Don’t Do Digital Design Wrong:
3D Technical Data Use Doesn’t End at Design

MBE Summit 2017

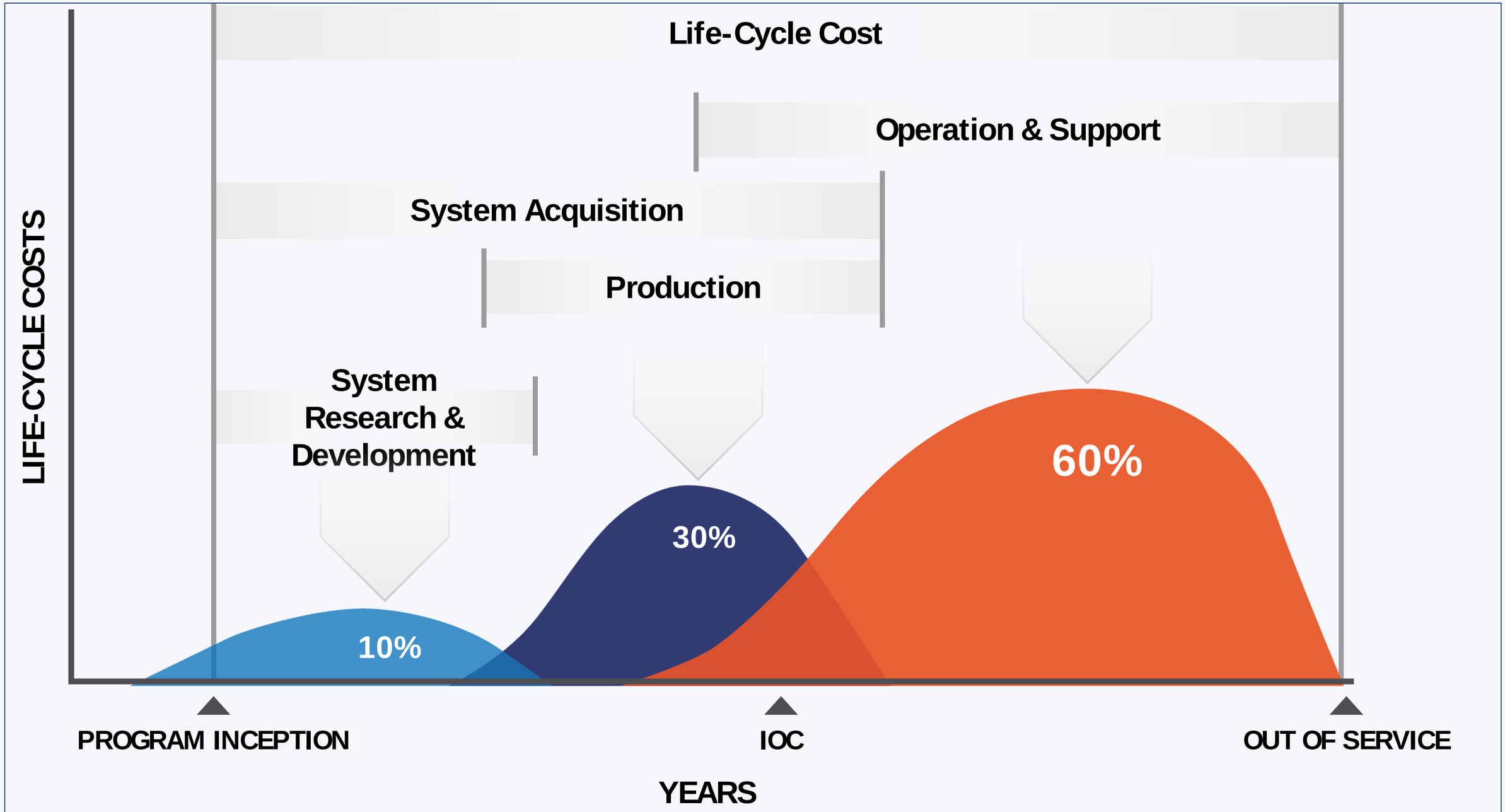
Tom Parks
April 6, 2017

LMI

Situation

- CAD/CAM has become the de facto means for design/ manufacturing – digital information is king
- Traditionally, CAD models are developed/optimized to support product design
- Model Based Enterprise (MBE) is becoming the new standard for life cycle management of weapon systems
  - Digital tapestry optimized around a core set of product models
  - Promises rapid, seamless, efficient, and affordable deployment of systems/products
  - Source model is created at beginning of the lifecycle then reused across the enterprise throughout product lifecycle (design through disposal)
