Preparing for the Future: Structuring Technical Data Packages (TDPs) Today for Digital Data Packages (DDPs) Tomorrow

GLOBAL PRODUCT DATA

INTEROPERABILITY

SUMMIT 2025

BOEING ELYSIUM LOCKHEED MARTIN NORTHROP GRUMMAN Parker PDES, Inc.® Connecting the Digital Enterprise

Phil Spreier, Customer Enagement Lead, Elysium

Agenda

1. **Introduction**
2. **Technical Data Packages (TDP)**
    1. MIL-STD-31000
    2. VDA 4953-2
3. **Digital Data Packages (DDP)**
4. **Recommendations and Best Practices**
5. **Future Directions and Innovations**
6. **Q&A and Discussion**

4 years working at Elysium in the Customer Engagement Lead role

Remote worker (living in Bend, Oregon, team in Southfield Michigan)

Experienced in

- 3D Modeling kernels (ACIS)
- CAD Interoperability (Spatial, Tech Soft 3D, Elysium)

Experienced in ISO Standards

- Member US TAG TC 171 SC 2 (PDF Standards)
- Member US TAG TC 184 SC 4 JWG 16 (Industrial Data)

3D PDF SME

What is a Technical Data Package?

NISTIR 7749 - Model Based Enterprise - Technical Data Package Requirements

- A technical data package (TDP) contains a technical description of an item adequate for supporting an acquisition strategy, production, engineering, and logistics support.
- The description defines the required design configuration or performance requirements, and procedures required to ensure adequacy of item performance.
- It consists of applicable technical data such as models, drawings, associated lists, specifications, standards, and performance requirements.

TDP Data Content

Annotated Models

Fully annotated 3D models that include all necessary design, manufacturing, and sustainment information.

Bills of Materials (BOMs)

Engineering Bill of Materials (EBOM) and Provisioning Bill of Materials (PBOM) derived automatically from the Product Lifecycle Management (PLM) system.

Specifications and Standards

Clear references to applicable specifications, standards, and quality assurance requirements.

Metadata

Searchable metadata to ensure easy access to product information.

Supporting Documents

Documents such as technical manuals, inspection reports (e.g., AS-9102), and configuration management records.

TDP Data Content (continued)

Certification and Validation

- Certified Models:
  - Models validated for accuracy and completeness, with certification processes clearly defined.
- Validation Tools: Archival and Retrieval standards to ensure data accessibility over the lifecycle.

TDP - Format and Delivery

Native, Neutral, and Viewable Formats:

