

Improving First Article Inspection in a Model-Based Environment

Technical Data Package
Summit Gaithersburg, MD



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Agenda

- **Mission and Vision**
- **Challenges in Our Industry & Supply Chain Risk**
- **DMSC & Value of Information Exchange Standards**
- **CAV**
- **Improving first article inspection in a model centric environment**
- **The Importance of FAI**
- **Using Tools to improve AS9102 Compliance**
- **QMS Pilot Project**
- **Business process mitigates against successful FAI for Many Weapons Systems**

Quality Planning/Processes; Our Key to Success

Mission and Vision



Our Vision

Powered by Innovation, Guided by Integrity, We Help Our Customers Achieve Their Most Challenging Goals

Our Values

- *Do What's Right*
- *Respect Others*
- *Perform With Excellence*

Our Mission

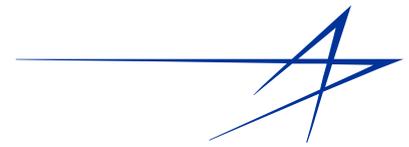
To Provide Superior Weapon Systems and Advanced Technologies that Protect Our Warfighters

Fundamental Business Principle

Our Business is Not the Objective ... It is the Result

Performance Is Our Objective

Peoples Lives are At Stake....



Toyota Recall



Clean Up Cost = Est. \$10B
Claims Cost = Est. \$20B

Gulf Oil Spill



Cost = Est. \$2B

Space Shuttle Challenger



IMPACTS

- Loss of Reputation
- Financial Loss
- Product Performance
- Product Recall
- Loss of Business

Missing Broach & Crimp



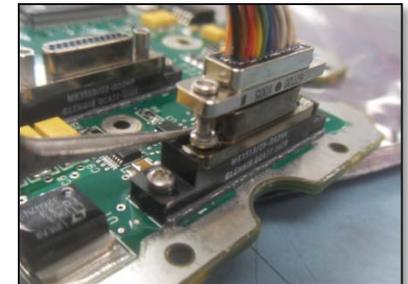
Connector Pins



Plating Issue



Power Supply



A Great First Article Inspection Can Catch Mistakes

Supply Chain Quality Risks



Risks

- Domestic and International Economy
- 2nd and 3rd Tier Supplier Performance
- Government Policy Changes
- International Trade Regulations
- Increased GIDEP Notifications

Quality Pressures

- Supply Chain, 2nd & 3rd Tier
- Experienced Talent
- Supplier Value Stream
- Fixed Price
- Non Traditional Quality is Less Tangible
- Technical Challenges

Preventing Difficult to Detect Risks

Pure Tin and Lead Free Problem

- Tin whisker effects documented since the 1940's
- Tin Whiskers
 - Occur on nearly all tin alloys
 - Few microns to 5 inch
 - Electrically conductive
- Hardware
 - tin plated nuts, bolts, covers, card guides, etc. also at risk
- Whisker induced failures:
 - Short Circuit - bridges from adjacent pins
 - Metal vapor arc - high voltage and specific atmosphere of catastrophic damage
 - FOD - whisker breaks off and interferes with mechanism

GOVERNMENT - INDUSTRY DATA EXCHANGE PROGRAM

Scope of Counterfeiting

More than a Backyard Industry!
Billions of Dollars Stolen

Counterfeit Removal
Reprocessing

Various Quality Strategies

- Development
- Production
- Life Cycle
- Subcontracts
- Distributors
- COTS/MOTS
- Service
- Software
- Hardware
- Labs

CAV & FAI Critical to Success

99.99% Success Rate Is Unacceptable

CAV

- **Characteristic Accountability & Verification (CAV)** – a process used to ensure that all Critical and Major characteristics are defined and accounted for in the product technical data package and manufacturing and quality plans, and to ensure that manufacturing planning includes controls adequate to ensure continued conformance of these characteristics.

- **All Components shall be subjected to First Article Inspection in accordance with AS9102. Those with Critical and/or Major Characteristics shall be subjected to recurring First Article Inspections. Critical or Major characteristic inspection shall be performed at the lowest possible component level that allows adequate inspection of the Critical or Major characteristic.**



