Digital Transformation at the 'Speed of Relevance'

PLM Road Map™ & PDT North America 2024
Value Drivers for Digitalization of the Product Lifecycle
Insights for the PLM Professional—Why the investment, what are the returns, and how are they achieved?
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CIMdata eurostep

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What is ePLM IDE ?

"In the beginning of a change, the patriot is a scarce man, and brave, and hated and scorned. When his cause succeeds, the timid join him, for then it costs nothing to be a patriot." – Mark Twain

enterprise Product Lifecycle Management (ePLM)

- A consistent set of business solutions that support the collaborative ***creation, management, dissemination, and use of product definition information, spanning from product concept to end of life***
- Provides a structured, authoritative product information backbone for weapons systems
- Rigorous configuration management of a weapon system top-down breakdown and all of its associated technical / product data
- Maintains traceability of all analysis and decisions throughout a weapon system's life cycle

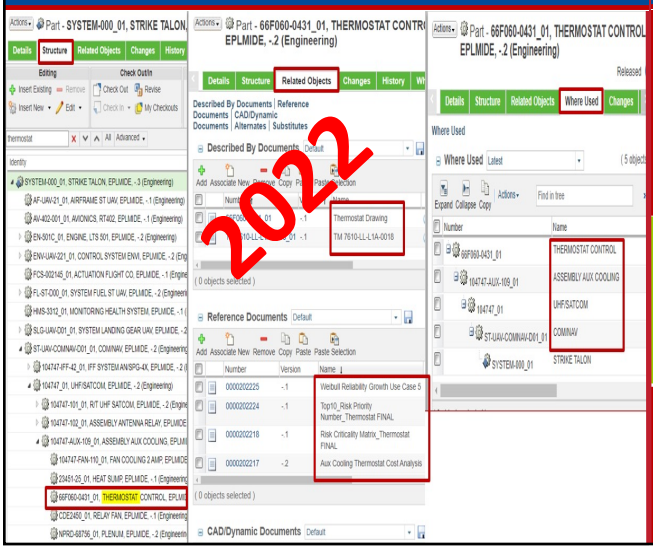
Integrated *Decision* Environment (*IDE*)

- Incorporates key system and support data (i.e. reliability, maintainability, cost, and supply chain) with RAM-C Modeling and Simulation tools for decision makers to determine lifecycle cost and readiness impacts of critical design and support modifications
- Supportability / RAM-C analysis to influence design for supportability and affordability
- Perform root cause analysis and implement materiel and non-materiel changes as necessary in sustainment
- Predictive analysis to optimize readiness and life cycle cost
- Integrated with PLM application to establish critical links between configuration changes, system baselines, and supporting analysis

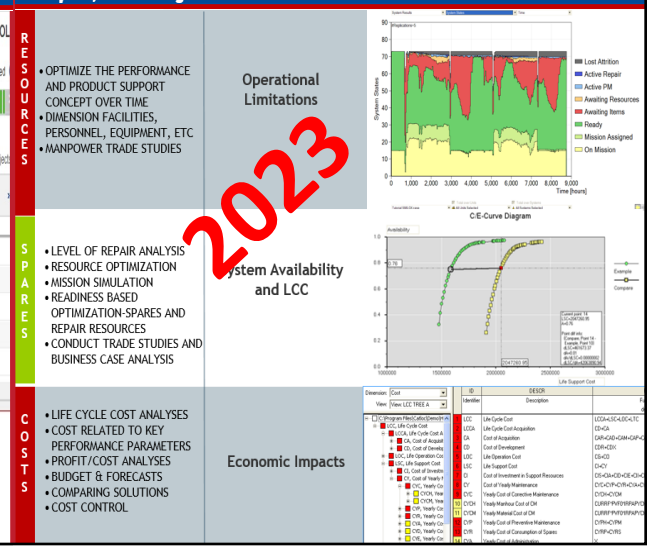
Functionally, ePLM IDE was designed to provide a common enterprise product model capability (digital twin), facilitating bi-directional traceability (digital thread) to more efficiently manage the digital models throughout the lifecycle, and provide a common data decision environment to address escalating life cycle cost growth across the Navy.

