

Standards-Compliant Technical Data Packages

Jennifer Herron, Action Engineering

GLOBAL PRODUCT DATA INTEROPERABILITY **SUMMIT 2023**





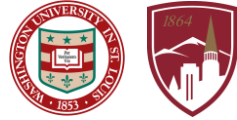
FOUNDER & CEO

(She/Her)

Jennifer Herron



EXPERTISE



B.S. in Mechanical Engineering

M.S. in Computer Engineering

- Advised **180+** organizations
- Strategic MBD and MBE Implementation Coaching
- MBD and MBE Solution Architecture
- MBD Pilot Planning
- MBD Modeling Standards and Best Practices
- Multi-CAD MBD and GD&T Authoring and Publishing
- MBD Supply Chain Readiness Coaching
- MBD-related software tool testing

CREDENTIALS



- Board Member, Digital Metrology Standards Consortium (DMSC), QIF
- ASME Y14 Series, Voting Member
- ASME Y14.46 Additive Manufacturing Product Definition, Voting Member
- ISO 10303 TC 184, DMSC Liaison
- AIAG TDP, Voting Member
- Dare to Lead Certified
- Certified Scrum Product Owner®, Scrum Alliance
- Patent for Toroidal Propulsion and Steering System (Snake)

PUBLICATIONS

- Re-Use Your CAD: The Model-Based CAD Handbook* - [2nd Ed.](#) & [1st Ed.](#)
- Industry [Blogs](#)

QUOTE

If you are going to **CHANGE** the results of your business, you have to change the **WAY** you do business.