- Effective employment of MBE requires models to include more information, covering a wide range of uses
  - Designers/modelers must think about the system lifecycle (beyond design)
  - Digital Master should be the bedrock for manufacturing, supporting, and maintaining a system throughout the lifecycle

System Life Cycle vs Cost*



60% of System Total Costs Result from Operations and Support, which covers 75 – 85% of the Lifecycle

LMI

*Data source is "Operating and Support Cost Estimating Guide", 2014
https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=e8a6d81f-3798-4cd3-ae18-d1abafaacf9f

Digital Master Must Support Multiple Needs

Product Support Management

Configuration Management

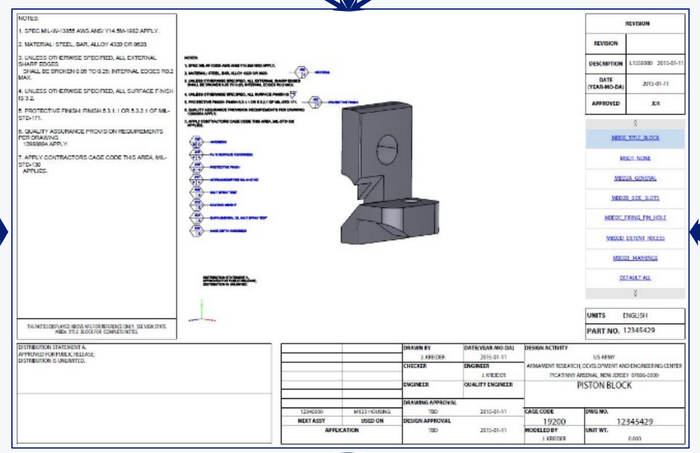
Maintenance Planning & Management

Depot Work Instructions

Parts Procurement (Sustainment)

