Connecting the MBE: Integrating 3D Technical Data Across the Life-Cycle

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Situation

• Model Based Enterprise (MBE) is the new standard for lifecycle management of weapon systems
  – System definition optimized around a core set of product models
  – Promises rapid, seamless, efficient, and affordable deployment
  – Source model created during system design phase then reused across DoD enterprise throughout the lifecycle (design to disposal)

• Proficient employment of MBE requires models to include more than just geometry to support a wide range of uses
  – Designers/modelers must consider system lifecycle needs (beyond design)
  – Digital Master should be the bedrock for manufacturing, provisioning, cataloging, maintenance, overhaul, parts procurement, and other operations and sustainment processes throughout the lifecycle
60% of System Total Costs Result from Operations and Support, which covers 75 – 85% of the Lifecycle
Digital Master **Must** Support Multiple Needs

Each area of Life Cycle Support comes with its own (and sometimes) unique data requirements that must be supported by the Digital Master.
Digital Master **Must** Support Parts Procurement

- Configuration Management
- Product Support Management
- Maintenance Planning & Management
- Depot Work Instructions
- IETMs
- Design Interface
- Non Graphical Attributes
- Parts Procurement (Sustainment)
- PHS&T
- Provisioning
- Support Equipment
- Sustaining Engineering
- Training and Training Support
The “39” Data Elements Required by DLA

- Specifications
- Dimensions
- Tolerances
- Welding requirements
- Materials (ballistics)
- Temper
- Heat treatments
- Finishes
- Rights in Data
- License Agreement
- Distribution Statement
- Document Type—Parts List, Detailed Drawing, Assembly List, Quality
- Assurance Provision, etc.
- Security code
- Tech data availability code
- Foreign secure
- Nuclear
- Subsafe
- Control code
- Legibility
- Completeness
- Restrictions
- Document approval
- Document title
- Document number
- Revision and date
- Revision type
- Expiration date
- Document data code
- Size of drawing, number of sheets, frames
- Call outs
- Sources
- First Article Test requirements
- Inspection requirements
- Higher level contract quality requirements
- Part number
- NSN
- Export control
- Commercial and government entity (CAGE) code
Solution Recommended by DLA

PDF\textsuperscript{1,2} with embedded 3D geometry and ancillary files attached as necessary.

Solution Recommended by DLA

PDF¹,² with embedded 3D geometry and ancillary files attached as necessary. PDF document can be read using Adobe Reader

- Widely available (installed on all DoD computers and ~90% of commercial computers)
- Software is available via free web download
- PDF format is intuitive to navigate

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Embedded precise 3D geometry\(^3\) provides the reader a convenient way to visualize the product and to make measurements that may not have been explicitly documented

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Neutral file solution for shape data and when available PMI data\textsuperscript{4}
- Provides full product definition
- Includes shape definition that can support system engineering, modeling & simulation, and manufacturing
- Meets TDP ‘publishing’ requirements
- Is a stand-alone product

\textsuperscript{1} Concept of Operations for DLA Procurement of Weapon System parts Using 3D Technical Data, LMI Report DL309T1, September 2014  
\textsuperscript{2} ISO 32000-1:2008 Document management -- Portable document format -- Part 1: PDF 1.7  
\textsuperscript{3} ISO 14739-1:2014 Document management -- 3D use of Product Representation Compact (PRC) format -- Part 1: PRC 10001  
3D PDF Demo: What it Tested
Three different parts
– Cable Sheave Guide, NSN 5340-01-608-4916
– Brake Shoe Cam, NSN 1005-00-701-2756
– Retaining Bearing Plate, NSN 3110-01-003-1296
Three different DLA Supply Chains
– Troop Support; Industrial Hardware (Philadelphia)
– Land & Maritime (Columbus)
– Aviation (Richmond)
DLA Operationally Tested the 3D PDF Solution

Process for procuring a part

Three different ESAs
- NAWC Lakehurst (Navy)
- ARDEC Rock Island (Army)
- Warner Robins (Air Force)
DLA Operationally Tested the 3D PDF Solution

Demo proved the viability of a 3D Technical Data Package using PDF!
Results of three demonstration projects

Cable Sheave Guide
• Small Midwest fabrication shop used 3D PDF file to build part
• Test articles delivered to NAWC Lakehurst
• Validated to the PDF data

Brake Shoe Cam
• Picatinny Arsenal used 3D PDF file and STEP to build part
• STEP file used for nominal geometry
• PDF used to obtain PMI
• Validated to the PDF data

Retaining Bearing Plate
• Small Western hardware manufacturing company
• Manufacturer cancelled the contract.
• The Technical Data Package was not an issue
Conclusions from 3D PDF Demo R&D Project

• DLA can use PDF 3D Technical Data Packages and STEP files in daily procurement operations
• Suppliers can use PDF 3D Technical Data Packages and STEP files for bid preparation, project planning and parts manufacture
• The use of templates and strict adherence to process rules are necessary to generate 3D Technical Data Packages that comply with DLA requirements from the authoritative model based definition.
• No process changes are required for transfer of PDF 3D Technical Data Packages and STEP files from ESA to DLA
• No procurement process changes are required for DLA use of PDF 3D Technical Data Packages and STEP files

3D PDF Solution Works!!!
Summary: Key Take Aways

- System designers/modelers need to consider and include data needs of many different life cycle users when building models.
- Need human-readable formats for most downstream users.
- Need comprehensive and fully annotated models to support generation of 3D PDF documents.
- DoD Policy/Standards need to be updated.
- Contracts with OEMs/builders must require applicable data in appropriate formats.
- DLA R&D is conducting 3D TD projects in FY18 – FY19 and seeking partners.
Help us, help you!!!

**DLA is seeking partners for identifying and testing 3D PDF and other neutral format solutions.**

- ISO 14306:2017 Industrial automation systems and integration -- JT file format specification for 3D visualization
- HTML 5.2 World Wide Web: the Hypertext Markup Language (HTML)
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