AESQ CONSORTIUM™

A Program of SAE ITC

AESQ Supplier Forum

26 October 2023 | Munich, Germany

Hosted by MTU Aero Engines

Welcome & Introductions

100+ Individuals Registered from 19 Countries

AESQ Supplier Forums

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

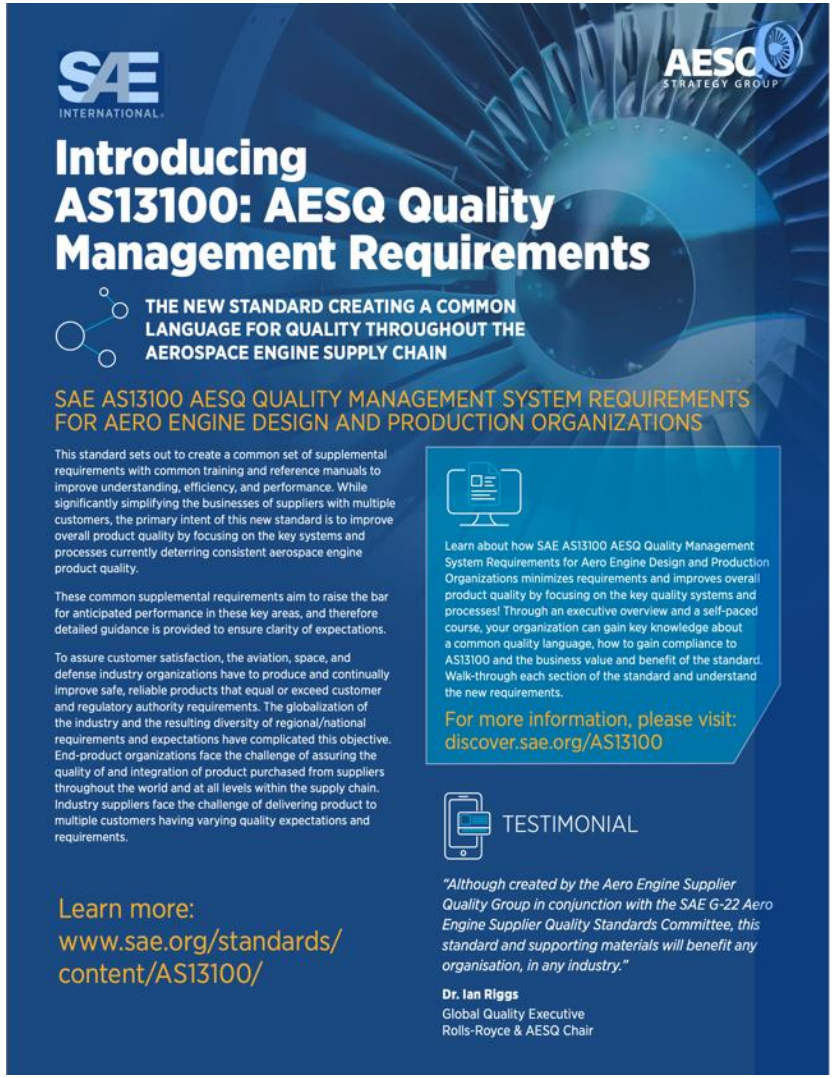
AESQ Supplier Forums provide an opportunity to:

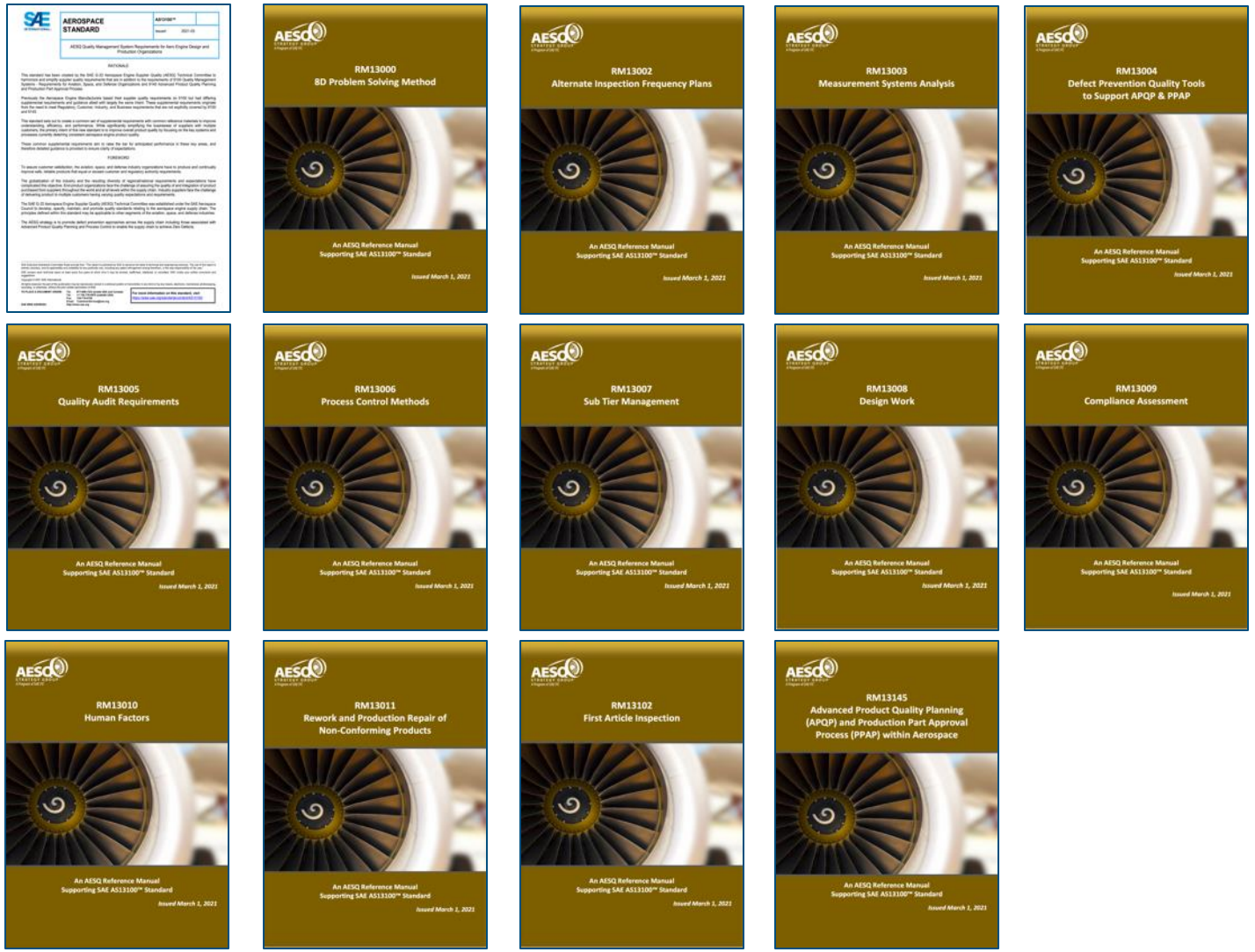
- Provide updates on the work of the AESQ
- Share best practices
- Provide feedback to the AESQ
- Develop a network of practitioners and Subject Matter Experts





