2021 DoD Engineering Data and Modeling Working Group

AGENDA

1400 – Welcome
1405 – The Charter
1415 – Relative roles of academia, industry, and government in DEDMWG
1420 – An OUSD(R&E) perspective to DEDMWG and Digital Engineering
1435 – Digital Engineering Handbook
1450 – ASME MBE Committee
1505 – Additive Manufacturing TDP Sub Committee
1525 – TDP Training Curriculum
1535 – DoD Data Management and the DID
1545 – Adjourn

2021 DoD Engineering Data and Modeling Working Group

DEDMWG Tri-Chairs

DOD – Jeff Windham - US Army Armament Center

Jeff Windham has over 35 years' experience as a systems engineer and configuration manager for the US Army Armament Center at Rock Island Arsenal, Illinois. He is currently the chief of the Small Caliber Systems Configuration Management Branch. He has a Master's Certification in Enterprise Configuration Management from CMPIC, is NDIA certified in Configuration and Data Management and teaches configuration management throughout the Army. He holds a BS in Aerospace Engineering from Mississippi State University and an MS in Business Administration from East Texas State University.

INDUSTRY – Ben Kassel - LMI

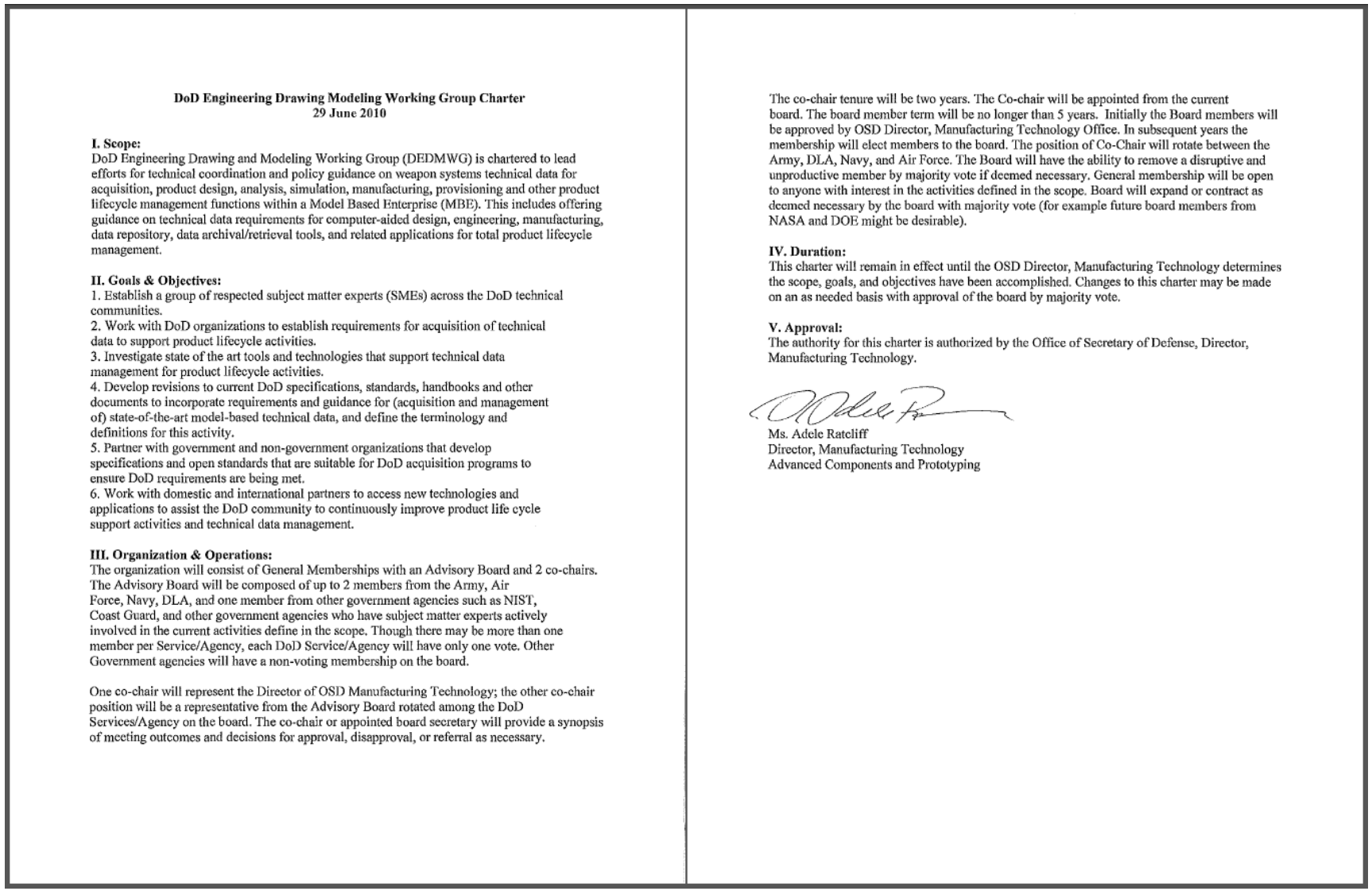
Ben Kassel is a Digital Engineering Senior Consultant at LMI and guest researcher at the NIST Engineering Laboratory in the areas of Digital Engineering and the Digital Thread enabled Model-Based Definition. Ben is proud to say he served NAVSEA for almost 37 years using, developing, and implementing Computer-aided Design technology at the David Taylor Model Basin and the NAVSEA 05 Computer-Aided Engineering Division.

ACADEMIA – Greg Harris Ph.D, PE - Auburn University

Following a most distinguished career with the US Army highlighted by leading the establishment of the Digital Manufacturing and Design Innovation Institute Greg returned to academia where he is the Director of the Interdisciplinary Center for Advanced Manufacturing Systems (ICAMS) at the Auburn University Samuel Ginn College of Engineering

2021 DoD Engineering Data and Modeling Working Group

Our first and last charter



DoD Engineering Drawing Modeling Working Group Charter
29 June 2010

I. Scope:
DoD Engineering Drawing and Modeling Working Group (DEDMWG) is chartered to lead efforts for technical coordination and policy guidance on weapon systems technical data for acquisition, product design, analysis, simulation, manufacturing, provisioning and other product lifecycle management functions within a Model Based Enterprise (MBE). This includes offering guidance on technical data requirements for computer-aided design, engineering, manufacturing, data repository, data archival/retrieval tools, and related applications for total product lifecycle management.