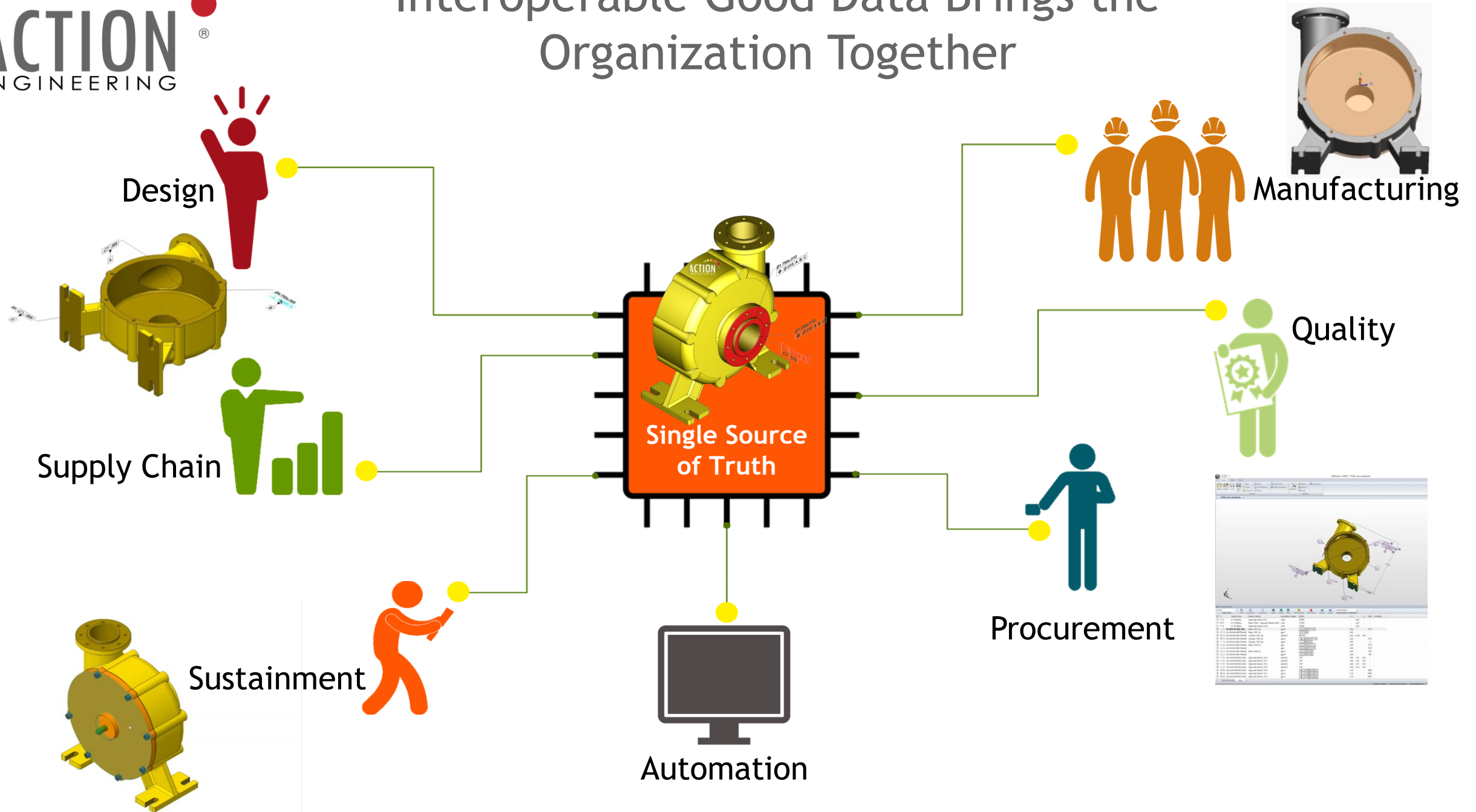
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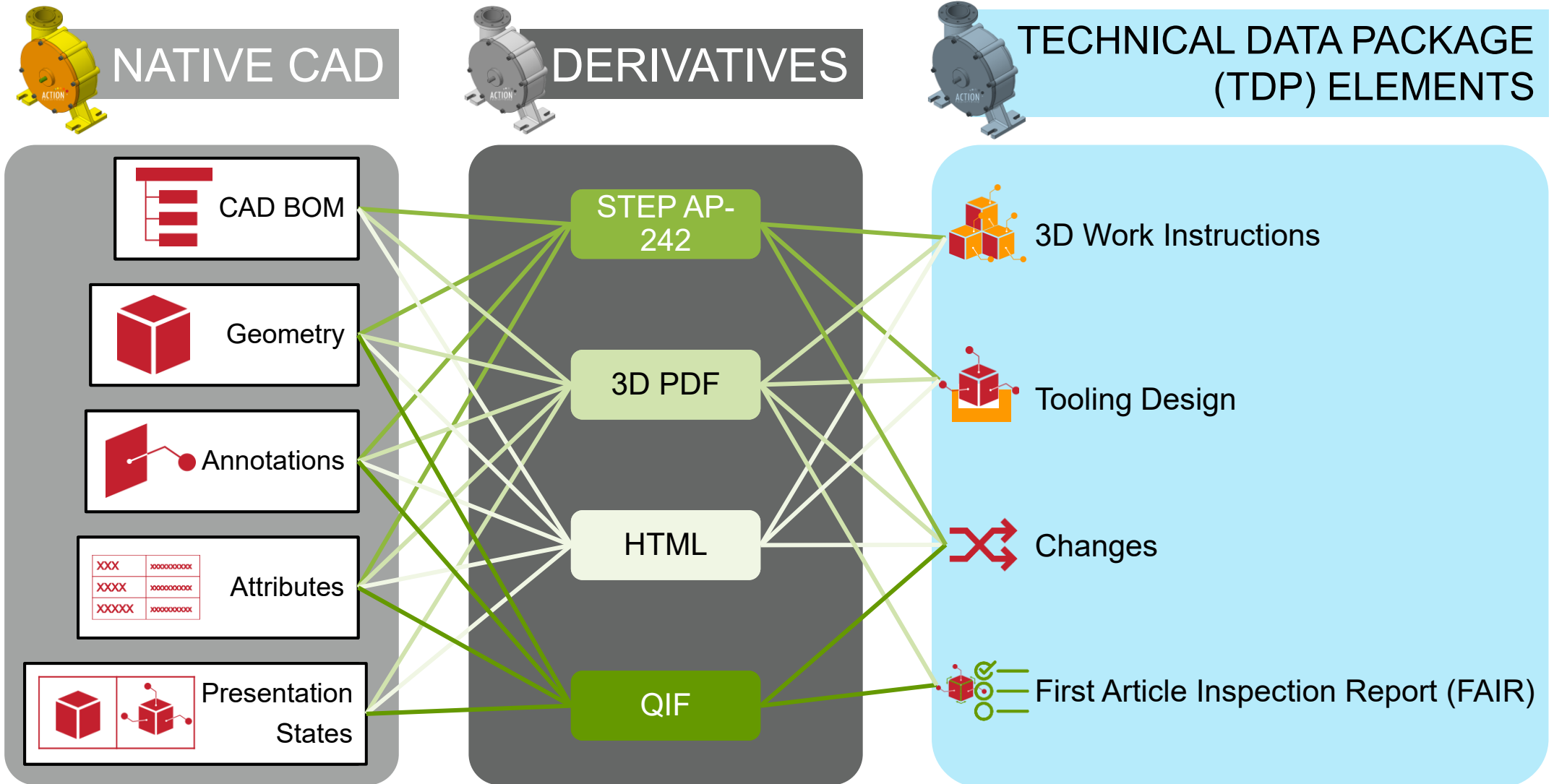
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- What are 3D Technical Data Packages (TDPs)?
- How is Aerospace doing using and re-using 3D TDPs?
- What Standards are available?
- Manufacturing Scenarios that Leverage 3D TDPs
 1. Design Review
 2. Quality Planning
 3. Engineering Changes

WHAT ARE 3D TECHNICAL DATA PACKAGES (TDPs)?

Interoperable Good Data Brings the Organization Together





IS AEROSPACE READY FOR 3D TDP USE AND RE-USE?

Aerospace 3D Readiness Rating



BENEFITS



OPERATIONAL



LEADERSHIP



DATA



CULTURE



BUDGET



SCHEDULE



 AEROSPACE INDUSTRY
 GOAL

WHAT STANDARDS ARE AVAILABLE?

