Assessing the use of PDF based 3D Technical Data Packages within the defense industrial base

Conducted by:

Catalyst Connection

Allison Haag

Anna Mancuso

Thomas Meshanko

Jeanne Straw

Debbie Wright

Sponsored by:

US Army's Armament Research, Development & Engineering Center (ARDEC)

The National Institute of Standards and Technology (NIST)

Background: What is a 3DTDP and why is it relevant?

- A 3DTDP is a PDF document that provides product information in a 3D interactive, fully-annotated format.
- The 3DTDP can be viewed with the standard and free Adobe viewer. It places no additional cost or burden on the entity viewing the data
- The 3DTDP includes design, manufacturing and systems integration data.
- The 3DTDP enables the DoD to phase out the use of 2D drawings and achieve cost and lead time reductions by eliminating recursive data translation operations

Key Objectives – 3D TDP Assessment

- **Connect** with individuals at supplier companies that are responsible for
  - receiving technical data and models
  - handling quotes/estimation
  - working with models related to design/production
- **Drive target decision makers** to view online demonstration/example of the 3D TDP tool and video instructions to describe key features and usage of 3D TDP
- **Gather Feedback** from the ARDEC supplier base after review and demonstration of the 3D TDP tool
- **Identify** which features of the 3D TDP are most useful and **determine** if there is anything important missing that is needed to make a part
- **Learn** how the 3D TDP will be used at supplier companies
- **Prepare** supplier base for roll-out of 3D TDP

Summary of Results

- Outreach to **309 contact targets** in Army supply chain resulted in **46 completed surveys**
    - 15% response rate

- All 46 respondents **reviewed the 3D TDP** prior to completing the survey

- Nearly the entire sample stated that they are in one or more of the following roles at their companies:
    Receiving technical data and models (n=40)
    Handling quotes and estimation (n=38)
    Working with models related to design (n=37)

- **89% of the respondents** said that the 3D TDP contains all of the information needed to make a part

Summary of Results

- The **"most liked" feature** of the 3D TDP was the **3D rotation and zoom**
  - Compiled from top-of-mind unprompted answers

- **Imbedded CAD and .STP files (91.3%)** and **Fully-annotated 3D viewable (87.0%)** were rated as the 2 "most useful" features of the 3D TDP

- **89%** of respondents feel that the **3D TDP is better or much better** than 2D drawings for conveying design intent.

Summary of Results

- **84.4%** of respondents plan to use the 3D TDP in their **manufacturing planning**
- **76.1%** of respondents plan to use the 3D TDP to develop their **CAM program**
- **73.9%** of respondents plan to use the 3D TDP as an **instrument to convey intent for shop floor**
- In addition to these assessment responses there is a **rich amount of additional feedback and miscellaneous comments** from respondents
  - Candid feedback from the 5 (out of 46) respondents thought something was missing from the 3D TDP
  - Freeform and top-of-mind responses about what they liked about the 3D TDP resulted in a wide variety of responses
  - 23 respondents gave insight on additional ways they will use the 3D TDP in the operations at their company

BACKUP MATERIAL

Q1 – Have You Reviewed the 3D TDP?

- The target contacts were guided to review the 3D TDP **before** proceeding to the assessment tool
- The assessment was designed to "kick out" and direct respondents to the 3D TDP if they answered no to this question

Value	#	%
Yes	46	100%
No	0	0%

Q2 – Role of Respondent

- The instructions in the outreach letter tried to ensure that the respondents of this assessment were decision makers related to receiving technical data, handling quotes and working with models.

- Respondents were able to choose multiple selections for this question.

Which of the following are you involved with?	#
Receiving technical data and models	40
Handling quotes and estimation	38
Working with models related to design	37
Working with models related to outsourcing	26
Other	6

Q3 – 3D TDP contains all the information needed to make a part?

- 89% of respondents said that the 3D TDP contains all of the information needed to make a part.
- The following page details some of the reasons behind the 5 respondents that answered no.

Value	#	%
Yes	41	89.1%
No	5	10.9%

Q4 – What is missing from the 3D TDP?

- The following are details from the 5 respondents who thought something was missing from the 3D TPD

What was missing?
It contains the data needed only if the source CAD files and .STP files are attached and the tolerances, paint specs are listed
It doesn't appear that the geometric file (STEP, DXF, ETC) was evident. It appears that they're imbedded, but we would need them readily available.
Tolerances
We did not see the ability to print only the information contained in the part window. The video references the ability to make prints; however, it is not clear if the print would be made using the supplied model or viewer
We would need to extract mass properties. We would need the ability to section cut the model in order to determine core designs, if required

Q5 – What do you like about the 3D TDP?

