AS13100 Standard Overview & Deployment

Supplier Forum April 21st 2021
Please note we are recording today’s webinar.

This recording will be available for free viewing on the AESQ website subsequent to this event. An email notification will be issued to attendees when the video is available.
AS13100 Standard Overview & Deployment

Supplier Forum April 21st 2021
Welcome to the AESQ Supplier Forum

Over 1600 people registered from 41 Countries
AESQ Supplier Forums

Typically held twice a year, rotating around North America, Europe and Asia

AESQ Supplier Forums provide an opportunity to:

• Provide updates on the work of the AESQ
• Share best practice
• Provide feedback to the AESQ
• Develop a network of practitioners and Subject Matter Experts
Introducing AS13100: AESQ Quality Management Requirements

THE NEW STANDARD CREATING A COMMON LANGUAGE FOR QUALITY THROUGHOUT THE AEROSPACE ENGINE SUPPLY CHAIN

SAE AS13100 ENSURE QUALITY MANAGEMENT SYSTEM REQUIREMENTS FOR AERO ENGINE DESIGN AND PRODUCTION ORGANIZATIONS

This standard sets out to create a common set of supplemental requirements with common terms and reference manuals to enhance understanding, efficiency, and performance. While significantly simplifying the business of suppliers with multiple customers, the primary focus of this new standard is to discover and improve product quality by focusing on the key systems in aerospace industry, detecting critical control deficiencies, and identifying how to fix them.

Those common supplemental requirements sit to raise the bar for high-tailed performance in these key areas, and therefore ensure guidance is provided to ensure clarity of expectations.

To ensure customer satisfaction, this selection, scope, and value-in-use organizations have to produce and continually maintain high-quality products that meet or exceed customer requirements. Organizations across the aerospace industry and the resulting diversity of operational requirements and environments have created the environment. This product organizations face the challenge of ensuring the quality of the integration of systems produced from captive or through the world and at all levels within the supply chain. Industry leaders face the challenge of defining a method to motivate customers bearing varying quality expectations and requirements.

Learn more: www.sae.org/standards/content/AS13100/

AESQ – Aerospace Engine Supplier Quality Strategy Group

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BREAK

15
Use the Chat Function to Ask a Question...

... or just make a comment.
AERO ENGINE SUPPLIER QUALITY GROUP (AESQ) OVERVIEW

BARBARA NEGROE
EXECUTIVE SOURCING QUALITY LEADER
GE AVIATION
Aero Engine Industry Burning Platform

Aero Engine Manufacturers created a Collaboration working group to address burning platform in 2013 with key Global Suppliers

Used the Automotive example of QS-9000 with Ford, GM and Chrysler as the model

- Airline passengers set to double in size over the next 20 years
- Customers expect Zero Defects
- Increasing level of supplier made engine content
- Global Supplier Footprint
- Large number of common suppliers between engine manufacturers
- Wide range of Aerospace engine supplier businesses, from <$1M to >$2B
- Improving Quality, Cost and Delivery remains a key challenge
Aero Engine Supplier Quality Group Principles

- Aero Engine Manufacturers created a Collaboration working group to address burning platform in 2013 with key Global Suppliers
- Used the Automotive example of QS-9000 with Ford, GM and Chrysler as the model
- Purpose is to:
  - Simplify and Standardize Aero Engine supplier requirements through the removal of duplication and waste
  - Create a common language for Quality
  - Build on existing industry standards, where they exist
  - Create Requirements that are simple, prescriptive, and auditable
  - Promote the use of standardized 3rd party training
  - Deliver results with pace
  - Focus on effective deployment and improving the capability of the shared supply chains
Aero Engine Supplier Quality (AESQ) Members

GE Aviation
Pratt & Whitney
Rolls Royce
Safran Aircraft Engines
Honeywell Aerospace
MTU Aero Engines
GKN Aerospace
PCC Structural, Inc.
Howmet Aerospace
IHI
The AESQ Steering Group Members

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Executive Sourcing Quality Leader
GE Aviation

Lisa Claveloux
Sr. Director Quality
Raytheon Technology Corp.

Helen Djäknegren
Director Global Supplier Quality
GKN Aerospace

Ian Riggs
Global Quality Executive
Rolls-Royce

Emmanuel Vivier
VP Quality Commercial Engines
Safran Aircraft Engines

Barrie Hicklin
Director, Quality Systems & Regulatory Compliance
Honeywell

Martin Schäffner
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MTU Aero Engines

James Clifton
VP Quality
PCC Structural

Osa Omoruyi
Director of Quality
Howmet

AESQ – Aerospace Engine Supplier Quality Strategy Group
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AESQ Vision

To establish and maintain a common set of Quality Requirements that enable the Global Aero Engine Supply Chain to be truly competitive through lean, capable processes and a culture of Continuous Improvement.
Aero Industry Requirements Flowdown 2012

Regulator Requirements

Customer Requirements

Industry Requirements

NADCAP

IAQG (AS9100, AS9145, AS9102, etc.)

ISO (ISO9001, ISO19011, etc.)