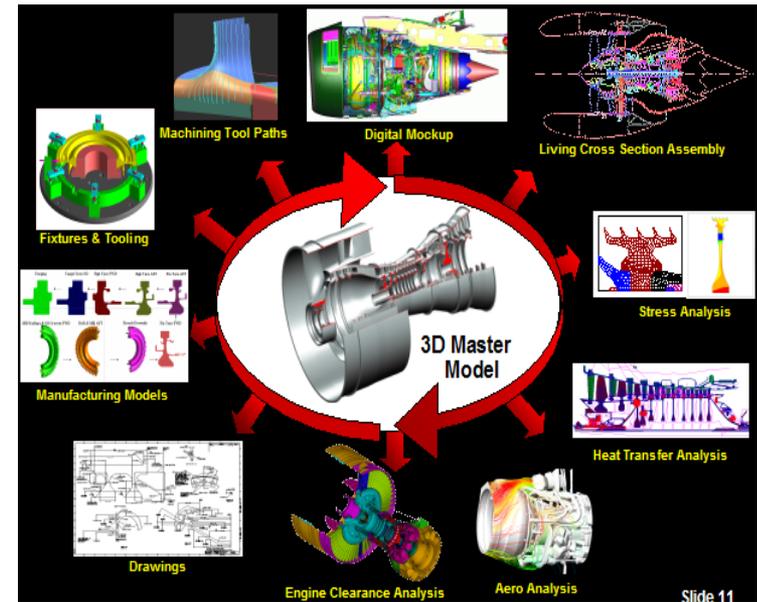
What Are The Requirements

Top Product Definition Issues



- CAD data (including GD&T) does not flow seamlessly to downstream processes when components are not from same vendor.

- GD&T data is not associated with individual features of the part (the CAD model) which makes it impossible to automate inspection process programming. If GD&T information is expressed as annotations in CAD files or as notes on drawings, it is not available to automated computer processes that can use it.



- It is difficult if not impossible to know if a vendor truly supports a standard as advertised. When a vendor claims that its product conforms to a standard, there is often no means of certifying that the product actually does conform to the standard as claimed. There continues to be divergence in the use and interpretation of GD&T standards both within the U.S. and at the international level. Some major companies have adopted internal variations in the way that they interpret and apply the standards. It is believed that this practice will result in interoperability problems in the near future. The standards effort must be international, involving multiple government standards organizations.

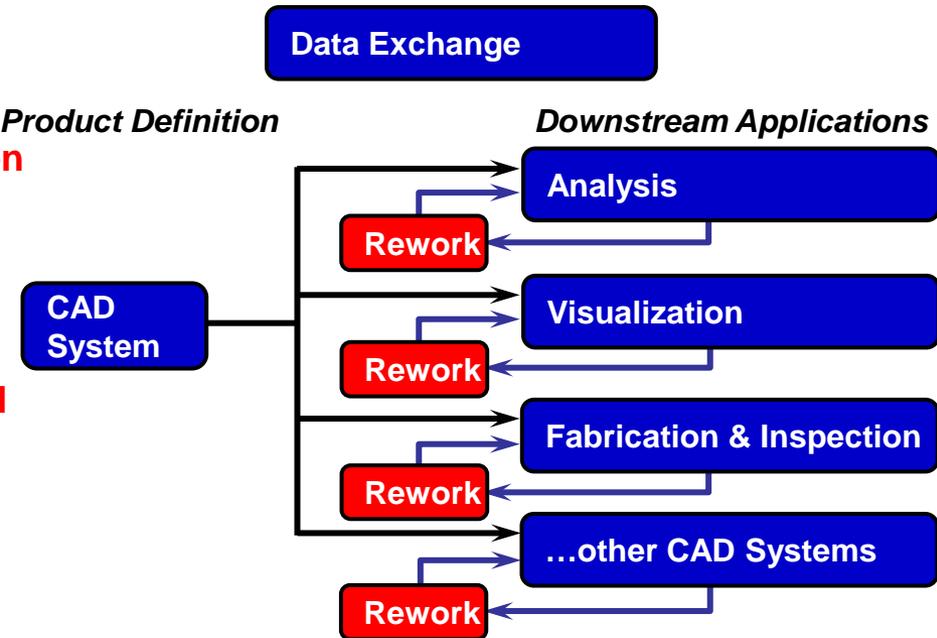
- Crosscutting Issue: There are currently no “consensus” approaches to the interconnection of components/systems. The “big picture” needs to be defined before unified efforts can be developed to solve this important problem. There is no shared vision between vendors and users for interoperability

Top Inspection Process Definition Issues



- The lack of comprehensive non-shape information available from the product
- Definition model – CAD tolerance data, material properties, optical properties, etc.
- The lack of a standard mechanism to capture and exchange knowledge – including
- Methods, practices, and rules.
- The lack of resource definition from the product definition model or elsewhere – such

- As inspection equipment capability, capacity, available configuration, performance,
- Measurement uncertainty, etc.
- Does DMIS support all measuring devices?
- The macro-to-multiple-micro planning interface is not well defined.