Engineering

- ASME Y14 (Product Definition)
- ISO 10303 (STEP & PLCS)
- ISO 14306, 14739-1 (3D Viewables)
- MIL-STD-31000B (TDP)

Product Structure

- MIL-STD-881F (Work Breakdown Structure)
- MIL-HDBK-61A (Configuration Management)
- EIA-649 (Configuration Management)

Manufacturing

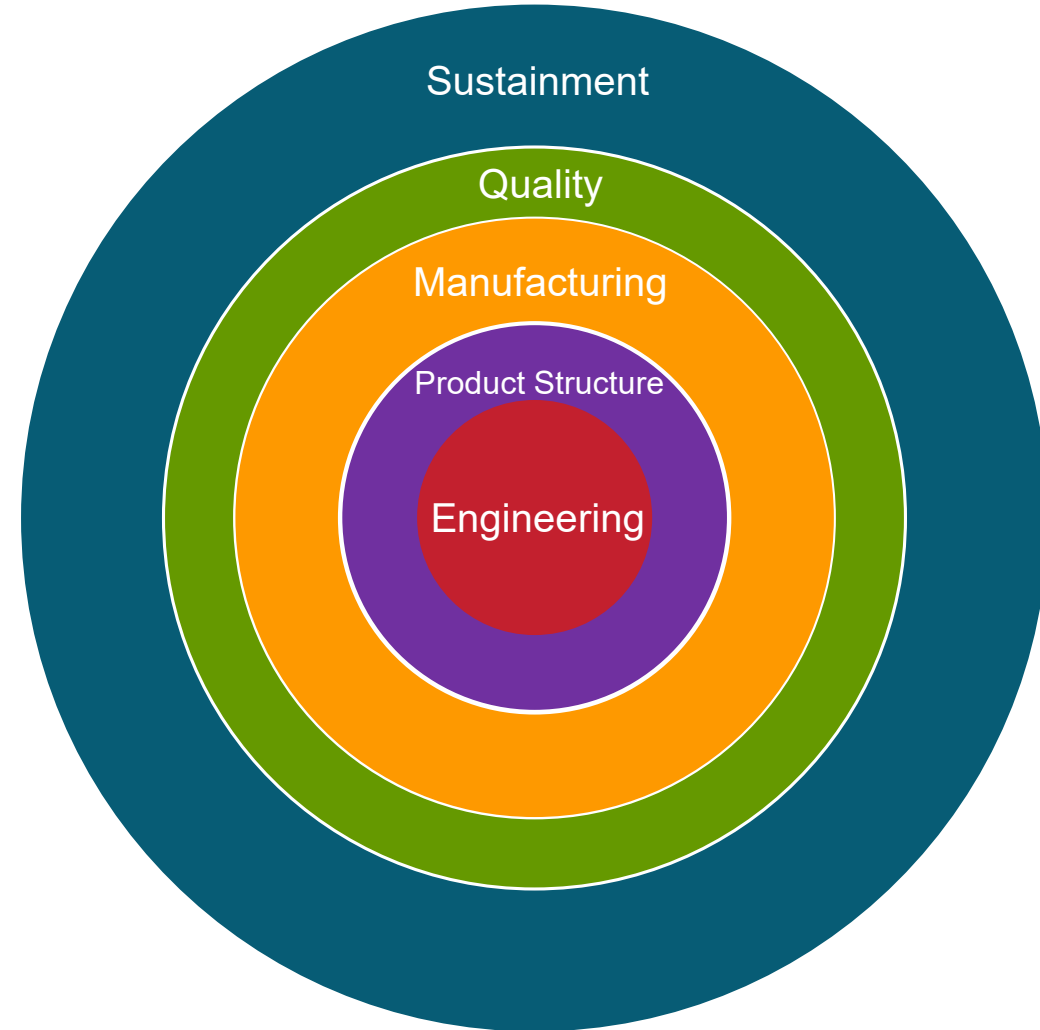
- ISO 10303-203, 214, 242 (STEP)
- MTConnect
- ASME, ASTM (Process Standards)

Quality

- QIF (Quality Information Framework)
- ISO 16949 (IATF AIAG Quality Management System)

Sustainment

- S-Series
- NAVSEA 9090-700E (SCLISIS)



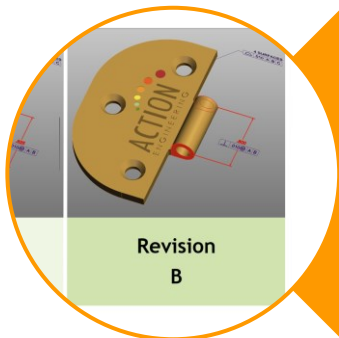
MANUFACTURING SCENARIOS THAT LEVERAGE 3D TDPs



