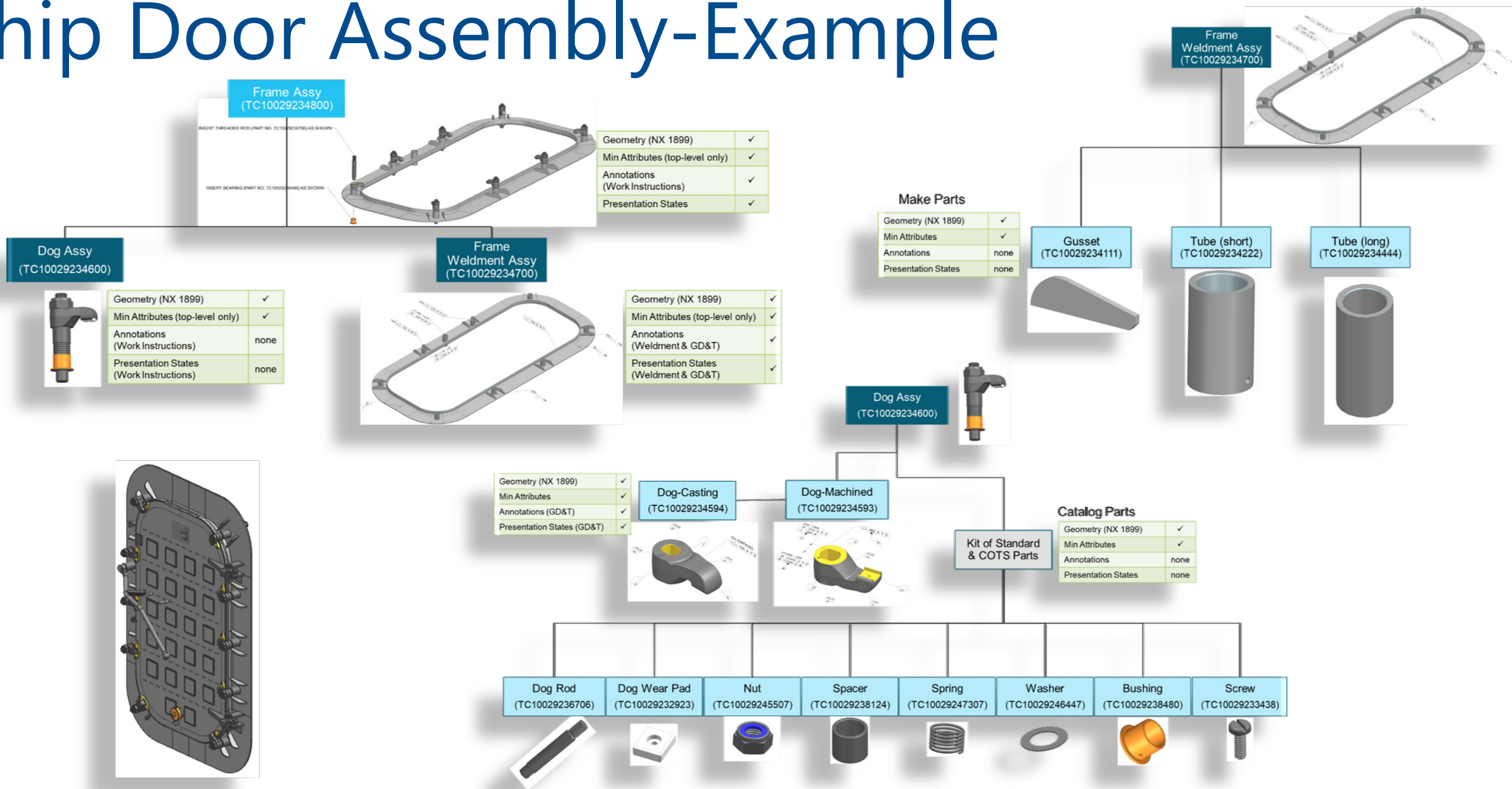
- CAD Software: SIEMENS NX 1899+

## Evaluation Applications:

- CAD Software:
  - Siemens NX 1899+
  - Siemens NX 1973
  - Dassault CATIA V5-6R2017 (R27)
- Publishing Software:
  - Anark Core Workstation 4.5.57
  - Siemens NX 1973
  - Tetra4D 2019.1.10
  - Dassault CATIA V5-6R2017 (R27)



