





The Quality Information Framework for the World

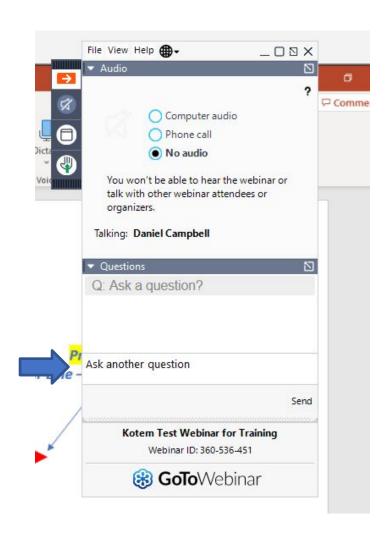
4.19.22



House keeping



- You will have the opportunity to submit text questions to today's presenter by typing your questions into the Questions pane of the control panel.
- You may send in your questions at any time during the presentation; we will collect these and address them during the Q&A session at the end of today's presentation.
- You will receive an email with a link to today's webinar presentation.











The Quality Information Framework for the World

4.19.22



Today's Speaker





DMSC President

Curtis Brown





CREDENTIALS

- Principle Mechanical Engineer and MBE Focus Lead at the Kansas City National Security Campus (KCNSC) managed and operated by Honeywell Federal Manufacturing and Technology
- Chairman for DOE's National Security
 Enterprise MBE Transition Initiative Team
- Major contributor to the NSE's MBE Maturity
 Index w/ MBE Lexicon
- Inventor of a fully semantic tolerance application, Feature-Based Tolerancing (FBTol)
 Advisor that checks and scores PMI
- DMSC President; Co-Chair for Model-Based
 Product Characteristic Working Group

QUOTE

Attain trusted models, managed for confident reuse, throughout all product lifecycle activities.





Who is the DMSC?



We developed and maintain a standardized, interoperable, data framework for manufacturing.

We create Quality Standards that impact the digital thread through digital metrology and interoperability.



qifstandards.org



Who is the DMSC?



- A non-profit, cooperative sponsorship, consortium organization. Conceived & sponsored in 1983; Separate legal entity 2005, dba Digital Metrology Standards Consortium as of 2018.
- Dedicated to identifying, promoting, fostering, and encouraging the development and interoperability of information standards that benefit the digital metrology community.
- Preparing standards that impact the model-based quality enterprise.
- A professional group of manufacturing metrologists, software developers, and innovators worldwide. Note: 500+ years of experience contributed to the QIF.
- Maintainers of <u>Dimensional Measuring Interface Standard</u> (DMIS) standard.
- Developers & maintainers of <u>Quality Information Framework</u> (QIF) standard.
- ANSI accredited standards developing organization
- A-Liaison member of ISO / TC 184 / SC 4 (allows for harvesting ANSI standards)
- Charters working groups for enhancement of existing or creation of new standards



DMSC's Quality Standards Pedigree



I ((' I (A A A I)							ogy Standa Incorpora		DBA as Digital Metrology Standards Consortium (DMSC					
DMIS 1.0 Began		DMIS 2.1 Accepted as ANSI Standard		ANSI Update & Accepted as ISO Standard		DMIS 5.1 ANSI Update		DMIS 5.2, ISO 22093 Accepted by ISO		QIF v2.0 ANSI Update		QIF v3.0 ANSI Update		
1986	(88)	'90	95	(01)	'04	07	(10)	(11)	13	14	(16)	2018	2020	
	DMIS 2.0 Released		3.0 ANSI Update		DMIS 5.0 ANSI Update		5.2 ANSI Update		QIF v1.0 Accepted as ANSI Standard		QIF v2.1 ANSI Update & DMIS 5.3		QIF v3.0 Accepted as ISO	
Dime	nsional N	/leasuring	g Interfa	ace Stand	ard (DN	∕IIS)					ANSI Update		23952	

ISO 22093:2011 – Industrial automation systems and integration – Physical device control – Dimensional Measuring Interface Standard (DMIS)

Quality Information Framework (QIF)



Quick Poll



What QIF Version are you primarily using or planning to use?

- □ QIF 3.0
- □ QIF 2.1
- □ Before QIF 2.1
- ☐ Future QIF version
- None / To Be Determined

ISO/ANSI/DMSC QIF 3.0 - 2018



ISO/TC 184/SC 4

Secretariat: ANSI

Voting begins on:

Voting terminates on: 2019-10-14

Quality information framework (QIF) — An integrated model of manufacturing quality information

ICS: 25.040.40

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD HINTH DIED ISHED AS SILCH

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL TECHNOLOGICAL. COMMERCIAL AND USER PURPOSES. DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL BEGULIATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITE TO SUBMIT, WITH THEIR COMMENT NOTIFICATION OF ANY RELEVANT PATEN RIGHTS OF WHICH THEY ARE AWARE AND T PROVIDE SUPPORTING DOCUMENTATION. This document is circulated as received from the committee secretariat.

FAST TRACK PROCEDURE



Reference number ISO/DIS 23952:2019(E)

© ISO 2019

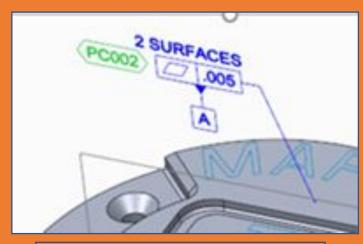
- Sent to Resolution M: Nov 2018
 - ISO / TC 184 / SC 4 approved by "Unanimous Consent" for Fast Track Ballot
- ISO Approved: July 2020
 - Approved and completely harvested the ANSI/DMSC QIF v3.0 standard
 - Changed only the cover-sheet, copyright, headers, and footers
 - Includes an Explanatory report for harvesting QIF 3.0 into the ISO TC184 / SC4 Working Group 15 on Digital Manufacturing
 - Includes a mapping of entities found between STEP-AP 242 and QIF.