Design Review



Quality Planning



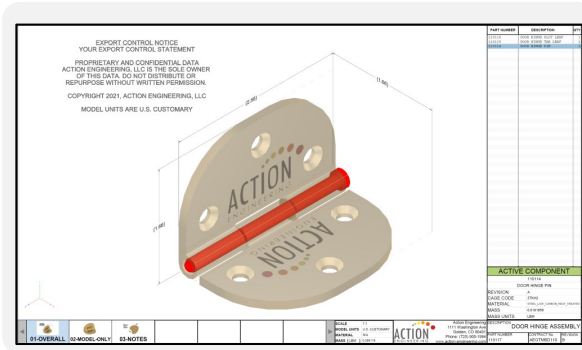
Engineering Changes



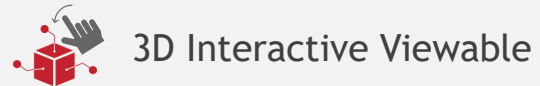
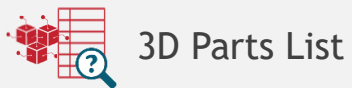
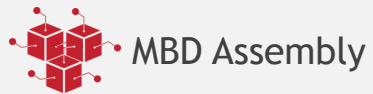
Design Review



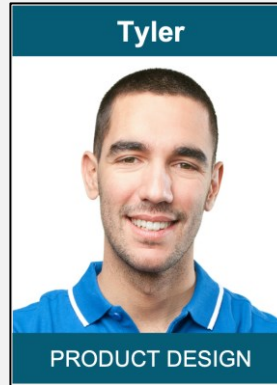
What



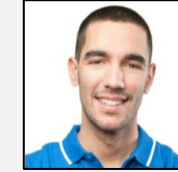
MBD Capabilities



Who



How



Author
MBD Assembly
Product Definition

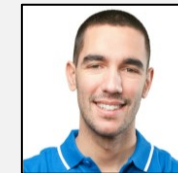
Publish
3D Interactive
Viewable

Send to
Manufacturing



Perform
Manufacturing
Review

Provide Feedback
to Engineering







Update
MBD Assembly

Publish & Release
3D Technical Data
Package



MBD Capabilities

-  MBD Assembly
-  3D Parts List
-  3D Interactive Viewable
-  Commenting

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MODEL UNITS ARE U.S. CUSTOMARY


| PART NUMBER | DESCRIPTION | QTY |
|-------------|----------------------|-----|
| 110114 | DOOR HINGE SLOT LEAF | 1 |
| 110115 | DOOR HINGE TAB LEAF | 1 |
| 110116 | DOOR HINGE PIN | 1 |

| ACTIVE COMPONENT | |
|------------------|----------------|
| 110114 | DOOR HINGE PIN |
| REVISION | A |
| CAGE CODE | 3TKH2 |
| MATERIAL | BRASS_WROUGHT |
| MASS | 0.2191856 |
| MASS UNITS | LBM |


3D Interactive Viewable and 3D Parts List

MBD Assembly

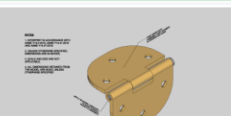
Search



01-OVERALL



02-MODEL-ONLY



03-NOTES

Part Number: 110117
Part Revision: A
Description: DOOR HINGE ASSEMBLY

PART NUMBER: 110116
NOMENCLATURE: DOOR HINGE SLOT LEAF
REV: A
CAGE CODE: 3TKH2
MATERIAL: BRASS_WROUGHT
MASS: 0.131149
MASS UNITS: LBM

Commenting

Attribute List

Attributes

Part Number: 110117

Description: DOOR HINGE ASSEMBLY

Revision: A

Revision Date: 2023-02-01

Revision Description: Creo 8 upgrade. Adjusted note list font, view orientation, added REV_DESCRIPTION

Linear Units: Not Specified

Angular Units: Not Specified

Mass: 0.267084

Mass Units: LBM

Contract Number: AEGTMBD110

Distribution Code: Not Specified

Original Design Activity or ODA: Not Specified

Cage Code: 3TKH2

Part Number: 110117
Part Revision: A
Description: DOOR HINGE ASSEMBLY

1. The gap between the hinges is larger than in Rev A.
2. The S and T Leaf have different dimensions on the tabs.
3. The pin did not change.
4. Please double check the material is ok for each part.



Metrics

| | |
|--|------|
| Reduction in duplicating manual data entry | 24% |
| Documented feedback loops | 100% |

Reduce Current Pain Points

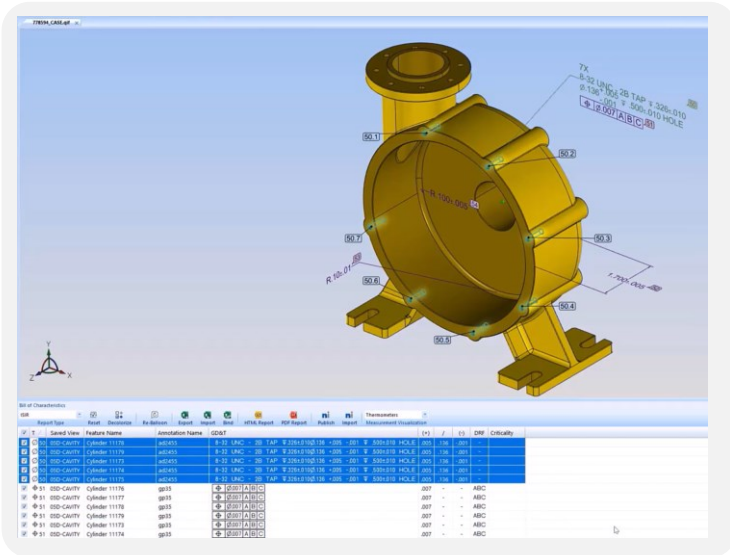
- Reduces communication gap between Engineering and Manufacturing
- Improves design review process



