U.S. ARMY

DEVCOM ARMAMENTS CENTER

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND ARMAMENTS CENTER

MIL-STD-31000
Technical Data Packages in Acquisition

17-APRIL-2024

JEFF WINDHAM
james.j.windham.civ@army.mil

The Technical Data Package and MIL-STD-31000

What is it?

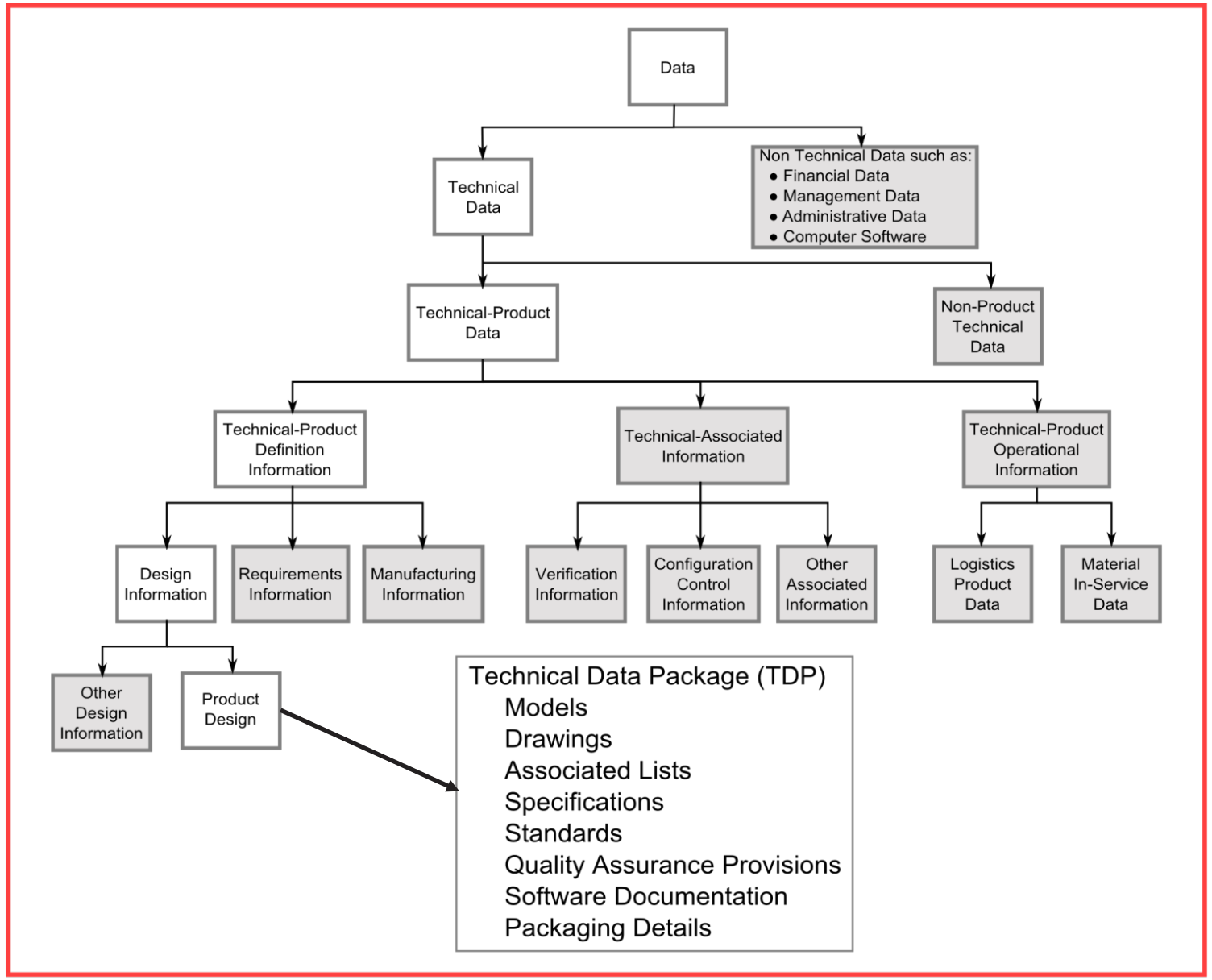
What is it used for?