Latest Activities - Working Groups



Model-Based Characteristics

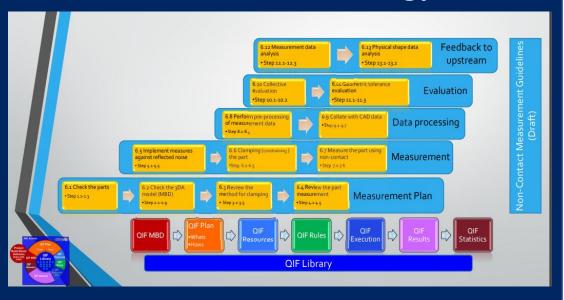




Model-Based Characteristics: Nomenclature, Definitions, Symbols, Data Structures, and Practices for Product Definition. Includes Persistent Identification (e.g., UUIDs)

Characterstics with optional augmentations

Non-Contact Metrology



Non-Contact Metrology

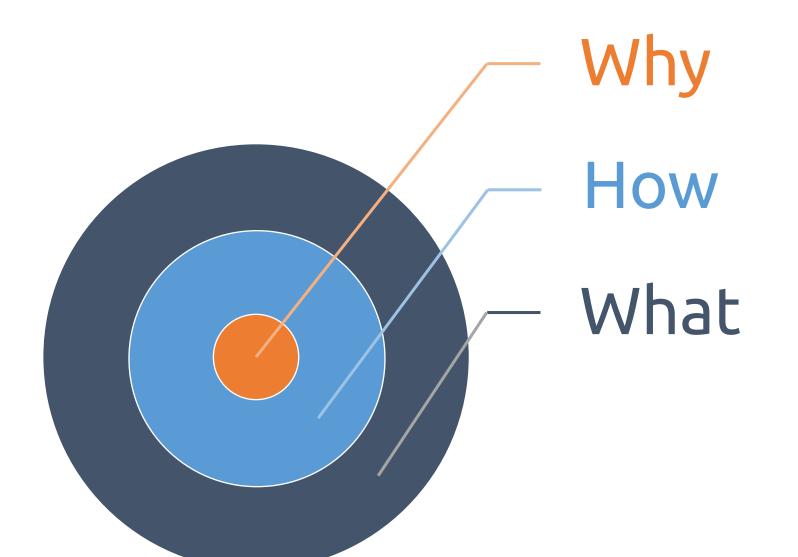
DMSC to enhance support for non-contact measurement workflows utilizing QIF

Working jointly with AIST/MMJ to develop enhancement to QIF 3.0 standards; ANSI & ISO



Why, How, What is the QIF?





The manufacturing world needs a interoperability standard for digital metrology.

ANSI/DMSC -> ISO Standards

- Structured Neutral Format
- Minimal Software Development
- XML Schema

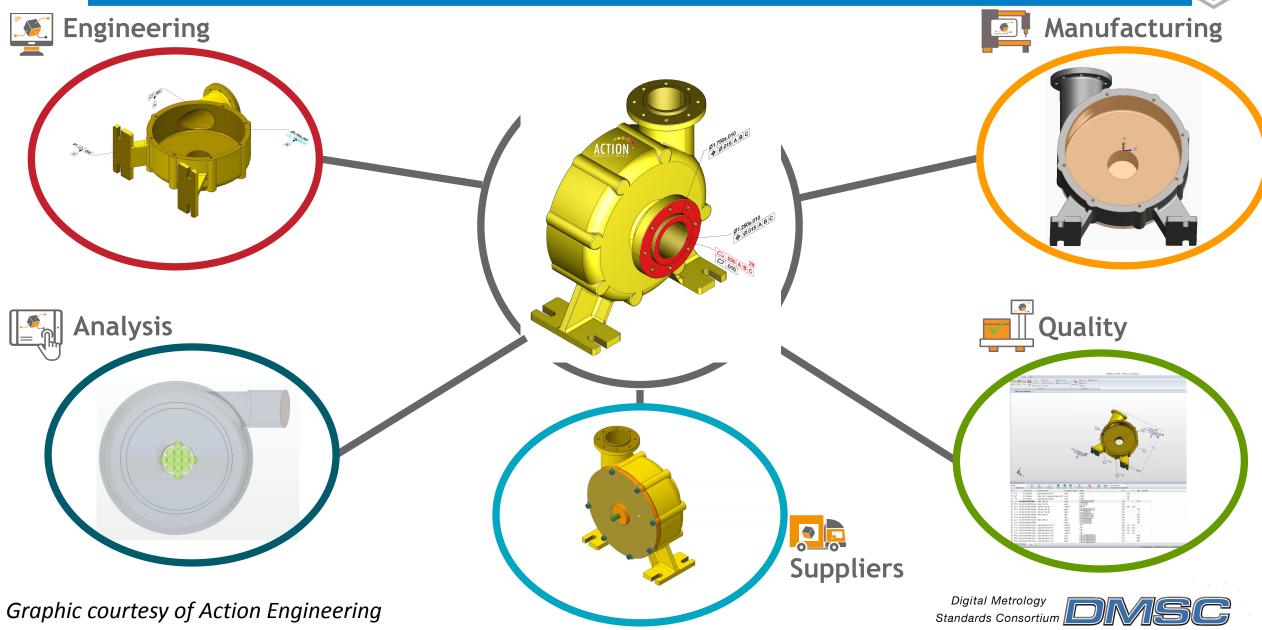
3D digital metrology data that is:

- Persistent
- Traceable
- Trusted



The DMSC and QIF enables Industry 4.0





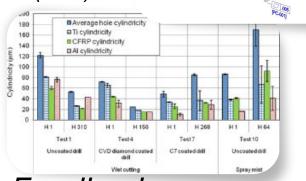
The QIF Standard



- Quality Information Framework (QIF)
 - ANSI/DMSC QIF v3.0 2018
 - ISO QIF 23952 2020

An Integrated Model for Manufacturing Qual^{*}

- Defines, Constrains, and Exchanges:
 - Model-Based Definition
 - Feature-Based (Metrology/Measurement)
 - Semantic PMI (Characteristics)
 - Quality Planning
 - The Whats: qBOM = Bill of Characteristics (BoC)
 - The Hows: Inspection Plan (Methods)
 - Measurement Execution
 - DMIS 5.3 w/QIF QPIds
 - Measurement Results
 - Piece Part
 - Statistical
- Enterprise Connectivity for Quality Feedback
 - QIF's Quality Persistent ID (QPId) (i.e., Universal Unique ID (UUID))
 - 651aded1-ff04-498a-968e-044147a2506d