AESQ Supplier Forums: Focus on AS13100 Deployment



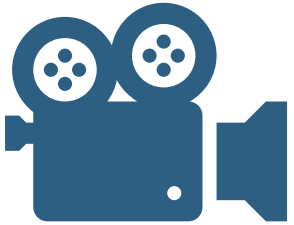


Housekeeping

Be on time

Coffee & Lunch Breaks

Emergency Exit



Today's event is being recorded and will be available on the AESQ website for viewing

Toilets

Silence Cell Phones

No Smoking

Except in designated areas outside

Agenda

Topic	Presenter
Welcome & Introductions	**Lisa Claveloux**, Sr. Director, Quality, Pratt & Whitney **Markus Braig**, Director Quality Supply Chain and MRO, MTU Aero Engines
Keynote Address	**Dr. Silke Maurer**, Member of the Executive Board, Chief Operating Officer, MTU Aero Engines
AESQ Overview, Vision & Objectives	**Denis Pottier**, Head of the Purchasing Quality Assurance, Safran Aircraft Engines
AS13100 Overview	**Helen Djäknegren**, Director Supplier Quality & Development, GKN Aerospace
Deployment Update	**Uzam Khan**, Supplier Quality Executive, Civil Aerospace Operations, Rolls-Royce **Jim Wilson**, Sr. Manager, Supplier Quality, & Development, Pratt & Whitney Canada

Agenda

Topic	Presenter
- BREAK -	
Best Practices for Human Factors	**Steve Roebuck**, Head of Certification, Rolls-Royce
Supplier Success Story with Aubert & Duval	**Pierre Castagnos,** Directeur Qualité Progrès et Client / Progress and Customer Quality Director, Aubert & Duval **Gilles Bresson,** Responsable Compliance Système Qualité, Surveillance et Prévention / Quality System Compliance Manager, Aubert & Duval

Agenda

Topic	Presenter
Subject Matter Interest Group (SMIG) Breakout Sessions	1. **Problem Solving** (RM13000) – Jun Sakai, IHI 2. **Alternative Inspection** (RM13002) and **MSA** (RM13003) and **Process Control** (RM13006) – Marnie Ham, GE 3. **Defect Prevention** (RM13004) – Ebru Cetin, MTU 4. **Compliance Assessment** (RM13009) and **Quality Audit Methods** (RM13005) – Jim Wilson, Pratt & Whitney 5. **Sub-Tier Management** – Helen Djäknegren, GKN 6. **Human Factors** (RM13010) – Beata Tarczon, MTU 7. **FAI** (RM13102) – Klaus Dietershagen, MTU 8. **Training** – Earl Capozzi, Pratt & Whitney
GROUP PHOTO & LUNCH	

Agenda

Topic	Presenter
Keynotes	**Thomas Frank**, SVP Corporate Quality, MTU Aero Engines & **Alfred Höpp**, Director Supplier Management Forgings and Technology, MTU Aero Engines
Training Overview	**Earl Capozzi**, Associate Director, Discipline Chief, Quality & Process Engineering/Supplier Quality, Pratt & Whitney
Breakout – Zero Defects Game	**Uzam Khan**, Supplier Quality Executive, Civil Aerospace Operations, Rolls-Royce
- BREAK -	

Agenda

Topic	Presenter
AS13100 FAQ Panel	**MODERATORS:** **Barrie Hicklin**, Sr. Director, Quality Systems & Regulatory Compliance, Honeywell Aerospace **Markus Braig**, Director Quality Supply Chain and MRO, MTU Aero Engines **PANELISTS:** **Barbara Negroe**, Executive Sourcing Quality Leader, GE Aerospace **Earl Capozzi**, Associate Director, Discipline Chief, Quality & Process Engineering/Supplier Quality, Pratt & Whitney **Florence Augeard**, Supplier Quality Assurance Manager, Safran Aircraft Engines **Marnie Ham**, Consulting Engineer, GE Aerospace
AESQ How to Get Involved	**Jun Sakai**, Chief Engineer, IHI Corporation
Summary & Close	**Lisa Claveloux**, Sr. Director, Quality, Pratt & Whitney