II. Goals & Objectives:
1. Establish a group of respected subject matter experts (SMEs) across the DoD technical communities.
2. Work with DoD organizations to establish requirements for acquisition of technical data to support product lifecycle activities.
3. Investigate state of the art tools and technologies that support technical data management for product lifecycle activities.
4. Develop revisions to current DoD specifications, standards, handbooks and other documents to incorporate requirements and guidance for (acquisition and management of) state-of-the-art model-based technical data, and define the terminology and definitions for this activity.
5. Partner with government and non-government organizations that develop specifications and open standards that are suitable for DoD acquisition programs to ensure DoD requirements are being met.
6. Work with domestic and international partners to access new technologies and applications to assist the DoD community to continuously improve product life cycle support activities and technical data management.

III. Organization & Operations:
The organization will consist of General Memberships with an Advisory Board and 2 co-chairs. The Advisory Board will be composed of up to 2 members from the Army, Air Force, Navy, DLA, and one member from other government agencies such as NIST, Coast Guard, and other government agencies who have subject matter experts actively involved in the current activities define in the scope. Though there may be more than one member per Service/Agency, each DoD Service/Agency will have only one vote. Other Government agencies will have a non-voting membership on the board.

One co-chair will represent the Director of OSD Manufacturing Technology; the other co-chair position will be a representative from the Advisory Board rotated among the DoD Services/Agency on the board. The co-chair or appointed board secretary will provide a synopsis of meeting outcomes and decisions for approval, disapproval, or referral as necessary.

The co-chair tenure will be two years. The Co-chair will be appointed from the current board. The board member term will be no longer than 5 years. Initially the Board members will be approved by OSD Director, Manufacturing Technology Office. In subsequent years the membership will elect members to the board. The position of Co-Chair will rotate between the Army, DLA, Navy, and Air Force. The Board will have the ability to remove a disruptive and unproductive member by majority vote if deemed necessary. General membership will be open to anyone with interest in the activities defined in the scope. Board will expand or contract as deemed necessary by the board with majority vote (for example future board members from NASA and DOE might be desirable).

IV. Duration:
This charter will remain in effect until the OSD Director, Manufacturing Technology determines the scope, goals, and objectives have been accomplished. Changes to this charter may be made on an as needed basis with approval of the board by majority vote.

V. Approval:
The authority for this charter is authorized by the Office of Secretary of Defense, Director, Manufacturing Technology.

Ms. Adele Ratcliff
Director, Manufacturing Technology
Advanced Components and Prototyping

Established in 2008 as the DoD Engineering Drawing and Modeling Working Group

Established a group of subject matter experts across the DoD to address the acquisition of technical data within a Model-Based Enterprise

Primary focus was to adjust MIL-DTL-31000C from a drawing based to a model based paradigm

Renamed after the release of MIL-STD-31000 to emphasize being dedicated to the 3D Model-Based Definition

2021 DoD Engineering Data and Modeling Working Group

Proposed Charter

I. Scope:

The availability and flow of product model and other technical data in all phases of a product lifecycle focusing on the acquisition, creation, and use of shape and product manufacturing information necessary to enable manufacturing, digital information visualization, and the digital twin within the sustainment phase.

II. Goals & Objectives:

a. Maintain a network of technical data subject matter experts (SMEs) across the DoD.
b. Develop guidance for DoD organizations to establish requirements for acquisition of technical data to support product lifecycle activities.
c. Advocate for the tools, technologies, and standards that support technical data management across the product lifecycle.
d. Advocate for the availability of product model and other technical data within the OSD Digital Engineering Working Group (DEWG).
e. Advocate the DoD position for product model and other technical data within the INCOSE Digital Engineering Information Exchange Working Group (DEIXWG).
f. Assess tools and technologies for potential implementation into DoD systems.
g. Identify technical data standards, their status, and the conditions for their use.
h. Participate in the development of product model and other technical standards as directed by the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)).
i. Coordinate with the Defense Standardization Program Office and non-government standards bodies to ensure DoD requirements are being met.

III. Organization & Operation

a. Definitions
   i. General Working Group Members – Active participants from government, industry or academia with interests in the activities defined in the scope of the working group.
   ii. Advisory Board – The Advisory Board consists of each of the Tri-Chairs and between two (2) and four (4) general members. DoD civilian employees or active military shall always make up the majority of the Advisory Board.
   iii. Tri-Chairs – Three members selected by the Advisory Board to lead the working group. One of the Tri-Chairs shall be from DoD, one of the Tri-Chairs shall be from industry, and one of the Tri-Chairs shall be from academia.

b. Functions and Responsibilities
   i. Advisory Board
      1. Appointment and removal of the chairs.
      2. Appointment and removal of the Advisory Board members.
      3. Request working group meetings.
      4. Approval of minutes of the working group meetings.
      5. Setting the priorities of the working group.
      6. Responses to questions from any of the Advisory Board member organizations.
      7. Responses to questions from any external organization.
      8. The DoD Tri-Chair shall lead the Advisory Board.
      9. Removal of a General Member.
      10. Report to ODASD(SE) as required.
   ii. Tri-Chairs
      1. Record and maintain meeting outcomes, decisions, actions, and referrals.
      2. Maintain an official list of the working group members.
      3. Maintain an official list of the Advisory Board.
      4. Schedule meetings.
      5. Lead meetings.
   iii. Working Group
      1. Submit ideas for consideration of the advisory board
      2. Attend working group meetings
      3. Participate in DEDMWG activities

IV. Duration:

This charter will remain in effect until the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)) determines the scope, goals, and objectives have been accomplished. Changes to this charter may be made on an as-needed basis by consensus of the advisory board.

V. Approval:

The authority for this charter is authorized by the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)).