How is it defined?

How to plan for it?

Where is it going?

TYPES OF DATA



TDP PURPOSE

- **Common Myth:** The TDP exists for purposes of manufacturing the item.

- **Fact:** The TDP does NOT exist for purposes of manufacturing… It exists for the purposes of defining the item.

  - *Its an engineering document, not a manufacturing document.*

- As the authoritative engineering definition of the item, it has many uses:
  - Manufacturing
  - Inspection/Quality Control
  - Logistics Support
  - Engineering Analysis
  - Configuration Mgt.
  - Interface Mgt.

PRODUCT DEFINITION APPROACH

- Three ways to define a product (from the acquirer's perspective):
  - **Fully Defined TDP**: Fully defines an item thru detailed design disclosure, i.e., drawings, specifications, CAD models, and includes dimensions, tolerances, materials, finishes, software code, quality inspections, packaging, etc.
  - **Performance Based TDP:** Defines an item thru "performance" parameters, not detailed design, i.e., performance specification.
  - **Commercial Item**: Defined by only commercial source and part number.

Source: MIL-STD-31000B

MIL-STD-31000 BACKGROUND

1. MIL-STD-31000 is a high-level document providing the definition and requirements for the TDP. (Detailed instructions are left to other standards (primarily ASME Y14 Series)).

2. MIL-STD-31000:

    a. Defines what a TDP is, to include its constituent parts (elements),
    b. Establishes how a TDP is ordered on a developmental contract, and
    c. Provides products to manage and control how a TDP is created during a development process.

3. It is written assuming an Acquirer – Supplier relationship. I.e., DOD is contracting for design of a new system or capability.

TDP DEFINITION

Technical Data Package (TDP)

The authoritative technical definition of an item.

This technical definition supports the acquisition, production, inspection, engineering, and logistics support of the item.

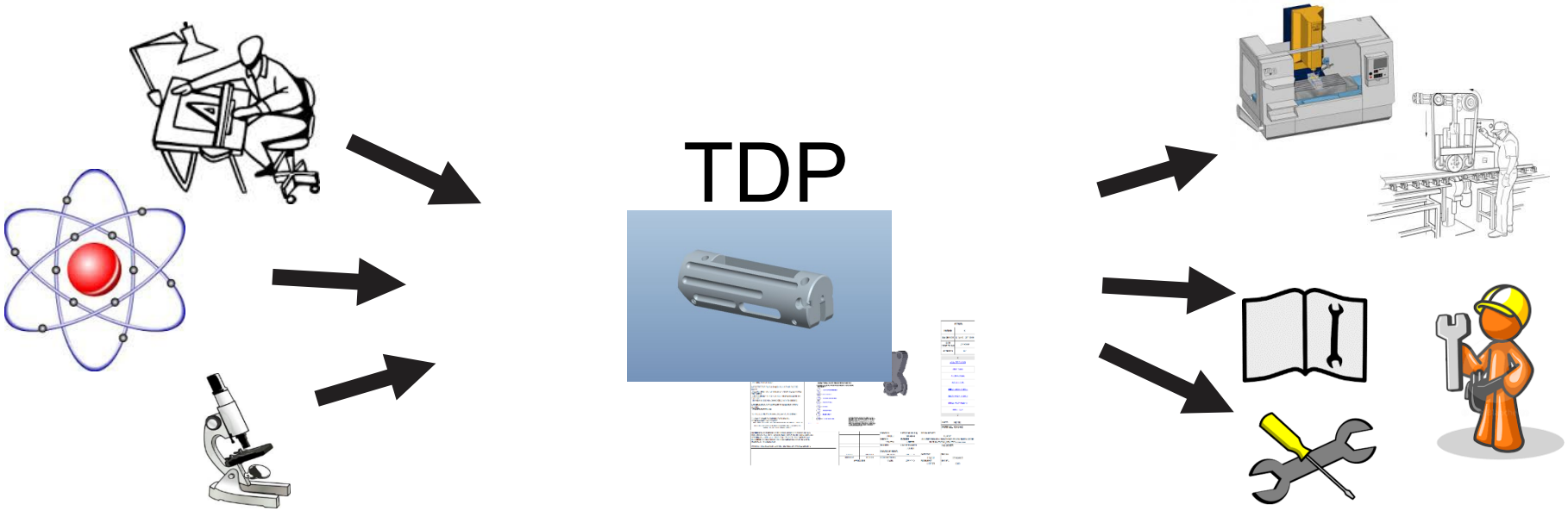
The description defines the required design configuration and/or performance requirements, and procedures required to ensure adequacy of item performance. It consists of applicable technical data such as models, engineering design data, associated lists, specifications, standards, performance requirements, quality assurance provisions, software documentation and packaging details.