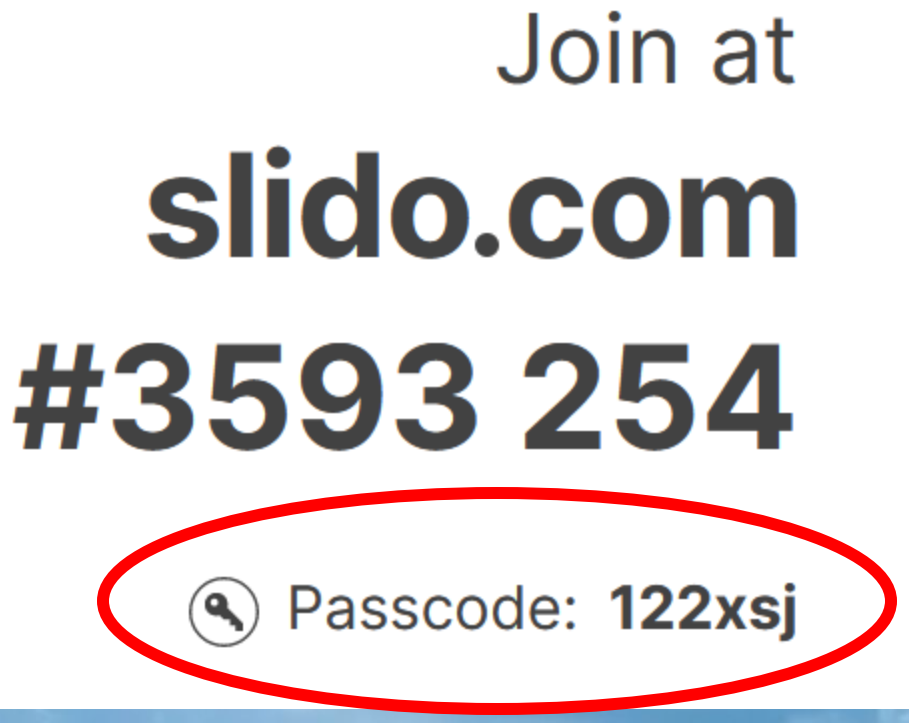
MTU Welcome

MARKUS BRAIG
DIRECTOR QUALITY SUPPLY CHAIN AND MRO
MTU AERO ENGINES

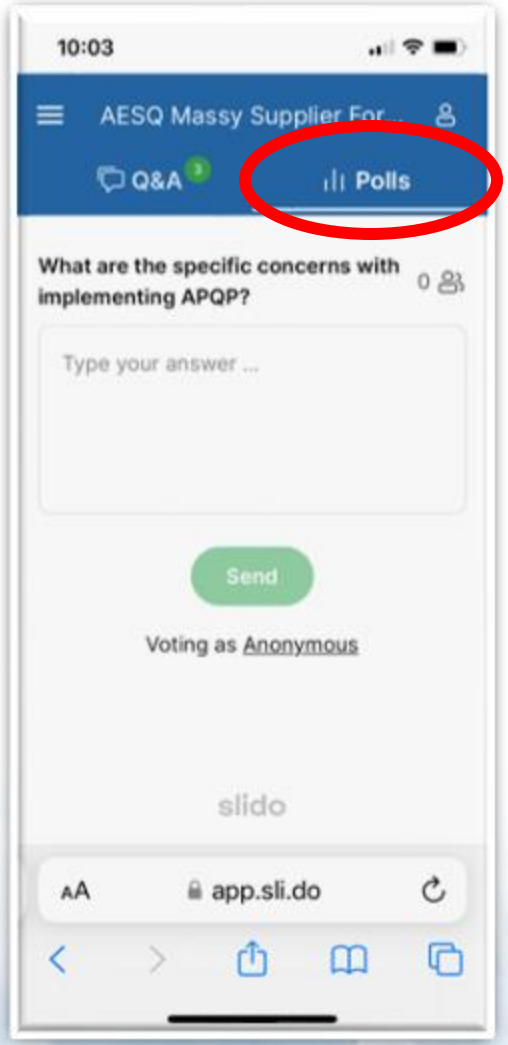
How to answer Slido Live Polling questions:

Cell Phones:
1. Scan the QR Code
2. Enter the Passcode 122xsj

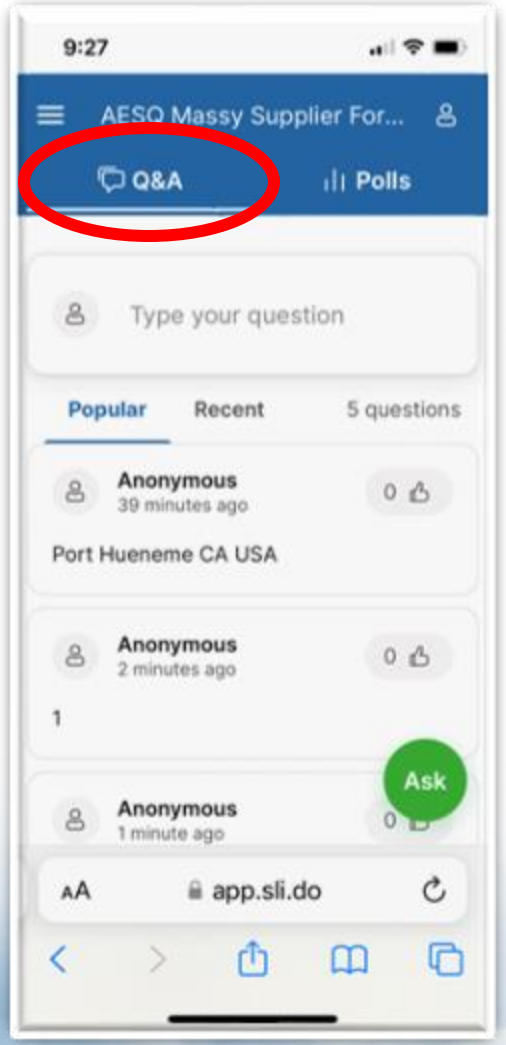
Laptop:
1. Go to slido.com
2. Enter #3593 254



How to Use Slido Live Polling App?



Answer Live Poll Questions



Add Your Own Questions

"Like" Questions

slido

What is the name of the city where you live?

ⓘ Start presenting to display the poll results on this slide.

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Have you attended previous AESQ Supplier Forums?

ⓘ Start presenting to display the poll results on this slide.

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What function are you in?