ePLM IDE Application:
Building the Foundation

ePLM IDE Application:
Building the "Digital Twin"



Leveraging the "Digital Twin" & "Digital Thread"
Analysis, Modeling & Simulation



ePLM IDE: Initial Focus on Operations & Sustainment
PLM for Product Support to "Overcome Failure"

Does the Support meet the various operational mission profiles?

- **What system design and configuration are optimal from a supportability perspective?**
- **How will Operational Availability (Ao) change over time and how do I manage it?**

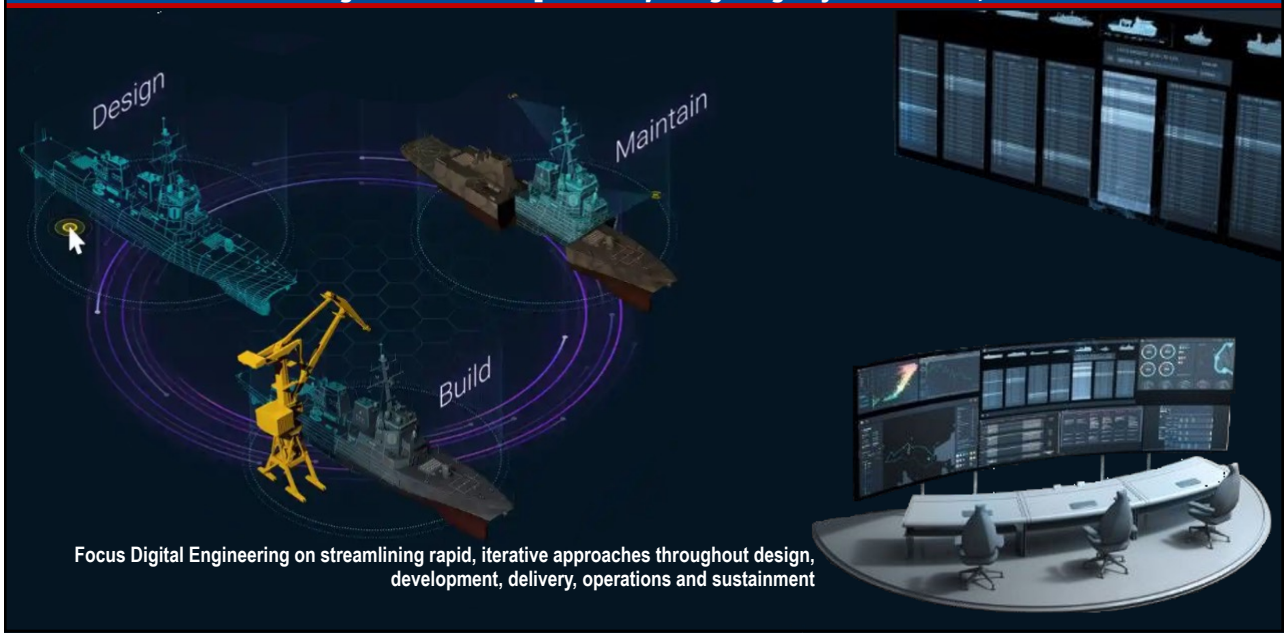
Does this "Digital Twin" match the Fleet's Physical Configuration?

Are we getting the correct "Digital Thread" data for analysis and decision?