AERO Engine Manufacturers

Rolls-Royce SABRe

GE S-1000

P&W ASQR-01

Safran SAFe

Aero Engine Supply Chain

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Product Life Cycle & Current AESQ Document Interaction

**AS9145 PPAP Events**
- **AS9145 PPAP Element Timing**
- **Design Release (CDR)**
- **Initial Prod. Approval**
- **Production Launch**
- **Kick Off**
- **End of Concept (PDR)**

**AS9145 APQP Phases**
1. **Planning**
2. **Product Design & Development**
3. **Process Design & Development**
4. **Product & Process Validation**
5. **Ongoing Production, use and Post Delivery Service**

**AS9145 Key PPAP Events**
- **Design Records & DRA**
- **Process Flow Diagram**
- **PFMEA**
- **Control Plan**
- **Packaging, Preservation & Labelling**
- **MSA**
- **FAI**
- **Production Readiness Review**
- **FAIR**
- **Production Process Run**

**AESQ 2nd Level Documents**
- **AS13000 – Problem Solving Requirements for Suppliers - 8D**
- **AS13001 – Delegated Product Release Verification Training Requirements**
- **AS13002 – Inspection Frequency Plans**
- **AS13003 – Measurement Systems Analysis**
- **AS13004 – PFMEA & Control Plans**
- **AS13006 – Process Control Methods**

AESQ – Aerospace Engine Supplier Quality Strategy Group
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**Example Best Practice Stories**

Sam Suzhou make Engine Mounts
16 Part Specific FMEAs using AS13004 created in 3 months
PFMEA led to the Introduction of error proofing and prevention controls
Defect Free since September 2017

Fan Case Delivered Defect Free at PPAP after applying AS13004, AS13003 and AS13006
70 consecutive parts now delivered Defect Free
Manufactured by GKN, Newington
PPAP completed in 6 months instead of the usual 18 months

IPT Turbine Blade machining using AS13006 Real Time SPC
98% of features Cpk >2, the other 2% Cpk >1.67
Zero Defect standard met since production start (5,000 blades)
AS13100 OVERVIEW

STRUCTURE & KEY HIGHLIGHTS

DR IAN RIGGS
QUALITY EXECUTIVE
ROLLS-ROYCE CIVIL AEROSPACE
Aero Industry Requirements Future Vision

Regulator Requirements

Customer Requirements

Industry Requirements

NADCAP (AS9100, AS9145, AS9102, etc.)

IAQG (AS9100, AS9145, AS9102, etc.)

ISO (ISO9001, ISO19011, etc.)

AERO Engine Manufacturers

AESQ AS13100 Quality Management Requirements
(Supplemental Requirements to AS9100 & AS9145)

AERO Engine Manufacturer Specific Requirements
(e.g. SABRe, S-1000, ASQR-01, SaFE)

Aero Engine Supply Chain
AS13100 Creation Process

Starting Point
September 2018

Requirements

Existing Engine Maker
Supplier Requirements

Harmonized Requirements

OEM Unique Requirements

Future Engine Maker
Supplier Requirements

Overall Number of Requirements
reduced by >50%

AES13100 Standard

Supporting Guidance & Best Practice Material

AESQ Reference Manuals

Existing & WIP
AESQ Standards

AS13100 Creation Process

Starting Point
September 2018

Requirements

Existing Engine Maker
Supplier Requirements

Harmonized Requirements

OEM Unique Requirements

Future Engine Maker
Supplier Requirements

Overall Number of Requirements
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AES1300 Standard

Supporting Guidance & Best Practice Material

AESQ Reference Manuals

Existing & WIP
AESQ Standards

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### AS13100 Structure

<table>
<thead>
<tr>
<th>AS13100 Requirements</th>
<th>Chapter A AS9100 Rev D Supplemental Requirements</th>
<th>Chapter B APQP &amp; PPAP AS9145 Supplemental Requirements</th>
<th>Chapter C Defect Prevention Quality Tools to Support APQP &amp; PPAP</th>
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<tbody>
<tr>
<td>Clause Number</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td>1 2 3 4 5 6</td>
<td>AS13100 Clause Number</td>
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</table>

#### Example Extract

9.3 Management Review
9.3.1 General Reference 9100D:09/2016 requirements.
9.3.2 Reference 9100D:09/2016 requirements.

9.3.2.1 Management Review Inputs - Supplemental Requirements

Management Reviews shall be conducted at least annually and consider the following performance topics:

- Cost of Poor Quality (COPQ).
- Manufacturing / Assembly Right First Time / First Pass Yield.
- Customer scorecards (where available).
- Human Factors reporting.
AS13100 Customer Specific Requirements

Designed to Include Customer Specific requirements that could not be harmonized within AS13100.

These documents shall:

- Require Compliance to AS13100
- Signpost to Customer Specific Documents *(where required)*
- Definition of customer specific acceptance thresholds called out in AS13100 e.g., Cpk, GR&R scope, etc.
- Additional Customer Specific requirements not defined within AS13100
- Defines company specific key roles and accountabilities for approvals
- Includes specific IT interface requirements
AS13100 Requirement Highlights

Table 1 provides a guide to the applicability of AS13100 Sections to Organization scope.

Table 2 defines an agreed set of Certification Requirements, matched to the scope of the supplier’s activities.

<table>
<thead>
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<th>AS13100 PARA/GRAPH REFERENCE</th>
<th>TYPE 1: MAKE TO PRINT</th>
<th>TYPE 2A: DESIGN AND MANUFACTURE</th>
<th>TYPE 2B: DESIGN ONLY</th>
<th>TYPE 3: DISTRIBUTOR</th>
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</tbody>
</table>
Section 4.3.5 requires the organization to conduct a **Compliance Assessment** of their QMS to ensure that it captures all of the requirements of AS13100 and customer specific requirements.

The results of this review are to be provided to the customer upon request.

Any compliance gaps must be highlighted to the individual customer and a resolution agreed.

Reference Manual RM13009 provides information to support this requirement.
AS13100 Requirement Highlights

AS13100 Section 8.3 includes common Requirements for Design & Development. Key Supplemental Requirements include;

- Specifies AS9145 APQP & PPAP for Managing New / Changed Product Designs
- Defines Design FMEA approach to meet Design Risk Analysis requirement
- Requires the use of Cross Functional Teams for Design & Development Activities
- Defines requirements for Design for ‘X’ (Manufacture, Assembly, Servicing, Disposal)
- Specifies the use of AS9116 to manage Design Changes

Reference Manual RM13008 Provides Guidance for Design Work
AS13100 Requirement Highlights

AS13100 Section 8.4.1, 8.4.2 and 8.4.3 define the additional requirements for Supplier Evaluation, Selection, Control and Performance Monitoring.