2021 DoD Engineering Data and Modeling Working Group

OUSD(R&E) perspective to DEDMWG and Digital Engineering

DEDMWG

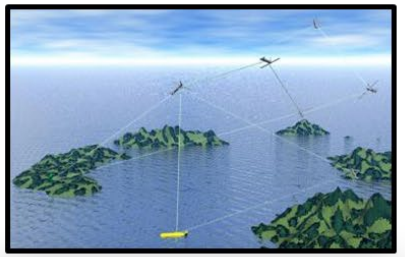
Tracee Walker Gilbert, Ph.D.
Contractor Support, Engineering Tools and Environments
Office of the Under Secretary of Defense (Research & Engineering)

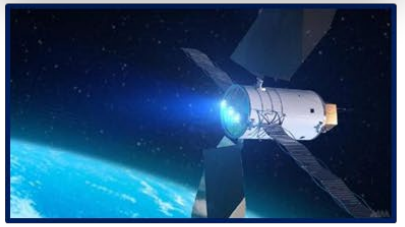
April 16, 2021

2021 DoD Engineering Data and Modeling Working Group

USD(R&E) Mission

- **Ensure Technological Superiority for the U.S. Military**
  - Set the technical direction for the Department of Defense
  - Champion and pursue new capabilities, concepts, and prototyping activities throughout the DoD research and development enterprise
- **Bolster Modernization**
  - Pilot new acquisition pathways and concepts of operation
  - Accelerate capabilities to the warfighter



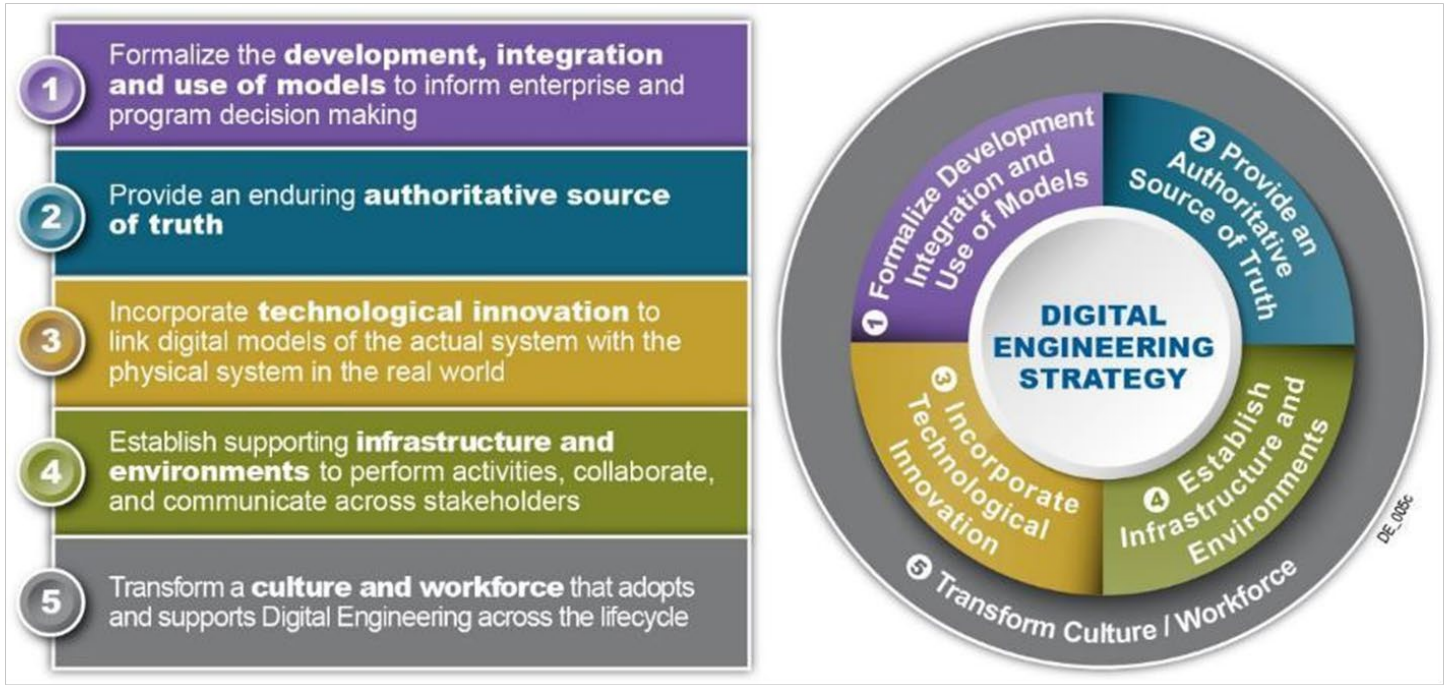


"Our mission is to ensure that we, if necessary, reestablish and then maintain our technical advantage."
– Under Secretary Griffin, April 2018

2021 DoD Engineering Data and Modeling Working Group

Digital Engineering

***"An integrated digital approach that uses authoritative sources of systems' data and models as a continuum across disciplines to support life cycle activities from concept through disposal"* - DAU Glossary**



2021 DoD Engineering Data and Modeling Working Group

Digital Engineering Implementation

Dr. Griffin

"This strategy describes the "what" necessary to foster the use of digital engineering practices. Those implementing the practices must develop the "how" – the implementation steps necessary to apply digital engineering in each enterprise."