ⓘ Start presenting to display the poll results on this slide.

Dr. Silke Maurer

COO | MTU Aero Engines


#PASSION FOR
#QUALITY
→ IT STARTS WITH US!

Aerospace Engine Supplier Quality Group (AESQ) Overview

DENIS POTTIER
HEAD OF THE PURCHASING QUALITY ASSURANCE
SAFRAN

AS13100 OVERVIEW

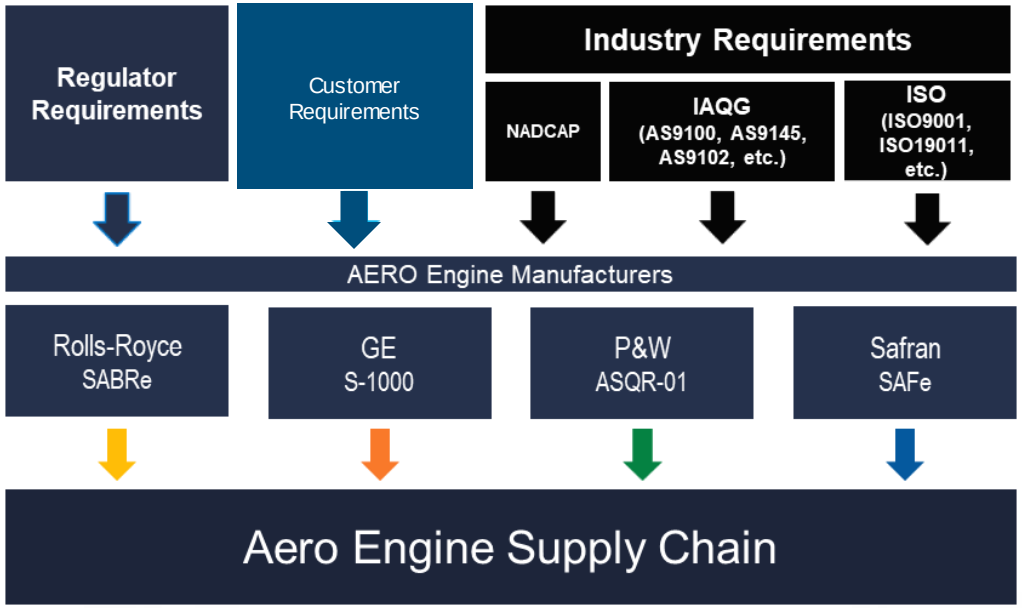
WHAT PROMPTED AESQ TO FORM? – VIEW FROM 2013

- Unprecedented production ramp ahead
- Expanding global supplier footprint and increasing supplier engine content
- Common supply base, multiple OEM customers
- Customers required engine OEM's to improve management of supply base
- Aerospace Engine Supplier Quality [AESQ] group formed to supplement AS9100, and later AS9145, for critical safety nature of engines

AS13100 OVERVIEW

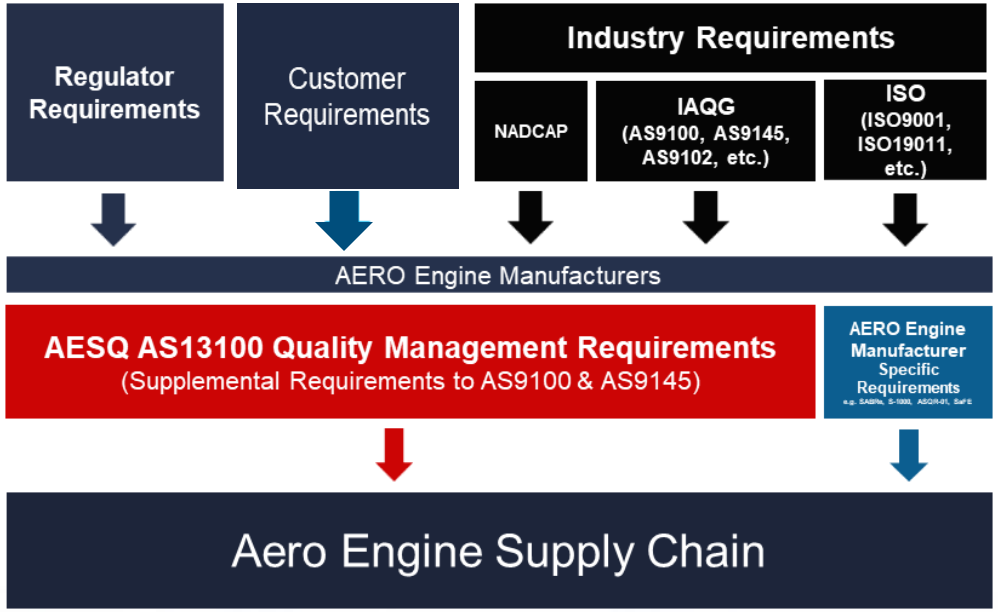
AERO ENGINE REQUIREMENTS FLOWDOWN

2013



- Differing supplemental requirements to AS9100 [Regulatory, Customer, business] and guidance albeit with largely the same intent

2023



- Creates a common set of supplemental requirements
- Simplifies the compliance for suppliers with multiple customers
- Common reference materials to support understanding, efficiency, and effective deployment of foundational quality tools

AESQ Overview

AEROSPACE ENGINE SUPPLIER QUALITY GROUP

Vision

To enable and accelerate the achievement of Zero Defects and a quality first culture across the global aero engine supply chain.