- **Which system elements are the cost drivers?**
- **How many technicians do I need and where?**
- **What and how many spare parts should I keep on ship?**

Digital Transformation at the Speed Of Relevance

"Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates it and adapts its way of fighting." - James Mattis, Former SecDef



Focus Digital Engineering on streamlining rapid, iterative approaches throughout design, development, delivery, operations and sustainment

Digital Transformation Direction

Moving from Strategic to Tactical Implementation

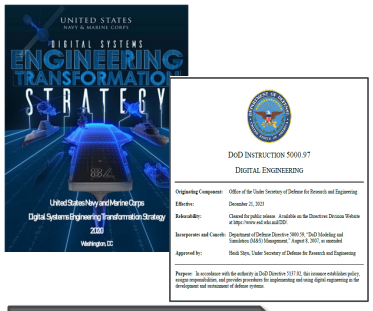
2023 NSS: Equip workforce with cutting edge technology and better integrate data and analytic tools to support decision-making.

2022 NDS: Enable more comprehensive, data driven assessment and reporting of readiness. Assess availability and demands against long-term force readiness, threats, missions, sustainability, recap and modernization.

2022 NDBOP: Ensure accurate, timely, and relevant performance and cost data for decision-making with skills and knowledge to analyze results. Enable root cause analysis to achieve the target.

2019 DOD DMS: Treat Data as a Strategic Asset. Develop data standards supporting interoperability. Deliver a DoD Enterprise Cloud Environment to leverage commercial innovation. Analyze data to generate insights, answer critical operational and business questions.

2019 DOD DES: Provide an enduring, authoritative source of truth. Formalize the development, integration, and use of models to inform enterprise and program decision making. Transform the workforce to support digital engineering across the lifecycle.



2020 DON DES: Implement Digital Engineering for all new and legacy Naval programs as determined by the PEOs. Develop authoritative knowledge source to access models, data and strategies that support digital transformation.

2023 DODI 5000.97: Use digital engineering methodologies, technologies, and practices across the life cycle of defense acquisition programs, systems, and systems of systems to support research, engineering, and management activities.

Weaving the "Digital Tapestry"

Multi-directional "Bill of Information" support from "Conception to Expiration"

Application Lifecycle Management's (ALM) crucial role in PLM

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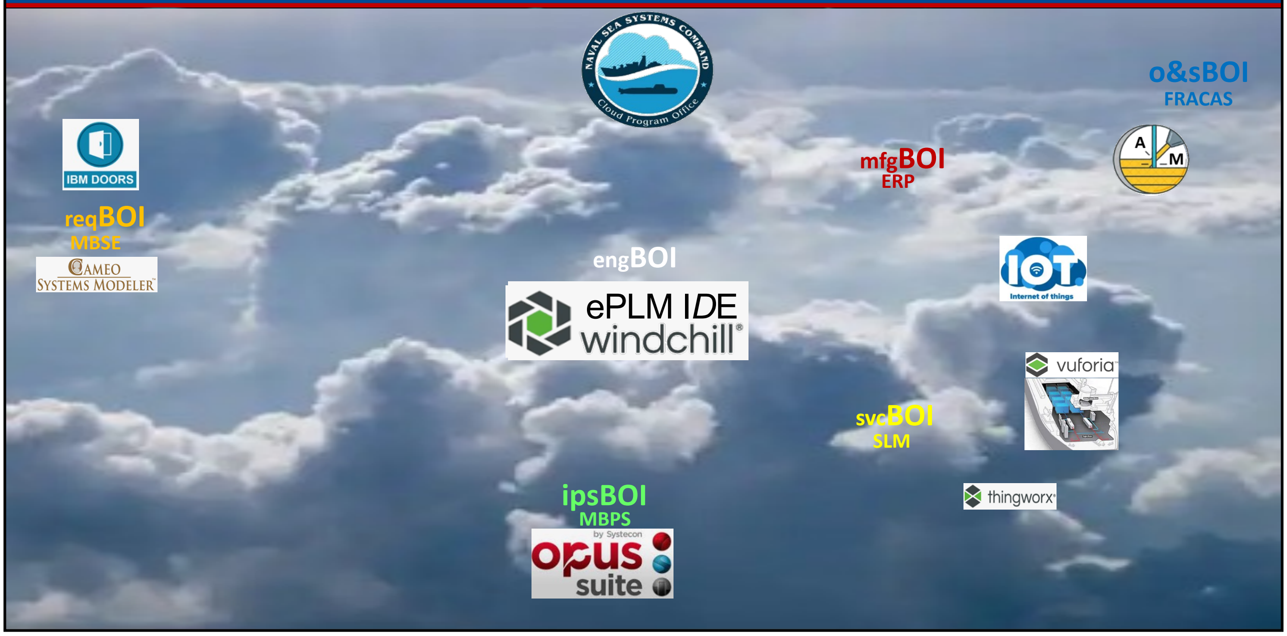

