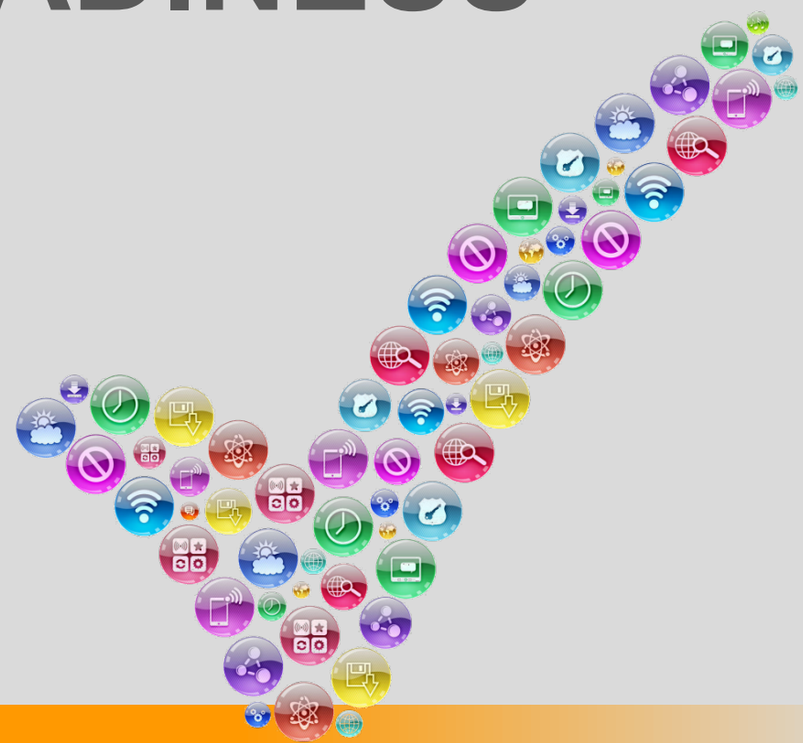
ACTION ENGINEERING

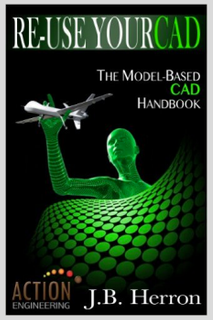
MBD SUPPLIER READINESS

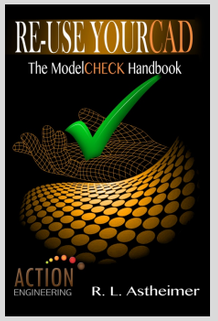


MBE Summit // April 5, 2017

Action Engineering Company Information

Model-Based Consulting and Training





TAKE ACTION TO BUILD YOUR DIGITAL ENTERPRISE™

Training

MBD/MBE EDUCATION – CAD Agnostic
Model Based Enterprise (MBE) Overview – What, Benefits, How
Introduction to MBD – What, GD&T, How
PLANNING
MBE Implementation
MBE Planning and Roadmap Building
IMPLEMENTING
Model Schema and Organization – CAD Agnostic
How to Write a Modeling Guide – CAD Agnostic
Reading, Commenting and Publishing 3D PDFs
CAD & PDM IMPLEMENTATION: SOLIDWORKS
Using SOLIDWORKS MBD
Administration, Set-up, and Best Practices for SOLIDWORKS and Enterprise PDM for MBD
Model Checking Automation for MBD
Reading, Viewing, and Reviewing MBD in SOLIDWORKS and eDrawings
CAD IMPLEMENTATION: Creo
Using Creo MBD
Model Checking Automation for MBD – ModelCHECK Administration and Best Practice
Reading, Viewing, and Reviewing MBD in Creo and CreoView
CAD IMPLEMENTATION: NX
Using NX MBD