Benefits of Model Centric



- **Shorten Design Cycle & Improve Quality by Eliminating Parallel Data Paths**
 - **Avoid conflicts between model and drawing**
 - **Minimize risks associated with data re-creation**
 - **Minimize costs by facilitating data reuse**
 - **No need to recreate model dimensions to capture design intent**
 - **Enable design activities to better collaborate through sharing models**
 - **Enable the future management of key characteristics (per AS9100) and their relationships to product definition data**
- **Enhance Downstream Data Sharing via Configuration Managed Models**
 - **Enhance Visualization**
 - **Model use in Documentation**
 - **Streamline simulation to optimize the total product design throughout the life-cycle**
 - **Manufacturing Engineering and our suppliers fabricate and Inspect from model data**
- **Competitive Industry Requirement**
 - **Leverage efficiencies related to the use of standards for data exchange and electronic data transfer throughout our supply chain**



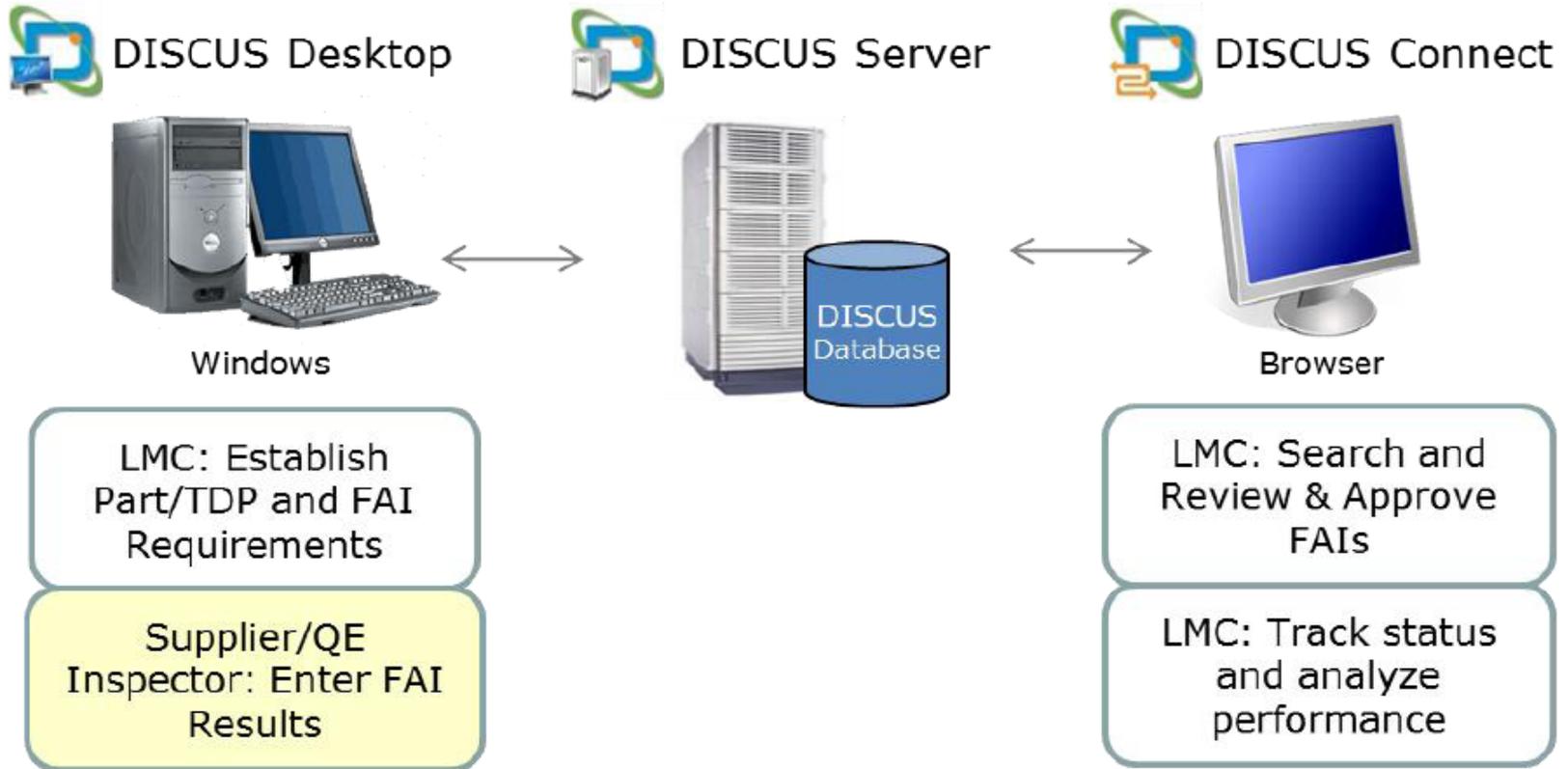
Why the FAI is so important

- Customer requirement
- Reassurance that we are compliant to specifications
- Repeatable process
- Parts are built correctly
- Assure the shop/supplier is capable

