Dennis D. Beeson DEE Technical Integration Lead Northrop Grumman Corporation

Dennis.Beeson@ngc.com

## GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2023



PDES, Inc.<sup>®</sup>

Copyright © 2023 Boeing. All Rights Reserved Copyright © 2023 Elysium Inc. All Rights Reserved Copyright © 2023 Northrop Grumman Corporation. All Rights Reserved Copyright © 2023 Parker-Hannifin Corporation. All Rights Reserved Copyright © 2023 PDES. All Rights Reserved Products, names, and company names are trademarks or registered trademarks of their respective owners.

#### **Presenters Bio**

Global Product Data Interoperability Summit | 2023

### **Dennis Beeson**



**DEE Technical Integration Lead** 

**Northrop Grumman** 

#### Contributions

- 1<sup>st</sup> Comprehensive Digital Engineering **Environment (DEE) Architecture Model**
- 1<sup>st</sup> F/A-18 Bunker Buster Desert Storm
- 35<sup>th</sup> Certified Software CMM Level 4 Org.
- 89A to 12C F/A-18 Operational Flight Program **Avionics Upgrades**

#### **Work Experience**

37 years - Software & System Engineering

#### **Education & Certifications**

- **UCLS Executive Leadership Program**
- MIT MBSE, SAFe ARCH, 6-Sigma, Covey
- **BS. Computer Science Clarke College**





Certificate in Advanced Leadership

and Management

SCHOOL OF MANAGEMENT



- **Purpose** What does the Digital Engineering Environment (DEE) produce and deliver?
- Concept of Operations (ConOps) How do <u>users interact</u> with the DEE?
- **ASoTs** Where is the product configuration baseline managed and controlled?
- **Data Model** How is the product baseline stored in the ASoTs?
- **Digital Thread** What is <u>linked together</u> to create the product baseline?
- Summarize Lessons learned

MBSE diagrams are simplified to highlight topic of modeling digital threads



#### Purpose – What is the purpose of your Digital Engineering Environment?

Global Product Data Interoperability Summit | 2023

- Product Baseline drives system design, manufacturing, and sustainment
- **Contract Deliverables –** CDRLs drive definition of product baseline and digital thread
- Digital Thread electronic threads created to support definition of product baseline

#### 0V-2 Operational Resource Flow Internal Description | 🌇 (U) 0V-2 Digital Engineering Environment (DEE) Demo Model J **Digital Engineer Environment DEE** System Architecture : Contractor Design Review, Government Comments CDRLs : GOVT Program Management 🔗 Leadership Review. : Program Management Assessment : GOVT Analysts Approval Systems Engineering (Models, Requirements, Design Integration Testing) System Architecture Design Review Model Based Engineering MBE A Review Hardware Architecture, : Systems Engineer & **GOVT Systems** Review Verification and Validation Data Software Engineering (SDP, SRD, SDD, CSCI list, STP. Engineers STR, Manuals, Builds) : Software Engineer & : Application Lifecycle Management A **GOVT Software** CM/DM (CM plans, CCBs, Engineering Change (ECP : Configuration Engineer : Product Lifecycle CDRLs, Reports) Management **Review Software** Management Architecture Mission Assurance (Quality Program Plan. : Quality Non-Compliance, Status Reports) Assurance : GOVT Test Review. CAD PCB / Wire Harness Electrical Engineer Approval, Assessment : GOVT CAD Mechanical Configuration Manager Mechanical Engineer & Query CM/DM Data Test (Plans, Procedures, Analysis, Study, Reports System Test Engineer & Review. Approval Sustainment (Plans, Requirements, Analysis, Installation, Training, Reporting) Assessment : GOVT : Sustainment 🖗 Sustainment Engineer 😤 Sustainment Training & Manuals Analysts : Training 🔗 Cyber Security (Plans, Assessments, Reports) Security Engineer & : DEE Management Information Technology (Plan, Metrics) : Information **Technology Engineer**

#### **OV-2 – DEE Customer and Supplier Exchanges**

Government CDRLs helped define the product baseline and deliverables reviewed



#### Use Cases – How do users interact with the DEE?

Global Product Data Interoperability Summit | 2023

- Use Cases critical to understanding the creation, update, and maintenance of product baseline
- User Roles model user interaction with DEE ASoT Systems
- Use Cases are critical to analyzing, documenting, and agreeing on how users will interact with the DEE