Source: MIL-STD-31000B

TDP BACKGROUND

- The TDP is the single authoritative definition of the product.
- It is the culmination of the science, engineering and design efforts that came before it...,

  ... and is source data for all mfg., logistics, and acquisition activities which comes after it.



TDP LEVELS

- **Three Levels:**

(Pre-milestone A to B)

1. **Conceptual level:** Defines design concepts; consists of only simple sketches/models, artist's renderings, and/or basic textual data.

(Milestone B-C)

2. **Developmental level:** Supports the analysis of a specific design approach, the fabrication of prototype materiel for test or experimentation, and limited production by, or with assistance from, the original design activity.

(Milestone C and later)

3. **Product level:** Contains information necessary to fully define the item and enable the procurement or manufacture. Defined to the extent necessary for a competent manufacturer to produce an item.

TDP TYPES

Two Types:

- 2-dimensional (line drawing based)

- 3-dimensional (solid model based)
  a) 3D native CAD models
  b) 3Di pdf viewables derived from 3D native CAD
  c) Neutral files derived from 3D native CAD
  d) 2D drawings derived from 3D native CAD

Source: MIL-STD-31000B

TDP ELEMENTS

1. Engineering Design Data (CAD Models, Drawings, 3Di Viewables, etc.)
2. Specifications
    a) Defense specifications (e.g. MIL-DTL-12345)
    b) Program-unique specifications (e.g. PRF-98765432)
    c) Commercial Specifications (e.g. ASME/SAE etc.)
3. Special Inspection Equipment (SIE)
4. Special tooling
5. Software documentation
6. Special Packaging Instructions (SPI)
7. Quality Assurance Provisions (QAPs)
8. Required Mfg. Process Descriptions (Critical Mfg. Process Desc.)
9. Additive Mfg Data File

THE GOOD OLD DAYS

- Back in the day, TDPs were primarily 2D drawings, designed on paper, documented on paper, stored on paper, revised on paper and delivered on paper.

- Later came microfilm/microfiche, then electronic storage. Basically, another way to view the paper.

- The paper drawing was the master and the authoritative. Concepts like native, neutral or viewable formats, derivative formats, etc. didn't exist.

- Today it is much more complicated and requires more extensive planning.

3D TDP TERMINOLOGY

FORMAT

Native
-CREO
-CATIA
-SolidWorks
-NX
-Solid Edge
-AutoCAD Inventor

-Authoring software.
-Can generate Neutral and Viewable (directly or via third party software.)

or

Neutral
-STEP
-IGES
-STL

-High fidelity model.
-Typically non-annotated.
-Can be imported into Native.
-Typically intended for Machine-Machine transfer.

or

Viewable
-3Di pdf
-JT
-X3D

-Lightweight.
-Fully annotated.
-Widely available and/or free viewer.
-Typically intended for human readable.

ORIGIN

Master

-Source for all other data.
-File from which all changes must originate.
-Almost always Native format.

or

Derivative

-Generated from Master.
-Cannot be directly changed.

VALIDATION STATUS

Authoritative

-Validated to be correct.
-Can “build to” and ”Inspect to”.
-Implied warranty as good data.

or

Reference

-For Information only.
-Can not ”Inspect to”.
-No Implied warranty.

TDP PLANNING CONSIDERATIONS

TDP Use: Identify how the TDP will be used by the Government

- Competitive procurement?
- Engineering analysis and simulation?
- Logistics planning?
- Configuration control?