Establishing Standards for PLM

"The standard is the standard. It is unflinching and unforgiving."-- Cdr. Guy Snodgrass, USN

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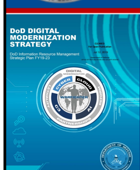


TREAT DATA AS A STRATEGIC ASSET
- **Establish policy and governance for Common Enterprise Data related to business operations and management**
- **Define an essential set of Enterprise Data Tags**

DATA = Raw Facts/Statistics
- Doesn't offer a clear enough picture to make decisions

INFORMATION = Organized context to the Facts/Statistics
- Makes data purposeful due to analysis for decision making

For PLM to be effective / useful Product Data needs to be standardized.
- PLM support requires a move from product data exchange to product information exchange, across different disciplines and domains
- The "Language of Product Data" needs a set of data standards for data exchange and sharing.
- There is a need to rethink standards and make it part of the process that can create value.

REQUIRES GOVERNMENT / INDUSTRY COLLABORATION!

Configuring Attributes in ePLM IDE

ANSI/EIA-649-B: Configuration Management Standard
ANSI/EIA-836: Configuration Management - Data Exchange and Interoperability
ASME Y14.24: Types and Application of Engineering Drawings
ASME Y14.35: Revision of Engineering Drawings
ASME Y14.41: Digital Product Definition Data Practices
ASME Y14.100: Engineering Drawing and Related Documentation Practices
Defense Acquisition Guidebook
Integrated Product Support Guidebook
ISO 10303 AP 242 managed model based 3D engineering
ISO 10303 APs: the "200 Series"
ISO 13584 PLIB: Parts Library
ISO 15531 MANDATE: Industrial manufacturing management data
ISO/IEC/IEEE 12207: Systems and software engineering - Software life cycle processes
ISO/IEC/IEEE 15288: Systems and software engineering — System life cycle processes
ISO/IEC/IEEE 24765: Systems and software engineering - Vocabulary
IEEE-STD-828 IEEE: Standard for Configuration Management in Systems & SW Engineering
IEEE 15288.1: Standards for Application of Systems Engineering on Defense Programs
ACMP 2009 (STANAG 4427): Guidance on Configuration Management
SAE GEIA-STD-0007: Logistics Product Data
SAE TA-STD-0017: Product Support Analysis
MIL-HDBK-61: Configuration Management Guidance
MIL-HDBK-502: DoD Handbook Product Support Analysis
MIL-STD-962: Defense Standards Format and Content
MIL-HDBK-539: Digital Engineering And Modeling Practices

ePLM IDE Tactical Implementation

"In preparing for battle, I have always found plans are useless but planning in indispensable."
Gen Dwight. D Eisenhower, 2x US President

Its all about Data, Processes, Technology & People!