# Ship Door Assembly-Example



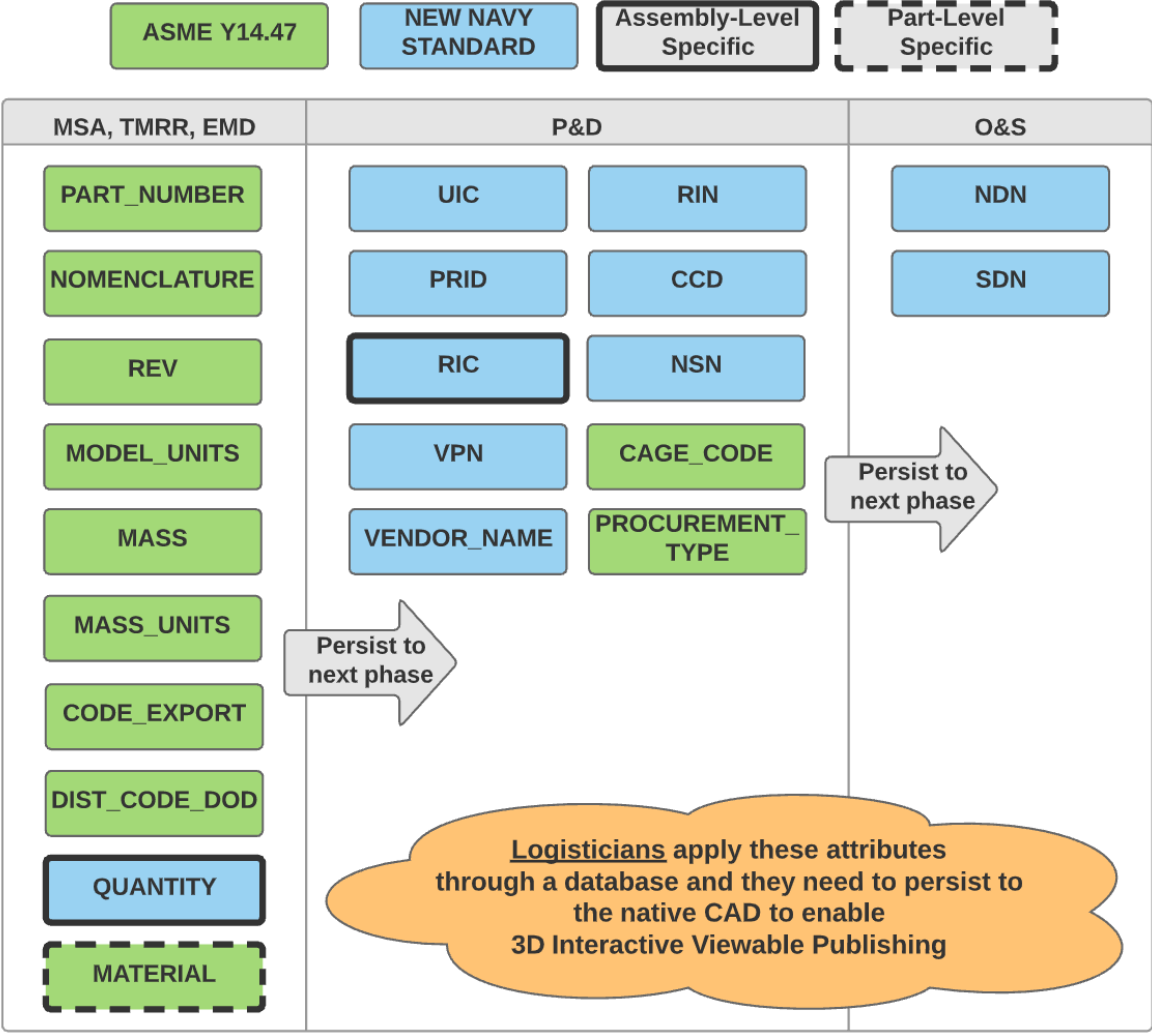


# Minimum Attribute List

LEGEND: New Navy Standard									
ASME Y14.47									
SCLIS									
S2000M & S3000L									
Where Defined									
Where Used									
MSA TMRR EMD P&D O&S									
ASME Unique									
Attribute Variable Name	Variable Name Description	Function	MSA	TMRR	EMD	P&D	O&S	ASME	ASME Description
<b>Conversion Items</b>									
DATE_CREATED	Item Identification Code	Used to identify the item and its location in the database. It is a unique identifier for the item.							Used to identify the item and its location in the database. It is a unique identifier for the item.
DATE_CREATED	Component Identification Code	Used to identify the component and its location in the database. It is a unique identifier for the component.							Used to identify the component and its location in the database. It is a unique identifier for the component.
DATE_CREATED	Material Identification Code	Used to identify the material and its location in the database. It is a unique identifier for the material.							Used to identify the material and its location in the database. It is a unique identifier for the material.
<b>Assembly-Level Specific Items</b>									
REV	Revision	Used to identify the revision of the item. It is a unique identifier for the revision.							Used to identify the revision of the item. It is a unique identifier for the revision.
PROCUREMENT_TYPE	Procurement Type	Used to identify the procurement type of the item. It is a unique identifier for the procurement type.							Used to identify the procurement type of the item. It is a unique identifier for the procurement type.
QUANTITY	Quantity	Used to identify the quantity of the item. It is a unique identifier for the quantity.							Used to identify the quantity of the item. It is a unique identifier for the quantity.
DATE_CREATED	Item Identification Code	Used to identify the item and its location in the database. It is a unique identifier for the item.							Used to identify the item and its location in the database. It is a unique identifier for the item.