Quality Planning



What



MBD Capabilities



MBD Component

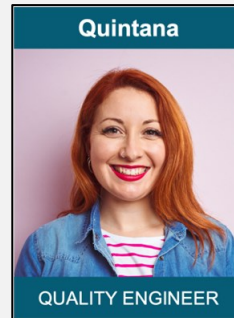
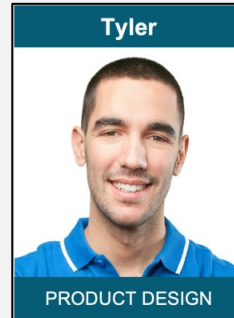


Bill of Characteristics (BoC)

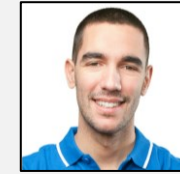


First Article Inspection Report (FAIR)

Who



How



Author
MBD Component
Product Definition

Pass to Quality



Perform Quality
Review

Create (Balloon)
BoC

Create
Quality Plan

Publish
Quality Plan and
FAIR



Inspect
3D Technical Data
Package

Record
Inspection Results



FAIR

SAE AS9102 First Article Inspection (Rev. B)
Form 3: Characteristic Accountability, Verification, and Compatibility Evaluation Sheet

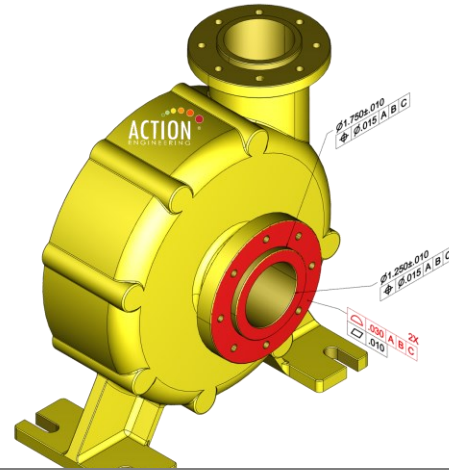
| 1. Part Number | | | | 2. Part Name | | | |
|-------------------------------|-----------------------|------------------------------|-------------------|---------------------------|--------|--------|---|
| 778594 | | | | PUMP CASE | | | |
| Characteristic Accountability | | | | Inspection / Test Results | | | |
| 5. Char. Num. | 6. Reference Location | 7. Characteristic Designator | 8. Requirement | 9. Results | Accept | Reject | 10. Designed Tooling/Gauging used to accept product |
| 27 | 05A-MOUNTING-LEGS | | .276 +.006 -.001 | .277 | | | |
| 27 | 05A-MOUNTING-LEGS | | .276 +.006 -.001 | .275 | | | |
| 27 | 05A-MOUNTING-LEGS | | .276 +.006 -.001 | .276 | | | |
| 27 | 05A-MOUNTING-LEGS | | .276 +.006 -.001 | .276 | | | |
| 29 | 05A-MOUNTING-LEGS | | Ø.276 +.006 -.001 | .277 | | | |
| 29 | 05A-MOUNTING-LEGS | | Ø.276 +.006 -.001 | .276 | | | |
| 29 | 05A-MOUNTING-LEGS | | Ø.276 +.006 -.001 | .277 | | | |
| 29 | 05A-MOUNTING-LEGS | | Ø.276 +.006 -.001 | .275 | | | |
| | | | | .10 | | | |
| | | | | .10 | | | |
| | | | | .10 | | | |
| | | | | .08 | | | |
| | | | | .09 | | | |
| | | | | .10 | | | |
| | | | | .08 | | | |
| | | | | .10 | | | |
| | | | | .08 | | | |
| | | | | .10 | | | |
| | | | | .09 | | | |
| | | | | .10 | | | |
| | | | | .08 | | | |
| | | | | .09 | | | |
| | | | | .001 | | | |

MBD Capabilities

MBD Component

Bill of Characteristics (BoC)

First Article Inspection Report (FAIR)