What You Need to Perform FAI

- Knowledge of FAI Process
- Work Instructions/Planning for part (SAP)
- BOM/Parts List
- [FAI Checklist](#)
- Vaulted Drawing and all engineering requirements

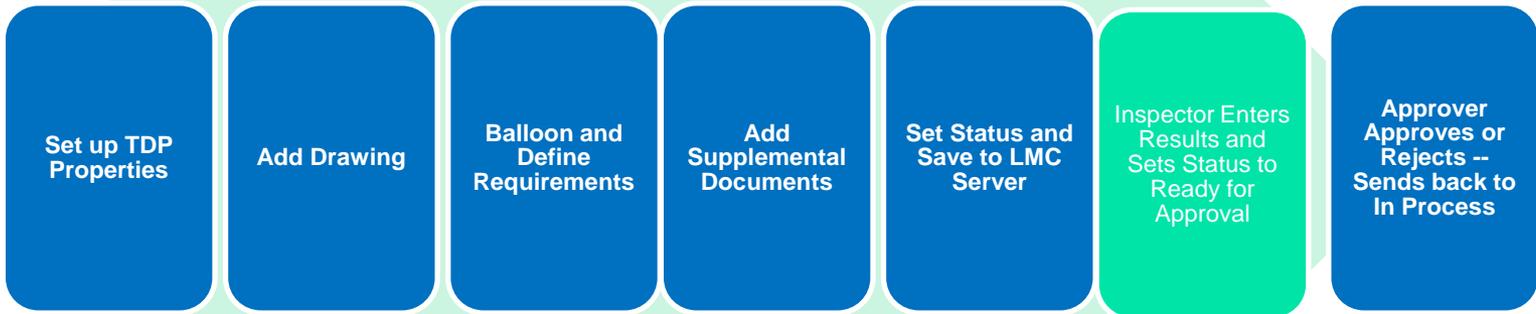
New DISCUS Process



TDP Process