TDP Fidelity: Identify the level of detail required in the product's part structure

- Will the TDP describe every part down to the individual components
- Will the TDP only describe down to the LRU/spare part level

TDP PLANNING CONSIDERATIONS

TDP Format: Will the format be Government's or Contractor's?

- Whose CAGE Code will be on the drawings?
- Whose format and drawing standards or 3Di template?
- Whose modeling standards?
- Whose part numbers?

TDP Control: Will the Govt or contractor be the Configuration Approval Authority over the initial release and subsequent changes?

TDP Maintenance: Who will maintain and update master documents?

TDP Access vs Delivery: Is the contractor providing access to the TDP or delivery of the TDP?

OTHER TDP CONSIDERATIONS

1. The TDP cannot contain information already in another published specification. Reference the published specification instead.

2. International standards not adopted by ANSI cannot be referenced in a TDP without prior Government approval.

3. All documents referenced in a TDP must be included, except those available in ASSIST or from the governing body.

4. Prohibited documents in a TDP:
    a) Technical/Maintenance/Operator Manuals
    b) Uncontrolled documents
    c) Unreleased documents
    d) Management plans

TDP OPTION SELECTION WORKSHEET

- The starting point for planning for the TDP.
- Becomes a contractual document supporting the SOW.
- When ordering 3D TDP, the Option Selection Worksheet must be supported by additional explanation, instruction, SOW verbiage, etc.
- Appendix A of MIL-STD-31000B gives detailed instructions on filling out the TDP Option Selection Worksheet.

TDP OPTION SELECTION WORKSHEET

SYSTEM:		DATE PREPARED:	
A. CONTRACT NO.	B. EXHIBIT/ATTACHMENT NO.	C. CLIN	D. CDRL DATA ITEM NO.

1. TDP LEVEL (CHOOSE ONLY ONE PER WORKSHEET). Note: The level selected must coincide with the requirements of the elements selected in block 5.

A. ☐ CONCEPTUAL LEVEL
☐ DEVELOPMENTAL LEVEL
☐ PRODUCT LEVEL

B. REMARKS:

2. TYPE AND FORMAT (X all that apply and complete as applicable.)

A. ☐ TYPE 2D: 2D DRAWINGS(describe in detail in remarks below or in block 11):

☐ NATIVE 2D CAD (SPECIFY TYPE): _____
☐ ISO 32000 PDF
☐ HARD COPY
☐ OTHER FORMAT (SPECIFY TYPE): _____

REMARKS :

B. ☐ TYPE 3D: 3D MODEL BASED (describe in detail in remarks below or in block 11):

☐ NATIVE 3D CAD (SPECIFY TYPE): _____
☐ 3Di VIEWABLE* FORMAT DERIVED FROM 3D NATIVE MODELS (Specify type, i.e. ISO 32000 PDF etc.).
☐ NEUTRAL FORMAT DERIVED FROM 3D NATIVE MODELS (Specify type, i.e. STEP AP203, AP 214 etc.).
☐ 2D DRAWINGS DERIVED FROM 3D NATIVE MODELS (Specify type, i.e. ISO 32000 PDF etc.).
☐ OTHER FORMAT (SPECIFY TYPE): _____

NOTE: 3Di viewable will be in ISO 32000 pdf format unless otherwise specified.

REMARKS :

3. CAGE CODE AND DOCUMENT NUMBERS	A. ☐ CONTRACTOR CAGE & DOCUMENT NUMBERS ☐ GOVERNMENT CAGE & DOCUMENT NO. (COMPLETE 3B, 3C, AND 3D)	
B. USE CAGE CODE:	C. USE DOCUMENT NUMBERS:	D. TO BE ASSIGNED BY:

4. DRAWING FORMATS AND/OR 3Di PDF FORMAT (X one and complete as applicable)

☐ CONTRACTOR FORMAT ☐ GOVERNMENT FORMAT
REMARKS:

5. TDP ELEMENTS REQUIRED (X all that apply)

☐ ELEMENTS REQUIRED TO BE DETERMINED BY CONTRACTOR

OR THE FOLLOWING ARE REQUIRED:

☐ CONCEPTUAL ENGINEERING DESIGN DATA
☐ DEVELOPMENTAL ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ PRODUCT ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ COMMERCIAL ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ SPECIAL INSPECTION EQUIPMENT (SIE) ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ SPECIAL TOOLING ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ SPECIFICATIONS
☐ SOFTWARE DOCUMENTATION
☐ SPECIAL PACKAGING INSTRUCTIONS (SPI) ENGINEERING DESIGN DATA AND ASSOCIATED LISTS
☐ QUALITY ASSURANCE PROVISIONS (QAPs)

6. APPLICABILITY OF STANDARDS. The following Standards apply: (X as applicable)

☐ ASME Y14.100 ENGINEERING DRAWING PRACTICES WITH APPENDICES: ☐ B ☐ C ☐ D ☐ E Company stds permitted? Y/N	☐ 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 Y14.41 DIGITAL PRODUCT DEFINITION DATA PRACTICES ☐ ASME Y14.5 DIMENSIONING AND TOLERANCING	☐ OTHER STANDARDS APPLY AS DESCRIBED:

TDP OPTION SELECTION WORKSHEET
PAGE 2

A. CONTRACT NO.	B. EXHIBIT/ATTACHMENT NO.	C. CLIN	D. CDRL DATA ITEM NO.

7. ASSOCIATED LISTS (X all that apply and complete as applicable.)

A. ☐ PARTS LISTS (X ONE)*	☐ (1) INTEGRAL	☐ (2) SEPARATE		☐ (3) CONTRACTOR SELECT
B. ☐ DATA LISTS	☐ REQUIRED (Specify Levels of ASSY) _____			
C. ☐ INDEX LISTS	☐ REQUIRED (Specify Levels of ASSY) _____			
D. ☐ WIRING LISTS	☐ (1) INTEGRAL	☐ (2) SEPARATE		☐ (3) CONTRACTOR SELECT
E. ☐ APPLICATION LISTS	☐ (1) INTEGRAL	☐ (2) SEPARATE	☐ (3) PLM MAINTAINED	☐ (4) CONTRACTOR SELECT
F. ☐ OTHER	☐ REQUIRED(Specify Levels of ASSY) _____			

**NOTE: USE OF SEPARATE PARTS OR WIRING LISTS ARE NOT RECOMMENDED ESPECIALLY WITH TYPE 3D TDPS.*

8. TDP DATA MANAGEMENT PRODUCTS

A. ☐ TECHNICAL DATA PACKAGE LIST (TDPL)
☐ SOURCE CONTROL APPROVAL REQUEST
☐ DOCUMENT NUMBER ASSIGNMENT REPORT
☐ PROPOSED CRITICAL MANUFACTURING PROCESS DESCRIPTION
☐ ENGINEERING DRAWING TREE
☐ TO LOWEST REPAIRABLE UNIT (LRU) LEVEL
☐ TO LOWEST COMPONENT LEVEL
☐ OTHER (DESCRIBE):_____

B. REMARKS:

9. TDP METADATA

☐ TDP METADATA REQUIRED (describe requirements):

10. TDP SUPPLEMENTARY DATA

☐ TDP SUPPLEMENTARY DATA REQUIRED (describe requirements):

11. OTHER TAILORING (Attach additional sheets as necessary

12. PROCURING ACTIVITY TITLE, SIGNATURE AND DATE

TITLE:	SIGNATURE:	DATE:

REVISED MIL-STD-31000

- MIL-STD-31000 is currently under review for modification.
- The primary reason for the modification is to add Additive Manufacturing (AM) to the TDP.
- Goal is to release this new revision in the fall of 2024.

ADDITIVE MFG. ASSUMPTIONS

1. AM capability has evolved rapidly over the last 10 years. We can expect it to continue to improve significantly in the near/medium term.

