

# MBD Minimum Digital Thread

Melissa Harvey | [Melissa.K.Harvey@Boeing.com](mailto:Melissa.K.Harvey@Boeing.com)

Product Data Management Specialist;

Boeing Commercial Airplanes

## GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2018



# Biography: Melissa Harvey

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- **Team/Job Title:**
  - Business Architecture Integration | Product Data Mgmt. Specialist
- **Education:**
  - B.S. Business Administration (City U)
  - A.S. Computer Drafting & Design (ITT Tech)
  - Cert. Additive Manufacturing Technology (MIT)
  - Cert. Model Based Systems Engineering (MIT)
  - Cert. Product Lifecycle Management (Purdue)
- **Current Assignment:**
  - AP242 Development Project (H&F RP, ed2 coding, AM Mapping, MOM Mapping)
  - A&D PLM Action Group MBD PM
- **Background:**
  - REDARS/EID Sys. Mgmt./User Engagement
  - LWG Test Integration
  - 787 MBD Supplier Distribution

# Agenda

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- Evolution of Doing Business
- Roadmap with Industry Data Standards
- Aerospace & Defense Action Group
- Minimum Digital Thread Analysis
- Key Take Away

# The Evolution of Doing Business

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## From DWGs to MBDs to Digital Thread and Beyond

**HISTORY / The First 100 Years**

Founded in **1916** in the Puget Sound region of Washington state

Became a **LEADING PRODUCER** of military and commercial aircraft

Completed a series of strategic mergers and acquisitions to become the **WORLD'S LEADING AEROSPACE COMPANY**

A heritage that

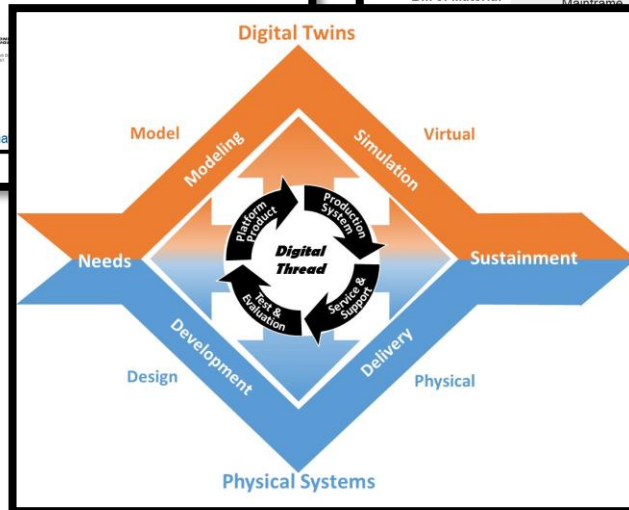
BOEING PROPRIETARY

Image courtesy of Boeing

**PLM Evolution at Boeing Commercial Airplanes**

	1960 - 1990	1990 - Now	2005 - Now	Future State
Design	2D Drawings	3D Model + 2D Drawings	3D Model Based Definition	Persistent Digital Twin
Change	Paper	Textual based, Boeing built	Textual based, Boeing built	Model Based; COTS
Validation	Physical Mockup	Spatial Pre Assembly	Spatial, Functional, Build & Support Pre-assembly	Digital Simulation + IoT
Bill of Material	Paper / Forms on Mainframe	Teamcenter Enterprise + Specialty PDMs	ENOVIA LCA / Teamcenter Enterprise + Specialty PDMs	Multi-View Tool Agnostic
		Option driven quantity based	Option driven instance based	Option driven, analytics enabled
		Customized COTS + Boeing IT	Customized COTS + Boeing IT	Platform COTS + Boeing IT
		Unix + Windows, Thick & Thin	Windows, Thick & Thin	Cloud, SAAS