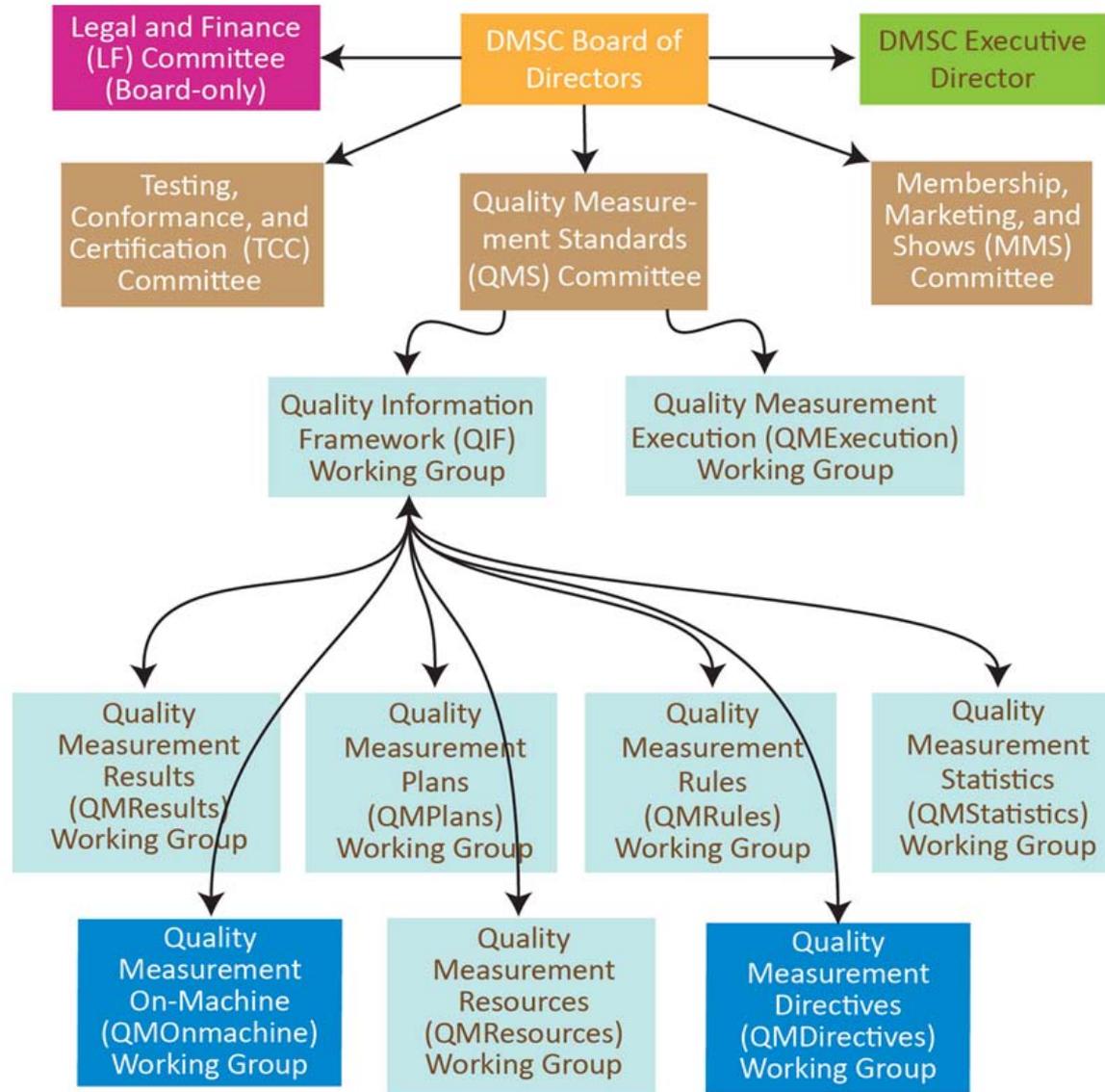


QE / SQFE Process

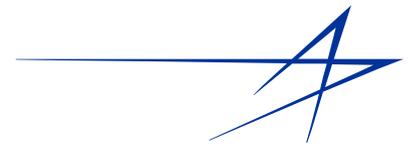


Inspector Process

DMSC Organization

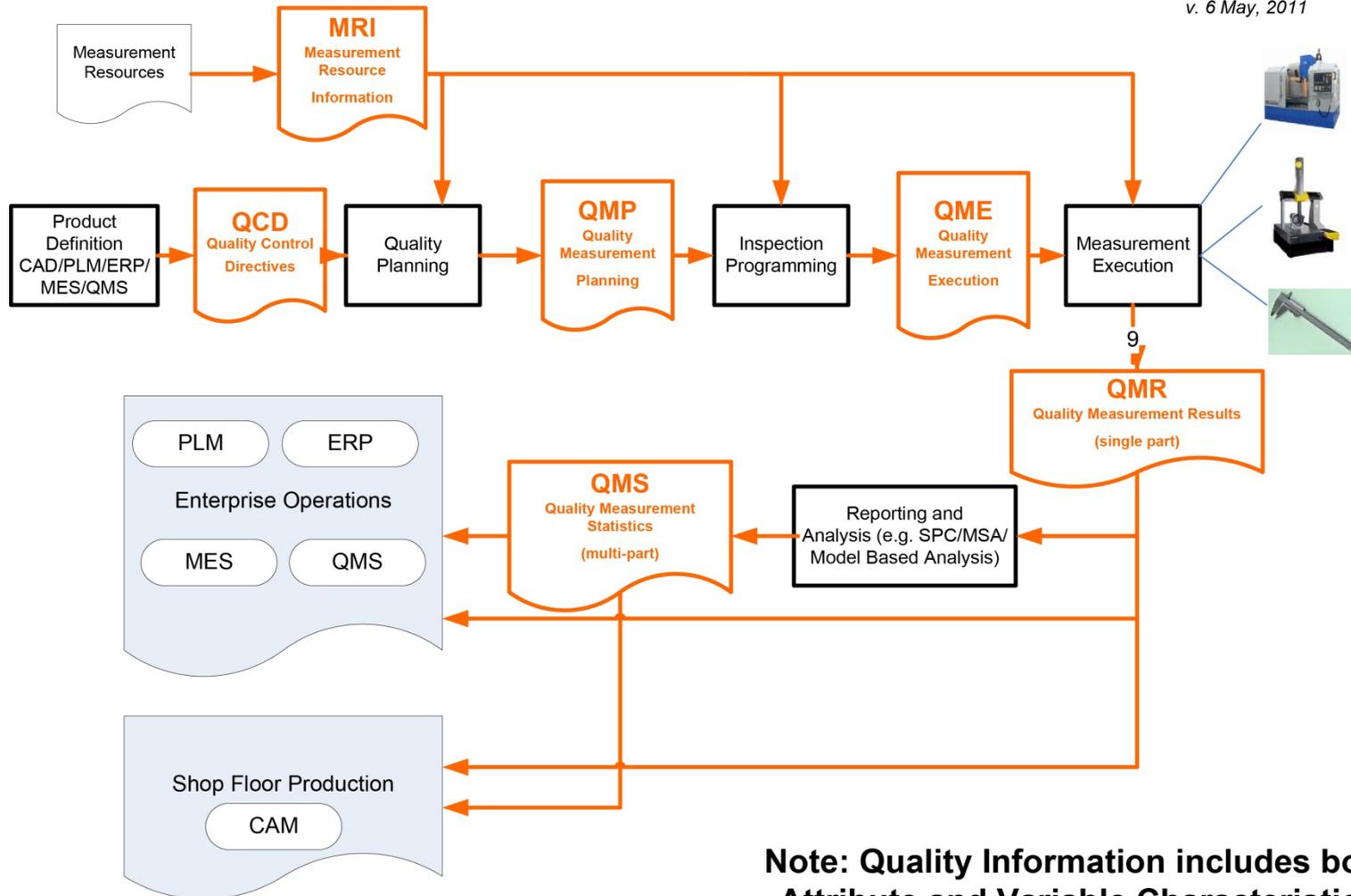


QIF Activity Model



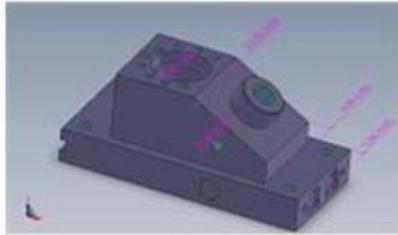
Quality Information Framework Activity Diagram

v. 6 May, 2011



Note: Quality Information includes both Attribute and Variable Characteristics

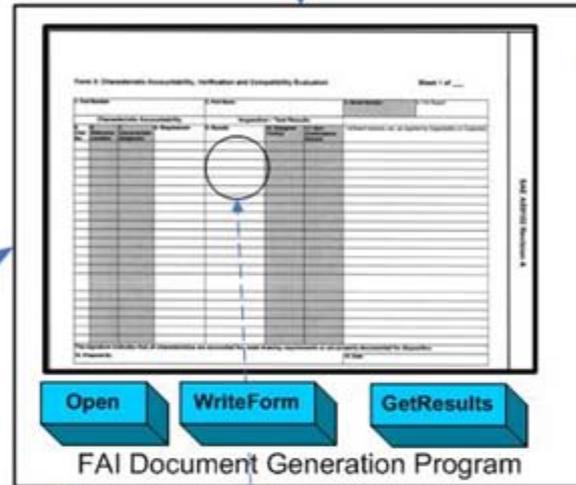
A system that generates AS9102a First Article Inspection Documents Using QIF Specifications