MBD Component

Bill of Characteristics (BOC)

| Report Type | Reset | DeColonize | Hide | Re-Balloon | Export | Import | Bind | HTML Report | PDF Report | Publish | Import | Measurement Visualization | Charts | | | | | | |
|-------------|-------------|-----------------------|-----------------|----------------|--------|--------|-------|-------------|--------------------|---------|--------|---------------------------|--------|--------|--------|--------|--------|--------|--------|
| Tag | Saved View | Feature Name | Annotation Name | GD&T | (+) | (-) | DRF | Criticality | Measurement Device | SN#1 | SN#2 | SN#3 | SN#4 | SN#5 | SN#6 | SN#7 | SN#8 | SN#9 | SN#10 |
| 11 | 04-DATUM... | Plane 11219 | gp19 | ⊥ 0.05 X Y Z | .050 | - | - | X Y Z | | .0135 | .0000 | .0135 | .0066 | .0135 | .0087 | .0159 | .0142 | .0201 | .0201 |
| 12 | 04-DATUM... | Plane 11219 | gp#1 | ⊥ 0.05 | .005 | - | - | - | | .0005 | .0000 | .0005 | .0002 | .0005 | .0004 | .0005 | .0006 | .0006 | .0007 |
| 13 | 04-DATUM... | Cylinder 11218 | ad3443 | ⊕ 04.750 +0.05 | .005 | 4.750 | -0.05 | - | | 4.7515 | .9713 | 4.7491 | 3.3166 | 4.8812 | 4.0218 | 5.7263 | 6.0904 | 7.5658 | 8.7953 |
| 14 | 04-DATUM... | Cylinder 11218 | gp20 | ⊕ 0.050 X Y Z | .050 | - | - | X Y Z | | 0.144 | .0000 | 0.144 | .0043 | 0.144 | .0100 | 0.150 | 0.172 | 0.173 | 0.197 |
| 15 | 04-DATUM... | Cylinder 11218 | gp42 | ⊥ 0.005 A | .005 | - | - | A | | .0016 | .0000 | .0016 | .0003 | .0016 | .0005 | .0017 | .0007 | .0017 | .0014 |
| 16 | 04-DATUM... | Plane 11203 | gp9 | ⊥ 0.050 X Y Z | .050 | - | - | X Y Z | | .0155 | .0000 | .0155 | .0046 | .0155 | .0071 | .0165 | .0117 | .0171 | .0198 |
| 16 | 04-DATUM... | Plane 11205 | gp9 | ⊥ 0.050 X Y Z | .050 | - | - | X Y Z | | .0110 | .0000 | .0110 | .0034 | .0110 | .0045 | .0115 | .0055 | .0125 | .0108 |
| 17 | 04-DATUM... | Plane 11203 | gp43 | ⊥ 0.005 A B | .005 | - | - | A/B | | .0016 | .0000 | .0016 | .0008 | .0016 | .0012 | .0018 | .0018 | .0019 | .0023 |
| 17 | 04-DATUM... | Plane 11205 | gp43 | ⊥ 0.005 A B | .005 | - | - | A/B | | .0019 | .0000 | .0019 | .0007 | .0019 | .0012 | .0019 | .0013 | .0023 | .0014 |
| 27 | 05A-MOUL... | Opposite Planes 11154 | ad2439 | 276 ±0.05 | .005 | 276 | -0.05 | - | | .2779 | .0291 | .2765 | .1561 | .2858 | .1638 | .3361 | .2981 | .3960 | .4295 |
| 27 | 05A-MOUL... | Opposite Planes 11156 | ad2439 | 276 ±0.05 | .005 | 276 | -0.05 | - | | .2779 | .0135 | .2759 | .1423 | .2779 | .2433 | .2877 | .3020 | .3430 | .3992 |
| 27 | 05A-MOUL... | Opposite Planes 11157 | ad2439 | 276 ±0.05 | .005 | 276 | -0.05 | - | | .2769 | .0012 | .2750 | .1139 | .2755 | .1221 | .2863 | .1732 | .2991 | .1741 |
| 27 | 05A-MOUL... | Opposite Planes 11158 | ad2439 | 276 ±0.05 | .005 | 276 | -0.05 | - | | .2775 | .0476 | .2765 | .1688 | .2926 | .2443 | .3305 | .3543 | .4275 | .4501 |



Solids: 1
 Faces: 67
 Triangles: 35370
 Length Units: Inch
 UNLESS OTHERWISE SPECIFIED,
 ALL DIMENSIONS ARE IN INCHES.
 Default GD&T Standard: ANSI
 PTC Creo Parametric 7

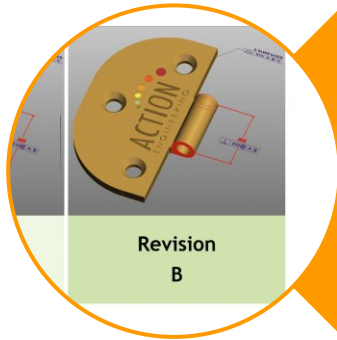


Metrics

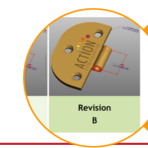
| | |
|--|-------------|
| Time Savings | 73% |
| Reduction in duplicating manual data entry | 66% |
| Increased Throughput in Quality | 53% |
| Data Traceability between Design and Quality | 100% |

Reduce Current Pain Points

- Reduces separation between Design and Inspection Data
- Reduces design interpretation errors and omissions