Reference Manual RM13007 Provides Guidance for Supplier Management
1. Single AESQ Standard aligned to AS9100 / ISO9001
   - Less Requirements for the Supplier (>50% less)
   - Lower cost (suppliers do not need to buy multiple standards)

2. Supported by Free Issue Reference Manual Guides

3. Will minimise the content of OEM Supplier Requirement Standards (SABRe, S-1000, ASQR-01 and SAFe)

4. Creates a common language for Quality, OEMs have adopted standard approaches within their own operations.

5. Aligns to relevant existing industry standards (ISO, AS9xxx, Nadcap, etc)

6. Supported by global approved training resources

7. Enables the AESQ OEMs to provide a harmonised approach to Supplier Development

8. Supplier Compliance continues to be assessed through Customer Audit

9. Allows AESQ to focus on Supply Chain Capability Development
AS13100 Core Writing Team: Thank you for sticking with it, every Wednesday, for two & a half years, even during the pandemic, to get it published.

Dr Ian Riggs
Rolls-Royce
Writing Team Leader

Larry Bennett
GE Aviation
Writing Team Deputy Leader

Elizabeth Pace
Raytheon

Earl Capozzi
Pratt & Whitney

Jim Wilson
Pratt & Whitney Canada

Catherine Catarina-Graca
Safran Aircraft Engines

Paula Adkins
Rolls-Royce

Peter Amsden
Pratt & Whitney
And also for the 99 Subject Matter Experts who created the Reference Manuals – Thank you
AS13100
REFERENCE MANUALS

MARTIN SCHÄFFNER
SENIOR VP CORPORATE QUALITY
MTU AERO ENGINES
AS13100 Supporting Reference Manuals

AS13100 Standard defines mandated requirements. The Standard is supported by free issue Reference Manuals from the AESQ Website:

→ https://aesq.sae-itc.com/content/aesq-documents

Reference Manuals provide industry best practice guidance and case study material on how to deploy quality tools effectively.

Reference Manuals are maintained and updated by the AESQ Subject Matter Interest Groups and may be updated at any time when new or revised information becomes available.
Defect Prevention Tools Must Work as a System
AS13100 Supporting Reference Manuals Examples

Marnie Ham  
RM13000  
Team leader

Helen Djäknegren  
RM13005  
Team leader

Catherine Catarina-Graca  
RM13010  
Team leader

Karl Evans  
RM13145  
Team leader

RM13000  
8D Problem Solving Method

RM13005  
Quality Audit Requirements

RM13010  
Human Factors

RM13145  
Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP) within Aerospace

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AS13100 Supporting Material

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<tr>
<th>RM#</th>
<th>Reference Manual and Forms</th>
<th>Issue Date</th>
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<tr>
<td>RM13000</td>
<td>Problem Solving Methods Including 8D</td>
<td>March 8, 2021</td>
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<tr>
<td></td>
<td>• 8D Interactive Tool (PowerPoint)</td>
<td></td>
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<td></td>
<td>• Supplier 8D Reporting Template (PowerPoint)</td>
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</tr>
<tr>
<td></td>
<td>• 8D Word Form (Word)</td>
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The key areas of focus of this group are:
• Problem Solving Approaches
• Problem Solving Methodologies
• Problem Solving using … 8D, 4D, 2D
• Forms
• Case Studies
• Basic Quality Problem Solving Tools

The key material from this group are:
• 8D Interactive Tool
• Reporting Template Directions
• 8D Form (Word)
• 8D Form (PowerPoint)
• 8D From (Excel) – coming soon
Problem Solving Approaches

Structured Problem Solving needed for most issues

Two main approaches:
- Individual Root Cause Analysis & Corrective Action
- Themed improvement

### RCCA Investigation Comparison Diagram

<table>
<thead>
<tr>
<th>AESQ 8D Problem Solving Methodology Per RM13000</th>
<th>ARP9136 9S Methodology</th>
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<td>D0 - Immediate Containment Action(s)</td>
<td>S0 - Start Immediate Containment Actions</td>
</tr>
<tr>
<td>D1 - Form Team</td>
<td>S1 - Build the Team</td>
</tr>
<tr>
<td>D2 - Define Problem and Impact</td>
<td>S2 - Define Problem</td>
</tr>
<tr>
<td>D3 - Interim Containment Action(s)</td>
<td>S3 - Complete and Optimize Containment Actions</td>
</tr>
<tr>
<td>D4 - Determine Root Causes</td>
<td>S4 - Identify Root Cause(s)</td>
</tr>
<tr>
<td>D5 - Determine Permanent Corrective Action(s)</td>
<td>S5 - Define and Select Permanent Corrective Action(s)</td>
</tr>
<tr>
<td>D6 - Implement Permanent Corrective Action(s)</td>
<td>S6 - Implement Permanent Corrective Action and Check Effectiveness</td>
</tr>
<tr>
<td>D7 - Determine Preventative Action(s)</td>
<td>S7 - Standardize and Transfer the Knowledge Across Business</td>
</tr>
<tr>
<td>D8 - Recognize the Team and Close Out Investigation</td>
<td>S8 - Recognize and Close the Team</td>
</tr>
</tbody>
</table>

RCCA Investigation Comparison Diagram

- **Record Issue in System**
- **Define Improvement Plan for Top Issues (Pareto)**
- **Issue Identified & Defined**
- **Containment (If required)**
- **Assess Impact**
- **Monitor Status**
- **Ensure Read Across of Lessons Learned**
- **Close**
- **Individual Root Cause Analysis & Corrective Action**

AESC – Aerospace Engine Supplier Quality Strategy Group

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Problem Solving Methodologies

Original Problem Solving - “Plan, Do, Check, Act” approach developed by Walter Shewhart and W. Edwards Deming back in the 1920’s