Service Strategies and Plans

Outlines DoD's five strategic goals for Digital Engineering initiatives

Enterprises

U.S.ARMY

U.S. AIR FORCE

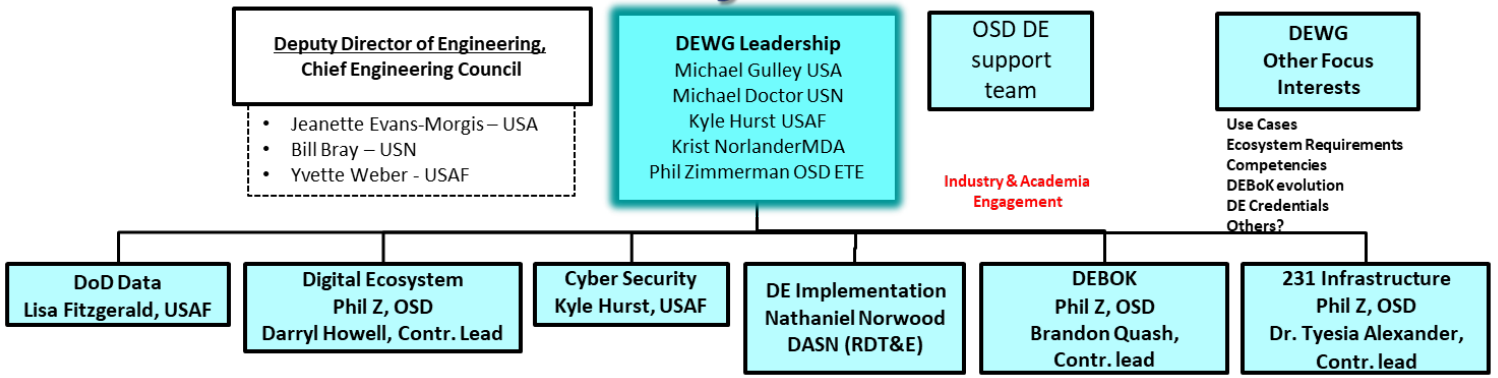
Collaborative Activities

- Collaboration
  - Digital Engineering Working Group / Community of Practice
    - Tiger Teams
  - Systems Engineering Research Center
  - INCOSE/NDIA Digital Engineering Information Exchange Working Group; Conferences, etc
  - Engineering WF Task Force
- DoD Digital Engineering Body of Knowledge (DEBoK)
- Align understanding of Modeling and Simulation with Digital Engineering

Implementing Digital Engineering Across the DoD

2021 DoD Engineering Data and Modeling Working Group

Digital Engineering Working Group Community of Practice



Services Prioritized DE Pain Point centric Tiger Teams (6)

DoD Data – DoD lacks the enterprise data management to ensure Authoritative Data & Models are widely available to or accessible

Digital Ecosystem – DoD needs technical solutions to provide collaborative, agile, secure, interoperable, & responsive digital ecosystems

Cyber Security - DoD needs cybersecurity protection to data, networks and hosting environments while managing access controls, data at rest, spillage control and exfiltration mitigation.

DE Implementation – DoD lacks applied, useful and shared examples of incremental DE/MBSE implementation and execution. Applied Methods/Road-Maps for DE/MBSE Implementation.

DEBoK – The DoD lacks a uniform and common understanding of what the DEBoK should be and what it should contain. There needs to be a structured, shared knowledge that is existent and accessible to the Engineering community.

231 Infrastructure – The National Def Authorization Act (NDAA) for FY20, Section 231 (Public Law 116-92) directs the Sec of Def to establish a DE capability to support automated approaches for testing, evaluation, and deployment throughout the defense acquisition process

Summary/Next Steps

- **Driving Digital Engineering transformation through a focus on implementation**
  - Addressing challenges, shares best practices, and facilitates tiger teams
  - Sponsoring research on metrics, curation, and tool innovation
  - Shaping initiatives across industry to drive digital engineering transformation
- **Shaping the Digital Engineering Community of Practice/Practitioners**

2021 DoD Engineering Data and Modeling Working Group

OUSD(R&E) perspective to DEDMWG and Digital Engineering

For Additional Information

Ms. Philomena M. Zimmerman

Deputy Director, Engineering Tools and Environments

DDR&E(AC)

Office of the Under Secretary of Defense
for Research and Engineering

571.372.6695

Philomena.m.Zimmerman.civ@mail.mil

Digital Engineering Handbook Development

Jeff Windham
US ARMY DEVCOM Armament Center
April 2021 DEDMWG
James.j.Windham.civ@mail.mil

Digital Engineering Handbook Background

- DOD Digital Engineering Strategy released in 2018. Established 5 fundamentals:
  1. Formalize the development, integration, and use of models to inform enterprise and program decision making
  2. Provide an enduring, authoritative source of truth
  3. Incorporate technological innovation to improve the engineering practice
  4. Establish a supporting infrastructure and environment to perform activities, collaborate and communicate across stakeholders
  5. Transform the culture and workforce to adopt and support digital engineering across the lifecycle
- DE Strategy is very high level document, basically a 30k ft. view.
- Many programs are trying to implement the DE Strategy but are asking for help.
- NAVSEA undertook effort to develop a handbook to aid programs in implementing DE. Other services have joined the effort.

2021 DoD Engineering Data and Modeling Working Group

Digital Engineering Handbook Issues

- Still early in the handbook content creation process.
- Goal is to provide more detail than the DE Strategy (think 1k ft. view). Less than 100 pages.
- Asking DEDMWG to be the first group to provide review/feedback.
- Scope, Foreword and definitions sent for DEDMWG review in Jan 2021. 134 comments received.
    - Need clarity on scope of handbook.
    - Initial document heavy on 3D CAD Model Based Definition.
    - Lots of differing opinions on definitions, e.g. “what is a digital twin?”
    - Who is the handbook written for?

2021 DoD Engineering Data and Modeling Working Group

Digital Engineering Handbook Issues

- Attempting to settle on a title:
  - *Digital Engineering Handbook*
  - *Model Based Enterprise/Digital Engineering Handbook*
  - *Model Based Digital Engineering Enterprise Handbook*
  - *Digital Engineering and Modeling Handbook*
- Need a better understanding of the problem statement to help scope and bound the handbook.

2021 DoD Engineering Data and Modeling Working Group

Digital Engineering Handbook Problem Statement Brainstorming

- **Take the Digital Engineering Strategy and articulates it at a level programs can actually implement.**
- **Program Managers unable to interpret the developed models.**
- **Understand how model data is interconnected with other disciplines/functional areas for consumption.**
- **Provide guidance with current digital engineering efforts that I can benchmark against.**
- **How are they effectively communicating the right digital engineering path forward using the government contracting process.**
- **How modeling fits in with digital engineering or vice versa.**
- **MBSE Tools access and use.**
- **Training personnel on how low to go with models before ready for use of tool which causes lack of understanding of value.**
- **Leadership support seems to lose its traction over time with pushback of personnel.**
- **Funding methodology (digital ecosystem) individual PMO or Enterprise?**
- **Understanding the CM DM aspects for version control and permissions to edit/view information.**

2021 DoD Engineering Data and Modeling Working Group

Additive Manufacturing TDP Sub Committee

John Schmelzle

NAWCAD LKE Additive Manufacturing
and Model Based Definition Lead

2021 DoD Engineering Data and Modeling Working Group

Additive Manufacturing TDP Sub Committee

Technical Data Package (TDP) definition: The authoritative technical description of an item (MIL-STD-31000B).