So that:

- Safety is assured
- Disruption is reduced
- Cost of Poor Quality is eliminated

Thru:

- Collaboration and shared learning
- Development of capability and expertise
- Implementation of simplified and common standards

AS13100 OVERVIEW

WHY IS AS13100 IMPORTANT

- All engine manufacturers are driving process control through APQP (Advanced Product Quality Planning)
- Despite the same foundational requirements, each were flowing different terminology, processes and tools
- Needed simpler and more consistent guidance for the supply base
- Asked for a forum to share best practices from across industry
- Needed to challenge current acceptance thresholds- raising the bar of performance for the whole industry, ex. product safety
- Essential to accelerate supplier capability through common development & training

Improving Safety & Quality Remained a Key Challenge

AESQ Consortium Company Members

AESQ Steering Group Members

GE Aerospace

Pratt & Whitney – Dependable Engines

Rolls-Royce

Safran Aircraft Engines

MTU Aero Engines

GKN Aerospace

Honeywell Aerospace

Howmet Aerospace

IHI

PCC Precision Castparts Corp.

AESQ Contributing Members

Cincinnati Thermal Spray
Collins Aerospace
Consolidated Precision Products
ITP Aero
Parker Meggitt
Rolled Alloys
Solar Atmospheres
Woodward

AESQ Steering Group Members

Barbara Negroe
Executive Sourcing Quality Leader
GE Aerospace

Lisa Claveloux
Sr. Director Quality
Pratt & Whitney

Helen Djäknegren
Director Supplier Quality
& Development
GKN Aerospace

Uzam Khan
Supplier Quality Executive
Rolls-Royce

Denis Pottier
Head of Purchasing Quality
Assurance Department
Safran Aircraft Engines

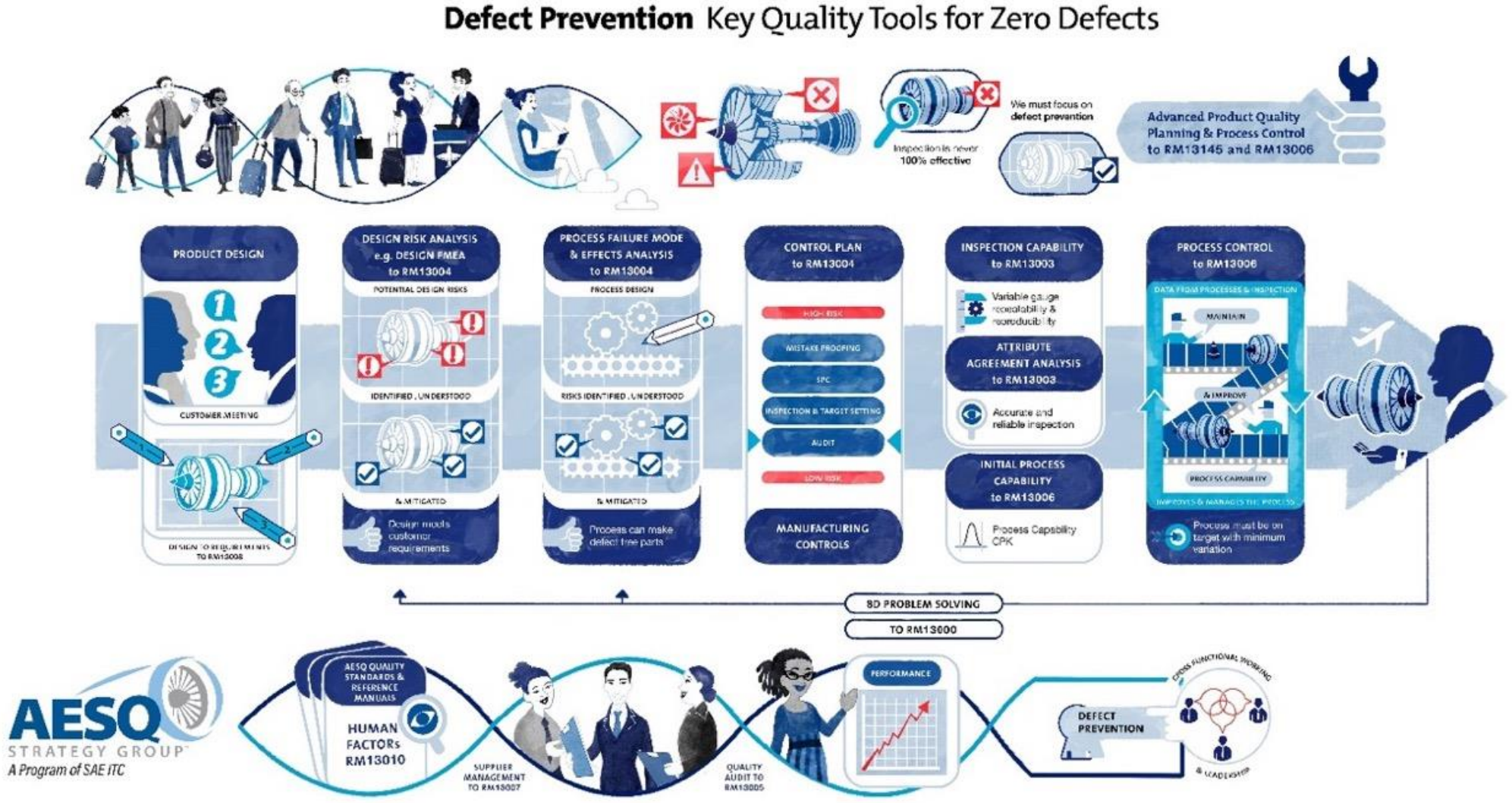
Jun Sakai
Chief Engineer
IHI Corporation

Barrie Hicklin
Sr. Director, Quality Systems
& Regulatory Compliance
Honeywell

Markus Braig
Director Quality Supply Chain
and MRO
MTU Aero Engines

James Clifton
Global Quality Director
Precision Castparts Corp.