Maps 8D and Plan, Do, Check, Act to other problem-solving methods

Basic Intent on all problem-solving methods:
- Define the problem and containment actions
- Understand the root cause
- List and assign actions to fix problem
- Evaluate results and standardise if problem is solved
Problem Solving Methodologies – Road Map

The Road Map shows how to start with the 8D problem-solving process and downsize it to a 4D or 2D methods

- 8D method for all major or complex problem-solving
- 4D method can be used for internal issues (ie problem that have not escaped)
- 2D methods can be used for simple problems

- The same forms can be used

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**Legend:**
- 8D: Major/Complex
- 4D: Medium
- 2D: Simple/Minor

**8D Methodology:**
- D0: Immediate action
- D1: Define Team
- D2: Define Problem
- D3: Interim Containment
- D4: Determine Causes
- D5: Develop CIA’s
- D6: Implement PCA’s
- D7: Preventive CIA’s
- D8: Recognize Team

**4D Methodology:**
- D2: Define Problem
- D4: Determine Causes
- D5: Develop CIA’s
- D6: Implement PCA’s

**2D Methodology:**
- D2: Define Problem
- D6: Solve Problem

**When to use 8D:**
- Need for Emergency Containment
- Need for Population Bounding
- Need for Interim Containment
- Root cause(s) and solution(s) not obvious
- Ex. 1: Escape found at customer
- Ex. 2: Escape found at supplier (e.g., NOE)

**When to use 4D:**
- No need for Emergency Containment Action
- No need for Population Bounding
- Problem contained to a specific area inside company
- Interim containment not always needed
- Root cause(s) and solution(s) not known but ideas abound
- Document using basic root cause tools
- Ex. 1: Part failure found to be nonconforming
- Ex. 2: Measurement system bias discovered
- NOTE: Add additional 8D steps when needed (e.g., D3, D7)

**When to use 2D:**
- Resolved immediately without a lengthy investigation
- Fix and move on; typical of many shop floor problems/shortfalls
- Cause and solution are generally known
- Not likely to need containment actions
- Confined locally to a specific work station
- Ex. 1: Replace battery in flashlight
- Ex. 2: Replace light bulb which burnt out
- NOTE: Add additional 8D steps if needed (e.g., D3, D4)
Problem Solving Using 8D (or 4D or 2D)

- The 8D problem-solving process established in 1980s by Ford Motor Company to standardize problem-solving
- This methodology was to be used as a standard tool for Ford suppliers where:
  - The problem cause was not known
  - It was suspected that the problem was complex with potentially several contributory causes
  - A cross functional team approach was required due to the complex nature of the problem being investigated

- The Eight Disciplines of Problem Solving
  - D0 - Emergency Response Actions and Prepare for 8D
  - D1 - Form the Team
  - D2 - Define the Problem
  - D3 - Develop Interim Containment Actions
  - D4 - Diagnosis: Identify and Verify Root Causes and Escape Point
  - D5 - Identify Permanent Corrective Action for Root Cause and Escape Point
  - D6 - Implement Permanent Corrective Action
  - D7 - Prevent Recurrence
  - D8 - Recognize the Team

- 4D Methodology (D2, D4, D5, D6)
- 2D Methodology (D2, D6)
**Forms (Excel)**

Excel Form derived from the A3 format of having a one-page summary of the problem and the solution.

Other documents and pages are the back up

RM13000 has a case study in the document that walks through how to use this form

<table>
<thead>
<tr>
<th>8D A3 Worksheet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Name</strong></td>
</tr>
<tr>
<td><strong>DO: Immediate Containment Action(s)</strong></td>
</tr>
<tr>
<td>Direct Cause (addresses generation point)</td>
</tr>
<tr>
<td>* Effective? Y__ N__</td>
</tr>
<tr>
<td><strong>D1: Form the Team</strong></td>
</tr>
<tr>
<td>Problem investigation owner:</td>
</tr>
<tr>
<td>Team members:</td>
</tr>
<tr>
<td>Detection Cause (addresses escape points)</td>
</tr>
<tr>
<td>* Effective? Y__ N__</td>
</tr>
<tr>
<td><strong>D2: Define the Problem</strong></td>
</tr>
<tr>
<td>* Describe method of effectiveness check</td>
</tr>
<tr>
<td><strong>D7: Prevent Recurrence (fix the system)</strong></td>
</tr>
<tr>
<td>PFMEA updated? Y__ N__</td>
</tr>
<tr>
<td><strong>D3: Interim Containment Action(s)</strong></td>
</tr>
<tr>
<td>Read across on similar process/product conducted? Y__ N__</td>
</tr>
<tr>
<td>Describe updates to QMS/lessons learned/communications to suppliers, etc.</td>
</tr>
<tr>
<td><strong>D8: Team Recognition</strong></td>
</tr>
<tr>
<td><strong>D4: Find the Root Cause(s)</strong></td>
</tr>
<tr>
<td>Pictures/Drawings/Evidence</td>
</tr>
<tr>
<td><strong>Direct Root Cause:</strong></td>
</tr>
<tr>
<td><strong>Detection Root Cause:</strong></td>
</tr>
</tbody>
</table>
Word Form is a 3 page “short form” 8D, similar the PW 8D

Other documents and pages are the back up

RM13000 has a case study in the document that walks through how to use this form
PowerPoint Form is a 2-page 8D, similar to the GE 3x5 Why.

Other documents and pages are the back up.