Image courtesy of Boeing



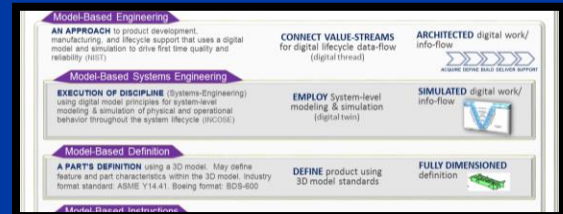
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# Driving the Digital Twin in Certification

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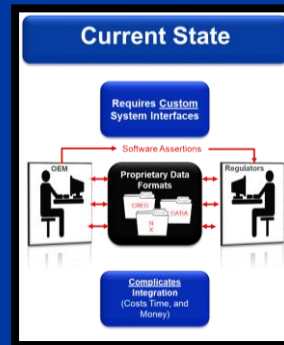
## Standards Enabling Interoperability

### Digital Everything



	1960 - 1990	1990 - Now	2005 - Now	Future State
Boeing Design	2D Drawings	3D Model + 2D Drawings	3D Model Based Definition	Persistent Digital Twin
FAA	2D Drawing	2D Drawings	Unique agreements with each OEM (many flavors of MBD)	Virtual MBD Certification & Flight Test

OEM 1 x Digital Everything  
OEM 2 x Digital Everything  
OEM 3 x Digital Everything



# A&D PLM Action Group

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## Mission:

- Define A&D common MBD definition
- Define minimum MBD data elements for the digital thread (design, manufacture, certification)
- Evaluate the ability of data standards to support that digital thread

## Vision:

- Industry standard for 3D MBD
- Standardized Regulatory “Technical Data Package”
- Requirements to PLM Vendors & Standard Bodies

## A&D Membership:



# Defining the Minimum MBD Digital Thread

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The following part types were deemed the minimum MBD elements to support the collective Aerospace and Defense business uses represented in the A&D action group. Each element was evaluated based on both the support by the standard and translation tool. Based on those results each element was categorized in one of the following five ways:

Table 2—Part Types Analysis Key

Category	Description	Associated Score
	Not Supported	0%
	Not Well Support	1-29%
	Partially Supported	30-85%
	Mostly Supported	86-99%
	Fully Supported	100%

Table 1—Part Types and Their Assignment

Part Type	Initial Analysis			Secondary Analysis		
	Assigned To	Software Used	Translation Tool Used	Assigned To	Software Used	Translation Tool Used
Composite - Detail - Core Stiffened Bond	Boeing	CATIA V5 R2015 SP2 HFX33	CATIA V5 Internal Translation	Airbus	CATIA V5 R27 SP2	CATIA V5 Internal Translation
Composite - Detail - Co-Cured/Co-Bonded	Boeing	CATIA V5 R2015 SP2 HFX33	CATIA V5 Internal Translation	Airbus	CATIA V5 R27 SP2	CATIA V5 Internal Translation
		NX Rev 11	NX Rev 11	Gulfstream	CATIA V5	CATIA V5

Table 3—Common MBD Elements and Their Support Level

Minimum Data Element	Evaluation Comments	Score:
Part Number & Revision	Typically encoded in file naming convention	
Solid Definition	Well supported	
Material Description	No recommended practice to guide vendor mapping	
Engineering Definition		
Marking Requirements – Export Control	Company specific representation	
Marking Requirements - Approval	Company specific representation	
Axis System		
Part Notes		
Dimensions		
Tolerances		
Annotations		
3D Views		
Roughness / Surface Conditions	AP242 ed1: only graphic presentation AP242 ed2 plans to cover the semantic representation	
Visibility by 3DViews		
Limited Area Application Indicator	Annotation supported, no semantic linkage	