- Most prevalent responses sorted to the top of the following table:

Compiled Responses	#
3D rotation and zoom	9
Drawing and 3D model are viewable in one location on any computer	6
Review all notes, specifications and dimensions	4
Attached STP file saves redrawing part	3
Easily viewable	3
Ease of use without having to load CAD software	2
Everything	2
Full representation of the part for quoting purposes and manufacturing	2
Provides necessary information needed to estimate, inspect and verify the part	1
Multiple views at the bottom of the page	1
Basic Tool	1
CAD like viewing - can visualize every feature detail	1
Ability to export the associated STP file	1
Having print and model form	1
Quick and responsive	1

Q6 – Usefulness of 3D TDP features

- **Imbedded CAD and .STP files (91.3%)** and **Fully-annotated 3D viewable (87.0%)** were rated as the 2 most useful features

Feature	#	Top Box (5) % extremely useful	Top-2-Box (4 or 5) % useful	Average out of 5	Variance
Imbedded CAD & .STP files	46	73.9%	91.3%	4.65	0.41
Fully-annotated 3D viewable	46	65.2%	87.0%	4.52	0.52
Printing of 2D views	46	52.1%	73.9%	4.15	1.15
Parameters Table	46	32.6%	71.7%	3.98	0.82
Interactive thumbnails	44	29.6%	68.2%	3.95	0.70
Thumbnail scrolling feature	44	27.3%	59.1%	3.75	0.98

Q6 – Usefulness of 3D TDP features

- The attribute that had the 3rd highest ratings was **Printing of 2D views. 73.9% of respondents said Printing of 2D views** was very useful or useful but it also had the highest variance (1.15)

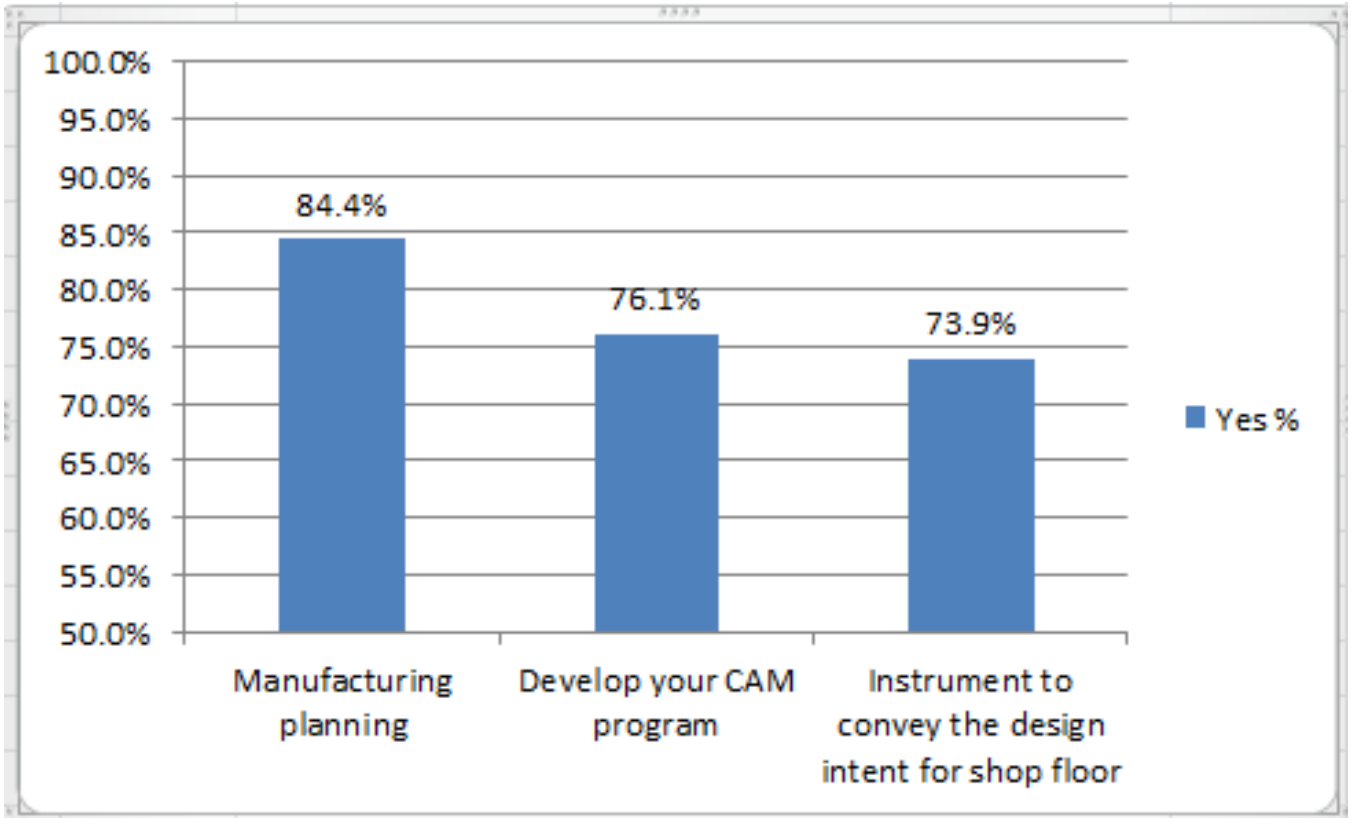
Feature	#	Top Box (5) % extremely useful	Top-2-Box (4 or 5) % useful	Average out of 5	Variance
Imbedded CAD & .STP files	46	73.9%	91.3%	4.65	0.41
Fully-annotated 3D viewable	46	65.2%	87.0%	4.52	0.52
Printing of 2D views	46	52.1%	73.9%	4.15	1.15
Parameters Table	46	32.6%	71.7%	3.98	0.82
Interactive thumbnails	44	29.6%	68.2%	3.95	0.70
Thumbnail scrolling feature	44	27.3%	59.1%	3.75	0.98