Industry Organization Memberships

ASME
SETTING THE STANDARD

QIF

Dimensional Metrology Standards Consortium
DMSC

DMDII
DIGITAL MANUFACTURING AND DESIGN INNOVATION INSTITUTE

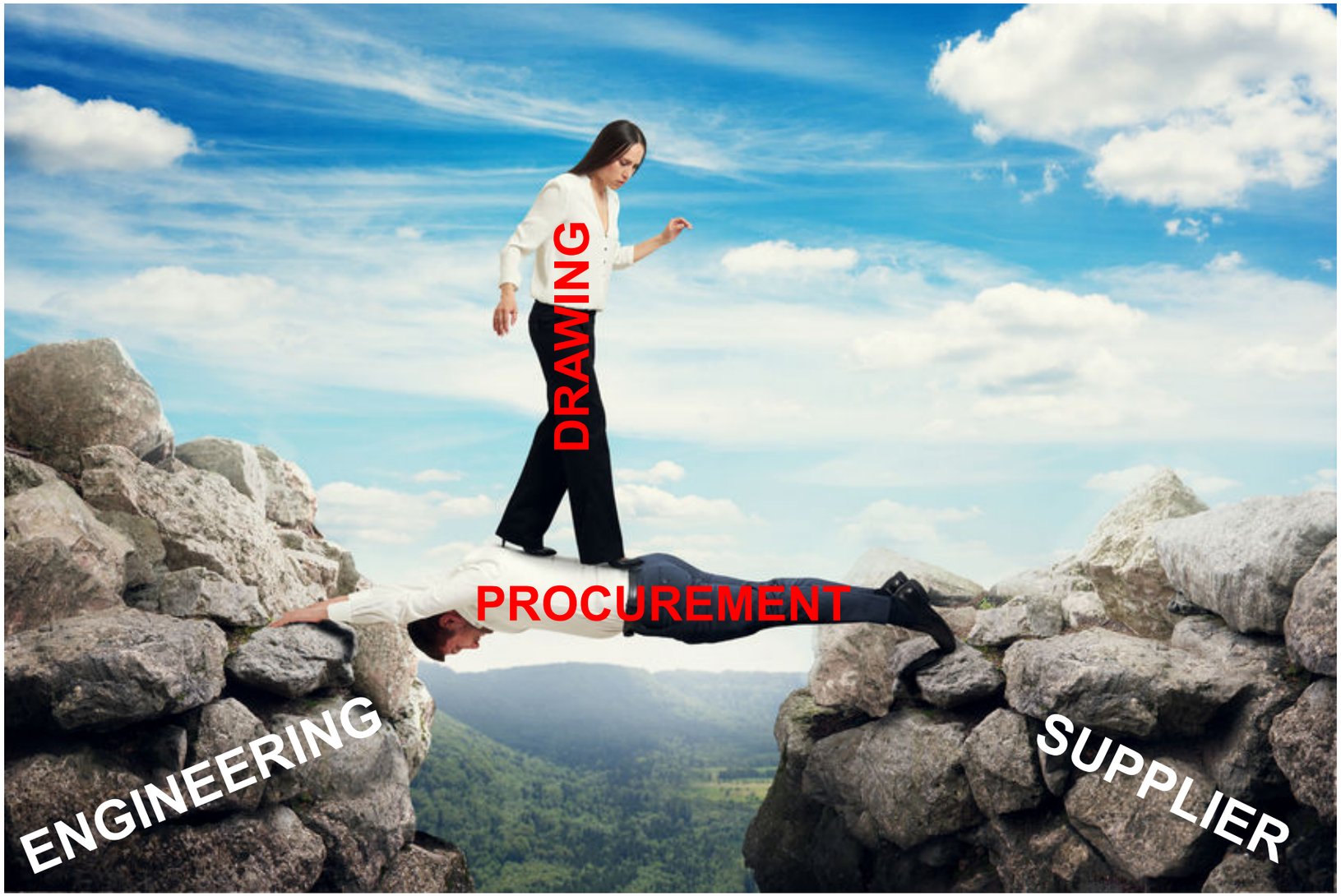
Topics

Suppliers are Ready

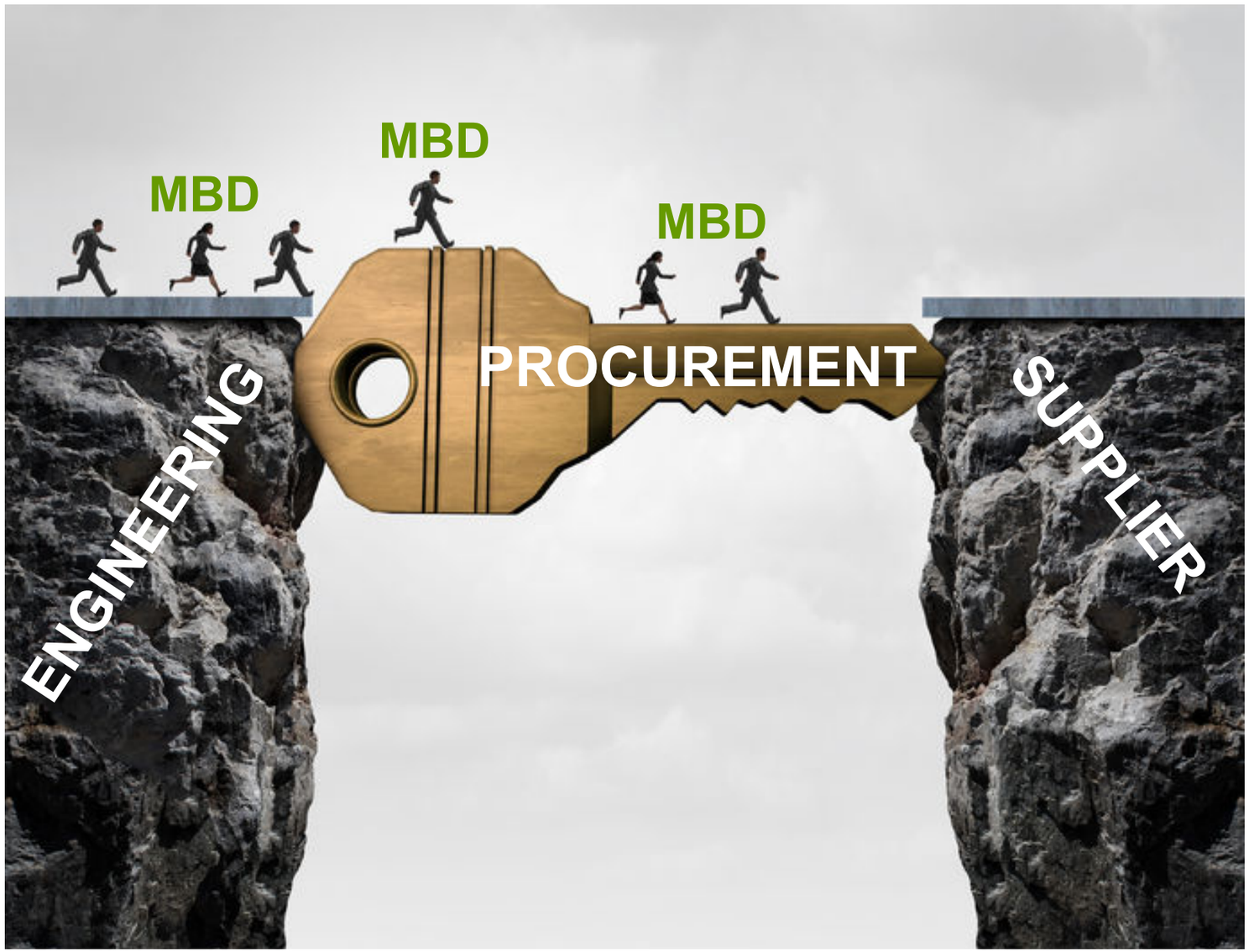
Define Expectations

Enable Access to Data

Procurement Bridges Engineering and Supplier



Procurement Bridges Engineering and Supplier



Topics

Suppliers are Ready

Define Expectations

Enable Access to Data

When 3D models are used, manufacturing is SMART

LIFECYCLE INSIGHTS

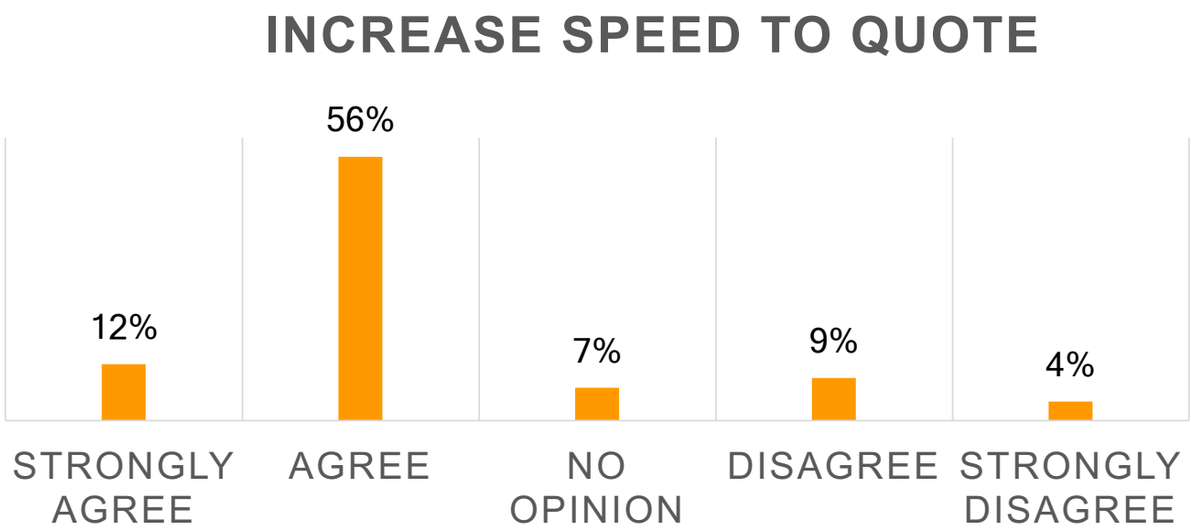
Percent of Respondents Experiencing Benefits from Including and Not Including 3D Models in Manufacturing Instructions		
	Do Not Include 3D Models	Include 3D Models
Average # of ECOs per development project	9.5	5.6
Average # of non-conformances per development project	6.5	3.3
% of respondents reducing scrap	10%	49%

2D DRAWING -BASED

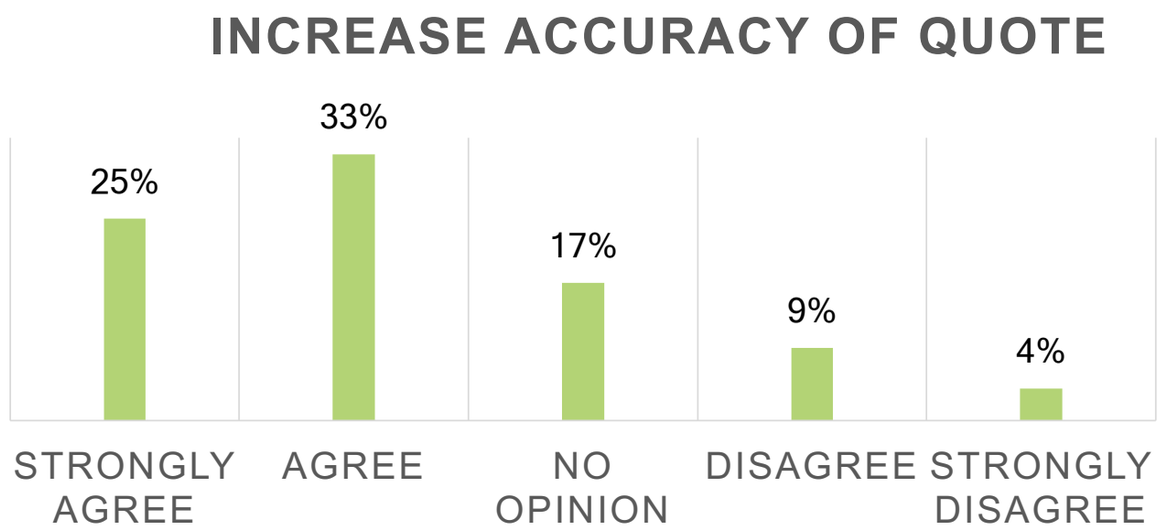
3D MODEL-BASED

REFERENCE: http://www.lifecycleinsights.com/study/the-design-and-documentation-study/