RM13000 has a case study in the document that walks through how to use this form.
Case Studies

- Real problems solved using 8D
- Each case is presented in a different format (Excel, Word, PowerPoint), all of which are acceptable
- The common thread is the 9 steps of the 8D process.
Basic Quality Problem Solving Tools

The 7 Basic Quality Tools for Process Improvement

- Cause-and-effect diagram
- Check sheet
- Control chart
- Histogram
- Pareto chart
- Scatter diagram
- Stratification (flowchart or run chart)

https://asq.org/quality-resources/seven-basic-quality-tools
Additional Resources

Step by step instructions to assistant with each discipline (D)

They are matched to the Word Form

Please address these key questions and sign off following items:

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you shipped, or is there any suspect material in transit to this or any other PW site?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have any similar parts in finished stores with the same problem?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have any suspect material currently in production that may exhibit this problem?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does this problem exist in similar PW part numbers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a sub-tier supplier contributed to this problem?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has any suspect material been drop shipped to a PW directed source?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AESC – Aerospace Engine Supplier Quality Strategy Group

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REFERENCE MANUAL RM13005

QUALITY AUDIT

HELEN DJÄKNEGREN
DIRECTOR GLOBAL SUPPLIER QUALITY
GKN AEROSPACE
Quality Audit Requirements – Driving factors

Current state

- Audit – a formal requirement to assure compliance and identifying areas of improvement
- Many external audits for an organization is, in many cases, a duplication between customers
- Audits constantly find evidence of non compliance
- RM13005 clarifies the audit requirements to drive a higher rigour in the internal audit program
- Organizations that can demonstrate a successful internal audit program and a lower risk level may be subject to fewer audits by the customer

Future state

- Risked based auditing
- One internal audits requirement
Quality Audit Requirements – Main Content

Enhance the requirements on the:

• Organizations internal audits

and the

• Organizations audits of its suppliers
Quality Audit Requirements – Four Audit Types

Quality System Audit

Intend to:

• Cover all quality management system processes to verify compliance to AS9100 and AS13100 as well as customer-specific requirements

Frequency:

• Complete Quality Management System shall be covered in a 3-year cycle
• Selected processes yearly
Quality Audit Requirements – Four Audit Types

Production Process Audit

Intend to:

• Evaluate the effectiveness and efficiency of each step of the manufacturing process – from receiving to dispatch
• Ensure it is capable of producing conforming parts

Frequency and checklists:

• Every manufacturing process must be audited on a 3-year cycle
• An approved checklist is provided in the RM13005
Product Audit

Intend to:
• Independently verify that the finished product fully conforms to the customer requirements
• Ensure that the production process verification processes remain accurate and stable

Frequency and scope:
• Part selection based on risk
• The parts to be audited shall be agreed with the customer
• Audit scope defined in RM13005
Special Process Audit

Intend to:
• Evaluate that the process is compliant to the requirements
• Ensure it is capable of producing conforming parts.

Frequency and Checklists:
• Every special process shall be audited yearly
• Nadcap Self Audit “Process Checklist” will cover the requirement when performed yearly
• Non Nadcap certified processes shall have an approved checklist
Annual Audit Report

- Organizations summary of all performed audits, results and improvement activities.

- Shall be available for the customer on request.

- Can be used by the customer as a part of their risk assessment tool for supplier audit planning.
A powerful and good audit relies on well trained auditors

- AS13100 requires quality auditors to receive industry recognized auditor training to AS9100 as part of their qualification program.

- In addition, auditors must be trained in the requirements of applicable regulations, certification programs and customer requirements.

- Auditors should also have a good knowledge and understanding of the production process and products that they are auditing.
Quality Audit Requirements – TEAMWORK!

A special thanks to all team members that have contributed to the requirements and the RM13005

- James Clifton PCC
- Ola Nydén GKN
- Ian Riggs RR
- Olivier Castets Safran
- Robert Caudill GE
- Per Rehndell GKN
- Jeff Long P&W
- Aaron Stahl PCC
- Barrie Hicklin Honeywell
- Michael Gehrmann MTU
- Brett Whittington Meggit
- Helen Djäknegren GKN
- Jim Wilson PW
- Rohnda McNiel Alcoa
- Jeremy Johnson RR
- Junichirou Teshima IHI
- Melanie Renault Safran
- Lisa Stömer MTU
- Susie Neal UTAS
- Hayley Roberts GE
- Robert Czanik GE
- Deborah Oberhausen PW/UTC
- Catherine Catarina-Garca Safran
- Austin Shears PCC
Quality Audit Requirements

• Audit is a powerful tool for the organization to constantly drive improvements.

• Correctly managed and performed, it will reduce the risk in your organization and thru the supply chain.

• Our goal has been to build a set of requirements that will help us in this journey and ultimately reduce the number of audits from your customers.
Why Human Factors in AS 13100

• Air traffic should double every 15 / 20 years

• Supply Chain risks are today one of the greatest concern for aviation stakeholders

Human Errors are the origin of most supply chain issues (About 80%)

Source: Allianz Risk Barometer 2014
Note: Respondents could select more than one risk
Human Factors Overview

Human Factors are becoming a key theme in the Part 21 Aerospace Industry due to

- Human Factors has been required in Maintenance organizations for the past 20 years
- Increase is non-conformance causal factors related to Human Factors
- Airframers are now demanding it as a requirement for their suppliers
- Human Factors are a key element of the ICAO Annex 19 Safety Management System requirements (Due to be published in 2022)

### AS13100 Supplemental Paragraph Reference

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Reference</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.3</td>
<td>All processes in the QMS must be documented, HF as part of this QMS needs to be documented</td>
<td></td>
</tr>
<tr>
<td>5.1.1.1</td>
<td>Leadership: Top Management shall reflect a commitment to Human Factors</td>
<td></td>
</tr>
<tr>
<td>5.2.1.1</td>
<td>Leadership: Establishing the Quality Policy / HF Policy</td>
<td></td>
</tr>
<tr>
<td>7.3.1</td>
<td>Human Factors Awareness. The organization shall provide an appropriate program of training and awareness of Human Factors based on role</td>
<td></td>
</tr>
</tbody>
</table>
Human Factors Quality Management System

Human Factors should be at least an integrated part of:

- Product and service design,
- Manufacturing / assembly,
- Product servicing
Human Factors Quality Management System

* Aéroplanes Henry Potez
  In your work, an error, something forgotten or bad workmanship can cause the death of one or more people
  …
  A person who makes an error must report it
  An error is a repairable and pardonnable mistake
  **But hiding it is a crime**
Human Factors Quality Management System

REASON MODEL – MODEL OF ANALYSIS

KPI

Objective Performance Analysis
Strategy Management Optimization Success

Key Performance Indicator

Latent Errors Activ Error
Human Factors Leadership and Policy

**Top Management shall reflect a commitment to Human Factors**

- Promote
- Share Vision
- Lead by example
- Lead by example
- Lead Change
- EMPOWER
- INSPIRE
- HELP

**HF Policy**

The organization shall have a policy that promotes Human Factors

**Commitment**

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Minimizing human errors in the supply chain is key toward product safety, quality and delivery.