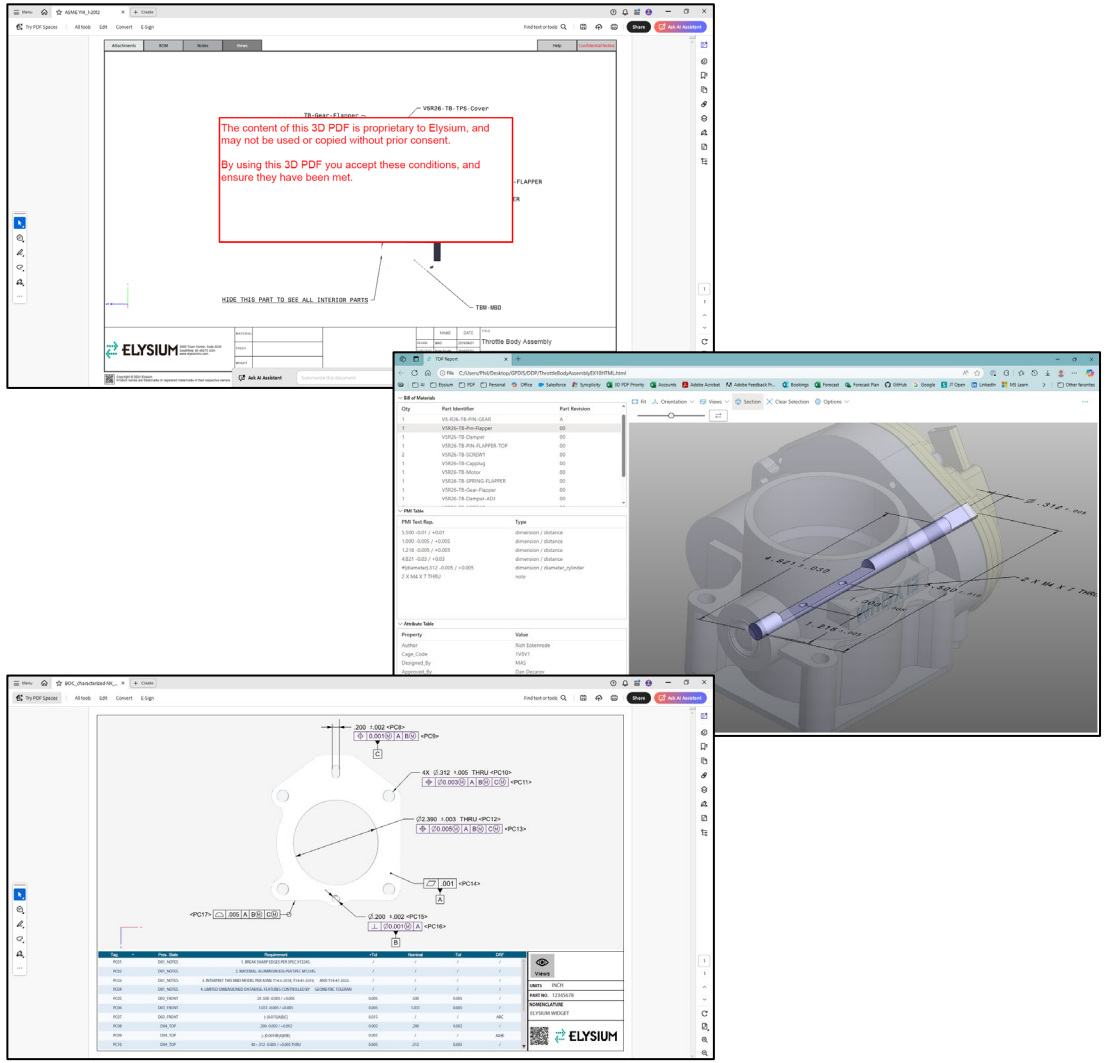
Models delivered in native CAD formats, validated neutral formats (e.g., STEP APs), and viewable formats accessible across the supply chain, such as 3D PDF

Interoperability Standards:

Compliance with standards like STEP, S1000D, and ASME Y14.41 to ensure compatibility and usability across systems.

Validated Translation Processes:

Ensuring data integrity during format conversions.



MIL-STD-31000: The DoD Standard for Technical Data Packages

Purpose

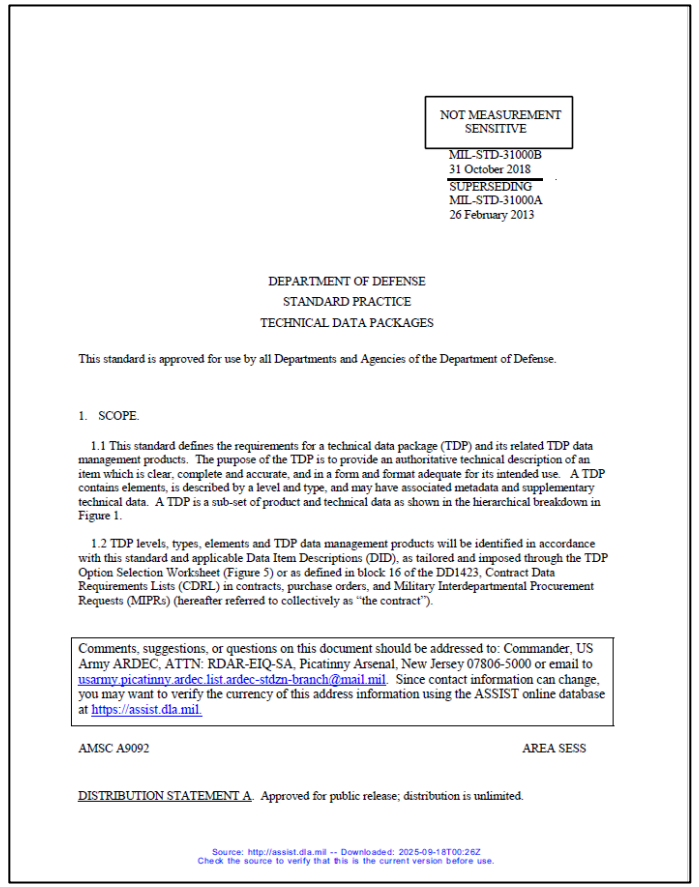
- An authoritative technical description of an item that is clear, complete, accurate, and in a form and format adequate for its intended use

TDP Levels:

- **Conceptual Level**
  Defines design concepts, often with simple sketches/models and basic textual data.
- **Developmental Level:**
  Provides data for analysis of a specific design, fabrication of prototypes, and limited production.
- **Product Level:**
  Offers comprehensive design, performance, manufacturing, inspection, and quality assurance information to enable procurement or manufacture by any competent manufacturer without additional design effort.