Suppliers **AGREE** there are benefits to MBD



68%
of respondents Agree

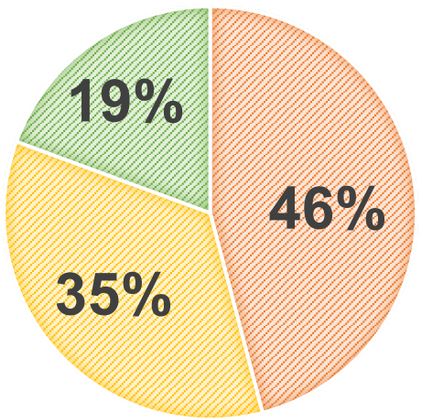


58%
of respondents Agree

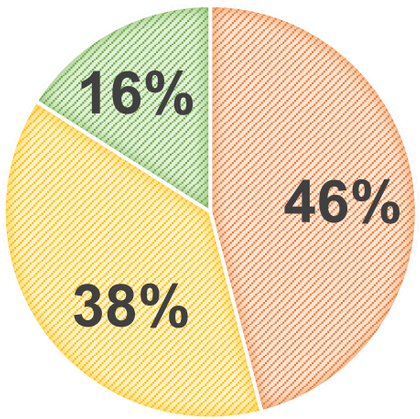
Representative Set of Suppliers

Today at least 50% of suppliers are ready for MBD in all areas

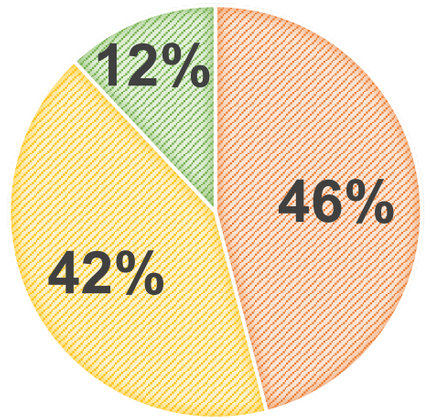
QUOTING



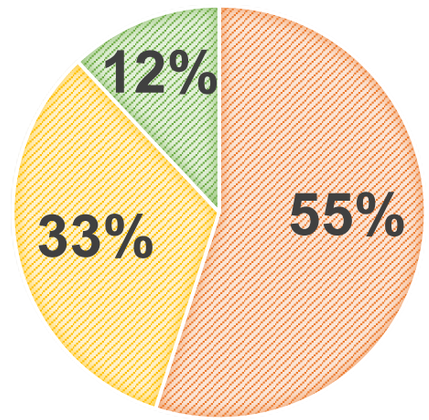
MANUFACTURING



TOOLING



INSPECTION

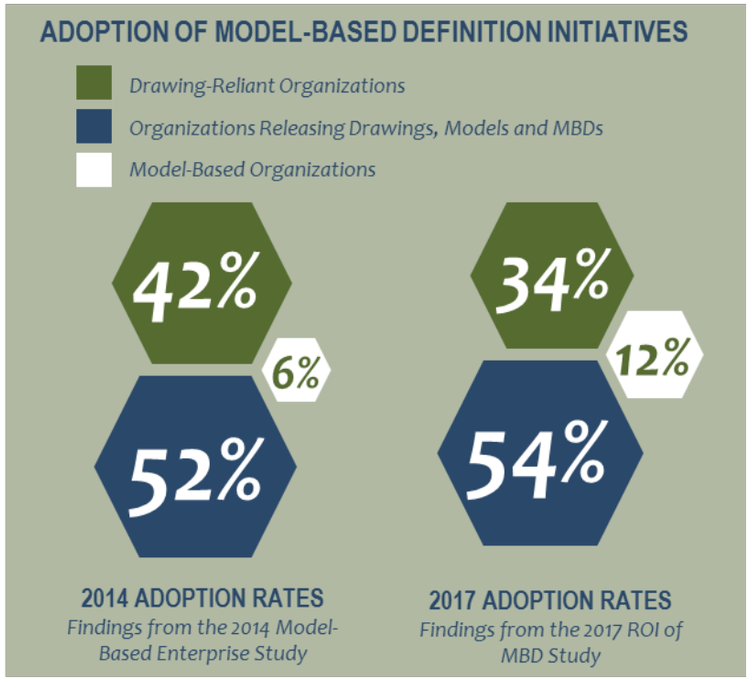


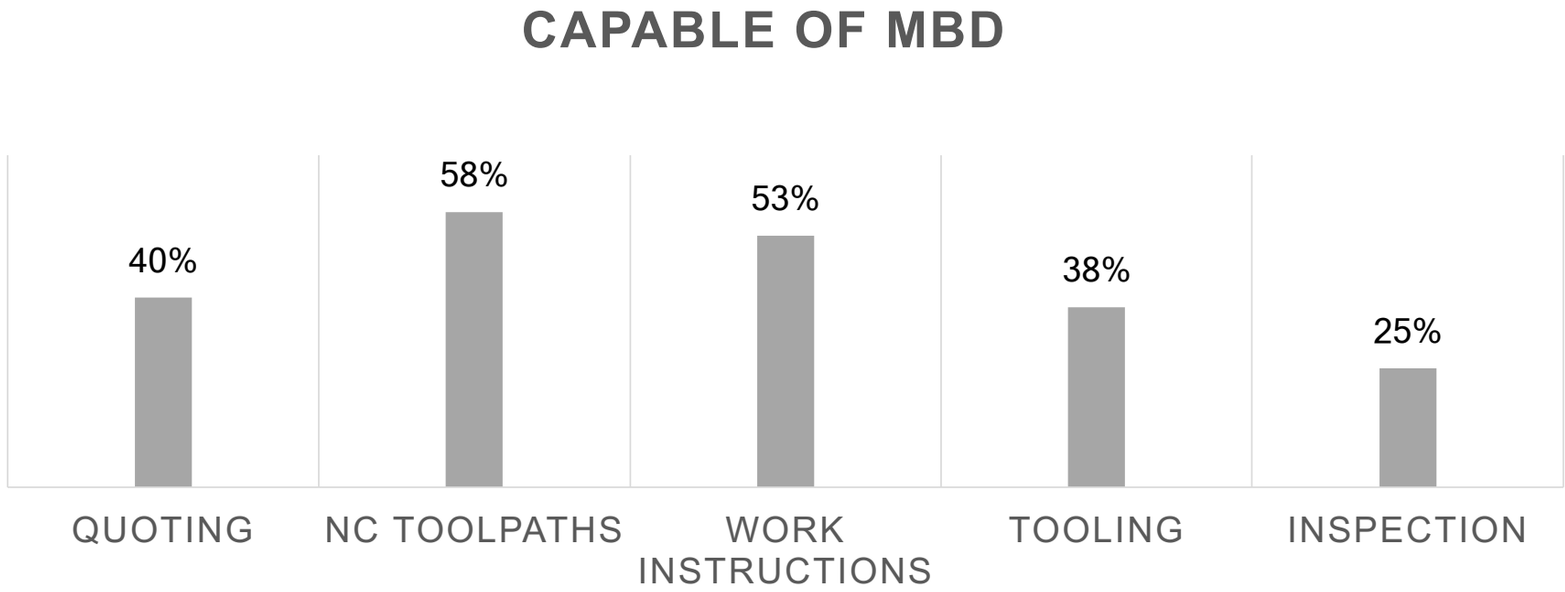
No plans to implement MBD

Plan to implement MBD in 6 mo. – 2 yr.

MBD Capable

Evaluate if Your Suppliers Meet Trends



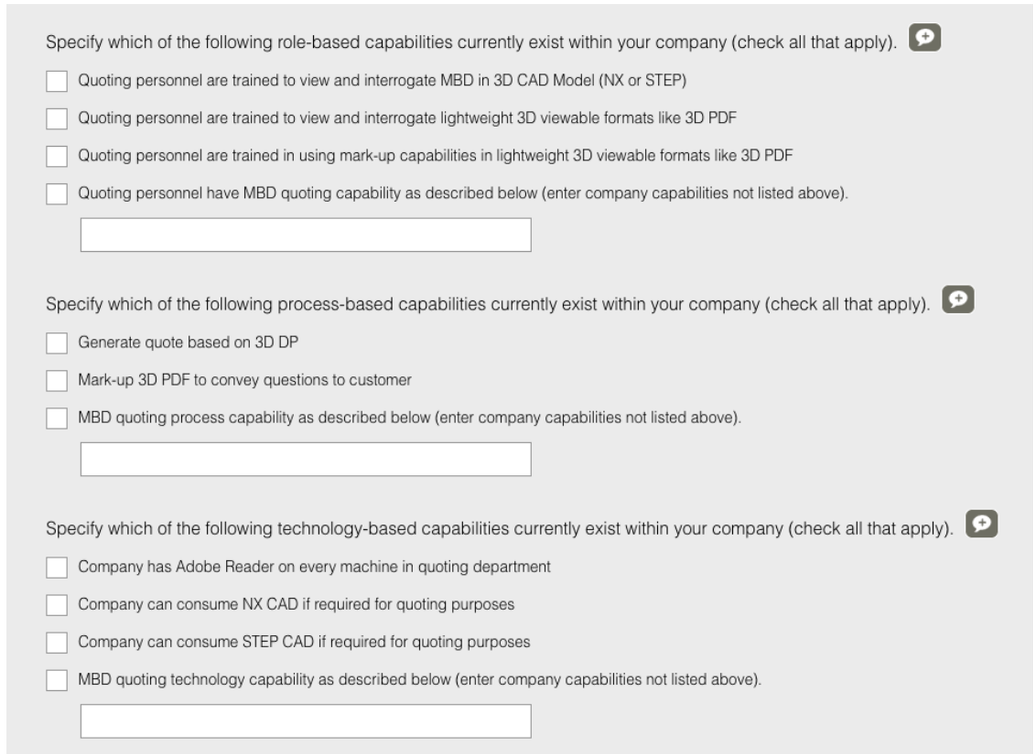


SUPPLIERS are *capable* of adopting MBD methods.

How Did We Assess Current Capability?

What	Question	Minimally Capable	Moderately Capable	Highly Capable
People	Quoting personnel are trained to view and interrogate MBD in 3D CAD Model (CATIA or STEP)			X
People	Quoting personnel are trained to view and interrogate lightweight 3D viewable formats like 3D PDF	X		
People	Quoting personnel are trained in using mark-up capabilities in lightweight 3D viewable formats like 3D PDF		X	
Process	Generate quote based on 3D DP	X		
Process	Mark-up 3D PDF to convey questions to customer			X
Tech	Company has Adobe Reader on every machine in quoting department	X		
Tech	Company can consume CATIA CAD if required for quoting purposes			X
Tech	Company can consume STEP CAD if required for quoting purposes		X	

EXAMPLE QUESTIONS



Executive Summary – Why are Suppliers Ready for MBD?