IETMs

PHS&T



Design Interface

Provisioning

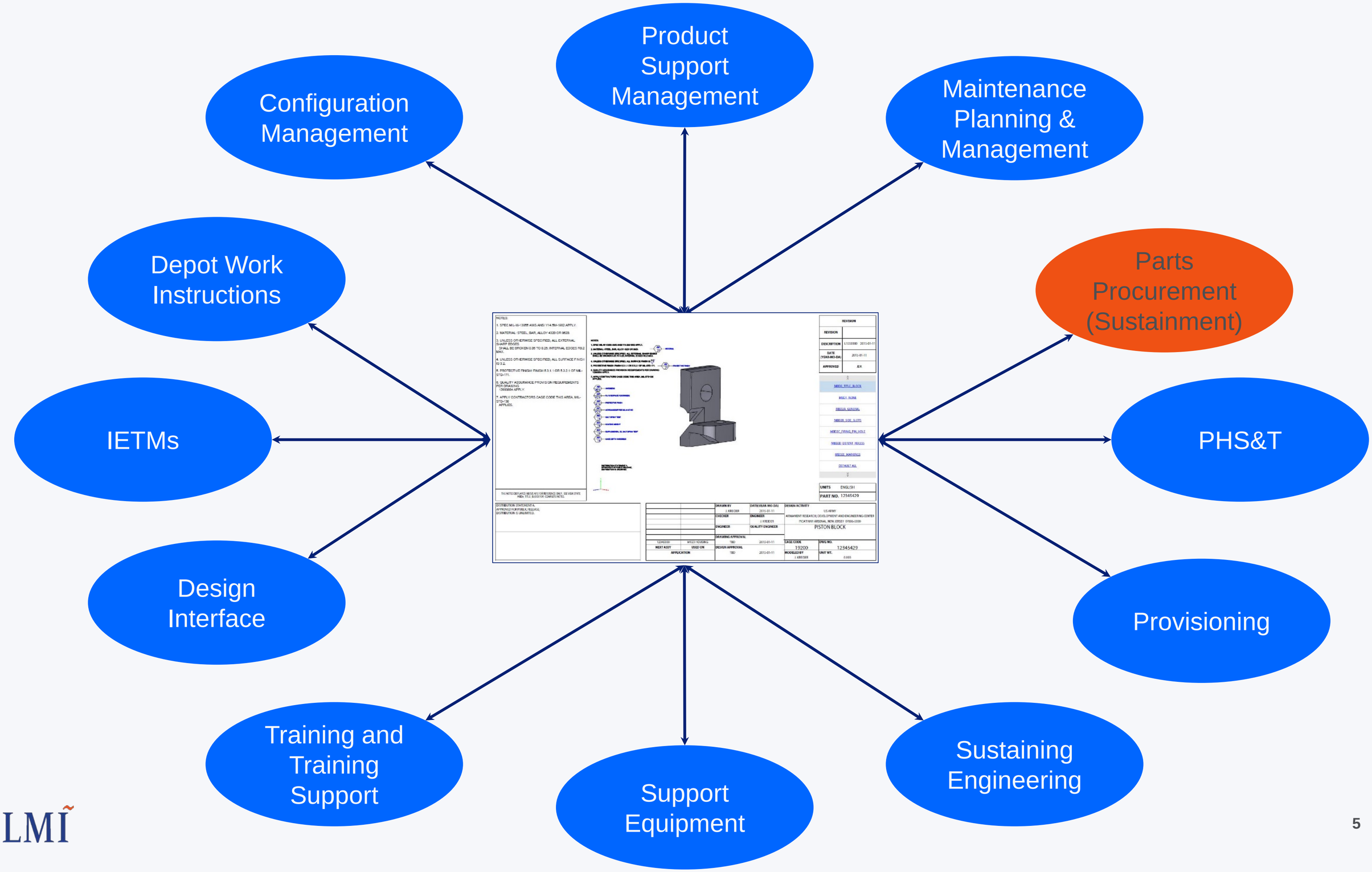
Training and Training Support

Support Equipment

Sustaining Engineering

LMI

Digital Master Must Support Multiple Needs



Digital Master for Sustainment: What's required of the 3D model/technical data?

- To support acquisition of sustainment parts, 3D technical data must:
  - Include a data set sufficiently complete to allow third parties to manufacture the item
    - Metadata beyond geometry
  - Provide acquisition personnel ability to easily view/read design information
    - Format must be human-readable and intuitive
    - Must be able to verify inclusion of specific data
  - Be readily useable and readable by potential suppliers/manufacturers
    - Format must be human-readable and intuitive
    - Format cannot require purchase of software to view/use the data (government fairness paradigm - avoid protests)

What are the options; what's the solution????

Comparison of Options

Options	**Requirements**		
	Full Data Access	Easily Locate Data	Supplier Accessibility to Data
(1) Provide/purchase S/W for each unique CAD Platform			
(2) Provide TDPs in One CAD Format			
(3) Provide TDPs in Neutral Format (3D PDF + STEP file)			

 Low cost solution

 High cost solution

 Does not meet requirement

Option 3 (3D PDF + STEP file) satisfies all the requirements!