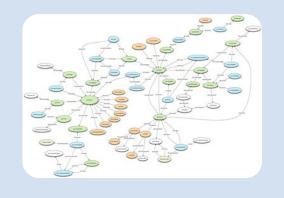


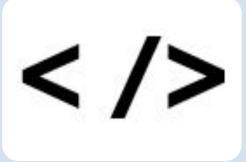
ė			SELVING THE PARTY NAMED IN COLUMN TWO IS NOT THE	THE PARK			PER STA	PROJECT OF STREET STREET, PROPERTY OF STREET, PROJECT OF STREET, PROJE				
	-	1000/1000	-	7000	E.	400001 901001	-	1		1444	****	
		1.0	1.	-	19.00	-	-		T	411	4.	
	-	11000100	-	700	-	2007 E	- AND	100		1.		
		100 3100	-	-	100	-	-	10000	b	2.1	1	
		707.90	-	- 5	-	-	-	.04	Ε	400		
	NAME OF STREET	1000	-		-	-	-	112870	н	2.1	1	
	OR E MA	NOTICE!	-	-	-	-	-	1100	р	3-1	-	
		150707	18	1000	-	- 10	-	100	t	18-21	_	
		electric control		min.	-	-		196	F	4+1	1	
	No. botto	1 more to an	1901	100.0		-	-	140	۲	4.1	1	



What is the QIF?













Feature-Based
Characteristic
Centered
Ontology of
Manufacturing
Quality
Metadata

Simple
Simple
Implementation
with Built-In
Code
Validation

Information
Semantically
Linked to MBD
for Full Data
Traceability via
Persistent IDs

(QPId/UUID)

QIF 3.0
Approved as an Digital Interoperability Standard ANSI/DMSC 3.0; ISO 23952:2020

Developed and Maintained by the Digital Metrology Standards Consortium (DMSC)



QIF Application Areas



Statistics: Reference a bundle of QIF Results sets and specify a statistical analysis method to be carried out. Can optionally include the results of the statistical analysis as well

Results: Measurement results data, associated with the MBD! This can be just tolerance evaluation results, and can even include all the point cloud data from the features.

DMIS is not part of QIF, ISO 22093, however the latest ANSI DMIS 5.3 has been updated to harmonize with the data traceability mechanisms in QIF.

QIF Statistics Statistical process control using QIF 6

QIF Results

DMIS

QIF via

ISO/DMIS 5.3

is fully linked to

QPlds

Measurement

result data

QIFMBD CAD. Shape, PMI. & Features

QIF Plans

Bill of Characteristics ("what") and Inspection Plan



Measurement

macros, and

best practices

Features Characteristi

QIF Library

QIF Resources

3

QIF Rules

Rules: templates for creating measurement rule instances. (e.g., If a Surface Profile tolerance value is less than x, then use a CMM method with at least **y** number of point/sq.in.)

MBD: is the basis for providing traceability to authority CAD data. It is not required for basic QIF use cases. Considered to be the strongest semantic CAD+PMI standard available.

Plans: range of optional levels of detail for measurement plans:

- What to Measure: Bill of Characteristics
- How to Measure: Inspection Plan
- Assign measurement resources
- Specify sampling point locations

Resources: specifies basic or highly detailed information about available measurement equipment (e.g., CMMs, probes, calipers, gages). As always, this data is contextual and semantic.



QIF Enables a Quality Digital Thread











QIF-MBD

QIF-Plan s QIF-Resour ces

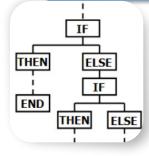
QIF-Docume nt

QUALITY DIGITAL THREAD



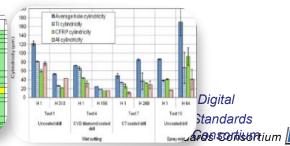
QIF-Rule s QIF-Executi on w/ DMIS 5.3

QIF-Resu Its QIF-Stati stics





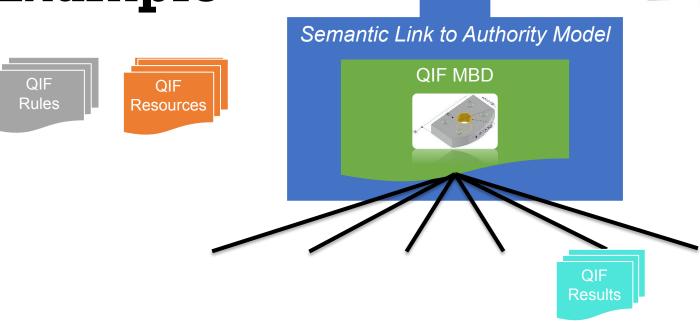






A QIF Workflow Example

Process is linked to the authority model construction of the authority measurement in the cess of the process of the construction of the c





| R. L. Crown | R. Crown | R. Resulting | R. Result

Identify Measurement Tasks (Bill of Characteristics)





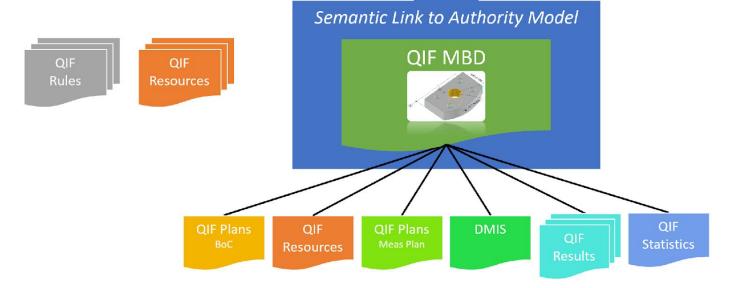


Workflow Example

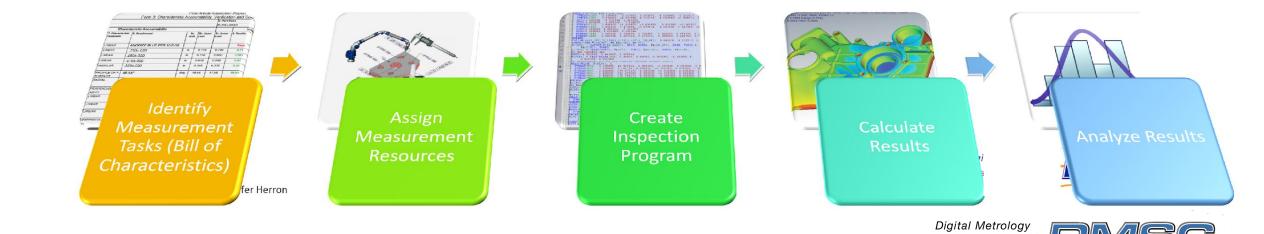
QIF DIA

All QIF data generated throughout the entire process is linked to the authority model.