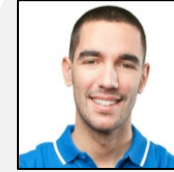
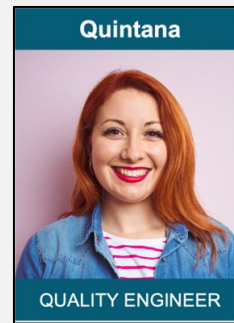
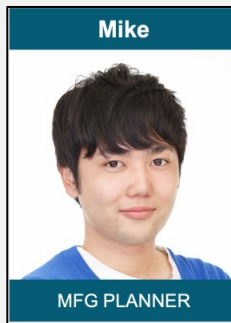
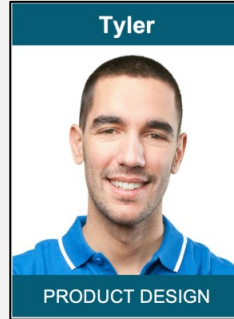
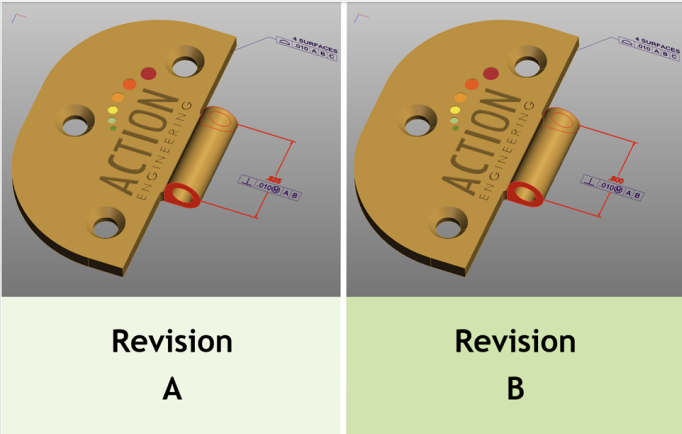
Engineering Changes



What

Who

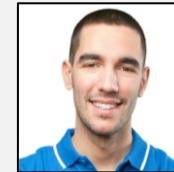
How



Revise
MBD Component &
Assembly
Product Definition



Automated Review
of unintended
changes



Remove unintended
changes Product
Definition

Publish & Pass
3D Report that
compares change to
a previous revision




Review
Revised MBD
Assembly




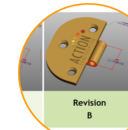
MBD Capabilities

 MBD Component

 MBD Assembly

 Change Detection

 3D Automated Reporting



MBD Capabilities



MBD Component



MBD Assembly



Change Detection



3D Automated Reporting

MBD Component



Tab

- Reduced Width
- Increased Gap

Holes

- Increased positional tolerance allowed
- Decreases manufacturing costs
- Increases manufacturer flexibility

MBD Assembly

| Value (First Model) | | Value (Second Model) | |
|---------------------|--|----------------------|--|
| A | | B | |

| Value (First Model) | | Value (Second Model) | |
|---------------------|--|----------------------|--|
| 2023-02-01 | | 2023-03-07 | |

| Result | Element T... | First Model | Second Model |
|--------|----------------|-------------|-----------------|
| Item | User Attribute | REV_HISTORY | REV_DESCRIPTION |
| Add | User Attribute | | REV_DESCRIPTION |

| Component Summary | | Component |
|-------------------|----------------------------------|-----------|
| Result | First Model | Component |
| Diff | 110115_hinge_s-leaf_creo-rev_a | |
| Diff | 110116_hinge_s-leaf_creo-rev_a | |
| Diff | 110117_hinge_assy_creo-rev_a_bdy | |
| Diff | 110117_hinge_assy_creo-rev_a | |
| Diff | 110114_hinge_pin_creo-rev_a | |

Attributes

- New Revision
- REV
- REV_DATE
- Revised the attribute name
- REV_HISTORY changed to REV_DESCRIPTION

Assembly BOM

- Rev B
- T-Leaf Rev B
- S-Leaf Rev B
- Pin Rev A

Change Report

Differences: Geometry: 10 PM: 4 Attribute: 33

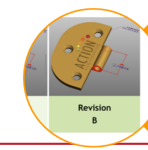
| Group name | Result | Element name | Type |
|--------------|--------|--------------|---------------|
| Ungrouped(4) | Diff | Diff.1 | Face Geometry |
| | Diff | Diff.2 | Face Geometry |
| | Diff | gp21 | OD&T |
| | Diff | hd2232 | Dimension |

| Assembly Tree (First Model) | Assembly Tree (Second Model) |
|----------------------------------|----------------------------------|
| 110117_hinge_assy_creo-rev_a | 110117_hinge_assy_creo-rev_b |
| 110116_hinge_s-leaf_creo-rev_a | 110116_hinge_s-leaf_creo-rev_b |
| 110115_hinge_s-leaf_creo-rev_a | 110115_hinge_s-leaf_creo-rev_b |
| 110114_hinge_pin_creo-rev_a | 110114_hinge_pin_creo-rev_a |
| 110117_hinge_assy_creo-rev_a_bdy | 110117_hinge_assy_creo-rev_b_bdy |