- Manufacturing is a no-brainer
  - Having models is better than drawings only
- Reduced time in quoting may yield significant savings
- How to accomplish digital inspection is still fuzzy. The following are needed:
  - Standard practices
  - Software tools
  - Training
  - Product definition that supports digital inspection
- A properly instantiated Digital Enterprise may lead to production cost savings

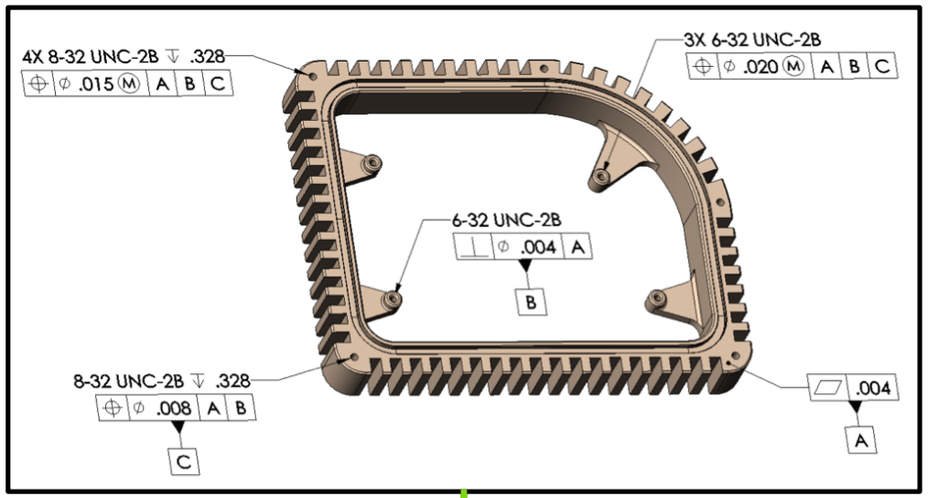
Topics

Suppliers are Ready

Define Expectations

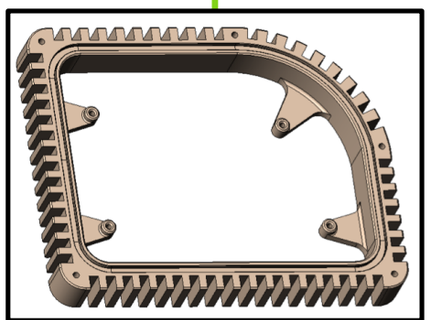
Enable Access to Data

What is MBD?

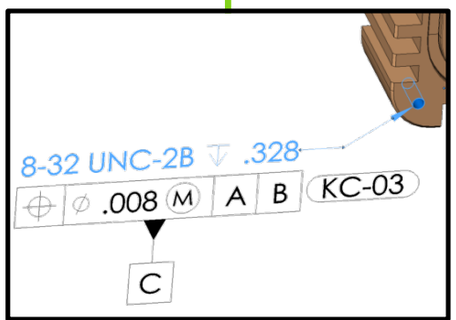


Model-Based Definition (MBD), is a model with Product Manufacturing Information (PMI) and consisting of:

1) **3D geometry** (serves as the basic dimensions)
2) **annotations*** (displayed notes, dimensions and tolerances or GD&T)
3) **attributes*** (metadata and queried data)
4) **presentation*** (saved views, presentation organization)



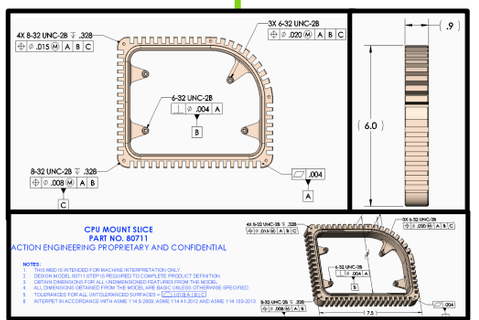
3D GEOMETRY



ANNOTATIONS*

PART NUMBER	8742659
DESCRIPTION	CPU MOUNT SLICE
MATERIAL	AL 6061-T651
COMPANY	Action Engineering
DATA RIGHTS	PROPRIETARY & CONFIDENTIAL
SUPPLIER	ACME MACHINING

ATTRIBUTES*

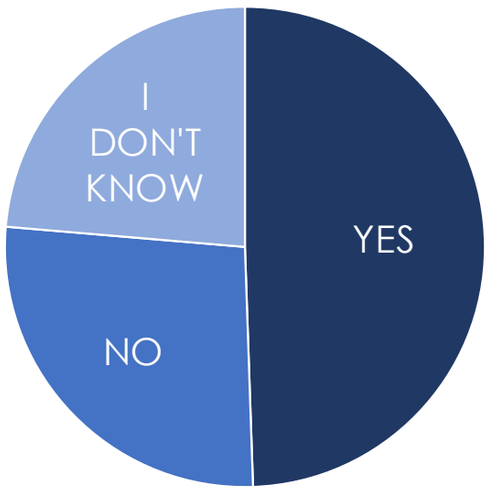


PRESENTATION*

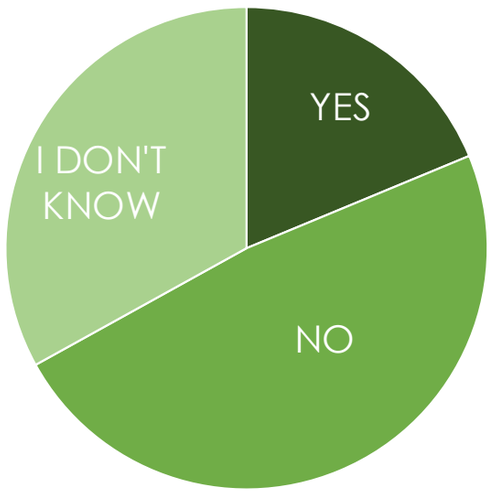
*As defined in ASME Y14 Series

Organizational Readiness: 3D Modeling Standard

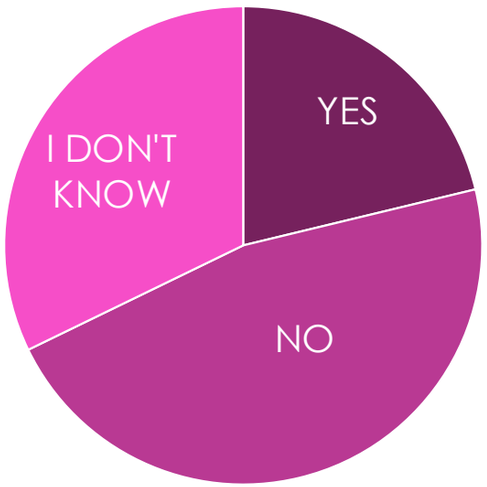
Does your organization **have** a standard for 3D modeling?



Does everyone **understand** this standard?



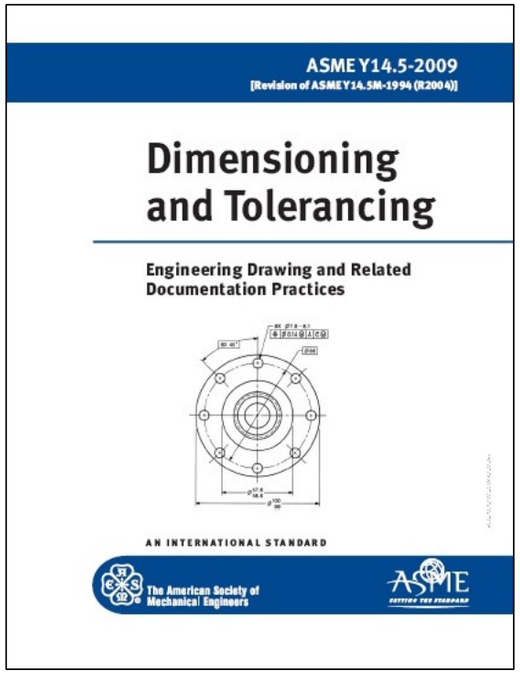
Does everyone **use** this standard?