2. AM offers design options not available with traditional manufacturing.

3. AM can produce parts on-demand and on-location. This is a game-changer logistically.

4. AM is a digital data driven technology. It requires a 3D CAD model.

5. Establishing the information infrastructure / data flow is necessary to the success of AM in DOD.

AM AND ON-DEMAND/ON-LOCATION IMPLICATIONS

1. AM only applies to a small percentage of parts currently. Three things will increase the percentage of parts made via AM:
   - AM technology will continue to improve. Improve in accuracy, materials/material properties, speed, build volume, and reduced cost.
   - As new items are developed, parts will be designed with AM as the intended manufacturing approach.
   - Increases familiarity with use of AM and its capabilities and limitations.

2. On-demand and on-location AM eliminates many of the concerns of the supply community, e.g., Average Monthly Demand, Parts on hand, Administrative and Production Lead Time.

3. AM and on-demand/on-location makes it easier to customize design for the user.

WHAT IS DRIVING THE RECOMMEND CHANGE TO -31000?

1. Other manufacturing technologies have been implemented with no fundamental changes to MIL-STD-31000 or to TDP content.
   - Why are changes being proposed to -31000 to accommodate AM?
   - Is AM fundamentally different than these other manufacturing technologies?
2. AM is fundamentally different in the following ways:
   - The AM process requires a 3D model.
   - The AM process reduces the distinction between engineering/design and manufacturing.
   - AM allows production of components in the field far more than other manufacturing technologies.
3. If the above is true, then it makes sense to modify -31000 to accommodate AM, and establish how engineering data will be structured to support AM, i.e. establish the concept of operations.

AM ISSUES

1. Three manufacturing approaches to take into account:
   - **Traditional** – Can't use AM
   - **Traditional or AM** – Can use either traditional mfg. or AM to make the part
   - **AM only** – AM is the only viable way to make the part

2. Three additive manufacturing locales to consider:
   - **Organic base** (e.g., Arsenal/Depot/Shipyard)
   - **Industrial base** (e.g., OEM/lower tier contractors)
   - **Field produced parts** (e.g., on-ship/on-post/forward operating base)

3. Several sets of information necessary to support AM:
   - **TDP** (as we know it currently)
   - **Additive Mfg. Data File** (3D model file)
   - **Required (Critical) Manufacturing Process Description (for AM)** (in some cases)

MIL-STD-31000 PROPOSED CHANGES

1. Draft -31000 would make the AM data file officially part of the TDP as a defined element.

2. The format of the AM data file within the TDP is STEP or NATIVE+STEP (unless otherwise specified).

3. Creation of the .stl or other 3D print file type would be left to the manufacturing organization.

4. AM data file would need the same level of validation/certification and configuration control as the rest of the TDP.

5. Required Mfg. Process Description added as a defined element of the TDP.

6. New DID proposed Required Mfg. Process Desc. for Additive Mfg.

TDP ELEMENTS AND DATA MGT PRODUCTS

TDP ELEMENTS CURRENT:	TDP ELEMENTS PROPOSED:
a. Engineering Design Data b. Special Inspection Equipment (SIE) design data and associated lists. c. Special Tooling design data and associated lists. d. Specifications. e. Software documentation. f. Special Packaging Instruction (SPI) documents, design data and associated lists. g. Quality Assurance Provisions (QAPs).	a. Engineering Design Data b. Special Inspection Equipment (SIE) design data and associated lists. c. Special Tooling design data and associated lists. d. Specifications. e. Software documentation. f. Special Packaging Instruction (SPI) documents, design data and associated lists. g. Quality Assurance Provisions (QAPs). h. Additive Mfg. Data File (AMDF) i. Critical Mfg Process Description/Critical Mfg. Process Description for Additive Mfg.

Thank You.

MIL-STD-31000 & ASME DRAWING STANDARDS

The TDP is defined primarily by MIL-STD-31000 and the ASME drawing standards below:

- ASME Y14.1 Decimal Inch Drawing Sheet Size and Format
- ASME Y14.1M Metric Drawing Sheet Size and Format
- ASME Y14.24 Types and Applications of Engineering Drawings
- ASME Y14.34 Associated Lists
- ASME Y14.35 Revision of Eng. Dwgs. and Associated Documents
- ASME Y14.46 Product Definition For Additive Mfg.
- ASME Y14.47 Model Organization Practices
- ASME Y14.5 Dimensioning and Tolerancing (GD&T)
- ASME Y14.100 Engineering Drawing Practices

WHAT IS MEANT BY MANUFACTURING AGNOSTIC?