DATA
- Aggregate
- Understand
- Organize

PROCESSES
- Build
- Validate
- Associate

PEOPLE
- Training
- Knowledge Transfer
- Operational Control

Maturity Level	Engineering Data Source	Engineering PS Build	Provisioning Data Source	Provisioning PS Build	Documents Association	Training & Knowledge Transfer	IWS Operational Control
Level 1	Not Started	Not Started	Not Started	Not Started	Not Started	Not started	Not Transitioned
Level 2		Extract data from provided EngineeringTDPs. Cleanse, review and align data	Opus/SIMLOX Data	Extract data from provided Provisioning TDPs. Cleanse, review and align data	Aggregate organize, and define association of Related Documents	IWS User Access Development	Establish Operational Business Rules, Roles, and Responsibilities
Level 3		Create Engineering Product Structures in a formatted load template	Level of Repair Analysis	Create Provisioning Product Structures in a formatted load template	Develop a formatted load template	Develop User Acceptance Test (UAT) training for IWS Team	Develop Operational Business Rules, Roles, and Responsibilities Standard Operating Procedures
Level 4	RAM-C Data: FMEA, RBDs, any other RAM-C analysis that has a structure	Upload initial Eng PS to NAVY DEV Environment	MRDB Data	Upload initial provisioning PS to NAVY DEV Environment	Upload Related Document objects to ePLM IDE and associate to PS.	Deliver User Acceptance Test Training for IWS Team to Validate Product Structure	
Level 5		ePLM IDE Team performs successful verification of Engineering PS upload		ePLM IDE Team performs successful verification of Provisioning PS upload	Perform successful verification	Deliver Phase 1 ePLM Basic Training: -User Basic Navigation -Comms & Dig Collaboration -PS Build and Edit -Related Document Upload & Management	Phase 1 Interim Transition of ePLM IDE Operational Control. IWS Team able to navigate, communicate, build and edit PSs, upload and associate Related Documents, review and approve documents. Minimal support needed by ePLM IDE Team
Level 6	2D Drawing files with their associated parts list	Conduct User Acceptance Test (UAT) to Validate Product Structure	ERP exports of APL's	Conduct User Acceptance Test (UAT) to Validate Product Structure	IWS Team reviews / approves Related Document associations		
Level 7		IWS Team accepts Engineering PS in NAVY DEV Env		IWS team accepts Provisioning PS in NAVY DEV Environment	Customer Validated Document Association- in Navy DEV Environment		Phase 2 Interim Transition of ePLM IDe Operatioinal Control. IWS Team able to perform Change Management capabilities: -Problem Report Generation -Engineering Change Request -Engineering Change Notice
Level 8	3D CAD	Engineering PS transitioned to Production Environment under active configuration control by IWS Team	ICAPS Provisioning files	Provisioning PS transitioned to Production Environment under active configuration control by IWS Team	Customer Validated Document Association in Production Environment	Deliver Phase 2 Change Management: Engineering Change Proposal (ECP) Training: -Problem Report Generation -Engineering Change Request -Engineering Change Notice	IWS PMO able to maintain full IWS configuration and change management so that data is able to be used for Ship Change Documentation and Readiness Modeling.