LMI

Recommended Solution*: 3D TD Format for Acquisition of Sustainment Parts

- 3D PDF (PRC** format) + STEP file (AP203 format)
  - 3D PDF document can be read using Adobe Reader or Adobe Acrobat software
    - 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
  - 3D PDF + STEP is a neutral file combination that provides full product definition, includes geometry to create machine code for CNC manufacturing, meets TDP ‘publishing’ requirements, and is a stand-alone product
- Caveat: preferred format may change over time

LMI

* Concept of Operations for DLA Procurement of Weapon System parts Using 3D Technical Data, LMI Report DL309T1, September 2014

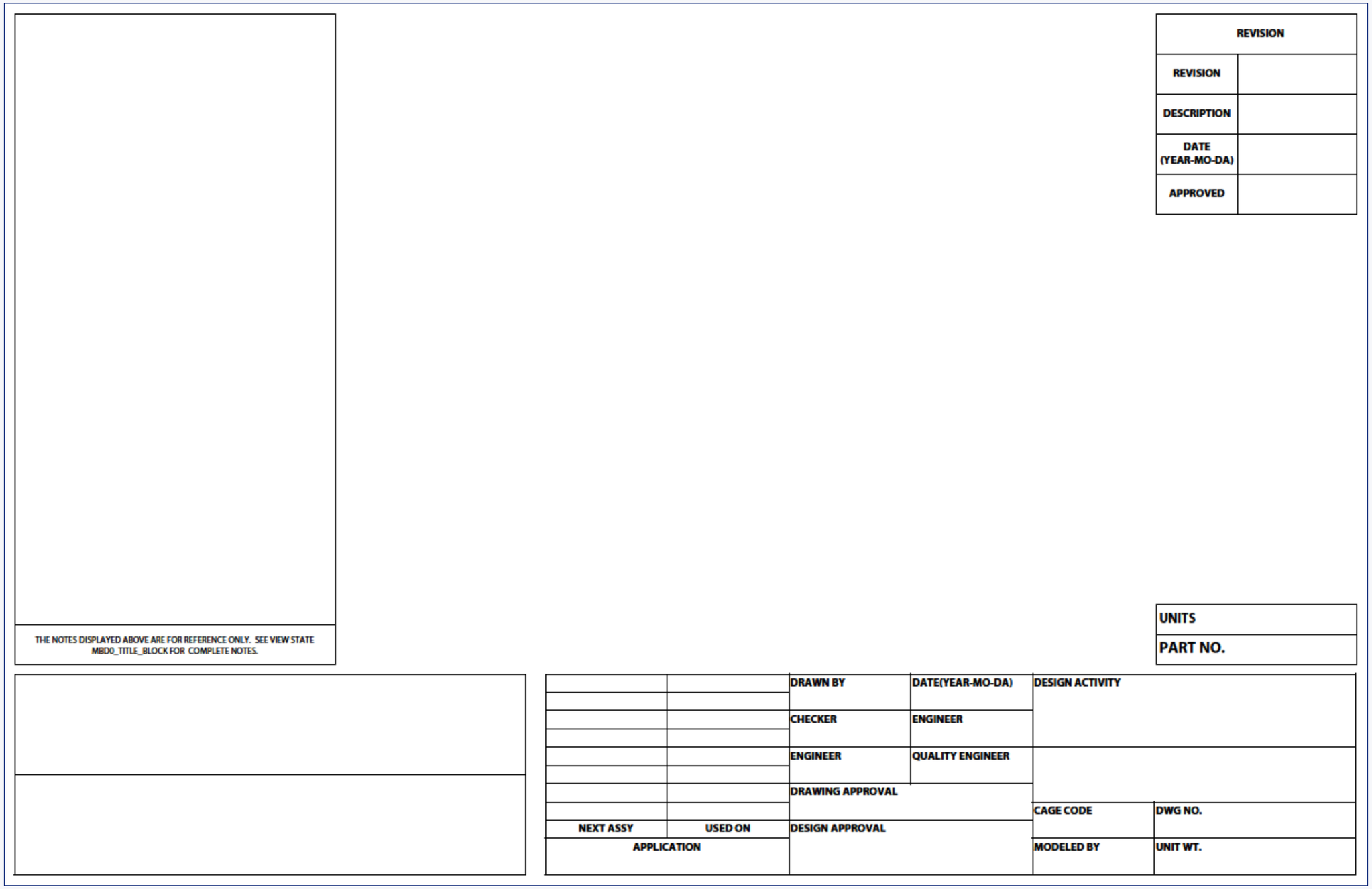
** Product Representation Compact

How do you produce a 3D PDF document?

- Use ‘built-in’ CAD software capability
  - Not available for all CAD platforms
  - Output format and completeness varies
  - Output templates may/may not support ‘tailoring’
- Use CAD ‘add-on’ conversion software
  - Varies by CAD platform
  - Output format and completeness varies
  - Output templates may/may not support ‘tailoring’
- Use third party conversion software
  - Multiple vendor packages available
  - Desk-top and server solutions available
  - Output format and completeness varies – templates can be tailored
- Digital Master must contain required information* (slide 19) and it must be annotated in the model, irrespective of conversion method/software

Native file model must include required data and must be annotated to produce useful 3D PDF file

3D PDF File Example



Proposed End-state for DoD Acquisition of Sustainment Parts

- OEMs/system designers develop and deliver annotated models with requisite data set to support sustainment (see slide 18)

- Military Services (PMOs, ESAs) acquire or develop complete and validated 3D technical data in 3D PDF (PRC) and STEP (AP203) file formats and provide it to appropriate acquisition organizations

- DoD acquisition organizations use 3D PDF (PRC) and STEP (AP203) files to build solicitations for weapon system parts procurement

Achieving the End State

- DLA commissioned R&D Task as ‘proof of process’ for procurement of parts using 3D PDF + STEP file
  - LMI & ATI coordinating 3D PDF Demo
  - DLA Supply Chain participants
    - Aviation
    - Land & Maritime
    - Troop Support
  - Service participants (Engineering Support Activities)
    - ARDEC
    - NAWC Lakehurst
    - Warner Robins
  - DCMA participating