DATE_CREATED	Component Identification Code	Used to identify the component and its location in the database. It is a unique identifier for the component.							Used to identify the component and its location in the database. It is a unique identifier for the component.
DATE_CREATED	Material Identification Code	Used to identify the material and its location in the database. It is a unique identifier for the material.							Used to identify the material and its location in the database. It is a unique identifier for the material.
<b>Part-Level Specific Items</b>									
MATERIAL	Material	Used to identify the material and its location in the database. It is a unique identifier for the material.							Used to identify the material and its location in the database. It is a unique identifier for the material.

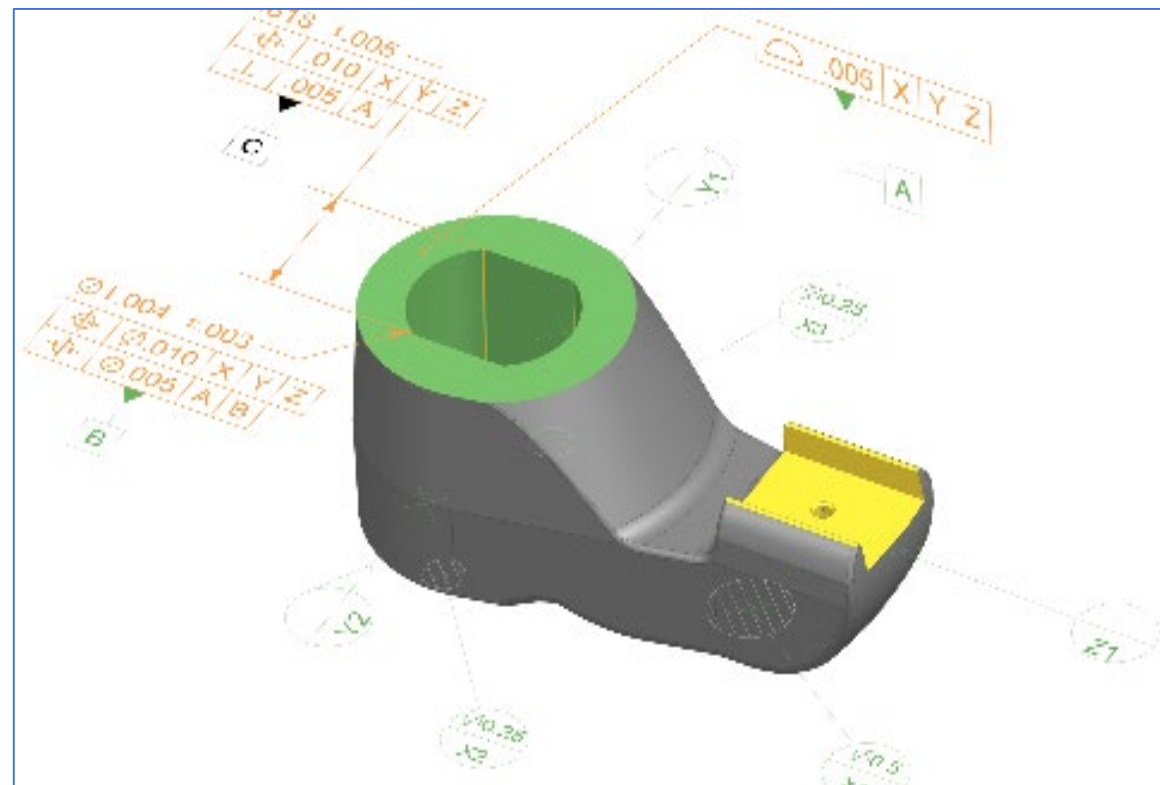
LEGEND:			New Navy Standard	SCLIS
			ASME Y14.47	S2000M & S3000L
Attribute Variable Name	Variable Name Description	Map to Common Items		
Logistics Items on the border between CAD and PLM				
AEL Column Number				
AINAC				
contractIdentifier				
DISI	Data Interface Suppression Indicator			
DO/VC	Data Originator/Validation Code			
documentIdentifier				
EFD	Equipment Functional Description			
EIC	Equipment Identification Code			
hardwarePartProvisioning				
ISC	Installation Status Code			
maintenanceLevelIdentifier				
manufactureFromPart				
MCC	Mission Criticality Code			
meanTimeBetweenFailure				
meanTimeToRepair				
partIdentifier		PART_NUMBER		
partName		NOMENCLATURE		
PRID	Positional Reference Identification D	Find number used for identification of		
productIdentifier		PART_NUMBER		
productName		NOMENCLATURE		
productServiceLife				
rawMaterial		MATERIAL		
repairedFromPart				
RIN	Record Identification Number	Record number in the Navy logistics support		
VAL Date	Validation Date			
VS/AC	Validation Source/Action Code			
WCRE	Work Center Responsible for Equipment			