Technical Data Package
CAD + GDT
Other design and process data

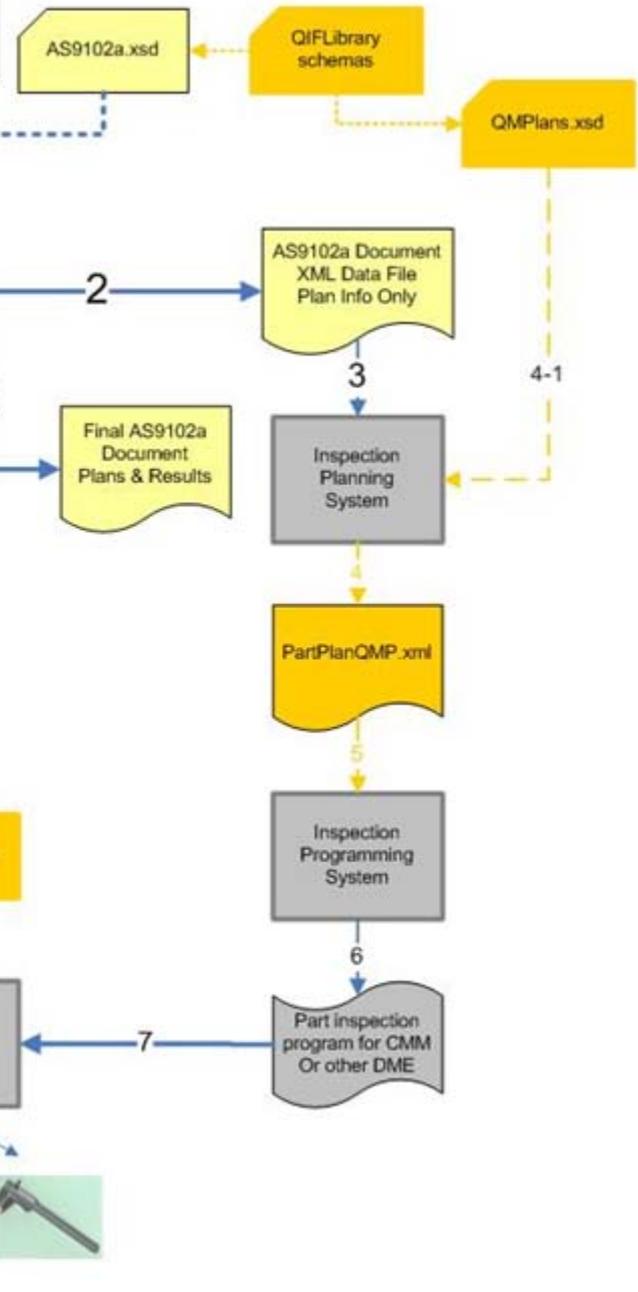


Quality Engineer

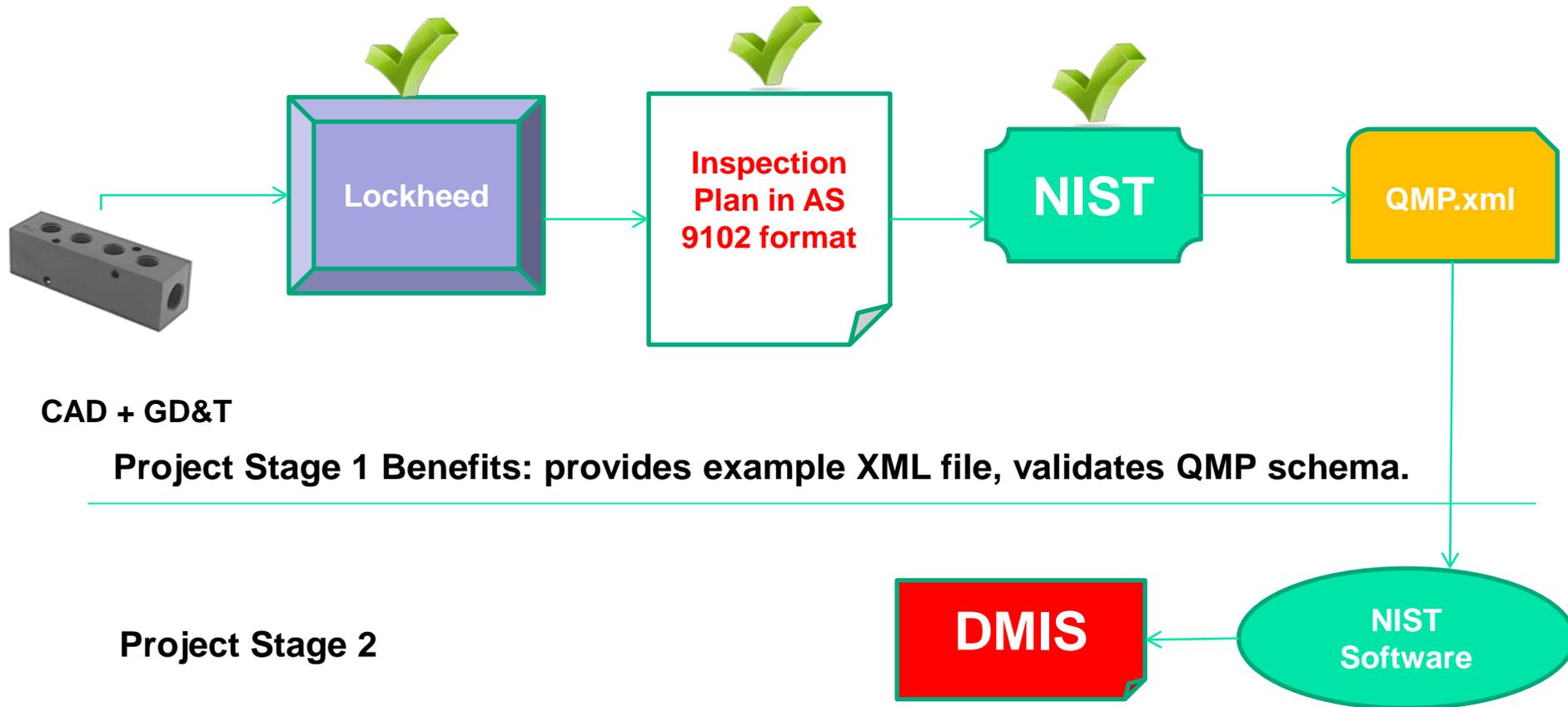


KEY

- Traceable to QIF
- QIF format
- Proprietary



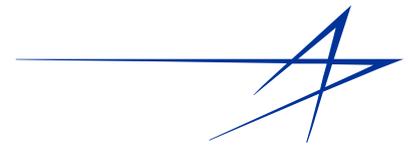
QMS Pilot Project (NIST-LMC)