Q7 – 3D TDP better than 2D for conveying design intent?

- 89% of respondents feel that the 3D TDP is better or much better than 2D drawings for conveying design intent.

Scale	#	%
1 - not better	0	0.0%
2	0	0.0%
3	5	10.9%
4	18	39.1%
5 - much better	23	50.0%
total	46	100.0%
Top 2 Box (4 and 5)	41	89.1%
Average	4.39	out of 5
Variance	0.47	

Q8 – How will you use the 3D TDP in operations at your facility?



Q8 – How else will you use the 3D TDP in operations at your facility?

	How else will you use the 3D TDP in the operations at your company?
1	A drawback in the sample 3D TDP is the lack of a 1st Angle Projection of the part. A FAP is useful for a simple part b/c it shows all info on ONE sheet of paper. In this example a separate sheet would need to be printed for the front, top, etc. views.
2	Ballistic requirements, Misc. performance requirements, dimensions/tolerances, etc.
3	Design and inspection
4	Designing weld fixtures, etc.
5	Engineering collaboration tool could be used during product launch.
6	Excellent tool for conference calls, design/planning meeting and overall collaboration throughout the manufacturing process
7	Exporting 3D geometry for use in analytical process
8	Forward to sub-tier specialty processing vendors for quotes and services when allowed by regulations.
9	I could not find a way to print a full-page of the drawing only. This makes it difficult to view the smaller print on the title block or dimensioned portions of the print. Although we would use the 3D model, there is still information that is useful
10	Inspection planning, , CMM programming, sales activity if appropriate
11	Instant part perception across the board to all subs. No need to develop a solid model with the possibility of mistakes. Part can flow to as many subs as required to minimize guess work.
12	Interpretation of design and visualization of final product

Q8 – How else will you use the 3D TDP in operations at your facility?

	How else will you use the 3D TDP in the operations at your company?
13	It will be used to convey all pertinent part manufacturing information between Program Managers and the rest of the company.
14	It will definitely help in the quoting process. I look forward trying a sheet metal and assembly sample.
15	QA/Test, assembly, and final inspection documentation document publication.
16	Quality planning. It would be nice if you could work in a balloon print function and inspection report page to document the dimensional results.
17	Solid model will be used for solidification modeling.
18	The ability to extract the STEP file for import into machining software is the most useful feature, followed by the annotations for whole size tolerance or threads. Almost all other feature definitions would be extrapolated out of the CAD.
19	Tooling build
20	Useful to use to convert to machining language for CNC machining
21	We will model file directly for manufacturing planning and fixture design without first having to make our own 3d model from 2D prints.
22	Where will be able to download this program. I see that it uses Cad and STP formats is there any others that it will use.
23	Will be useful to record revision changes to a model by embedding the old rev in the document that can be retrieved at a later date