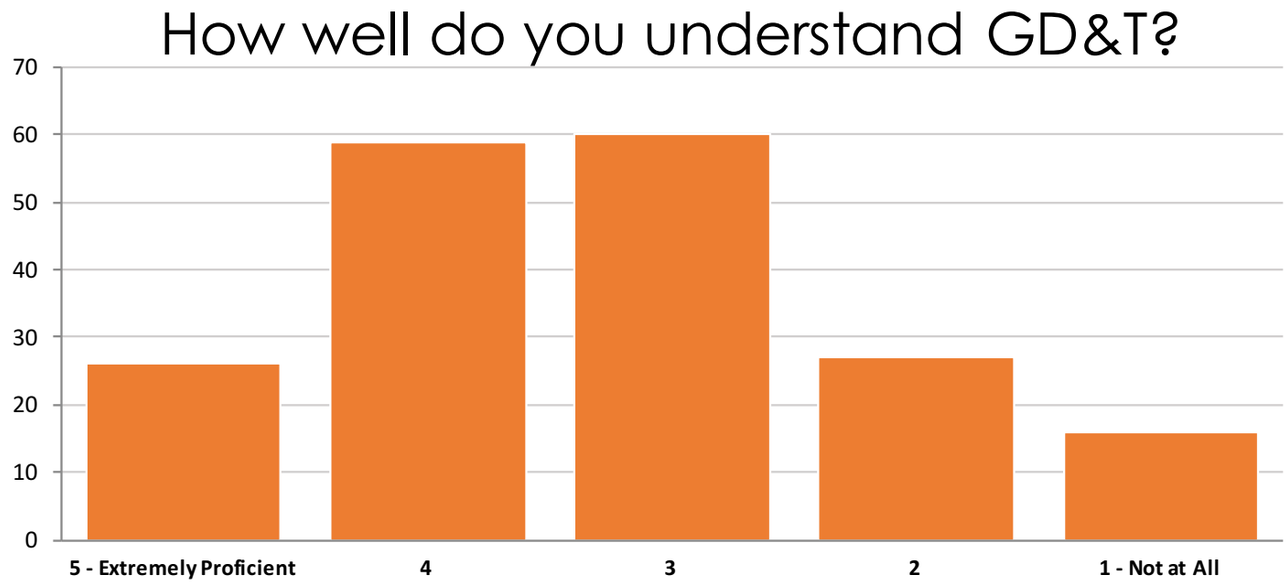


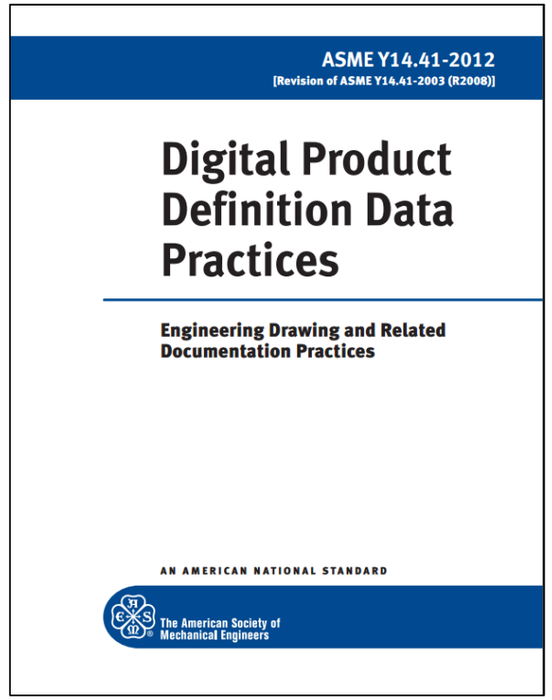
DEFINE EXECUTION

ACHIEVE ROI

Organizational Readiness: GD&T







BUILD PROFICIENCY

ACHIEVE ROI

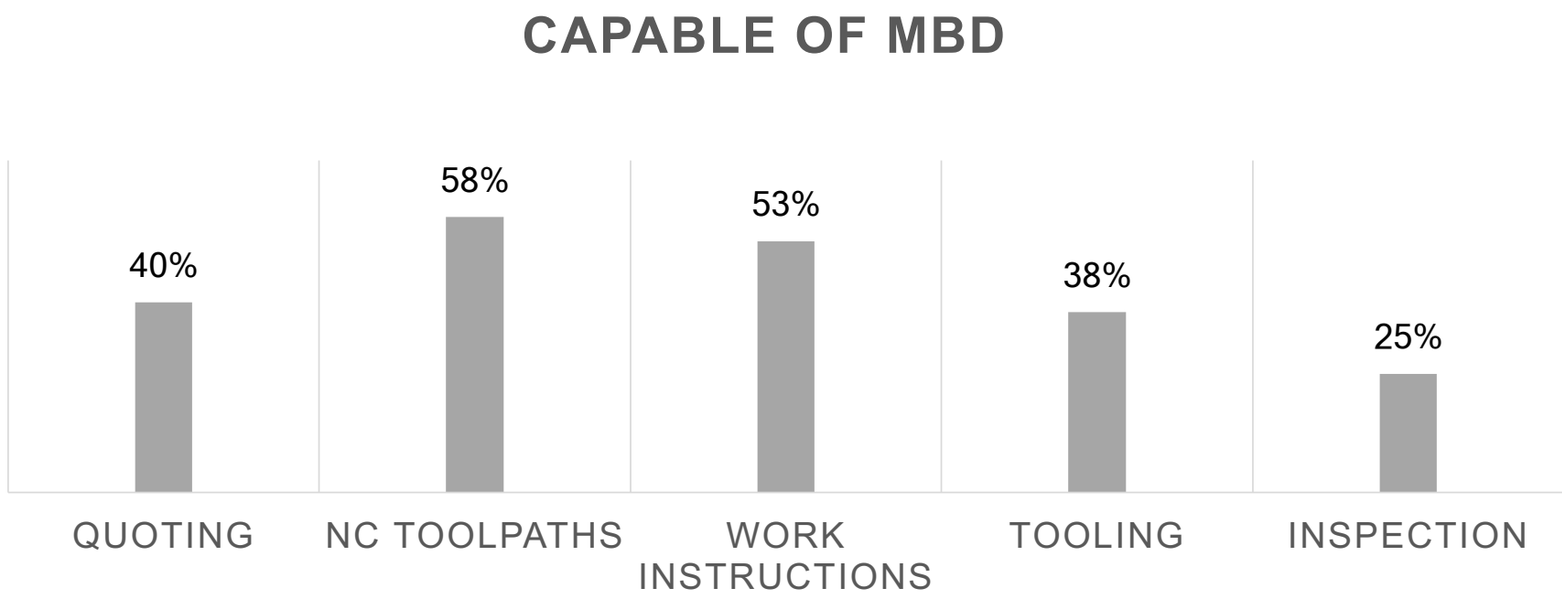
GD&T
=
Geometric Dimensioning & Tolerancing

MBD Supplier Readiness

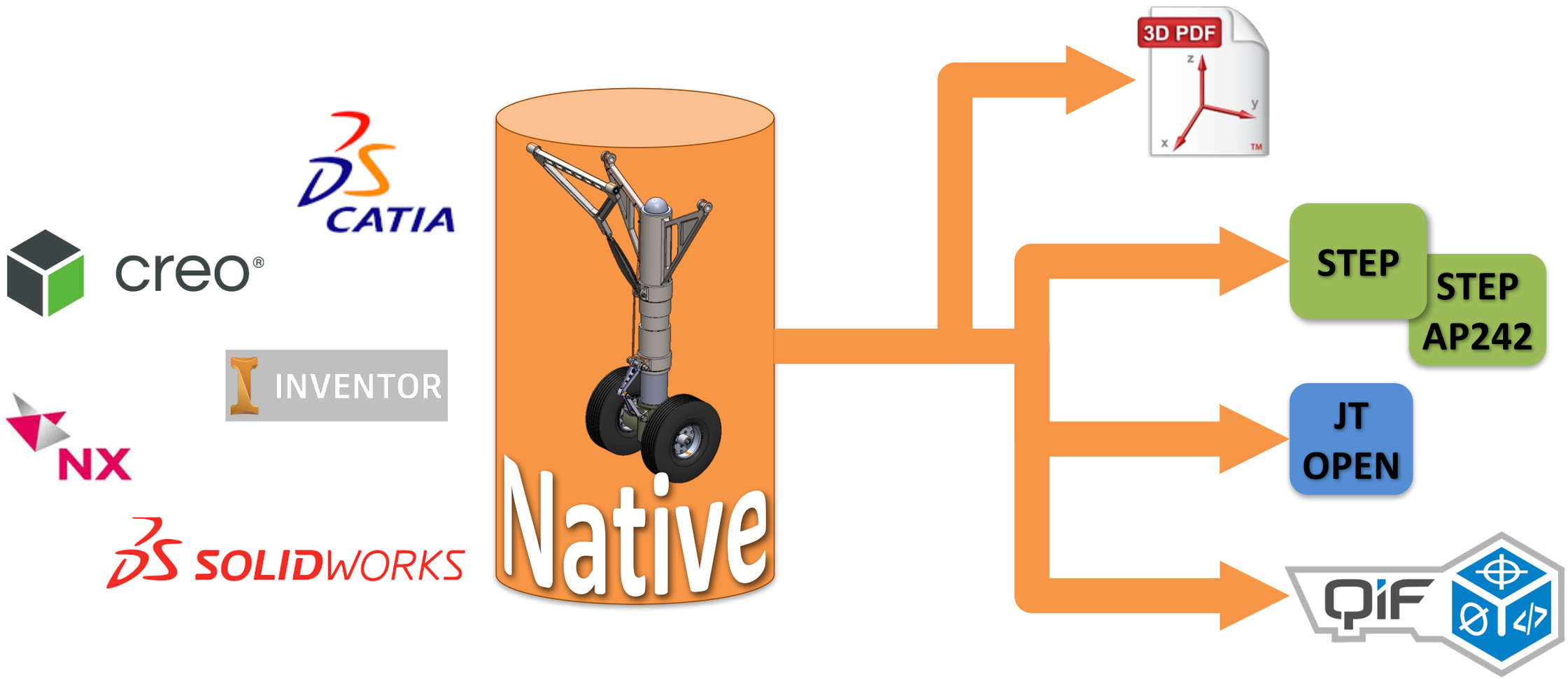
- EVALUATE
  - Internal and external supplier capability to quote, manufacture, create tooling, and inspect using MBD
  - Flexibility to adapt to new procedures for receiving and delivering 3D information
- SOCIALIZE
  - Be careful – this is not a typical contractual relationship
  - Build partners
- TRAIN
  - Define your Product Definition
  - Explain your Product Definition
  - Evaluate proficiency and understanding of your Product Definition

Determine MBD Usage by Function

- Quoting
- Manufacturing Toolpaths
- Tooling Design
- Work Instructions
- Inspection Instructions
- Inspection Operations
- Inspection Reporting