This fulfills traceability requirements, and provides fertile opportunities for data mining.

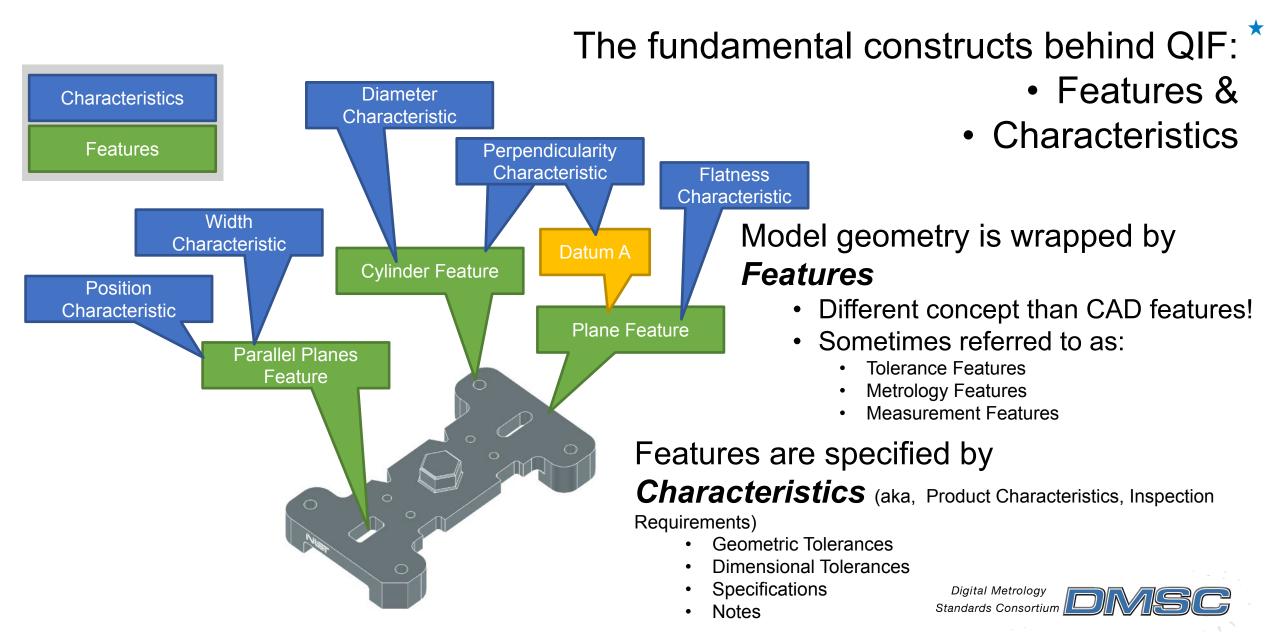


Standards Consortium



QIF: Features & Characteristics





What is a QPid?



QIF Persistent Identifier (QPId) noun Cu·pid \'kyü-pəd\

- Universally Unique Identifier (UUID) (adopted by Microsoft as GUID)
 - ISO/IEC 9834-8
 - 550e8400-e29b-41d4-a716-446655440000

- QPIds uniquely identify
 - QIF Document
 - QIF Plan
 - QIF Result
 - QIF Rule Set

- Feature Item
- Characteristic Item
- Product Item
- Resource Item



An Important Mechanism that facilitates Lifecycle Connectivity w/Traceability



Example QPId



QIF Document identified with QPId

<QPId>906c4d97-5a81-4ccb-b328-2bab6b800765</QPId>

Shape Feature of Complex Surface has QIF File ID & QPId

<GenericFeatureNominal id="3178">

<QPId>27B6743A-126D-4CE2-84C5-A174A4FF0120</QPId>

Surface Profile Tolerance Characteristic has QIF File ID & QPId

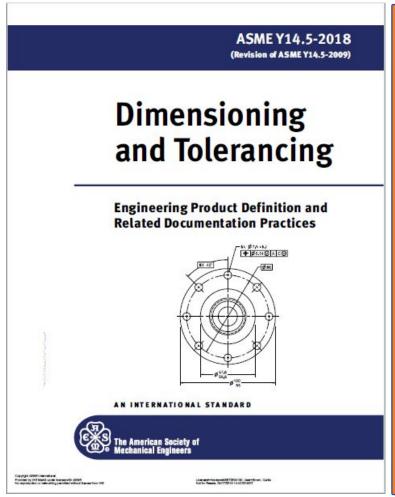
<SurfaceProfileCharacteristicNominal id="2022">

<QPId>C650DF4C-4FC7-4841-916A-2BC4CA78D766</QPId>





How does it work for multiple GD&T Standardspr



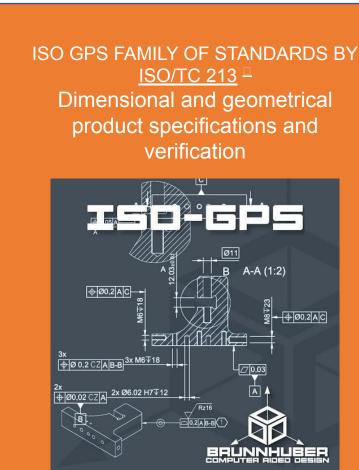


Image from





Model-Based Characteristics Working Group



Manufacturers want:

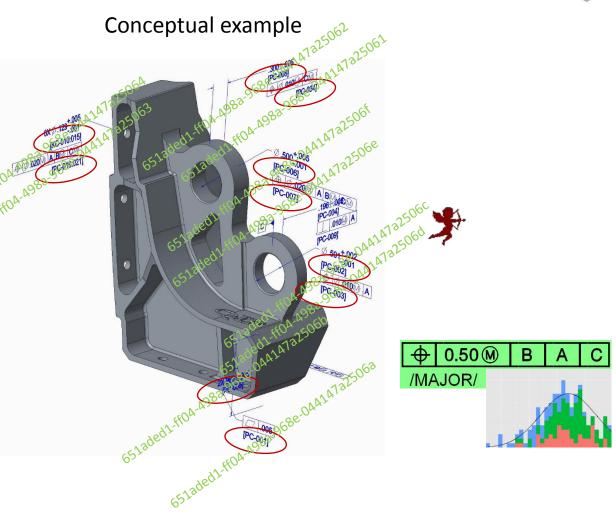
 Model-Based Product Characteristic Tags w/ optional Augmentations such as Criticality Classification, Product Requirement Associations, and/or Quality Plan Requirements