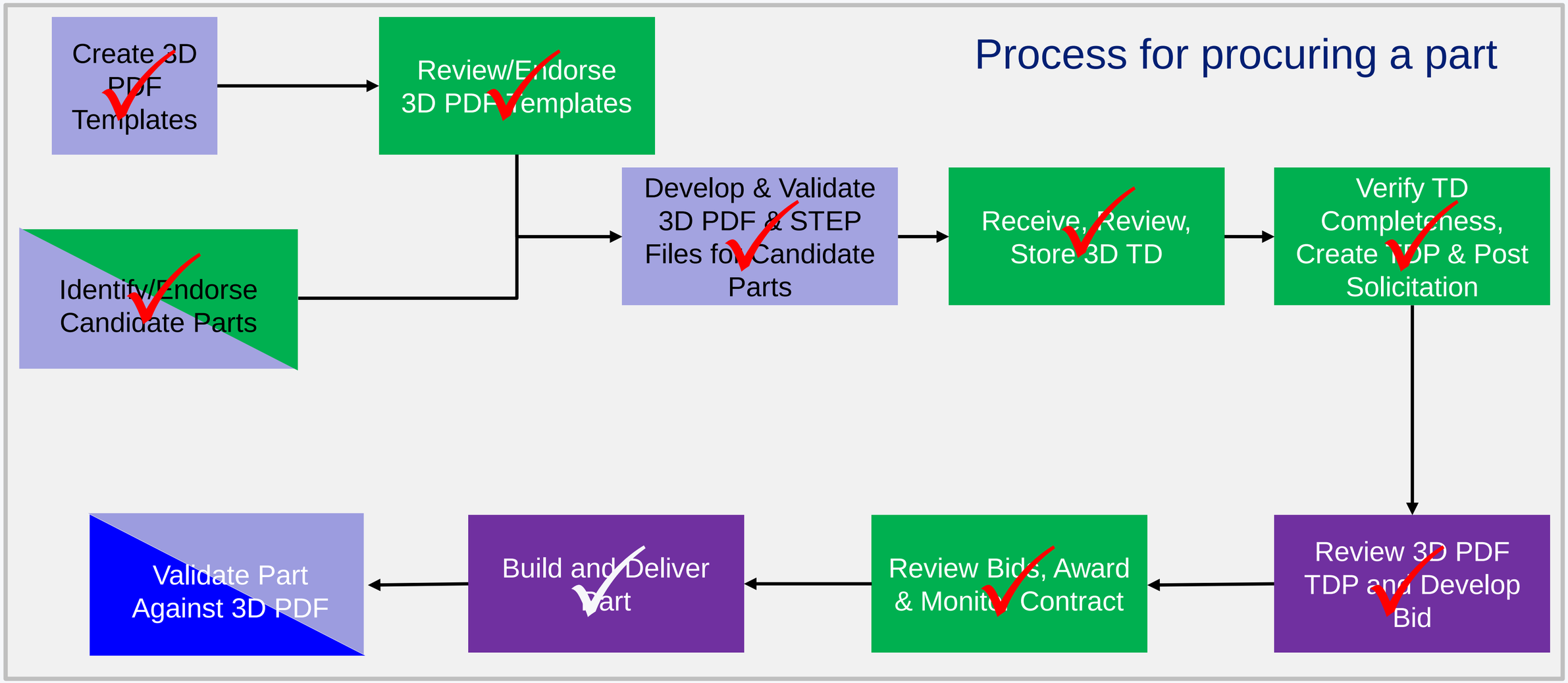
DLA 3D PDF Demo Objective

- Demonstrate/assess DLA's capability to acquire real parts (Class IX items)* using only 3D PDF technical data plus a STEP file (AP203)
  - Includes demonstrating/assessing ESA processes to deliver 3D PDF technical data to DLA
  - Includes DLA ability to receive and use 3D PDF technical data from ESAs
  - Includes assessing supplier's ability to use 3D PDF and STEP files
  - Includes DCMA's ability to use 3D PDF data for on-site inspection

LMI

* Parts are for R&D purposes only and will not be inserted into the operational supply chains