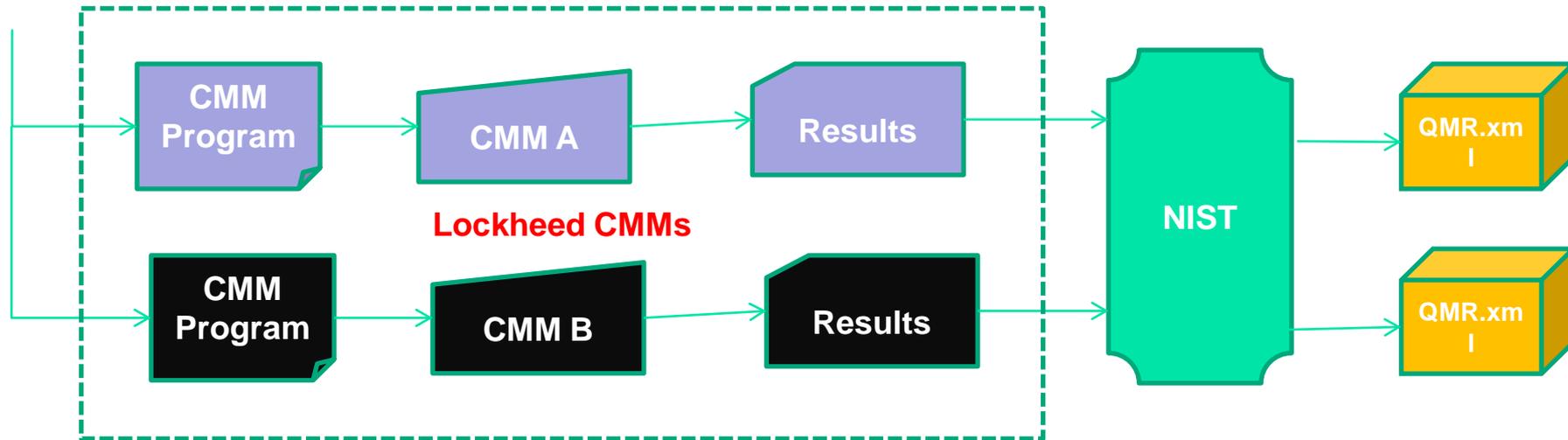
Quality Measurement Planning Pilot Project

Hypothetical Stage 3: A measurement planning solution provider may export QMP from its planning software. This stage is only doable when the first two stages are successful and attract interest from Lockheed management level and vendors.

QMS Pilot Project (NIST-LMC)



Measurement requirements
(CAD + GD&T)

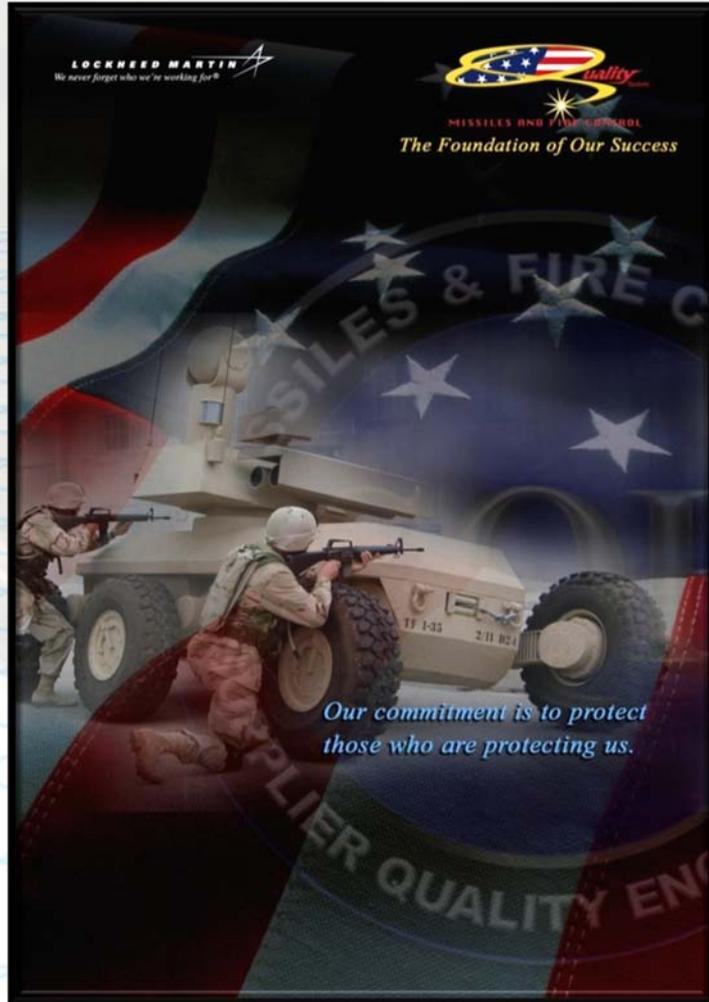


Quality Measurement Results Pilot Project

Project Stage 1: Benefits: validate QMR schema; provides example QMR files; demonstrates interoperability of QMR.

Hypothetical Stage 2: A CMM software vendor may generate/convert measurement results in QMR. This stage is only doable when the first stage is successful and attracts interest from Lockheed management and a vendor.

In Summary



Automation Improves Our Success

- **Customer Expectations**
- **Complexity of Industry and Risks**
- **Result of Failure is Severe**
- **MFC Expectations**

Product Definition and Requirements are Vital

Protecting the Customer's Interest