Emphasis on 3D data

- **3D TDPs** are a core offering, explicitly including **3D native models**, **neutral CAD data** (e.g., STEP files), and **viewable CAD data** (e.g., **3Di PDF**).
- **3Di technical data** is defined as a 3D viewable representation (often PDF) that details the complete technical description, including geometry, topology, relationships, tolerances, attributes, and metadata.
- See DI-SESS-82351A for requirements



NOT MEASUREMENT SENSITIVE

MIL-STD-31000B
31 October 2018
SUPERSEDING
MIL-STD-31000A
26 February 2013

DEPARTMENT OF DEFENSE
STANDARD PRACTICE
TECHNICAL DATA PACKAGES

This standard is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE.

1.1 This standard defines the requirements for a technical data package (TDP) and its related TDP data management products. The purpose of the TDP is to provide an authoritative technical description of an item which is clear, complete and accurate, and in a form and format adequate for its intended use. A TDP contains elements, is described by a level and type, and may have associated metadata and supplementary technical data. A TDP is a sub-set of product and technical data as shown in the hierarchical breakdown in Figure 1.

1.2 TDP levels, types, elements and TDP data management products will be identified in accordance with this standard and applicable Data Item Descriptions (DID), as tailored and imposed through the TDP Option Selection Worksheet (Figure 5) or as defined in block 16 of the DD1423, Contract Data Requirements Lists (CDRL) in contracts, purchase orders, and Military Interdepartmental Procurement Requests (MIPRs) (hereafter referred to collectively as "the contract").

Comments, suggestions, or questions on this document should be addressed to: Commander, US Army ARDEC, ATTN: RDAR-EIQ-SA, Picatinny Arsenal, New Jersey 07806-5000 or email to usarmy.picatinny.ardec.list.ardec-stdzn-branch@mail.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST online database at https://assist.dla.mil.

AMSC A9092 AREA SESS

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

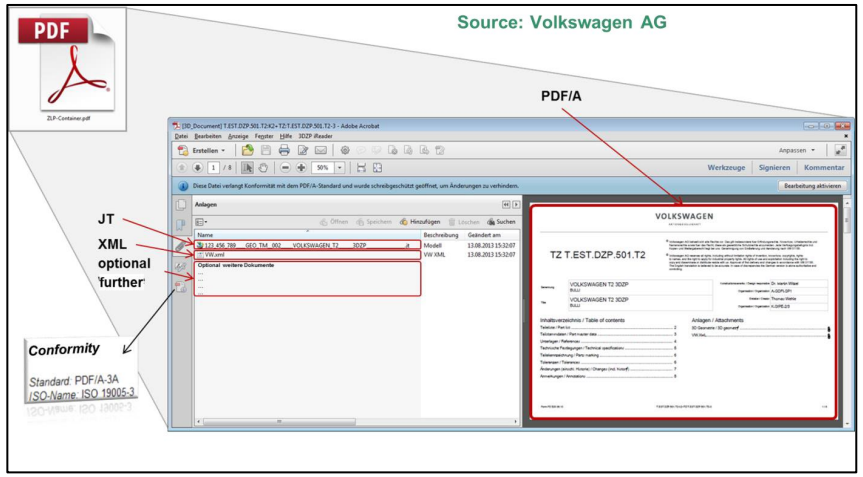
VDA 4953-2: Drawing-free Product Documentation in Automotive

Published by the German Association of the Automotive Industry (VDA)

introduces the "DFP container" (PDF/A-3) as the core mechanism for bundling product documentation.

This container combines various elements to create a comprehensive, system-neutral document:

- **3D Portion:** Contains the annotated geometry representation, typically in **JT format** (ISO 14306). The 3D model serves as the **primary documentation of geometry**.
- **Metadata Portion:** Includes structured metadata in **STEP AP242 BO XML format** (ISO 10303-242). This covers non-geometrical, organizational, and technological data related to the overall part.
- **Presentation of Metadata:** Rendered in **PDF/A format** (ISO 19005). This acts as the central display and often the "home page" for the DFP container.
- **Optional Elements:** Additional user-defined components suitable for long-term archiving can be included.