Osa Omoruyi
VP Quality
Howmet Engine Systems



Defect Prevention Tools Must Work as a System

AS13100 Overview Structure & Key Highlights

HELEN DJÄKNEGREN
DIRECTOR, SUPPLIER QUALITY & DEVELOPMENT
GKN AEROSPACE

AS13100 Creation Process

Starting Point September 2018

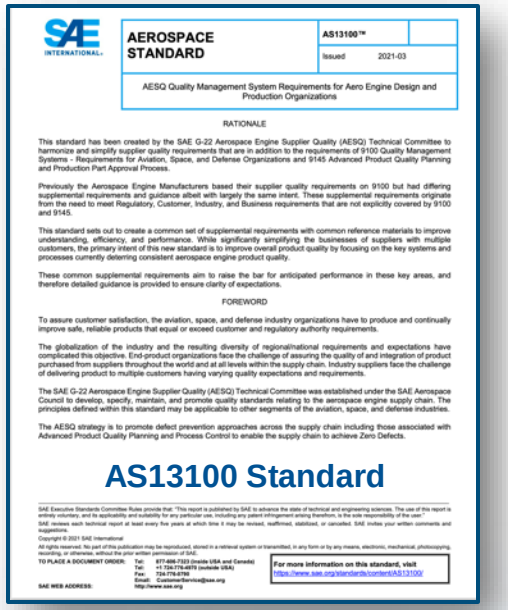
Existing & WIP AESQ Standards

OEM Unique Requirements

Engine Maker Supplier Requirements pre AS13100 introduction

Harmonized Requirements

Requirements

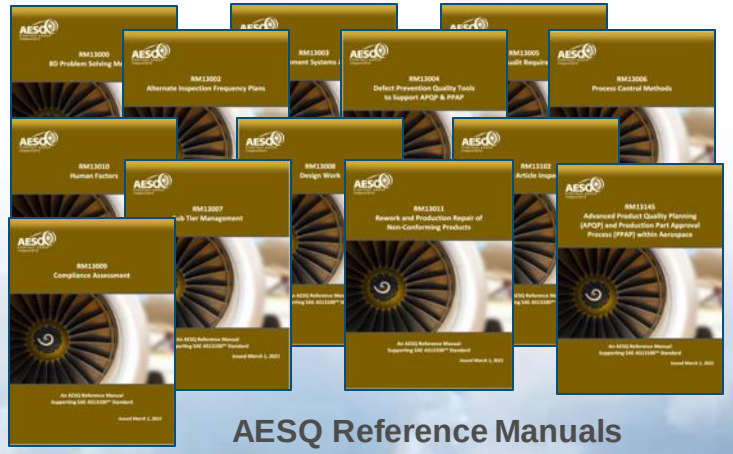


AS13100 Standard

Supporting Guidance & Best Practice Material

Future Engine Maker Supplier Requirements

Overall Number of Requirements reduced by >50%



AESQ Reference Manuals

AS13100 Structure

AS13100 Requirements	Chapter A ISO9001/AS9100 Rev D Supplemental Requirements										Chapter B APQP & PPAP AS9145 Supplemental Requirements						Chapter C Defect Prevention Quality Tools to Support APQP & PPAP							
Clause Number	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	DFMEA	Product KCs	Process Flow Diag.	PFMEA	Process KCs	Control Plan	MSA	Process Capability

Example Extract

9.3 Management Review

9.3.1 General Reference 9100D:09/2016 requirements.

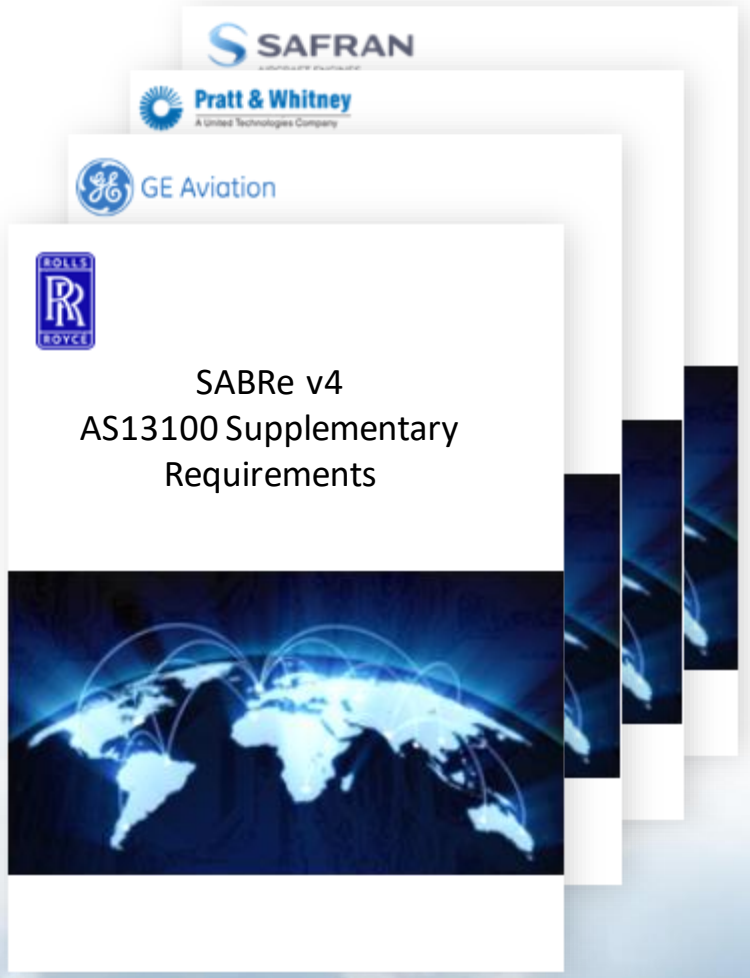
9.3.2 Reference 9100D:09/2016 requirements.

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



Customer Specific requirements are designed to include 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
- Define company specific key roles and accountabilities for approvals
- Includes specific IT interface requirements

AS13100 Requirement Highlights

What requirements in AS13100 Chapter A apply to my organization ?

Determine what type of organization you are in Table 2

Agree the type with your customer

Identify your applicable requirements in Table 1

Deploy

Identify your organization type

Guidance in AS13100 Appendix B

Do you manufacture or assemble at least one part defined by the Customer (e.g., customer-proprietary design, customer-directed 3rd party design), including castings and forgings?