Critical manufacturing process: A process that is the only known manufacturing method that will result in the production of an acceptable item. (MIL-STD-31000B)

Product Definition Data Set (PDDS): A collection of one or more data file(s) that discloses, directly or by reference, by means of graphic or textual presentations, or combinations of both, the physical or functional requirements of an item. *(ASME Y14.41- 2012).*

Additive Manufacturing Data Package (AMDP): A separately released NAVAIR Document specifying the additive manufacturing process of an item.

Material Validation Plan: A NAVAIR Document embedded in the PDDS specifying material validation requirements for each AM part. (Typically involves testing of coupons manufactured concurrently with the AM component)

2021 DoD Engineering Data and Modeling Working Group

MIL-STD-31000

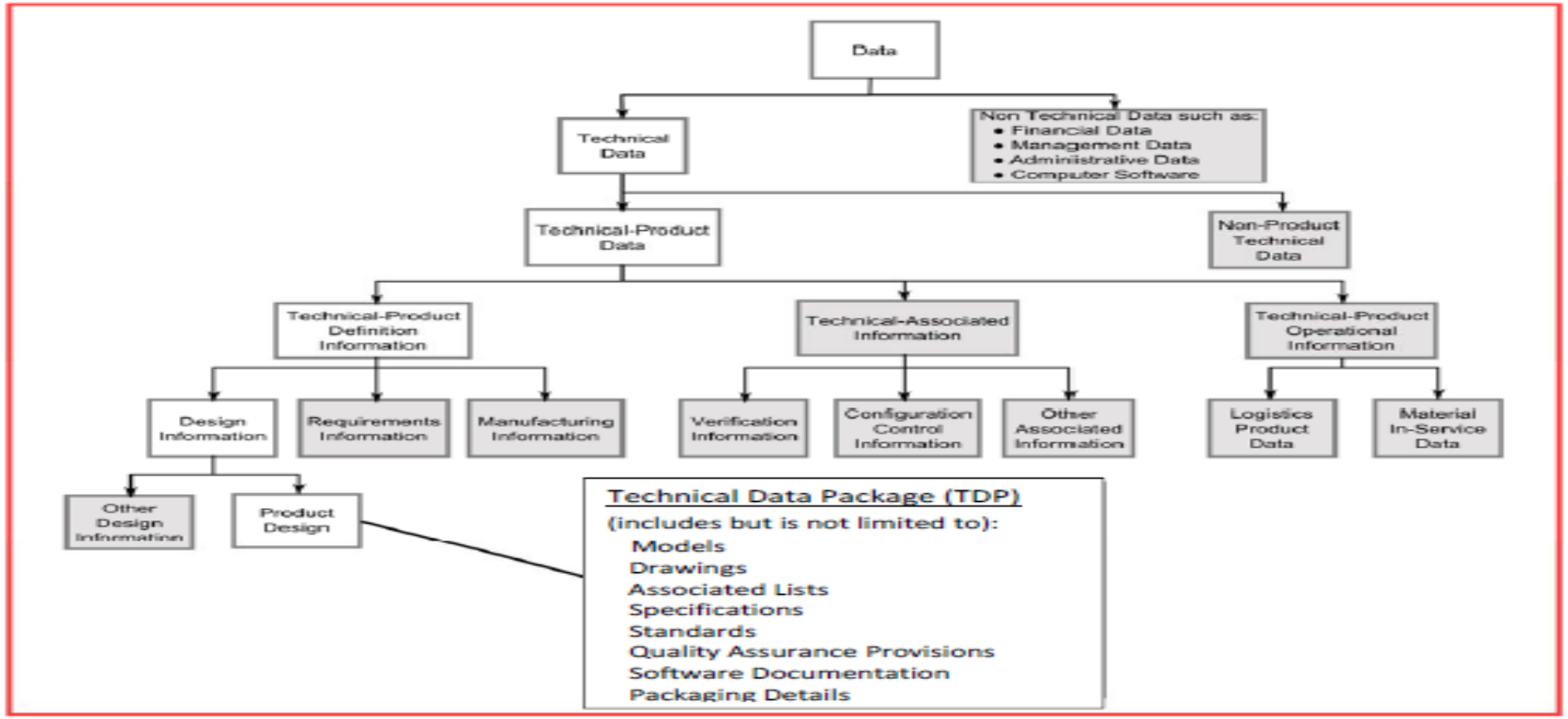
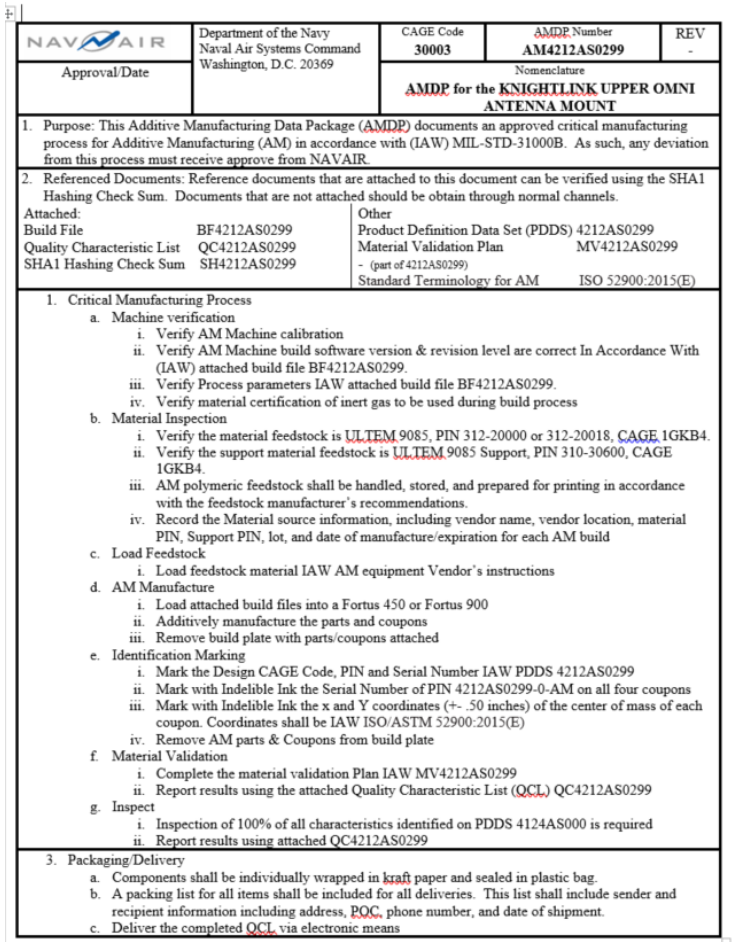