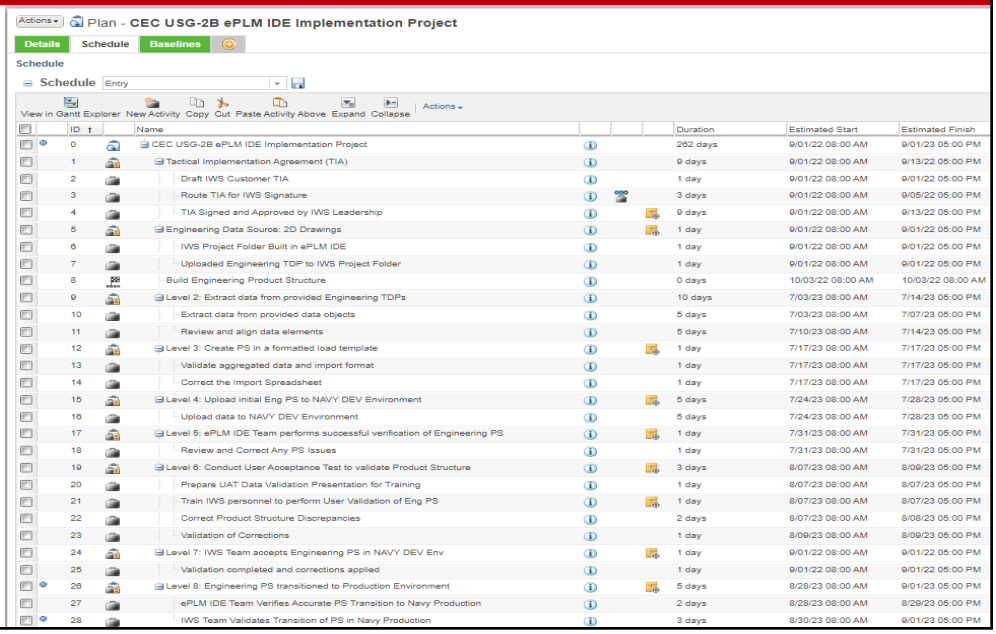
Tactical ePLM IDE Employment

Organizational Convergence – User Perspective

Its all about Data, Processes, Technology & People!

PEOPLE / TECHNOLOGY INTERFACE
- Early Access leads to early adoption
- Build "Muscle Memory"
- Visualize "Wins"

PROCESS
- Develop an Agile mindset
- Understand PLM processes that lead to successful adoption
- The PEO IWS Leadership Perspective from an IWS "eaches" program view



ID	Name	Duration	Estimated Start	Estimated Finish
0	CEC USG-2B ePLM IDE Implementation Project	262 days	9/01/22 08:00 AM	9/01/23 05:00 PM
1	Tactical Implementation Agreement (TIA)	9 days	9/01/22 08:00 AM	9/13/22 05:00 PM
2	Draft IWS Customer TIA	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
3	Route TIA for IWS Signature	3 days	9/01/22 08:00 AM	9/05/22 05:00 PM
4	TIA Signed and Approved by IWS Leadership	9 days	9/01/22 08:00 AM	9/13/22 05:00 PM
5	Engineering Data Source: 2D Drawings	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
6	IWS Project Folder Built in ePLM IDE	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
7	Uploaded Engineering TDP to IWS Project Folder	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
8	Build Engineering Product Structure	0 days	10/03/22 08:00 AM	10/03/22 08:00 AM
9	Level 2: Extract data from provided Engineering TDPs	10 days	7/03/23 08:00 AM	7/14/23 05:00 PM
10	Extract data from provided data objects	5 days	7/03/23 08:00 AM	7/07/23 05:00 PM
11	Review and align data elements	5 days	7/10/23 08:00 AM	7/14/23 05:00 PM
12	Level 3: Create PS in a formatted load template	1 day	7/17/23 08:00 AM	7/17/23 05:00 PM
13	Validate aggregated data and import format	1 day	7/17/23 08:00 AM	7/17/23 05:00 PM
14	Correct the Import Spreadsheet	1 day	7/17/23 08:00 AM	7/17/23 05:00 PM
15	Level 4: Upload initial Eng PS to NAVY DEV Environment	5 days	7/24/23 08:00 AM	7/28/23 05:00 PM
16	Upload data to NAVY DEV Environment	5 days	7/24/23 08:00 AM	7/28/23 05:00 PM
17	Level 5: ePLM IDE Team performs successful verification of Engineering PS	1 day	7/31/23 08:00 AM	7/31/23 05:00 PM
18	Review and Correct Any PS Issues	1 day	7/31/23 08:00 AM	7/31/23 05:00 PM
19	Level 6: Conduct User Acceptance Test to validate Product Structure	3 days	8/07/23 08:00 AM	8/09/23 05:00 PM
20	Prepare UAT Data Validation Presentation for Training	1 day	8/07/23 08:00 AM	8/07/23 05:00 PM
21	Train IWS personnel to perform User Validation of Eng PS	1 day	8/07/23 08:00 AM	8/07/23 05:00 PM
22	Correct Product Structure Discrepancies	2 days	8/07/23 08:00 AM	8/08/23 05:00 PM
23	Validation of Corrections	1 day	8/09/23 08:00 AM	8/09/23 05:00 PM
24	Level 7: IWS Team accepts Engineering PS in NAVY DEV Env	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
25	Validation completed and corrections applied	1 day	9/01/22 08:00 AM	9/01/22 05:00 PM
26	Level 8: Engineering PS transitioned to Production Environment	5 days	8/28/23 08:00 AM	9/01/23 05:00 PM
27	ePLM IDE Team Verifies Accurate PS Transition to Navy Production	2 days	8/28/23 08:00 AM	8/29/23 05:00 PM
28	IWS Team Validates Transition of PS in Navy Production	3 days	8/30/23 08:00 AM	9/01/23 05:00 PM