Note: This includes suppliers that purchase parts from third parties manufactured against Customer proprietary drawings and don't add any additional value themselves.

Yes → **Type 1: Make to print**

No ↓

Do you only manufacture or assemble finished part(s) produced against drawings, etc., proprietary to your company?

Yes → **Type 2a: Design/ Make**

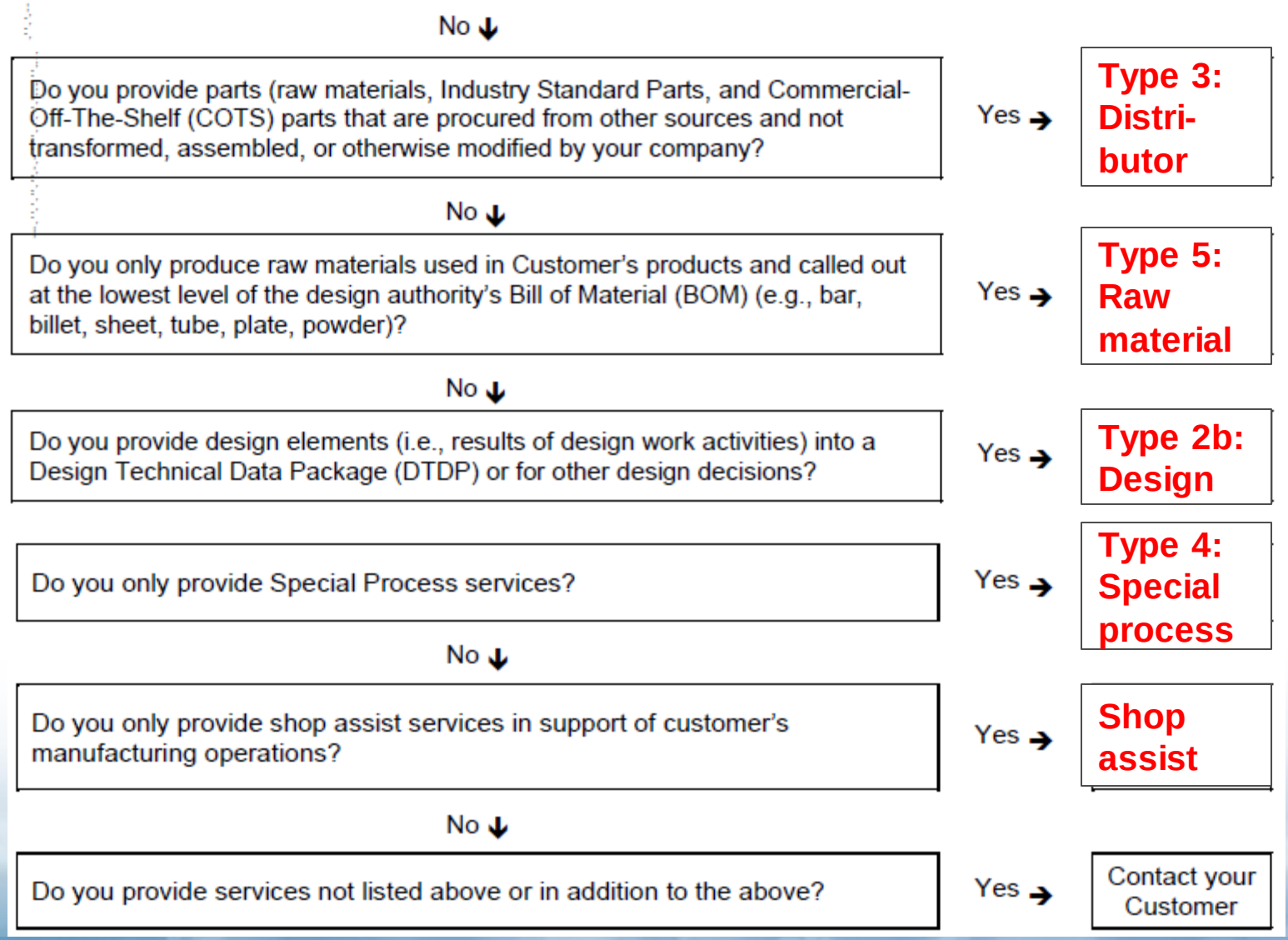
No ↓

Continued on next slide

AS13100 Requirement Highlights

Identify your organization type – cont.

Ensure that you agree the type with your customer



AS13100 Requirement Highlights

AS13100 PARAGRAPH REFERENCE	ORGANIZATION TYPE					
	TYPE 1: MAKE TO PRINT	TYPE 2A: DESIGN AND MANUFACTURE	TYPE 2B: DESIGN ONLY	TYPE 3: DISTRIBUTOR	TYPE 4: SPECIAL PROCESS	TYPE 5: RAW MATERIAL
4.3.1	X	X	X	X	X	X
4.3.2	X	X	X			
4.3.3	X	X	X	X	X	X
4.3.4	X	X	X	X	X	X
4.3.5	X	X	X	X	X	X
4.4.3	X	X	X	X	X	X
5.1.1.1	X	X	X	X	X	X
5.2.1.1	X	X	X	X	X	X
5.3.1	X	X	X	X	X	X
6.1.3	X	X	X	X	X	X
7.1.3.1	X	X	X	X	X	X
7.1.5.1.1	X	X			X	
7.1.5.1.2	X	X			X	
7.1.5.1.3	X	X			X	

Identify your applicable AS13100 Chapter A paragraphs in Table 1

Deploy the requirements

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

slido

Which organization type best describes your organization?

ⓘ Start presenting to display the poll results on this slide.

AS13100 Benefits

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 Requirement Highlights

AESQ CONSORTIUM™
A Program of SAE ITC

The current AS13xxx series of standards have been integrated into AS13100;

- AS13000 Problem Solving using 8D
- AS13002 Alternative Inspection Plans
- AS13003 MSA
- AS13004 Process FMEA and Control Plans
- AS13006 Process Control

Free issue Reference Material is available to support the deployment of AS13100.