Human Errors

- Concession
- Notification of Escape
- Delay
- Part Shortage
- Outstanding Work
- Damage

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Special Thanks to the Team

Catherine Catarina | SAFRAN
-------------------|---------
Christine Brown   | RR      
Nicholas Watling  | P&W     
Ludovic Chevet    | Airbus  
Brandon Richard   | GE      
Hakan Bjorkalv    | GKN     
Richard Bolingbroke| TIMET   

Part of the team speaking One VOICE about Human Factors requirements at a common supplier facility Nov 2019
Why AS13100 APQP and PPAP?

- Reduce customer specifics.
- Establish common supply chain practices.
- Better customer/supplier application.
- Provide foundations for wider use;
  - All change situations – product, process and transfers.
  - It’s a Team sport - multi-disciplinary/ team to team working.
Aligned to Time and Customer/Supplier Based Management.

APQP and PPAP Timing Chart
(Time-based framework)

1. Planning
2. Design and Development
3. Process Design and Development
4. On-going Production, Use, and Post-delivery Service
5. Assess Feasibility

Product Status
Prototype/test product
Production trial products
Production products

APQP and PPAP Flow Diagram
(Customer/Supplier Management Process)

Customer Requirements
- Project Start Up
- Progress APQP Phases 2, 3, 4
- Metrics
- Approval

Organization Actions
- Progress APQP Phases 2, 3, 4
- Metrics
- Approval

Customer Review
- Approval
- Final

AESQ – Aerospace Engine Supplier Quality Strategy Group
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Example Reference Manual Content - APQP and PPAP Elements and Planning Toolbox

**What**

APQP and PPAP Timing Plan

**When**

Planning for APQP and PPAP

27 Core APQP and PPAP Elements
Example Reference Manual Content – Configurable for various “Change Situations”

27 Core APQP and PPAP Elements

APQP and PPAP Elements and…..
- APQP Phases
- APQP and PPAP Events
- Planning Deliverables (KO>PDR)

Configure based on “Application Tables”

Table 1: Application Matrix for Events

Table 2: Application Matrix for APQP and PPAP Elements

Where

New Product Design V Transfer
Example Reference Manual Content – How To’s

**How**

**Feasibility Assessment**

**Process**

1. **Feasibility Assessment**
   - Process design action
   - Can be produced when recommended changes are implemented

2. **Sufficiently defined (Design Record)?**
   - Yes
   - No

3. **Conduct assessment(s)**
   - With recommendations
   - Is the design feasible?
   - Yes
   - No

4. **Design revision is required to produce product within the specified requirements.**
   - No
   - Yes

5. **Can be produced as specified with no revision.**

**Tools**

**Table 13: Feasibility Assessment (Example format)**

<table>
<thead>
<tr>
<th>Feasibility Assessment Outcome:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible</td>
</tr>
<tr>
<td>Not Feasible</td>
</tr>
</tbody>
</table>

**Notes:**
- Specific tools and techniques should be used.
- Additional assessments may be required.

---

AESQ – Aerospace Engine Supplier Quality Strategy Group

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Example Reference Manual Content - APQP and PPAP working together

APQP Package v PPAP Submission

Process Management Tools.
E.g.: Submission Level Table

<table>
<thead>
<tr>
<th>PPAP ELEMENT NUMBER</th>
<th>AESQ PPAP ELEMENT</th>
<th>SUBMISSION LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SL 1</td>
</tr>
<tr>
<td>1</td>
<td>Design Record</td>
<td>S R</td>
</tr>
<tr>
<td>2</td>
<td>Design FMEA</td>
<td>R (1)</td>
</tr>
<tr>
<td>3</td>
<td>Process flow diagram</td>
<td>R</td>
</tr>
</tbody>
</table>

Standard Approvers, Training and Qualifications

Customer	Organisation	Supplier

APQP Package

Forged Ring – Facility A
Forged Ring – Facility B
Location Pin – Facility C
Bearing – Facility D
Its Not Exclusive to Quality……..It's a Team Sport

Team and Leadership Guidance

Team and Leadership Guidance

RM13145
Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP) within Aerospace

An AESQ Reference Manual
Supporting SAE AS9100™ Standard
Issued March 31, 2021
### Special Thank You

<table>
<thead>
<tr>
<th>Organization</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolls-Royce</td>
<td>Karl D Evans – Team Leader</td>
</tr>
<tr>
<td>GE Aviation</td>
<td>Melanie Deroo</td>
</tr>
<tr>
<td>GE Aviation</td>
<td>Micheal Fuehner</td>
</tr>
<tr>
<td>MTU</td>
<td>Thomas Herter</td>
</tr>
<tr>
<td>GKN Aerospace</td>
<td>Ake Winkvist</td>
</tr>
<tr>
<td>GKN Aerospace</td>
<td>Inger Henstrom</td>
</tr>
<tr>
<td>Pratt &amp; Whitney</td>
<td>Brian Murphy</td>
</tr>
<tr>
<td>Safran</td>
<td>Nathalie Noblet</td>
</tr>
</tbody>
</table>
Return in 15 Minutes
Pause

Return in 14 Minutes
Pause

Return in 13 Minutes
Pause

Return in 12 Minutes
Pause

Return in 11 Minutes
Pause

Return in 8 Minutes
Pause

Return in 7 Minutes
Pause

Return in 6 Minutes
Pause

Return in 5 Minutes
Pause
Return in 4 Minutes
Pause

Return in 3 Minutes
Pause

Return in 2 Minutes
AS13100

SUBJECT MATTER INTEREST GROUPS

EMMANUEL VIVIER
VP QUALITY COMMERCIAL ENGINES
SAFRAN AIRCRAFT ENGINES
What is a Subject Matter Interest Group?