Multi-CAD Data Exchange



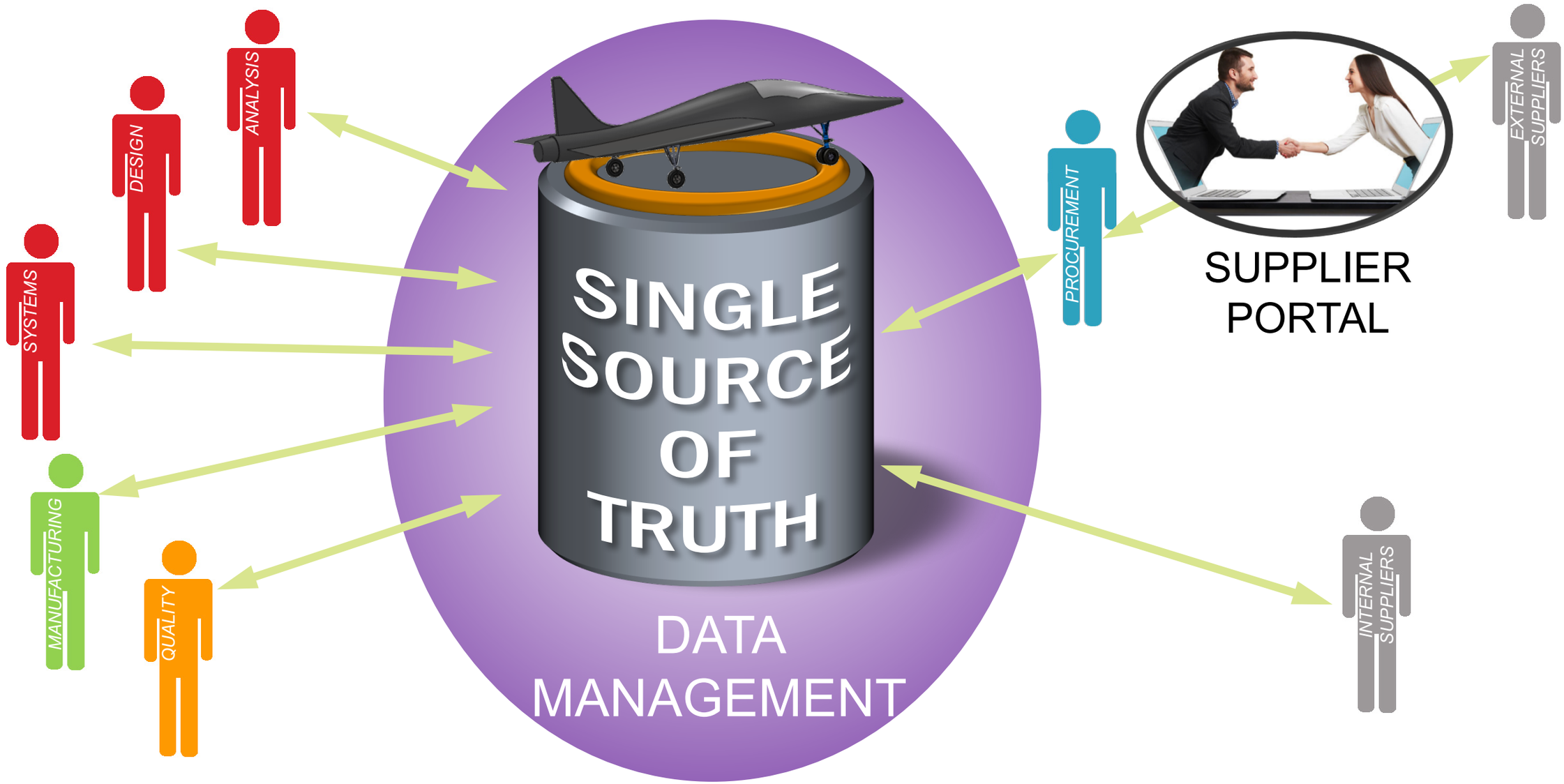
Topics

Suppliers are Ready

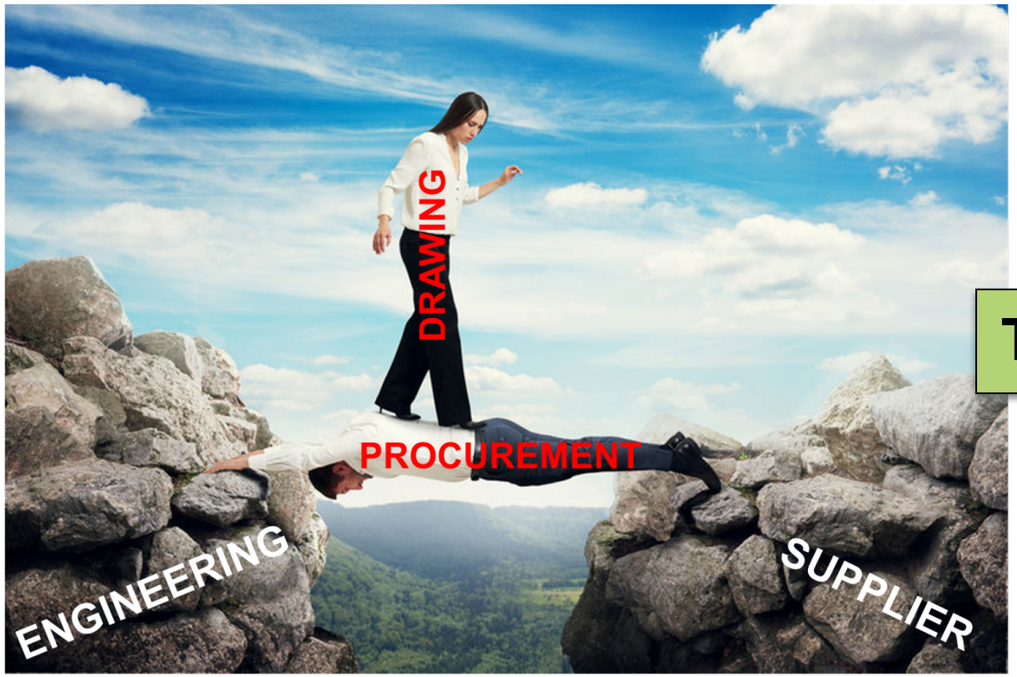
Define Expectations

Enable Access to Data

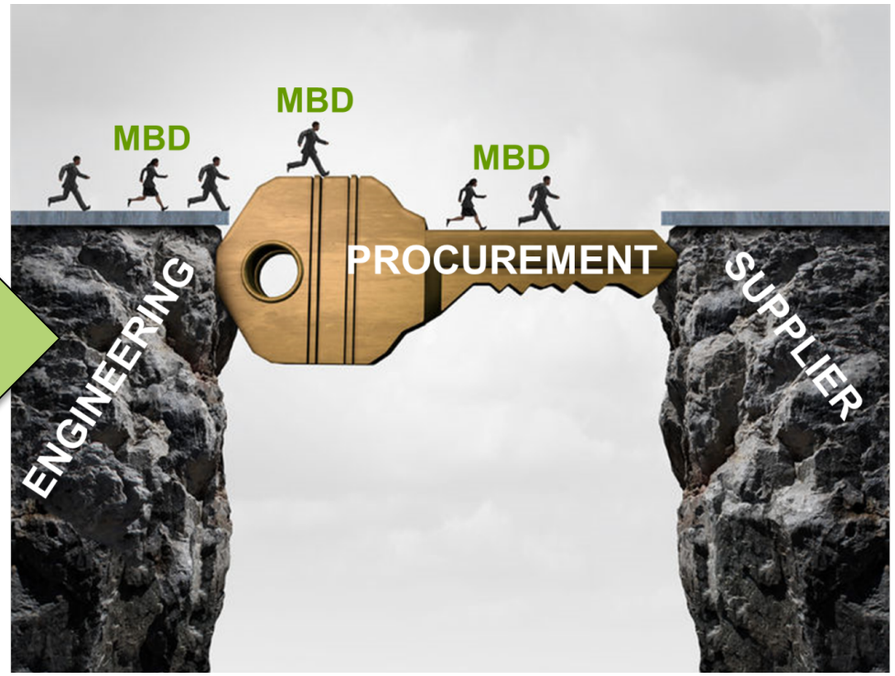
Overall MBE Capability



External Suppliers Require Extra Communication



TAKE ACTION

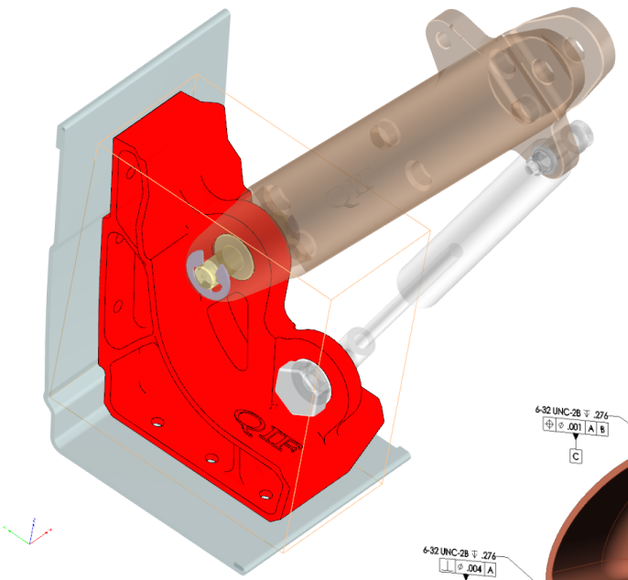


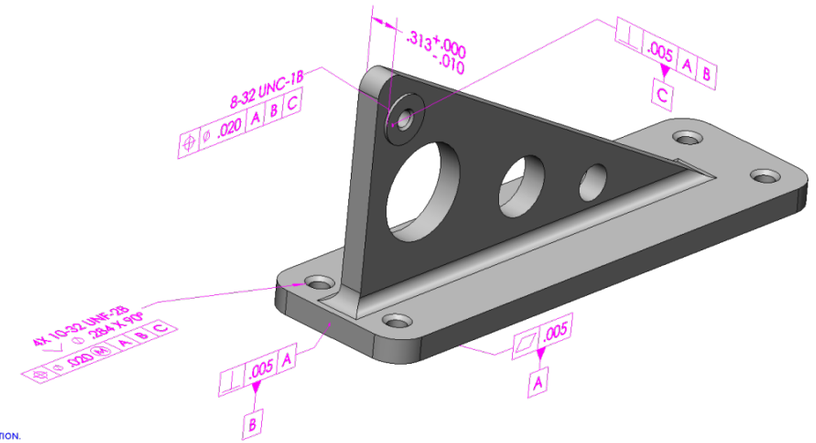
What did you learn?