Persistent Universal Unique IDs

A3AAD9BD-5D94-48B6-BF84-F17FAAFF34AA

 Product Acceptance Data Visualized on the Authorized Source Model



QIF with Persistent Model-Based Product Characteristics:

Enables Measurement Results to be

Traceable Back to the Model

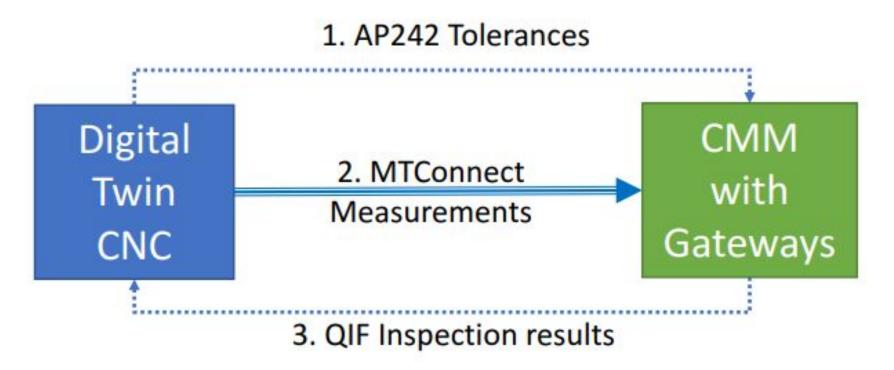


Digital Twin Demonstration



• IMTS Grand Challenge

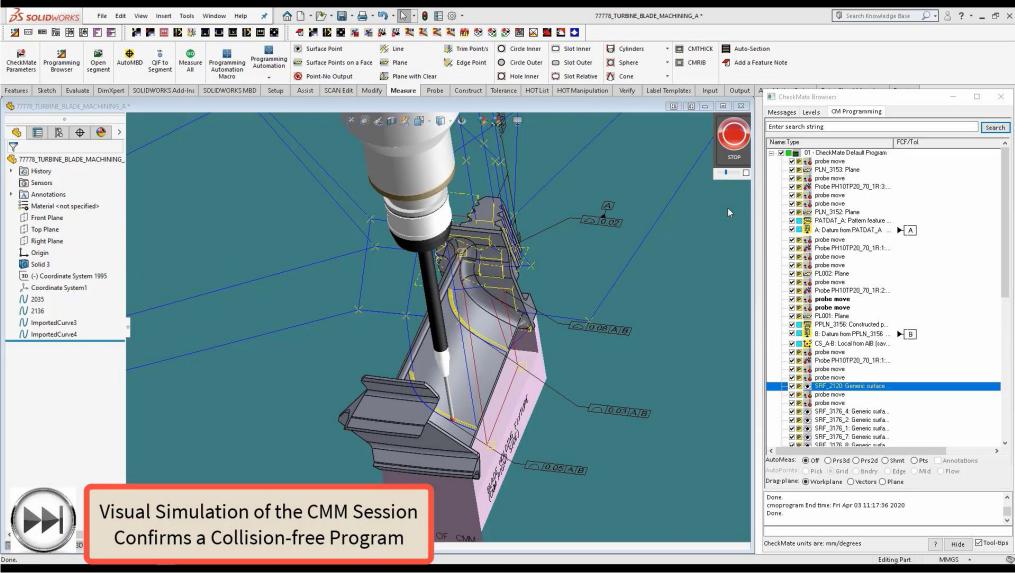






CMM Programming using QIF

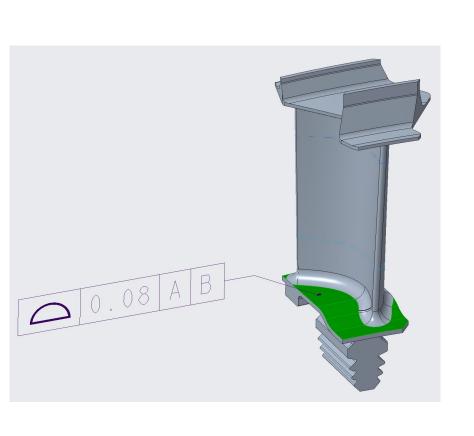


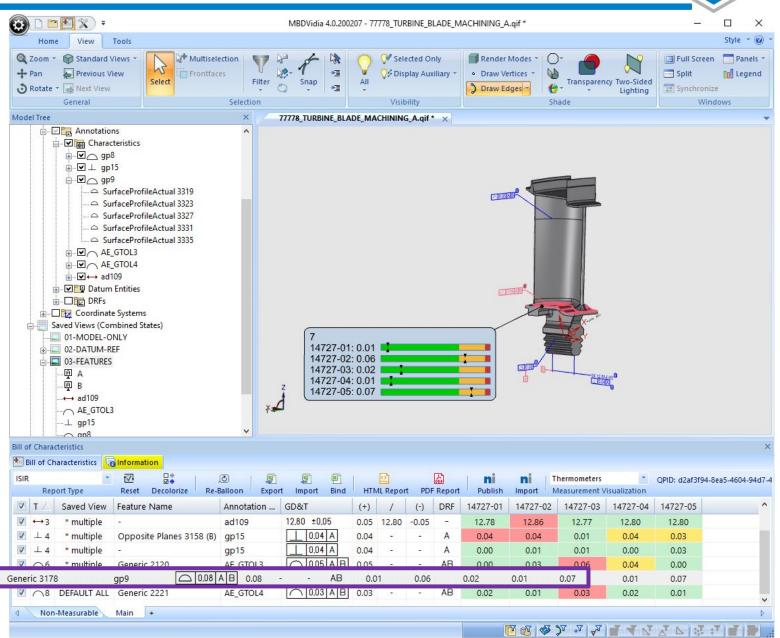


Recording Measurement Results

▼ △7 * multiple







QIF Business Value



Manufacturing (Users) Perspective

- Reduce Cost
- · A common information interface
- Freedom of choice in selection of both value and performance based metrology solutions.