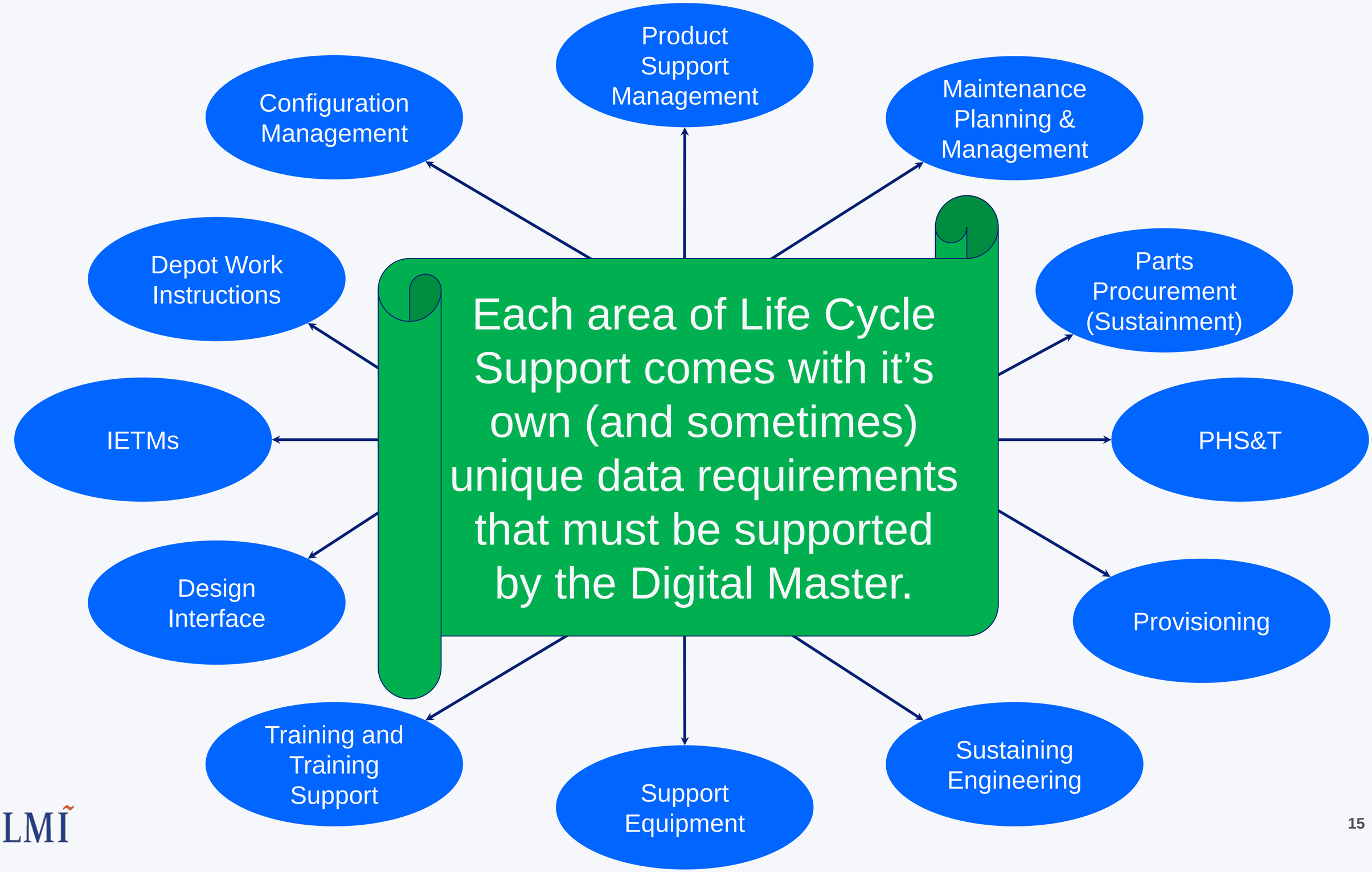
3D PDF Demo: What We've Accomplished



Key

- ESA
- DLA
- DCMA
- Supplier
- ✓ Completed
- ✓ In process

Digital Master Must Support Multiple Needs



Summary: Don’t Do Digital Design Wrong

- System designers/modelers need to consider and include data needs of downstream life cycle users when building models
- Need neutral/human-readable formats (3D PDF) for most downstream users
- Need comprehensive and fully annotated models to support generation of 3D PDF documents
- DoD Policy/Standards needs to catch up with 3D TD use
- Contracts with OEMs/builders must require applicable data in appropriate formats
- DLA R&D is conducting 3D TD projects in FY17

Points of Contact

- Emily Baigis (DLA R&D Sponsor)
  - 215-737-5781
  - Emily.Baigis@dla.mil
- Tom Parks (Project Leader)
  - 703-917-7223
  - tparks@lmi.org
- Dick Tiano (Tech Data SME)
  - 843-760-3333
  - dick.tiano@ati.org

BACKUP

Data Elements and Attributes Required by DLA as part of 3D Technical Data Package (TDP)* for Procurement

- 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

LMI

* Concept of Operations for DLA Procurement of Weapon System Parts Using 3D Technical Data , Appendix A, LMI report DL309T1, September 2014