FIGURE 1. TDP relationships

2021 DoD Engineering Data and Modeling Working Group

Additive Manufacturing Data Package

- Provides a document for the Manufacturing Process
  - Removes manufacturing information from the PDDSs
  - Stores build Files, Process Parameters
- Separately controlled. Revisions do not affect the PDDS
- Aligns with the US Army
- Published similar to an Associated list (AM+Drawing Number)
- Complies with MIL-STD-31000B
  - The AMPD is a critical Manufacturing process IAW paragraph 5.14.4



NAVAIR	Department of the Navy Naval Air Systems Command Washington, D.C. 20369	CAGE Code 30003	AMDP Number AM4212AS0299	REV -
Approval/Date		Nomenclature AMDP for the KNIGHTLINK UPPER OMNI ANTENNA MOUNT		

1. Purpose: This Additive Manufacturing Data Package (AMDP) documents an approved critical manufacturing process for Additive Manufacturing (AM) in accordance with (IAW) MIL-STD-31000B. As such, any deviation from this process must receive approve from NAVAIR.
2. Referenced Documents: Reference documents that are attached to this document can be verified using the SHA1 Hashing Check Sum. Documents that are not attached should be obtain through normal channels.

Attached:		Other	
Build File	BF4212AS0299	Product Definition Data Set (PDDS)	4212AS0299
Quality Characteristic List	QC4212AS0299	Material Validation Plan	MV4212AS0299
SHA1 Hashing Check Sum	SH4212AS0299	- (part of 4212AS0299)	
		Standard Terminology for AM	ISO 52900:2015(E)

1. Critical Manufacturing Process
   a. Machine verification
      i. Verify AM Machine calibration
      ii. Verify AM Machine build software version & revision level are correct In Accordance With (IAW) attached build file BF4212AS0299.
      iii. Verify Process parameters IAW attached build file BF4212AS0299.
      iv. Verify material certification of inert gas to be used during build process
   b. Material Inspection
      i. Verify the material feedstock is ULTEM 9085, PIN 312-20000 or 312-20018, CAGE 1GKB4.
      ii. Verify the support material feedstock is ULTEM 9085 Support, PIN 310-30600, CAGE 1GKB4.
      iii. AM polymeric feedstock shall be handled, stored, and prepared for printing in accordance with the feedstock manufacturer's recommendations.
      iv. Record the Material source information, including vendor name, vendor location, material PIN, Support PIN, lot, and date of manufacture/expiration for each AM build
   c. Load Feedstock
      i. Load feedstock material IAW AM equipment Vendor's instructions
   d. AM Manufacture
      i. Load attached build files into a Fortus 450 or Fortus 900
      ii. Additively manufacture the parts and coupons
      iii. Remove build plate with parts/coupons attached
   e. Identification Marking
      i. Mark the Design CAGE Code, PIN and Serial Number IAW PDDS 4212AS0299
      ii. Mark with Indelible Ink the Serial Number of PIN 4212AS0299-0-AM on all four coupons
      iii. Mark with Indelible Ink the x and Y coordinates (+- .50 inches) of the center of mass of each coupon. Coordinates shall be IAW ISO/ASTM 52900:2015(E)
      iv. Remove AM parts & Coupons from build plate
   f. Material Validation
      i. Complete the material validation Plan IAW MV4212AS0299
      ii. Report results using the attached Quality Characteristic List (QCL) QC4212AS0299
   g. Inspect
      i. Inspection of 100% of all characteristics identified on PDDS 4124AS000 is required
      ii. Report results using attached QC4212AS0299
3. Packaging/Delivery
   a. Components shall be individually wrapped in kraft paper and sealed in plastic bag.
   b. A packing list for all items shall be included for all deliveries. This list shall include sender and recipient information including address, POC, phone number, and date of shipment.
   c. Deliver the completed QCL via electronic means

2021 DoD Engineering Data and Modeling Working Group

Additive Manufacturing Build Files

- Attached to AMDP
- Also Controls Software/ Parameters
- Actual Build Files attached to document

NAVAIR Approval/Date	Department of the Navy Naval Air Systems Command Washington, D.C. 20369	CAGE Code 30003	AMDP Number BF4212AS0299	REV -
		Nomenclature **Build Files for the KNIGHTLINK UPPER OMNI ANTENNA MOUNT**		

1. Purpose: This Build File documents the authorized materials as well as the printers, associated software and parameters required to be used with the corresponding and attached build files to manufacture PIN 4212AS0299-0-AM in accordance with AM4212AS0299.