PEO IWS MBE Dashboard

Organizational Convergence – Leadership Perspective

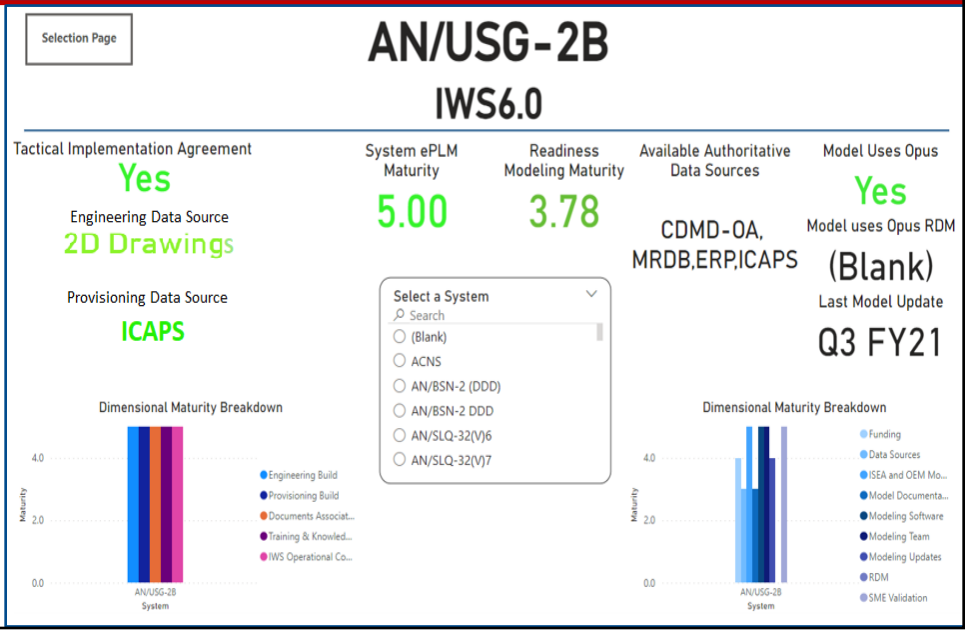
Its all about Data, Processes, Technology & People!

TECHNOLOGY

- Dashboard connected to ePLM IDE
- Demonstrate PLM Maturity via updates

PEOPLE

- PEO IWS access for understanding PLM processes
- The PEO IWS Leadership Perspective from a Command View
- Confidence in the next steps of Digital Transformation:
  - Accurate, collaborative, integration and management of data / information configurations from the very beginning of the program
  - Improvements in analysis and decision making
  - Reduced time in design to acquisition



Advancing Digital Transformation Knowledge

The Naval Surface Warfare Center PLM Certificate Programs

PEO IWS is pursuing an MBE approach across the IWS Enterprise to achieve a critical step change in lethality, affordability and velocity through:

- Enabling Product Lifecycle Management (PLM) capabilities will accelerate the design, build, delivery and sustainment of operationally dominant ship and submarine combat technologies at the peak of readiness, reliability, on time and on cost.
- Delivering PLM Training in a building block method:
  - The Basic Course is applicable for all personnel
  - The Advanced Course is more designed for engineers but can also include product support and personnel of other disciplines
  - Courses are SW agnostic with examples that support the topics
  - Includes presentations, discussions, and interactive exercises

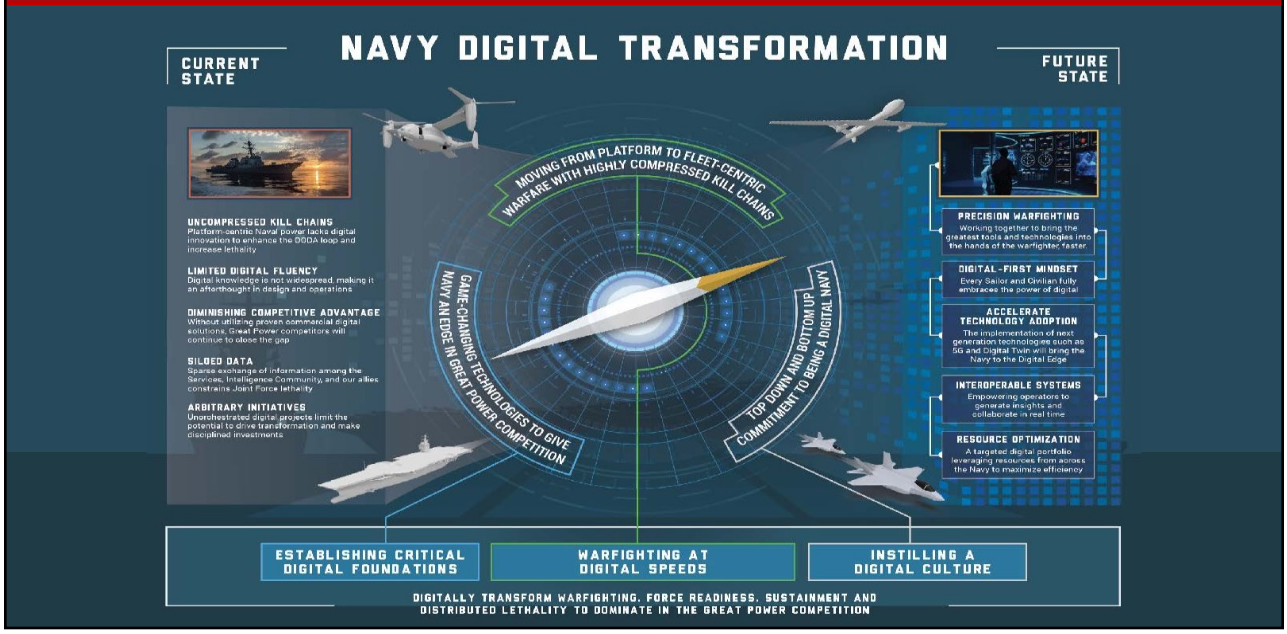
PLM Basic: PLM in a Digital Environment

1.1 PLM Key Concepts & Learnings
2.1 PLM's Role in Digital Transformation
2.2 The "Platformization" of PLM
3.1 Digital Deep Dive: Digital Thread/Digital Twin
3.2 PLM support of Maintenance, Repair & Overhaul Operations (MRO)
4.1 PLM & Organizational Change Management

PLM Advanced: PLM in a Model-Based Enterprise

1.1 Data Modeling within PLM
1.2 Classification and Data Search & Retrieve
2.1 Configuration Management's Role in PLM
2.2 Requirements Management
3.1 Model-Based Enterprise Solutions: MBE = MBSE + MBPS
3.2 Simulation Data & Process Management (SPDM)
4.1 Application Lifecycle Management & PLM

Digital Transformation Aligned to Naval Warfighting Concepts and Strategies



THE QUEST FOR DIGITAL TRANSFORMATION

TOLD IN SEAFARING METAPHORS