- The TDP does not exist for purposes of manufacturing. It exists for purposes of product definition. (It's an engineering document, not a manufacturing document.)

- Therefore, the TDP is "manufacturing agnostic" to the degree possible. This doesn't mean the TDP can be divorced from the manufacturing approach. The intended mfg. approach will greatly influence the design and TDP.

- One exception to "manufacturing agnostic" approach is the Critical Manufacturing Process Description. This is used when the manufacturing technique is critical to performance.

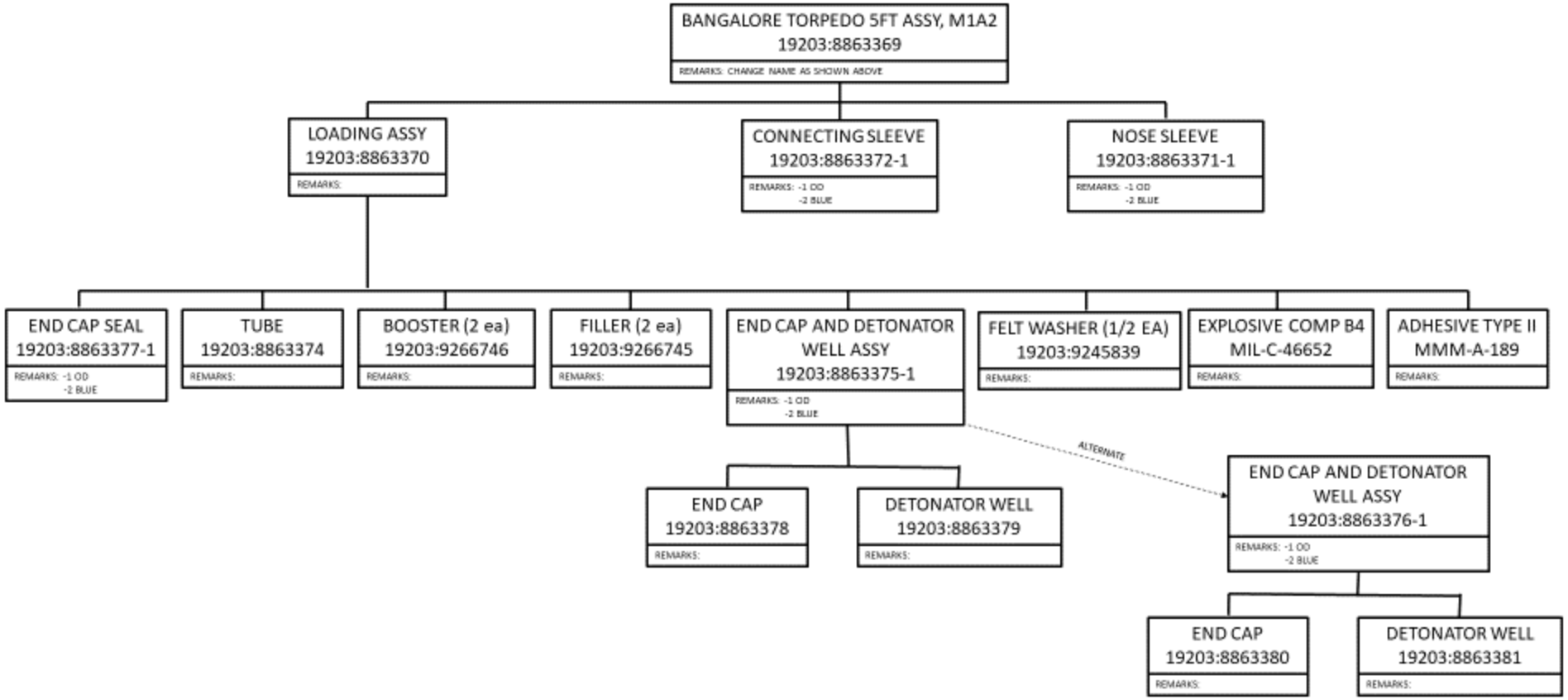
BACKGROUND AND RATIONALE

- Good TDP planning practices are needed to support digital engineering and acquisition efforts.
- Current TDP planning, development, and ordering practices are not well understood, including:
  - Purpose of a TDP
  - How a TDP is used throughout the product's lifecycle
  - 3D TDP requirements
    - Requires specialized knowledge
    - RFP/SOWs are generally not written by CAD or TDP experts
  - TDP Option Selection Worksheet incomplete or incorrect
  - Contract language ordering TDP not clear or specific enough
  - Data Rights are unspecified or not clearly delineated
  - TDP Access vs TDP Delivery vs TDP Control
- **Bottom Line: If the Government doesn't know what they need and contractors don't know what they are being asked to deliver, the resulting TDP will not meet the requirements of the program.**

TDP DATA MANAGEMENT PRODUCTS

- **Engineering drawing tree** - Usually created early in development and used as a “skeleton” or “road map” for TDP creation. Should be delivered and approved by the government early in EMD. Should include manufacturing, logistics and configuration management in the review/approval of the engineering drawing tree as it will impact all those area.
- **Technical Data Package List (TDPL)** - An index of all documents in the TDP. Generally delivered later in EMD after TDP is finished or near completion. A TDPL should be included anytime a TDP is delivered/updated.