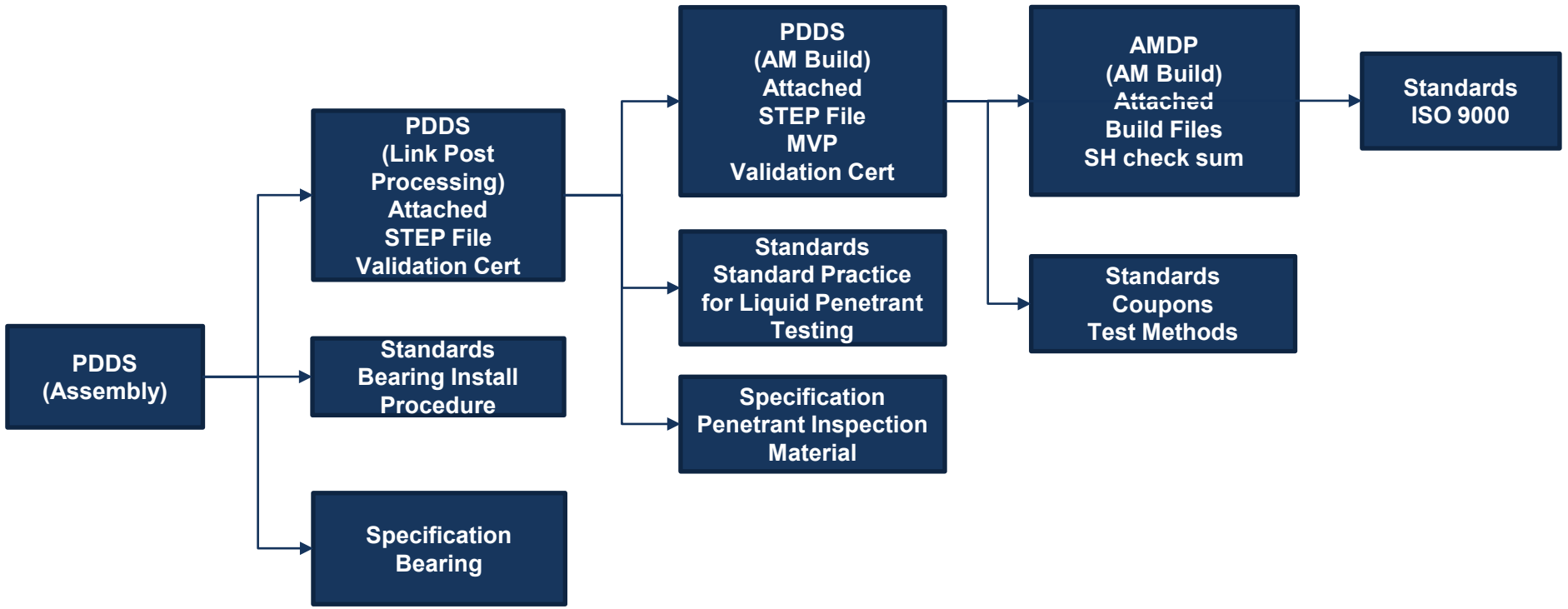
2. Referenced Documents.

Attached:		Other:	
Build File	BF4212AS0299-1	Additive Manufacturing Data Package	AM4212AS0299
Build File	BF4212AS0299-2		

Build File	Printer		Authorized Materials			Printer Software Version	Processing Parameters
	Vendor	Model	Material Nomenclature	Material PIN	Material CAGE		
BF4212AS0299-1	Stratasys (CAGE 1GKB4)	Fortus 450MC	ULTEM 9085	312-20000	1GKB4	F123 Series v2_1_5630	Use Default Parameters
				312-20018	1GKB4		
BF4212AS0299-2	Stratasys (CAGE 1GKB4)	Fortus 900MC	ULTEM 9085	312-20000	1GKB4		Use Default Parameters
				312-20018	1GKB4		

2021 DoD Engineering Data and Modeling Working Group

Configuration Control



2021 DoD Engineering Data and Modeling Working Group

Technical Data Package Guidance

Qualification Level		I	II	III	IV
Criticality		Minimal	Low	Medium	High
TDP Guidance	PDDS Attachments	1. STEP File 2. Model file validation Certificate 3. Required processes unique to part		1. STEP File 2. Model file validation Certificate 3. Material Validation Plan	
	AMDP	Separate Document not called for in the PDDS and not in the TDP		Required as a critical Manufacturing Process, called for in the PDDS, and thus becomes part of the TDP	
Organic Manufacture Package		1. AMDP 2. TDP		TDP	1. TDP 2. FAT requirements
Acquisition Package Contents		TDP			
Contract CDRL Guidance		100% check of all Major Characteristics called for in the TDP	100% check of all Characteristics called for in the TDP	100% check of all Characteristics called for in the TDP Material Validation Report	100% check of all Characteristics called for in the TDP Material Validation Report FAT Report

TDP Training Development

Jeff Windham
US ARMY DEVCOM Armament Center
April 2021 DEDMWG
James.j.Windham.civ@mail.mil

2021 DoD Engineering Data and Modeling Working Group

TDP Training Curriculum; Planning Development and Ordering

TDP planning, development and ordering practices are poor.

- Lack of understanding of what the purpose of a TDP is, or how it will be used throughout the lifecycle.
- Lack of understanding of 3D TDP requirements.
- 3D based TDPs are highly specialized and require significant degree of knowledge.
- Those writing SOWs in DOD are generally not CAD or TDP experts.
- Often times, the TDP Option Selection Worksheet is filled out and placed in an SOW with no other detailed description of what is required.
- Confusion by contractors on what they are suppose to deliver.
- Data Rights not understood or fully delineated.
- Access vs Deliver vs Control not detailed.

Bottom Line: Government doesn’t know what they need, contractors don’t know what they are being asked to deliver, confusion reigns.

2021 DoD Engineering Data and Modeling Working Group

TDP Training Curriculum Recommendation

- Part of the fix to this problem is a better understanding of the TDP, what it is, how its used, and how to order it.
- TDP training curriculum needs to be developed and offered, ideally via DAU.
- DEDMWG should work with DAU (or other training body) to develop class (most likely online, self paced).