PARTS LIST

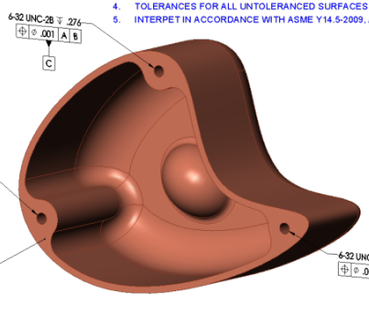
PART NUMBER	PART DESCRIPTION	PART QUANTITY
122333	BULKHEAD MOUNT	1
332211	QIF BRACKET	1
444555	QIF SHAFT	1
667788	QIF STRUT	2
60355K861	BALL BEARING	1
4170T211	CORROSION RESISTANT	1
97431A300	SIDE_MOUNT_EXTERNAL	2
NAS620-8	WASHER	2
91259A163	ALLOY STEEL SHOULDER	1
MS21043_06	HEXAGON_NUT	1
456987	BEARING_SHAFT	1
97431A270	SIDE-MOUNT_EXTERNAL	1

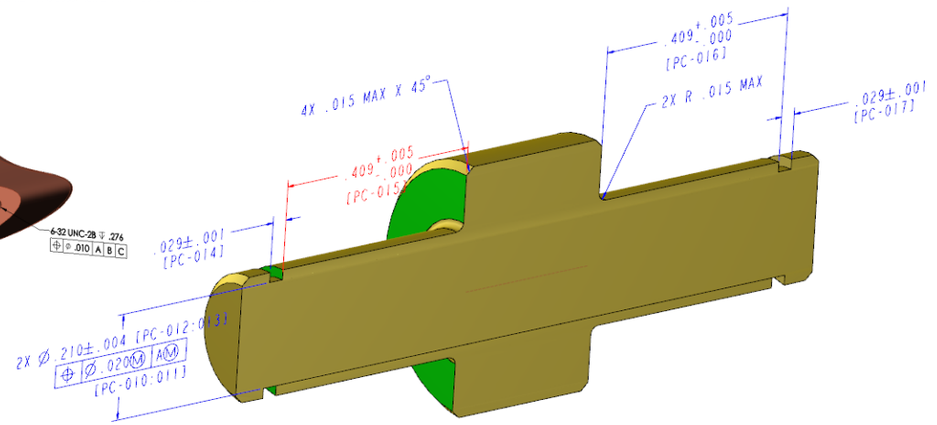
UNCLASSIFIED

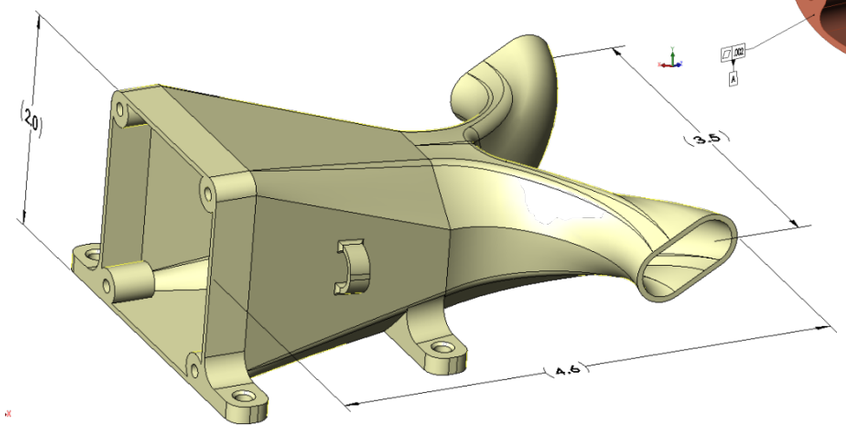


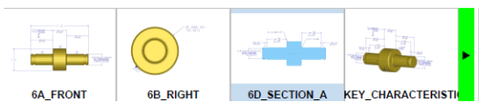


NOTES:
1. DESIGN MODEL 80313.STEP IS REQUIRED TO COMPLETE PRODUCT DEFINITION.
2. OBTAIN DIMENSIONS FOR ALL UNDIMENSIONED FEATURES FROM THE MODEL.
3. ALL DIMENSIONS OBTAINED FROM THE MODEL ARE BASIC UNLESS OTHERWISE SPECIFIED.
4. TOLERANCES FOR ALL UNTOLERANCED SURFACES = ⌓ |.010|A|B|C|
5. INTERPET IN ACCORDANCE WITH ASME Y14.5-2009, ASME Y14.41-2012 AND ASME Y14.100-2013.









APPROVER NAME	APPROVER FUNCTION	DATE	RELEASE APPROVAL	
C.BROWN	MANUFACTURING	2016-08-05	444555-PRT	2016-08-08
J.HORST	RESPONSIBLE ENGINEER	2016-08-02	R.ADMIRE	
R.ASTHEIMER	CHECKER	2016-08-01		
D.RAMSEY	DESIGN	2016-07-30		
J.HERRON	ORIGINATOR	2016-07-12		

MATURITY CODE	M3-PRODUCTION
ANNOTATION & ATTRIBUTE CODE	A3-FULL
GEOMETRY CODE	G3-FULL
MATERIAL	CRES 303
MASS	lbm 0

Find Out More…

Re-Use Your CAD™

Model-Based Business Process Coaching & Planning

- Model-Based Engineering & Enterprise (MBE) Planning
- PDM & PLM Process Implementation
- Tailor Business Practices and PDM/PLM Workflows to include 3D CAD
- Apply Configuration Management Directly to 3D Model Data Sets
- Strategies to Create and Consume MBD Models

Model-Based Training and Education

- Basic Training is CAD Agnostic and Focuses on MBE Philosophy
- Intermediate and Advanced Training is Software-Specific and Customized to Your Organization
- Understanding Model-Based Definition (MBD) and Technical Data Packages (TDP), per ASME Y14.41 and MIL-STD-31000A
- CAD Modeling Best Practice for MBE

CAD, PDM, PLM Software Selection Consulting

- Software Beta Testing
- User-Based Feedback and Improvement for Software Tools
- Assess and Recommend Software Tools for Compatibility with 3D Model-Based Engineering (MBE)

CAD Agnostic Course Listings

MBD/MBE EDUCATION	Course Number	Suggested Format
Model Based Enterprise (MBE) Overview – What, Benefits, How	101	Live or Online
Introduction to MBD – What, GD&T, How	102	Live or Online
PLANNING		
MBE Implementation	103	Live or Online
MBE Planning and Roadmap Building	104	Live
IMPLEMENTING		
Model Schema and Organization – CAD Agnostic	105	Live or Online
How to Write a Modeling Guide – CAD Agnostic	106	Live or Online
Reading, Commenting and Publishing 3D PDFs	107	Live or Online

CAD Specific Course Listings

CAD & PDM IMPLEMENTATION: SOLIDWORKS	Course Number	Suggested Format
Using SOLIDWORKS MBD	201	Live or Online
Administration, Set-up, and Best Practices for SOLIDWORKS and Enterprise PDM for MBD	202	Live or Online
Model Checking Automation for MBD	203	Live or Online
Reading, Viewing, and Reviewing MBD in SOLIDWORKS and eDrawings	204	Live or Online
CAD IMPLEMENTATION: Creo	**Course Number**	**Suggested Format**
Using Creo MBD	301	Live or Online
Model Checking Automation for MBD – ModelCHECK Administration and Best Practice	303	Live or Online
Reading, Viewing, and Reviewing MBD in Creo and Creo View	304	Live or Online
CAD IMPLEMENTATION: NX	**Course Number**	**Suggested Format**
Using NX MBD	401	Live or Online

Courses listed are not official SOLIDWORKS, DASSAULT, PTC, or SIEMENS sanctioned courses.

Contact Action Engineering

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COO

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720.595.4794

action-engineering.com

@ReUseYourCAD

Re-Use Your CAD

Online Resources

- Blogs
  - www.action-engineering.com/blog
  - blog.grabcad.com
  - MCADCafé.com
- LinkedIn Groups
  - Model Based Enterprise
  - Model Based Definition
- Events
  - 3D CIC + QIF Summit,
    October 3-5, 2017, Golden, CO

Part Layout Example

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UNCLASSIFIED

QIF BRACKET
PART NO: 332211

REVISION: G
REVISION DATE: 2016-08-23
REVISION HISTORY: UPDATED PARAMETERS TO MATCH INDUSTRY STANDARD

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NOTES:
1. INTERPET IN ACCORDANCE WITH ASME Y14.5-2009, ASME Y14.41-2012 AND ASME Y14.100-2013.