- **Document number assignment report** - Used to help track which part number/drawing numbers are assigned to what items. This helps with tracking the program progress and is needed for provisioning and logistics planning.
- **Source control document approval request** - Used for approval of source control drawings. (Source control drawings limit competition and should only be used when necessary.)
- **Proposed critical manufacturing process description** - Used to ensure critical manufacturing processes are necessary and properly defined.

ENGINEERING DRAWING TREE EXAMPLE



TDPL EXAMPLE

08/23/2017

Technical Data Package List
TDPL

SHEET NO ___ OF ___

ITEM NOMENCLATURE	CARTRIDGES, MILITARY PACK – 40MM, M1234 EXAMPLE
TECHNICAL DATA PACKAGE LIST	99999100:19200
DOCUMENT NUMBER	99999100:19200
SPECIFICATION	MIL-DTL-12345
NATIONAL STOCK NO	1305-00-000-1234
CONTRACT NO/PRON ID	W52P1J-17-A-EXAMPLE

SECTION B. PRODUCT DOCUMENTS AND ASSOCIATED LISTS

DOC. TYPE	SPECIAL CODE	DOCUMENT NUMBER	CAGE CODE	REV	DOCUMENT DATE	DOCUMENT TITLE	DIST. CODE	FILE TYPE	NOTE
DR		99999100	19200	D	07/03/2016	CARTRIDGES, MILITARY PACK – 40MM, M1234 EXAMPLE	A	CAD	
DR		99999101	19200	H	12/03/2016	CARTRIDGE, 40MM, EXAMPLE, M1234	A	3DI	
DR		99999110	19200	C	08/15/2016	CASE	D	CAD	
DR		99999111	19200	B	08/15/2016	CUP, CASE	D	PDF	
DR		99999120	19200	G	03/12/2016	PROJECTILE	D	CAD	
DR	DX	99999130	19200	C	03/12/2016	PROPELLANT	D	PDF	
DR	DX	99999140	19200	D	07/08/2016	PRIMER	D	PDF	
DR		99999141	19200	D	07/08/2016	CUP, PRIMER	D	C4	
DR		99999142	19200	D	07/08/2016	ANVIL	D	C4	
DR		99999143	19200	D	07/08/2016	PRIMING COMPOUND	D	C4	
DR	DX	99999150	19200	A	03/12/2016	WATERPROOF	D	PDF	

TDP BACKGROUND

- TDPs provide a technical description of an item which is **clear**, **complete** and **accurate**, in a **form** and **format** adequate for its intended use.

- TDPs define the **physical** and **functional** characteristics of the accepted configuration of the item and its subordinate assemblies, subassemblies, and parts.

- TDPs consist of a **level** and **type** and one or more **elements** as specified in the contract and TDP Option Selection Worksheet.