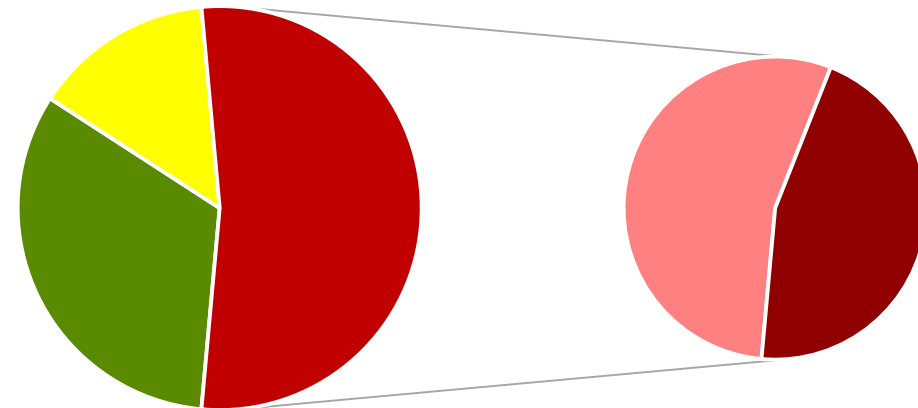
# Results

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Table 12—Overview Part Type MBD Elements Analysis and Their Support Level Score

Part Type	Data Element Support Score
Common MBD Elements	Partially Covered
Composite - Detail - Core Stiffened Bond and Co-Cured	Mostly Covered
Casting/Forging	Partially Covered
Forging	Partially Covered
Sheet Metal	Partially Covered
Machined	Not Well Covered
Part Type	Data Element Support Score
Tube Assembly - Flexible & Ridged	Partially Covered
Wire Harness	Not Well Covered
Installation	N/A
Standard Part - Electrical (Connector, Back Shell, etc.)	Not Well Covered
<b>Under Evaluation for Revision 2 of this Paper</b>	
Ducting - Metallic - Mechanically Fastened	
Standard Part - Mechanical	
Supplied Part - Mechanical Systems (Pump, Actuator, etc.)	
Supplied Part - E/E Systems (Battery, LRU, etc.)	

## MBD Digital Thread Analysis



- Well Supported
- Partially Supported
- Gap in Vendor Imp
- Gap in Standard Rep

For full results: <https://www.cimdata.com/en/aerospace-and-defense>

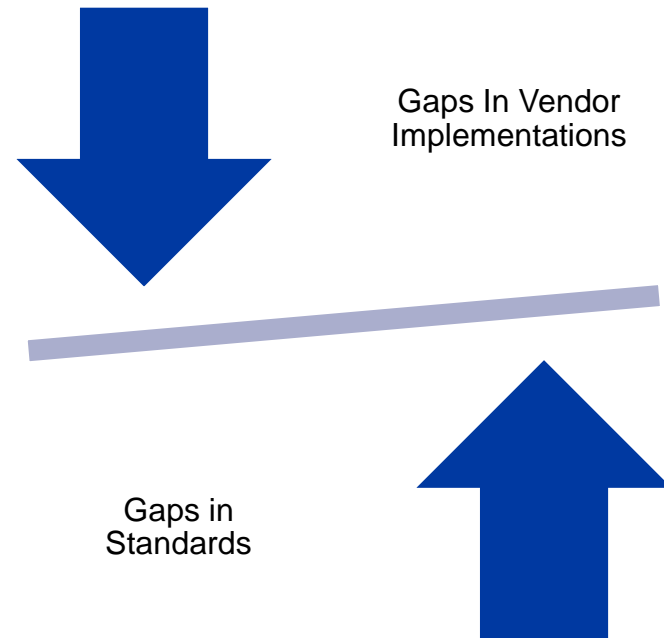


# Next Steps

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1. Engaging to close the gap on vendor implementation
2. Engaging to close the gap in standards
3. Continuing our analysis of the minimum digital thread
4. Developing a White Paper for standardized technical data package content for MBD certification

## Simplify & Standardize



# Call to Action

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- Assess your MBD modeling methods and certification process. **Are you ready to for the industry to standardize?**
- Standards organizations are developing roadmaps to the future state also. **GET INVOLVED!**
- Leverage your relationships with vendors to push demand for standards adoption; **they want your money.**
- **Have fun!** Remember what excited you about being here.



# Questions?