ELYSIUM

| Feature | Result | First Model | Second Model |
|--------------------------|--------|---------------------------------|---------------------------------|
| Max deviation | Diff | 0.0150000 in | -0.0150000 in |
| Max deviation coordinate | Diff | (-0.002419, 0.141365, 0.830000) | (-0.044364, 0.132754, 0.815000) |

Change Detection and 3D Automated Reporting



Metrics

| | |
|--|-----|
| Time Savings | 75% |
| Reduction in duplicating manual data entry | 80% |
| Cost reduction due to scrap reduction | 20% |

Reduce Current Pain Points

Improved change communication

Reduces change interpretation errors and omissions



Key Performance Indicators (KPIs)

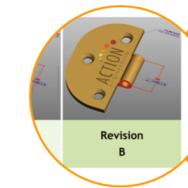
| | |
|----------------------------------|---|
| Sustain Existing Business | Definitive Communications between Engineering and Manufacturing and Quality |
| Cost Reduction | Decrease part costs by up to 35% |
| Business Growth | A new business offering to deliver standard-compliant MBD assemblies to customers |



Design Review



Quality Planning



Engineering Changes



GETTING STARTED

Assess Your Readiness

- Complete 3D Transformation Readiness Assessment
- Conduct Process and Software Tools Inventory
- Collaborate on Customized Business Case

Prove Your Case

- Visualize your products as 3D data
- Maximize 3D data for manufacturing using our software tools
- Benchmark Efficiencies with Your Data

Form Your Team

- Set a Neuroscience-Based Organizational Change Foundation
- Empower Cross-Functional Ownership
- Refine Plan of Action for 3D Transformation

Build Your Foundations

- Assess Supply Chain Readiness
- Interview Users and Stakeholders
- Identify Training Needs
- Create Communication Plan



Plan Your Rollout

- Establish Iterative Project Practices
- Establish a Range of Use-Case Scenarios
- Establish Metrics
- Develop Strategic Implementation Roadmap
- Plan Your Pilots

Get Rolling

- Enunciate New Processes
- Learn Tools and Standards
- Train Authors, Practitioners, and Conversers

Pilot & Learn

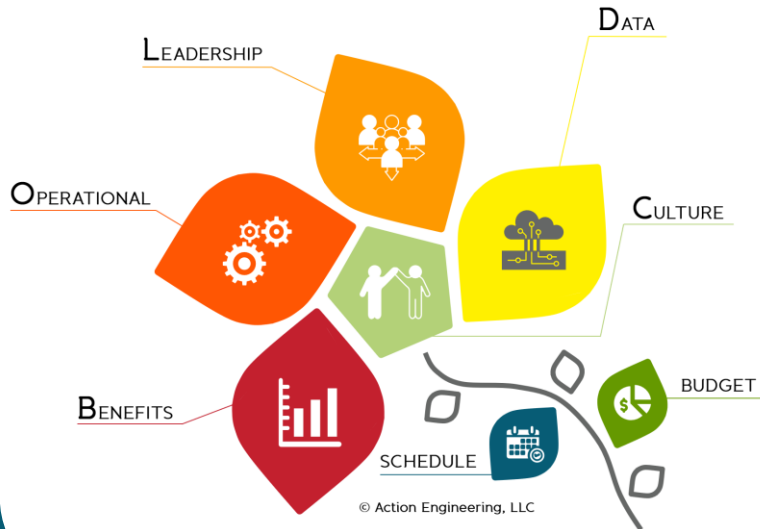
- Test & Increment New Processes
- Write & Increment Your Modeling Standards
- Train Consumers and Engage Supply Chain

Scale & Expand

- Amplify Stakeholder Communications
- Expand Pilot Complexities
- Scale Training
- Refine Tools
- Practice, Reflect, and Adapt

ROI & ACTIONABLE READINESS ASSESSMENT

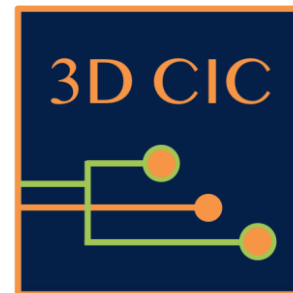
BOLD Culture Scorecard



3D TRANSFORMATION IMPLEMENTATION FRAMEWORK



FOSTERING COMMUNITIES OF PRACTICE



3D Collaboration &
Interoperability Congress

EXPERT GUIDANCE



Team Training



1:1 Coaching



FOUNDER & CEO

Jennifer
Herron



jennifer@action-engineering.com

action-engineering.com

3D Collaboration & Interoperability Congress
March 4-7, 2024
Golden, Colorado

3DCIC.com
The Digital Future...

A QR code located in the bottom right corner of the banner, which likely links to the 3DCIC.com website. The banner has a dark blue background with orange and green accents and a circuit-like graphic on the right side.

3DCIC.com