- Interoperability allows for Best-In-Class / Best-in-Value (hybrid solution)
- One standard format for measurement results.
- Persistent traceability between disciplines and back to the Model
- Enables Quality solutions to communicate inspection results back to design & manufacturing.
- Impacts quality functions within a Model-Based Enterprise
- Common format of PMI & feature-based MBD, linked w/ quality information
- ANSI recognized standard, an ISO standard even better

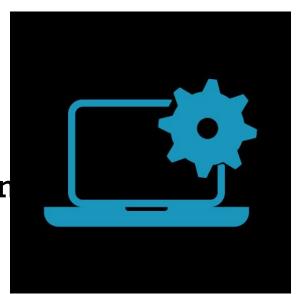


QIF Business Value



Vendor's Perspective

- Reduce Cost
- Concentrate on Core Competency
- Inherent validations for data correctness
- Ease of (XML Schema Based) Implementation
- Cost efficient to implement and use
- Minimize software development
- Avoid non-value (proprietary systems) development
- Complete and extensible
- Expanded market opportunities (penetrate proprietary systems)
- One standard format for measurement results.
- Common format of PMI & feature-based MBD linked w/ quality information
- ANSI recognized standard, an ISO standard even better



Quick Poll



What is your organization's current level of QIF maturity?

- None
- Investigating
- Planning
- Implementing
- Adopting







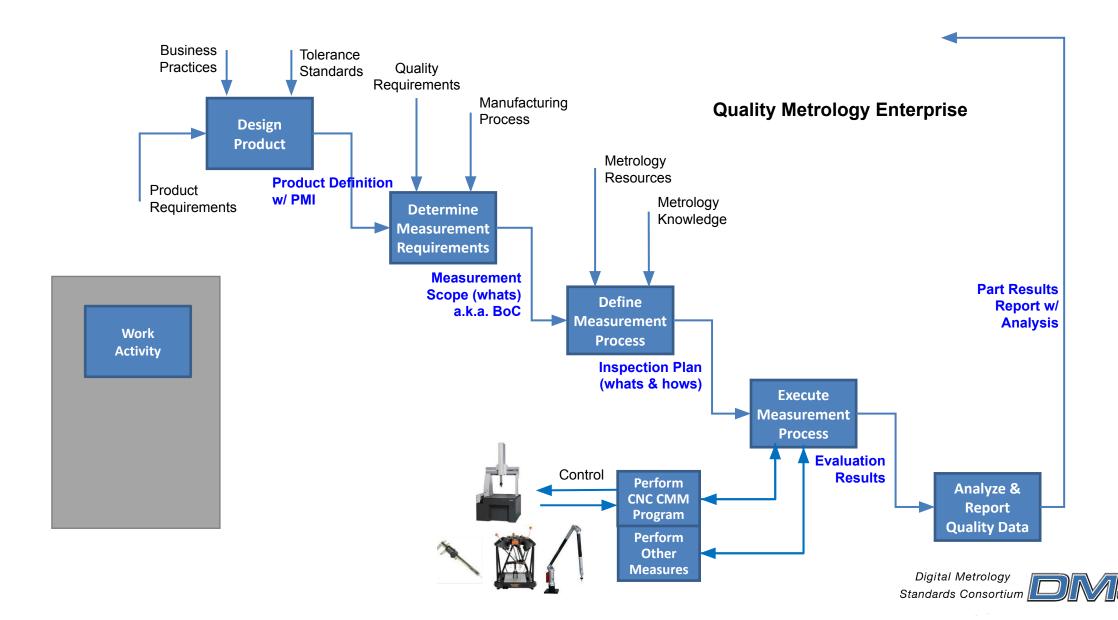
Critical Enabler for Digital Transformation