Innovated by prostep ivip (DDP working group)

- Developed to address increasing adoption of model-based engineering (MBE), digital thread and digital twin technologies
- Mission is to include all standard formats for model-based systems engineering (MBSE) across the V-Model
- Emphasis on data collaboration using cross-domain linked data.

Digital Data Package (DDP) Definition

- A standardized container format for the exchange of machine-readable and human-readable product data.
- Enables seamless data exchange and collaboration on semantic product data linked across different standard formats and domains throughout the entire product lifecycle.
- Designed to resolve data collaboration conflicts and provide a unique solution to business challenges in complex product development.
- Allows organizations to create and share a "digital thread" based on linked Model-Based Systems Engineering (MBSE) standards along the V-Model, enabling the exchange of engineering data for a digital twin.

DDP - Core Concept & Structure

A container file (PDF/A-3 or ZIP) that encapsulates three main components:

- **Domain-specific, standards-based documents**
  Such as ReqIF, SysML XMI, STEP AP242, JT, FMI, SSP, I++, VEC, or URLs to resources.
- **A dictionary**:
  Contains all relevant entities and relations extracted from neutral format files, including cross-format and cross-domain links, and relations added by the author.

A visual and interactive content overview

- Generated from the dictionary and rendered as PDF content or HTML5 (for ZIP), allowing human-readable and interactive review without specific software.

Introduce DDP concepts into your TDP today

- Choose a container file format
- Include a 3D viewable
- Attach or link to domain-specific, standards-based documents
- Include a Dictionary

Two common file formats used as a DDP container

- ZIP (ISO/IEC 21320-1)
  - Unstructured, compressed, secure
- PDF/A-3 (ISO 19005-3)
  - Structured, compressed, secure, archivable
  - No embedded 3D viewable, must be an attachment

I would suggest an alternative container that is appropriate for most use cases…

- PDF (ISO 32000)
  - Commonly used for Technical Data Packages
  - Structured, compressed, secure, allows embedded 3D

Include a 3D Viewable

PDF

- Use PRC (ISO 14739)

PDF/A-3

- Include 3D viewable as an attachment
- Make sure description field is filled out

ZIP

- Include 3D viewable in the ZIP file

Attach Or Link To Domain-Specific, Standards-Based Documents

PDF

- Link whenever possible
- Add description to attachments
- Potential to add button or hotkey to launch attachments

PDF/A-3

- PDF/A-3 explicitly excludes external file references. All associations must be made through attached files, not through links to external resources.

ZIP

- Include documents in the ZIP file

Include a Dictionary

XMP

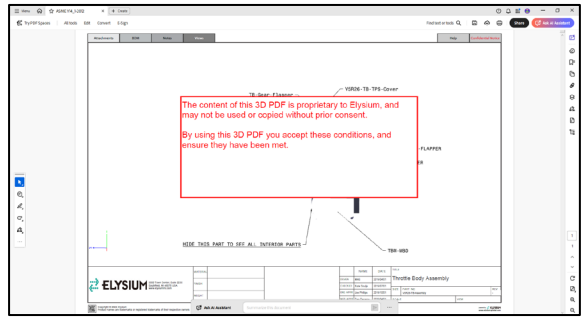
- You can use standard schemas like Dublin Core, Adobe PDF, EXIF, Photoshop, etc., directly within the XMP metadata stream.
- You can embed an XMP Extension Schema describing any custom metadata properties. This ensures future interpretability and compliance.
- XMP metadata must conform to RDF syntax rules..

PDF/A-3

- PDF/A-3 mandates the use of XMP metadata to identify conformance to the PDF/A standard

ZIP

- The ZIP format includes basic metadata like compression method, CRC checksums, and timestamps.
- Each file inside the ZIP archive retains its own metadata (e.g., filename, modification date, permissions)
- Limitations:
  - ZIP files do not support structured metadata like XMP or RDF natively.
  - Metadata is generally not searchable or indexable unless extracted and processed externally..



Take Aways

Digital Data Packages are the future for exchanging and collaborating using linked data

You can begin your DDP journey by enabling key concepts in your current TDP:

- 3D Viewable
- Linked Data
  - Consider using Hyperlinks or launching attachments in your TDP
- Dictionary
  - Create a metadata dictionary using XMP

Train your user community

- Track their feedback for continuous improvement