2. DESIGN MODEL 332211.PRT or 332211.QIF IS REQUIRED TO COMPLETE PRODUCT DEFINITION.

3. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

4. SCALE AND SIZE ARE NOT APPLICABLE.

5. ALL DIMENSIONS OBTAINED FROM THE MODEL ARE BASIC UNLESS OTHERWISE SPECIFIED.

6. TOLERANCES FOR ALL UNTOLERANCED SURFACES = ⌓ .020 | A | B(M) | C(M) AND INSPECTION IS NOT REQUIRED.

7. KEY CHARACTERISTICS (PC) SHALL BE VALIDATED PER AS9102B AND QIF 2.1 AND ARE IDENTIFIED AS: (PC-###).

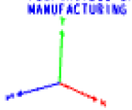
8. ALL BOTTOM FILLETS ARE MAX R 0.031.

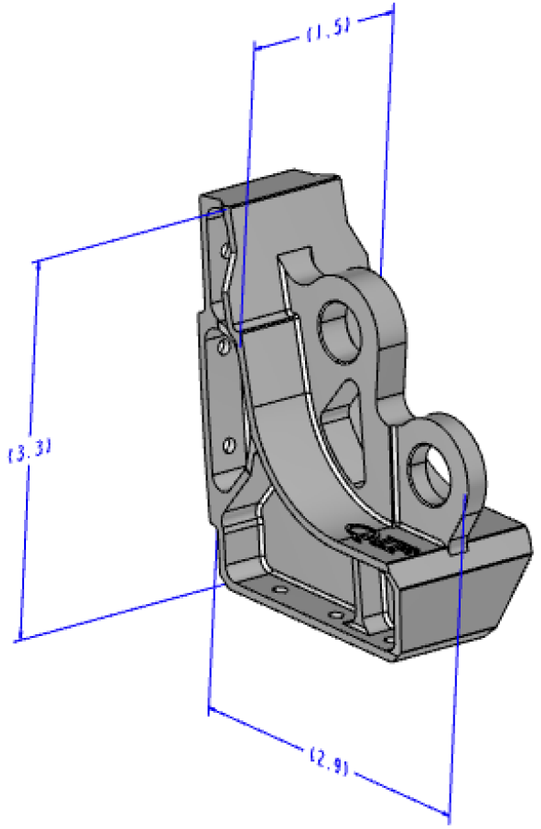
9. UNLESS OTHERWISE SPECIFIED, MAXIMUM SURFACE ROUGHNESS FOR ALL MACHINED SURFACES SHALL BE 125 MICROINCHES.

MATERIAL: AL 6061-T6
MASS: 0.221 lbm
MATURITY CODE: M3-PRODUCTION
ANNOTATION & ATTRIBUTE CODE: A2-PARTIAL
GEOMETRY CODE: G3-FULL

RELEASE APPROVAL
R.ADMIRE 2016-06-30

APPROVALS
FUNCTION NAME DATE
DESIGN D.RAMSEY 2016-07-26
CHECKER R.ASTHEIMER 2016-07-27
RESPONSIBLE ENGINEERING J.HORST 2016-07-27
MANUFACTURING C.BROWN 2016-07-30





REV	REV DESCRIPTION	
G	UPDATED PARAMETERS TO MATCH INDUSTRY STANDARD	2016-08-23

COMMENTS (ENTERED IN PDF ONLY)

PROJECT NUMBER QIF101

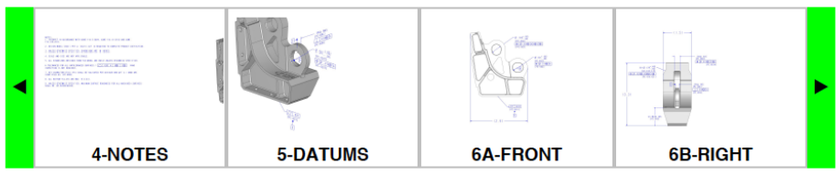
ACTION ENGINEERING, LLC
2269 S ELLIS CT
LAKEWOOD, CO 80228

CAGE CODE 3TKH2

DESCRIPTION: QIF BRACKET

NUMBER: 332211

REVISION: G



APPROVER NAME	APPROVER FUNCTION	DATE
C.BROWN	MANUFACTURING	2016-07-30
J.HORST	RESPONSIBLE ENGINEER	2016-07-27
R.ASTHEIMER	CHECKER	2016-07-27
D.RAMSEY	DESIGN	2016-07-26
J.HERRON	ORIGINATOR	2016-06-22

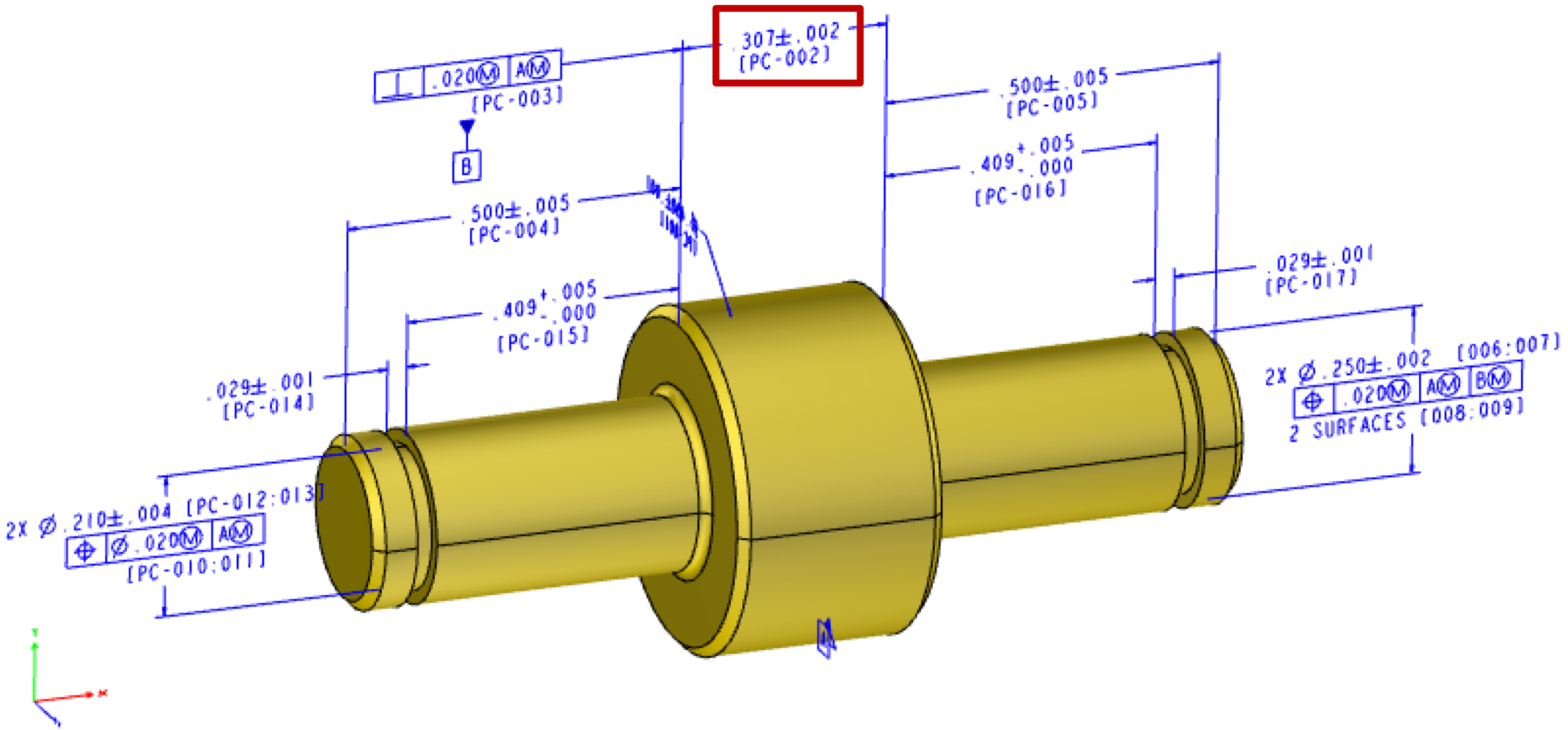
RELEASE APPROVAL	
332211-PRT	2016-06-30
R.ADMIRE	

Jennifer Herron Digitally signed by JenniferHerron Date: 2016.08.23 18:47:42 -06'00'

MATURITY CODE	M3-PRODUCTION
ANNOTATION & ATTRIBUTE CODE	A2-PARTIAL
GEOMETRY CODE	G3-FULL
MATERIAL	AL 6061-T6
MASS	lbm 0.221307

Identifying Product Characteristics with MBD

7. PRODUCT CHARACTERISTICS (PC) SHALL BE VALIDATED PER AS9102B AND QIF 2.1
AND ARE IDENTIFIED AS: [PC-###].



Creating a Data Package (DP)