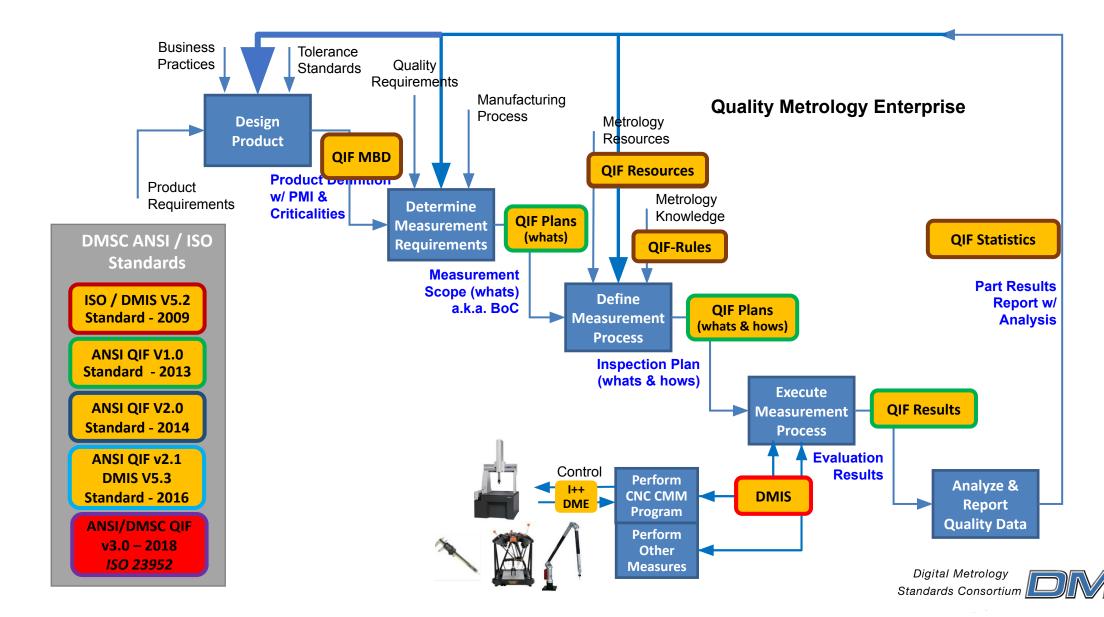
Product Acceptance Activity Workflow





Quality Information Activity Workflow

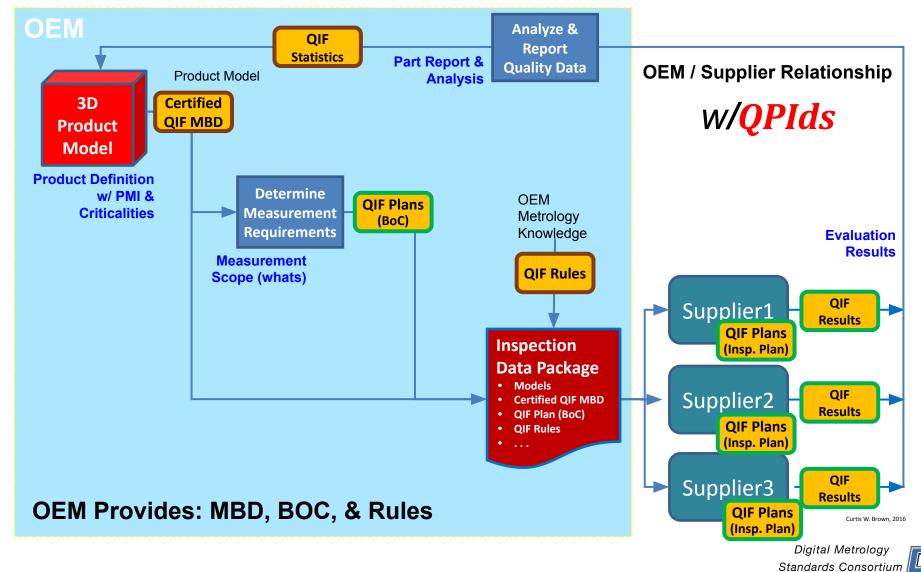




Use Case: Measurement (BoC) w/Rules



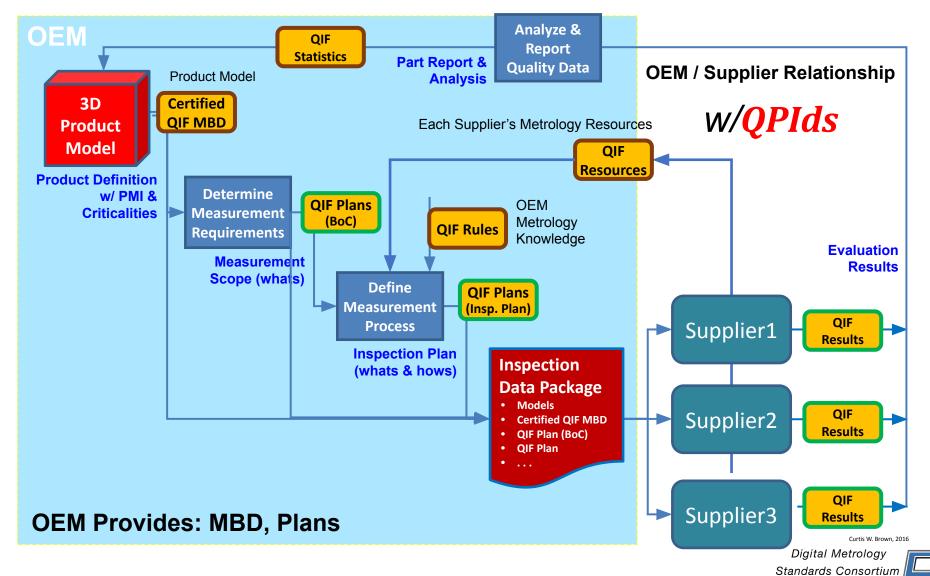
Buy: QIF advances the OEM/Supplier Relationship



Use Case: Supplier Specific Inspection Plans



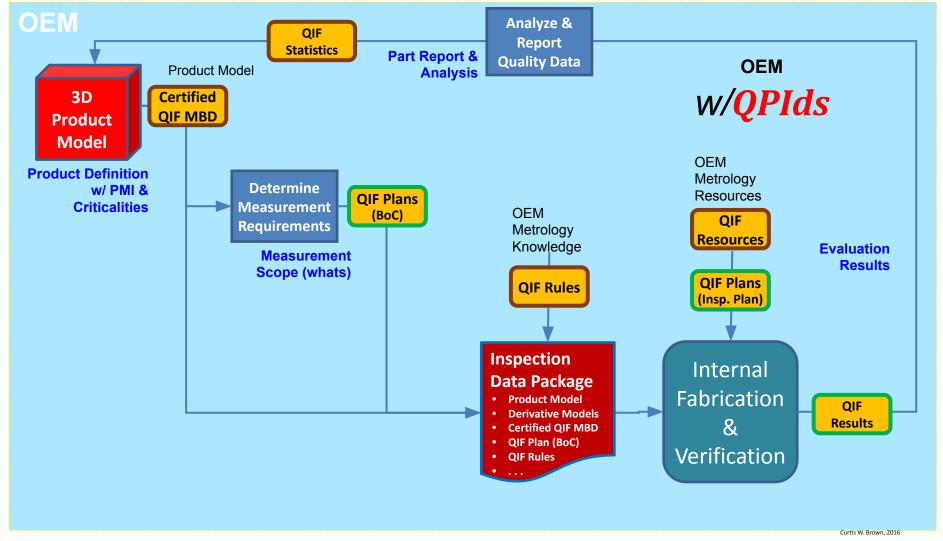
Buy: QIF advances the OEM/Supplier Relationship



Use Case: Fabrication



Make: QIF advances the OEM Fabricaion





Impacting the Digital Thread with Quality



- QIF is a global standard
- QIF defines a structured information format that captures, communicates and preserves digital metrology related data that enables manufacturing automation
- QIF's standardized containers simplify machine-to-machine connections by independent quality software providers
- QIF impacts Industry 4.0 & digital thread through quality interoperability
- The **DMSC** is **driving** the QIF standard onward:
 - Model-Based Characteristics Working Group
 - Non-Contact Measurement Work Group
 - Working with standard organizations to harmonize QIF with other standards