- The purpose of the Subject Matter Interest Group is to promote the effective deployment of the Key Quality Subject across the AESQ Supply Chain.
- The Group is made up of Subject Matter Experts from the AESQ Member Companies.
- It is accountable for the AS13100 related Requirements and associated Reference Manual content, ensuring that it is up to date and reflects current knowledge and best practice.
- It shall promote the effective deployment of the Reference Manual using Communities of Practice (CoP). The CoP is open to any subject matter expert from the AESQ Member Companies and the wider AESQ supply chain.
- Activities will include webinars, best practice sharing, development of shared training materials, conferences and published papers.
Community of Practice Activities

Generate New Knowledge

Measure State of Deployment

Capture & Disseminate Existing Knowledge

Sharing Events

Connect People
## AESQ Subject Matter Interest Groups

<table>
<thead>
<tr>
<th>Advanced Product Quality Planning &amp; Production Part Approval Process (PPAP)</th>
<th>Defect Prevention Tools to support APQP &amp; PPAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Work &amp; Production Repair &amp; Rework</td>
<td>Measurement Systems Analysis (MSA)</td>
</tr>
<tr>
<td>Sub Tier Management</td>
<td>Process Control Methods</td>
</tr>
<tr>
<td>Human Factors</td>
<td>Problem Solving Methods</td>
</tr>
<tr>
<td>DPRV Training</td>
<td>Quality Audit Methods</td>
</tr>
<tr>
<td>First Article Inspection</td>
<td></td>
</tr>
</tbody>
</table>
Subject Matter Interest Groups on the AESQ Website

- Select a specific Subject Matter Interest Group
- Link to support materials & events
- Link to Social Media Sites
- Get Involved
Training Program Goals

- Support deployment and adoption of AS13100
- Knowledge to design, maintain & assess business processes to meet intent of standard
- Focus on key concepts, impact to compliance and customer requirements and benefits to business performance
- Simplify and clarify the requirements with a standardized training approach
Executive Overview

Introducing SAE AS13100
The New Industry Standard for Quality

This exciting new standard creates a common language for quality throughout the supply chain. Watch our video series for executive perspectives from across the industry, and learn how compliance is critical to your company’s success.

https://discover.sae.org/AS13100-Executive-Overview
## Required Training

<table>
<thead>
<tr>
<th>Delegated Product Release Verification (DPRV)</th>
<th>AESQ Approved AS13100 Requirements Course</th>
<th>AESQ Quality Foundations Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPRV personnel shall be trained and certified in accordance with AS13001 Delegated Product Release Verification Training Requirements (7.2.3)</td>
<td>The organization shall ensure that Quality Leaders with responsibility for deploying the requirements of AS13100 within the organization are trained in the requirements of AS13100 and related Quality Management Standards through an AESQ approved AS13100 Requirements training course. Recommend for functional leaders responsible for creating or managing processes that are impacted by AS13100 Requirements (7.2.4)</td>
<td>The organization’s Quality Leaders with responsibility for supporting the design, manufacturing, and assembly operations via AS13100 shall undergo training in the AESQ Quality Foundations Training course. This course is also recommended for design engineering, manufacturing engineering and operations roles (7.2.4)</td>
</tr>
</tbody>
</table>

| Requirement since 2015 | | |
## AS13100 Training for Quality & Functional Leaders

<table>
<thead>
<tr>
<th>Level</th>
<th>Course Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level One</td>
<td>SAE Executive Overview</td>
<td>No cost</td>
</tr>
<tr>
<td>Level Two</td>
<td>SAE AS13100 Requirements Course</td>
<td>$399</td>
</tr>
<tr>
<td>Level Three</td>
<td>SAE Quality Foundations Course (Available Fall 2021)</td>
<td>$1095</td>
</tr>
</tbody>
</table>

- **Level One**
  - **SAE Executive Overview**
    - Five Part Video Series, 35 minutes
    - Executive perspectives from across the industry detailing why compliance is critical to your company's success

- **Level Two**
  - **SAE AS13100 Requirements Course**
    - Self-paced & online, 10-hours, 365 Days of Access
    - Comprehensive Course on AS13100
    - **Required** for Quality Leaders with responsibility for deploying the requirements of AS13100
    - **Recommended** for functional leaders responsible for creating or managing processes that are impacted by AS13100

- **Level Three**
  - **SAE Quality Foundations Course**
    - Virtual or Classroom, 3-days
    - **Required** for Quality Leaders with responsibility for supporting the design, manufacturing, and assembly operations
    - **Recommended** for design engineering, manufacturing engineering and operations roles
SAE AS13100 Requirements Course Demonstration

On Demand, 10 hours

Developed in partnership with the AESQ and the G-22 writing committee SMEs
SAE AS13100 Requirements Course Overview

☑️ **Required** for Quality Leaders with responsibility for deploying the requirements of AS13100

☑️ **Recommended** for functional leaders responsible for creating or managing processes that are impacted by AS13100

☑️ Provides knowledge and insight for each of the AESQ supplemental requirements

☑️ Provides knowledge that helps the learner assess, design, maintain and comply with the business processes & adds value to the business
SAE AS13100 Quality Foundations Course Overview

• Designed to bring together the key quality systems, processes and methodologies to show how they work as part of a system to focus on Defect Prevention.