MSA	Material Solution Analysis Phase
TMRR	Technology Maturation & Risk Reduction Phase
EMD	Engineering & Manufacturing Development Phase
P&D	Production & Deployment Phase
O&S	Operations & Support Phase





# Applied Standards



Standard	Reason	Activity
ASME Y14.47	Model Organization Practices	Attributes
S2000M	International Specification For Material Management	Attributes
S3000L	International procedure specification for Logistic Support Analysis (LSA)	Attributes
S1000D	Tagging & Authoring Guidelines	Attributes
Ship Configuration and Logistic Support Information System (SCLSIS)	For ordering replacement parts	Attributes
ASME Y14.41	Digital Product Definition Data Practices	Annotation 3D application
ASME Y14.5	Dimensioning and Tolerancing	Annotation Geometric Dimensioning and Tolerancing
ASME Y14.5.1M	Mathematical Definition of Dimensioning And Tolerancing Principles	Annotation Geometric Dimensioning and Tolerancing
ASME Y14.47	Model Organization Practices and Model Organization Practices	Presentation States and Publishing 3D Interactive Viewables
ISO 10303-203, 214, 238, 242	Publish STEP files	Publishing 3D Interactive Viewables
ISO 14306	Publish JT files	Publishing 3D Interactive Viewables
W3C	Publish HTML5 files	Publishing 3D Interactive Viewables
ISO/IEC-19775-1	Publish X3D files	Publishing 3D Interactive Viewables
ISO 14739-1	Publish PRC files	Publishing 3D Interactive Viewables

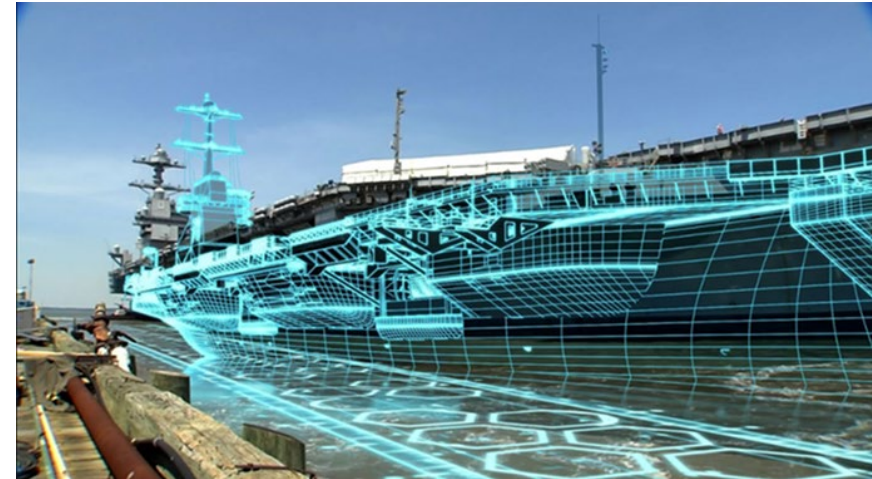
# Conclusions

## Phase 1 Summary:

- ✓ Brought together a diverse group of government and industry stakeholders.
- ✓ Came through comprehensive review of existing standards.
- ✓ Developed practical use cases and theoretical solutions.
- ✓ Met the milestones and deliverables for phase 1.

## Phase 2 Summary:

- ✓ Received Phase 2 funding
- ✓ Execute Phase 2 kick-off meeting
- ✓ Create and publish prototype 3D artifacts
- ✓ End user feedback meetings
- Document end user feedback
- Final report



# Questions?