Modernization of DOD Data Ordering Practices

Jeff Windham
US ARMY DEVCOM Armament Center
April 2021 DEDMWG
James.j.Windham.civ@mail.mil

2021 DoD Engineering Data and Modeling Working Group

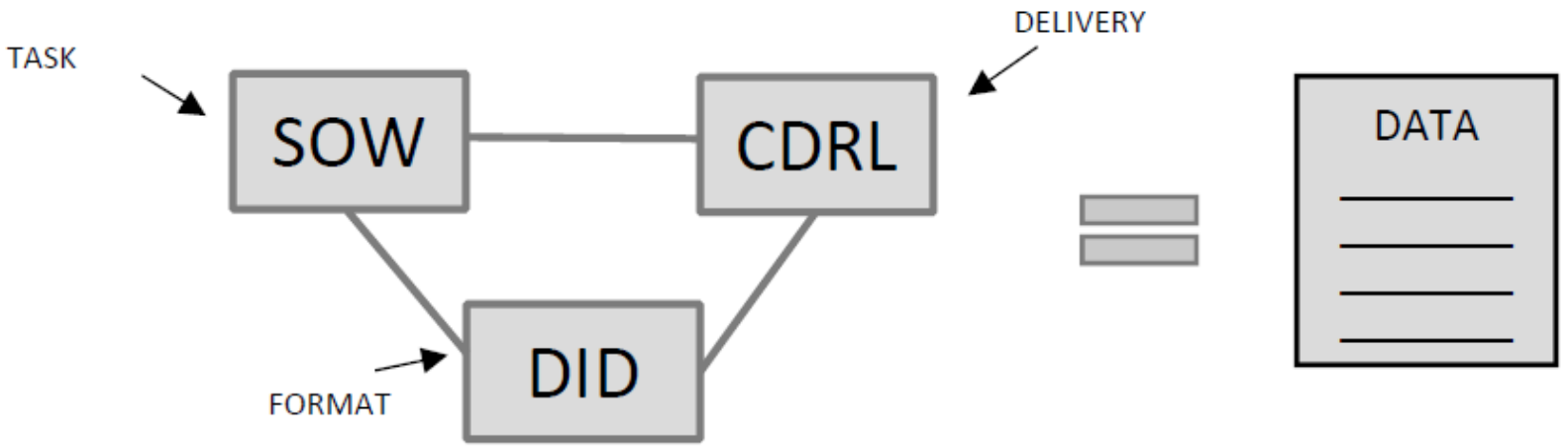
DOD Data Policies

Per DOD data management policies, to obtain data from a contractor, three things are required:

1. A Statement of Work (**SOW**) describing the work task to be conducted.

2. A Contracts Data Requirements List (**CDRL**) (DD form 1423) (An index which includes time, place, frequency and method of delivery.)

3 A Data Item Description (**DID**) describing the data format.



2021 DoD Engineering Data and Modeling Working Group

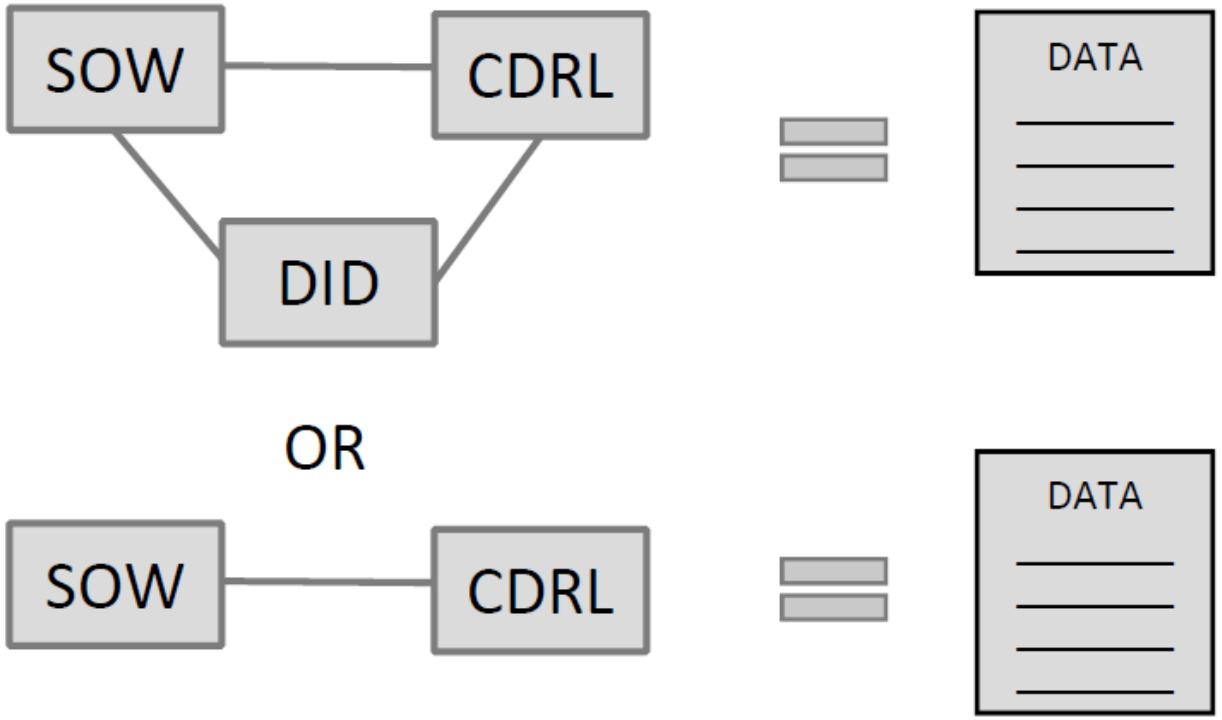
The Problem

- DIDs were created to force standardization of data format at a time when data was created via typewriter and mainframe computer.
- Currently, data manipulation/reformatting tend to be trivial exercises.
- Many DIDs say nothing but "***provide in contractor's format***".
- In today's environment, a high degree of specialization of data format is the norm. This is especially true in the engineering data arena.
- Getting approval of one-time DIDs is a time consuming, non-value added work-around.
- Requiring DIDs in many cases is more of a hindrance than a benefit.

2021 DoD Engineering Data and Modeling Working Group

Proposal

- Get rid of the requirement that you must have a DID to obtain data.
- Get rid of the restriction on “tailoring up” a DID.



2021 DoD Engineering Data and Modeling Working Group

Whats next