Explore user interaction with DEE to perform critical processes



#### ASoT Models – What Authoritative Sources of Truth (ASoT)?

- **ASoT –** What Authoritative Sources of Truth (ASoT) Systems exist in the DEE?
- **ASoT Governance –** collectively identify, audit, maintain, and manage ASoT systems
- Product Baseline Need to know what data in ASoT system forms the product baseline
- Digital Linkages between ASoTs Identify critical digital threads that form product baseline internal and external to ASoTs
- ASoT Systems manage and control the product baseline for the program.





#### Clearly define and model ASoT systems used in the DEE



Approved for Public Release: NG23-1959. © 2023 Northrop Grumman Systems Corporation

#### Data Models – How is the product baseline stored in ASoT systems?

Global Product Data Interoperability Summit | 2023

- Data Models Describes how the product baseline is stored in ASoT Systems
- Conceptual Depicts how the customer and supplier exchange product information
- Logical Depicts which supplier roles produce what product information
- Physical Depicts how the product information is storage in the native ASoT Metadata
- **Common Data Model –** forms a common language to create, retrieve, search, and modify digital information in the DEE

Clearly define and model the data model (Conceptual, Logical, Physical)

Common Data Model - Automate discovery and generation





#### Digital Thread Models – What digital threads exist between ASoT Systems?

Global Product Data Interoperability Summit | 2023

- Example (Part): Modeling digital thread between MBSE product model(Element) and PLM(Part)
- Use Case The customer needs to review MBSE product model and related PLM(Part) Information
- **Structure** Modeling structure of a digital thread between (MBSE(Element) and PLM(Part)
- Data Model Physical attributes to be linked between MBSE product(Element) and PLM(Part) metadata fields



Use Cases - help analyzed, documented, and agree on customer needs



#### Digital Thread Models – How do I create a digital thread between Model(Element) and PLM(Part)?

Global Product Data Interoperability Summit | 2023



#### Digital Thread requires detailed knowledge of ASoT system metadata



Approved for Public Release: NG23-1959. © 2023 Northrop Grumman Systems Corporation

#### Digital Thread Models – What digital threads exist between ASoT Systems? (Continued)

Global Product Data Interoperability Summit | 2023

#### **Modeling Digital Thread:**

- **Product Linkage** determine if the linkage is critical to the product baseline.
- ASoT Linkage Identify the physical data attributes which will be linked.
- **Define type of linkage** SysML level associations (Association, Generalization, Satisfy, Derive, Trace, Verify, Refine)
- Automation Determine ability to automate digital linkage



#### ASoT Systems data models are complex to navigate with multiple trees and branches



#### Digital Thread Models – How do I create a digital thread between Model(Element) and PLM(CDRL)?

Global Product Data Interoperability Summit | 2023

- Example (CDRL): Modeling digital thread between MBSE product model and PLM CDRLs
- Use Case The customer needs to review MBSE product model and related CDRLs
- Structure Modeling structure of a digital thread between MBSE(element) and PLM(CDRL)
- Data Model physical data model depicts MBSE product structure and PLM metadata fields of CDRL data items





- Purpose
  - **Digital Thread –** Electronic threads created primarily to support definition of product baseline
- Concept of Operations (ConOps)
  - Use Cases are critical to analyzing, document, and agreeing on how users will interact with the DEE.
- ASoTs
  - ASoT Systems Manage and control the product baseline for the program.
- Data Model
  - Data Models Clearly define and model ASoT System data (e.g. Conceptual, Logical, Physical)
  - Common Data Model Automate discovery and generation of CDM
- Digital Thread
  - Modeling Digital Threads 1) Define user needs, 2) Clarify ASoT data linkage, 3) Define type of link, 4) Determine ability to automate digital linkage



Global Product Data Interoperability Summit | 2023

# **Questions?**

Thank you for attending the presentation!

I hope you found some useful tips and examples for your MBSE projects



Approved for Public Release: NG23-1959. © 2023 Northrop Grumman Systems Corporation