CY22 DMSC Members





































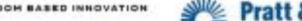






















A United Technologies Company





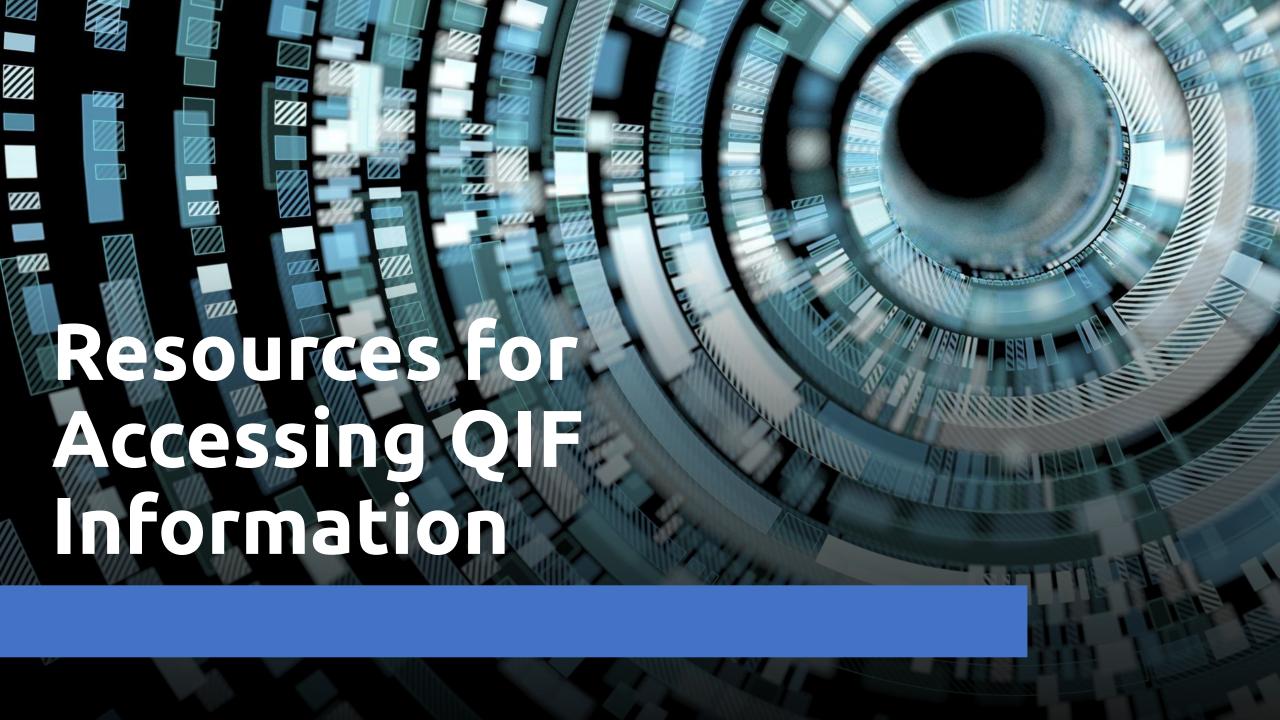
CY22 DMSC BoD & Officers



Daniel Campbell Capvidia	Jennifer Herron Action Engineering
Rosemary Astheimer Purdue University	Larry Maggiano Mitutoyo America Corporation
Jeremy Hamilton Deere & Co.	Sam Gambrell Lockheed Martin
Curtis Brown - President Honeywell FM&T	Ray Stahl - Secretary 2BMobile LLC
Rosemary Astheimer - Treasurer Purdue University	Mark Thomas – Executive Director Blue Tuna

Bailey Squire - Executive Director - Emeritus





QIF on the Web



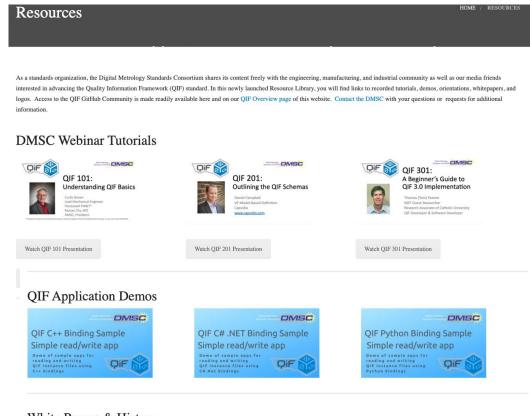
QIFStandards.org





https://qifstandards.org/

OIF Resources



White Papers & History







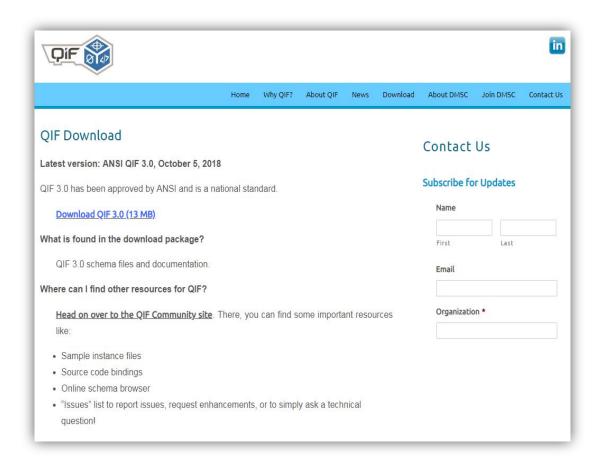


QIF on the Web



Download QIF

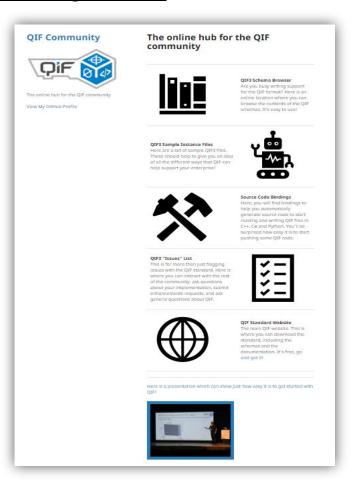
http://qifstandards.org/download/



OIF Community - GitHub

https://qualityinformationframework.github.io/

- QIF Schema Browser
- QIF Sample Instance Files
- Source Code Bindings
- QIF "Issues" List
- QIF Standard Website
- Getting Started Video





Quick Poll



What should the DMSC do next?

- Create a QIF Wikipedia Info Page
- Extend QIF with new Measurement Resources
- Extend QIF with additional Product Characteristics
 Capabilities
- Get QIF Registered as a NARA (national archive)
 Approved Format (Note: XML is an approved format)
- Provide a QIF MBD Viewer



Request to Take Action





Spread the QIF



Join the DMSC



Download QIF

Visit us at:



qifstandards.org



Join Us



<u>DMSC</u><u>Membership</u><u>Value</u><u>Summary</u>



Scan Me

Membership
Levels &
Application



Scan Me

DMSC Membership Meeting 21 April @ 10 AM EDT

Meeting Details



Scan Me



DMSC Panelists for Q&A











Daniel Campbell