• Supports Quality Leaders, at all levels in the organisation, to understand how these tools and processes work and what are the characteristics of successful deployment.

• Recommended for other functions with accountability for the quality of the design, production, assembly and test areas of the organisation including those in Design, Manufacturing Engineering, Operations, Maintenance and Business Improvement.
AS13100 Required Training Summary

- Available online, self-paced, closed-captioning in 7 languages
  - AS13100 Requirements Course
- Available as virtual Instructor-led & traditional Instructor-led
  - DPRV Training currently delivered in 7 languages via a virtual format.
- Training for the Foundations Course will be offered in English initially, with the addition of 7 languages

For more information:
Visit https://aesq.sae-itc.com/training
Visit https://discover.sae.org/AS13100
AS13100

DEPLOYMENT APPROACH

OSA OMORUYI
DIRECTOR OF QUALITY
HOWMET AEROSPACE
AS13100 Supplier Preparation Milestone Plan

Key milestones to achieve compliance to AS13100 by 1/1/2023

1. AS13100 Publication
2. SAE Press Release
3. Reference Manuals published
4. Virtual Supplier Forum 4/21/21
5. Complete AESQ AS13100 online training
6. Amend AS9100 Compliance Matrix with AS13100 supplementary requirements
7. Perform Gap Analysis to AS13100 supplementary requirements
8. Update QMS procedures to close gaps
9. Train employees in new requirements
10. Conduct Internal AS13100 Pre-Audit
11. Close Gaps with C/A’s

- Invitation on virtual forum
- Distribution / sharing of Information on AS13100 Training
- Develop plan for adoption and deployment
- Conduct internal stakeholder’s meeting on plan and deployment approach
- Provide organization-wide awareness training on AS13100 to promote adoption and deployment
- Remove AS1300x reference and replace with AS13100 section or incorporate AS13100 into your QMS as a unified QMS
- Ballot & release related AS13100 procedure

- Supplier now subject to AS9100/AS13100 audit
- Removal of AS1300x reference
- Incorporating AS13100 into QMS
- Conduct internal stakeholder’s meeting
- Conduct AS13100 Pre-Audit
- Close Gaps with C/A’s

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AESQ

HOW TO GET INVOLVED

JUN SAKAI
CHIEF ENGINEER
IHI CORPORATION
How to Get Involved - Overview

- To achieve implementation target, entire OEM & Supply Chain are encouraged to get involved.

- There are many ways:
  - To be informed of interested topics
  - Join in a Community
  - To be a Member

AESQ Strategy Group

AESQ Member

SAE G-22 Standards Writing Committee

AS13100 Subject Matter Interest Group

Training

Communication

Deployment

SAE Trainings
eNewsletter
SNS(Linkedin,etc)
Supplier Forum
Reference Manuals

OEM & Supply Chain

AS13100 Published 2021/3/1

2021

2022

AS13100 Implementation 2022/12/E

SAE G-22 Standards

Community of Practice (CoP)
“Get Involved” with AESQ

- Go to AESQ Homepage
  https://aesq.sae-itc.com/

- Click “Get Involved”
“Get Involved” Options

1. Sign up to receive AESQ eNewsletter

2. Become an AESQ Member

3. SAE G-22 Standards Writing Committee

Click on the appropriate link for additional information
“Get Involved” – Sign up to Receive AESQ’s eNewsletter

• Issued monthly

• Learn about AESQ’s current activities

• Complete online form to begin receiving
“Get Involved” – Become an AESQ Member

2 Membership Levels:

AESQ Strategy Group Member – specified in the AESQ Charter due to their critical support resulting in the establishment of the AESQ Strategy Group.

AESQ Member –

- Open to organizations engaged in the Aero Engine supply chain.
- Required to participate in the work of AESQ by providing resources to support AESQ working groups.
- Representatives shall be senior leaders from the organization or subject matter experts in a relevant area.

Complete Membership Application at bottom of page
“Get Involved” – Additional Options

- Attend AESQ Events
  (Supplier Forum, Webinar)
- Attend Subject Matter Interest Group Webinar or Join on LinkedIn
- Take a AS13100 Training Course
- Download Reference Manuals
- Watch the “Zero Defects” Video
- Listen to a Podcast
“Get Involved” – Attend a Supplier Forum

- Review presentations from previous events on the AESQ website.
- Watch for future events.
“Get Involved” – Watch “Move with SAE Mobilus” Webinar

This monthly webinar series will take a special look at AS13100.

Wednesday, May 19, 2021
11:00am (-5GMT) – 1 Hour

Special Guest Speakers:

Barbara Negroe
Executive Sourcing Quality Leader
GE Aviation

Larry Bennett
Principal Engineer, Global Sourcing Quality
GE Aviation
“Get Involved” – Subject Matter Interest Groups

- Follow AESQ's New Subject Matter Interest Groups
- Participate in a Community of Practice
- Sign up for a Subject Matter Interest Group Webinar
- Join Subject Matter Interest Group on LinkedIn
Summary

AS13100 Standard & Reference Manuals now published

Plan to get compliant by the end of 2022

Compliance is via self-assessment and customer audit

Get trained in the AS13100 Requirements and Quality Foundation courses

Consider getting your organization to become an AESQ member and take part in the Subject Matter Interest Groups

Improve your knowledge and capabilities by getting involved in the AESQ Communities of Practice

Delivery improved Quality Performance and Business Results

Stay in touch with AESQ through the website aesq.sae-itc.com
Question & Answer “Q&A” Ground Rules

We will now accept questions via the Chat function focused on but not limited to:

• AS13100 Standard
• AS13100 Training
• AESQ Reference Manuals
• Deployment and Transition

Please avoid questions regarding:

• Commercialism
• Pricing
• ITAR
• Export Control
Use the Chat Function to Ask a Question..

... or just make a comment.

be kind
Thanks for Attending

Stay in Touch on aesq.sae-itc.com