AS13001 DPRV Training will remain unchanged.

AS13100 organizes its additional requirements aligned to AS9100 and AS9145 standard structures.

It also includes requirements to other AS series standards including;

- AS9102 First Article Inspection
- AS9146 FOD
- AS9115 Deliverable Software
- AS9116 Design Change Process
- AS9117 DPRV
- AS5553 Counterfeit Parts (EEE)
- AS6174 Counterfeit Parts

iaqg
INTERNATIONAL AEROSPACE QUALITY GROUP

NEW

Accredited Nadcap™

Recognizes NADCAP certification for special processes for both internal and external operations.

(Section 4.3.3)

AS13100 Requirement Highlights

Organization's are required to include **Human Factors** within the scope of their QMS

(Section 4.4.3, 5.1.1.1, 5.2.1.1 and 7.3.1)

The organization shall conduct a **Compliance Assessment** of their QMS to ensure that it captures all of the requirements of AS13100.

Any gaps must be agreed with the individual customer.

(Section 4.3.5)

An agreed set of **Certification Requirements**, matched to the scope of the supplier's activities is defined

(Section 4.3.3)

AS13100 Requirement Highlights

AS13100 requires four **Audit Types** to be conducted;

1) Quality Management System Audits
2) Production Process Audits
3) Product Audits
4) Special Process Audits

(Section 9.2.3)

Auditor Competence Requirements defined for;

- Qualifications
- Education
- Experience
- Ongoing professional development

(Section 7.2.2)

Quality Leaders are required to attend the AESQ **Quality Foundation Training** Class. Also recommended for other key personnel

(Section 7.2.4)

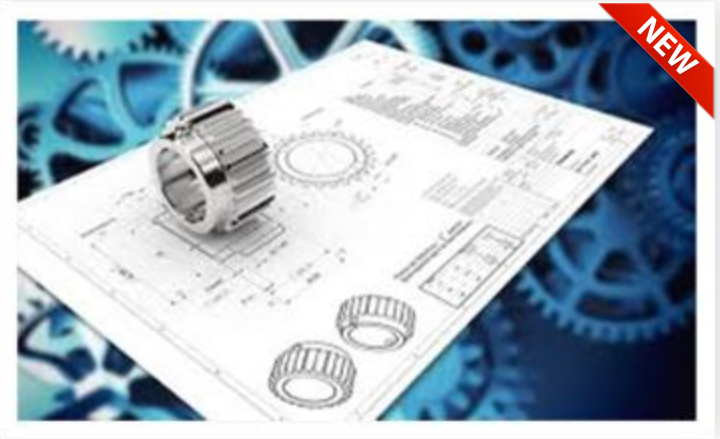
Organizations are required to provide **On the Job Training** that includes customer requirements, regulatory requirements, etc.

(Section 7.2.1)

AS13100 Requirement Highlights

Common **Record Retention** policy for OEMs

(Section 7.5.3.5)



Requirements for **Design & Development** defined including the use of **DFMEA** for Design Risk Analysis

(Section 8.3)

AS13100 defines the requirements for **Supplier Evaluation, Selection, Control** and **Performance Monitoring.**

(Section 8.4.1)

Compliance to **AS9146 FOD Prevention** is required in Design Requirements (8.3.3.3), Production Control (8.5.4.1) and Supplier Control (8.4.2.1)

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AS13100 Requirement Highlights

Specifies the use of **AS5553** Counterfeit Electrical, Electronic and Electromechanical Parts and **AS6174** for Counterfeit Material.

(Section 8.1.4.1 & 8.4.2.1)

NEW

The organization shall verify that the correct metallic raw material is used e.g. through the use of **handheld spectrometry.**

(Section 8.5.1.4.1)

Defines the use of **8D Problem Solving** for key issues.

Additional guidance on Problem Solving when 8D's are not required to be included in the Reference Manual RM13000.

(Section 10.2.3)

The organization shall ensure that it uses the customer created scorecard to prioritize improvement actions.

The organization must strive for **100% Quality & Delivery performance.**

(Section 9.1.2.1)

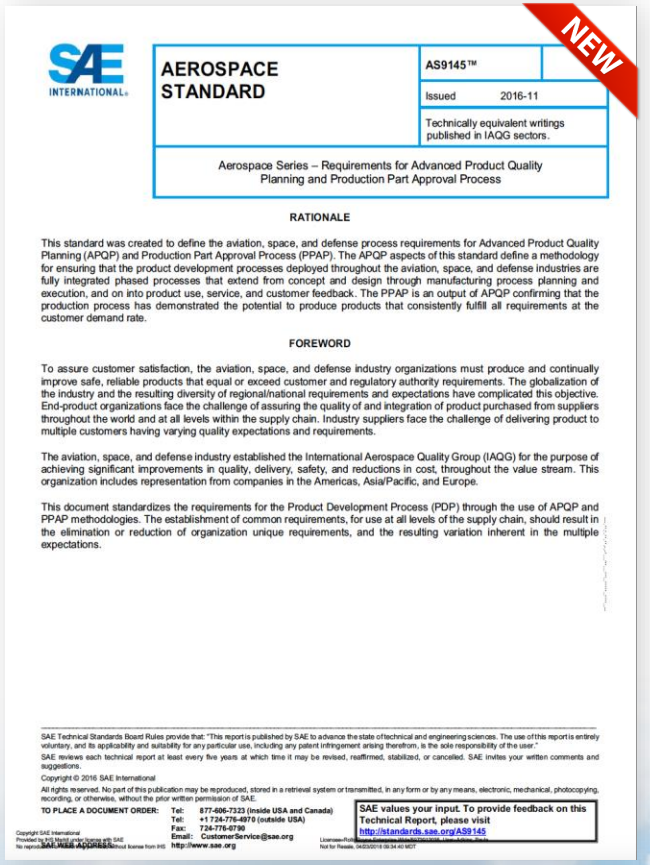
AS13100 Requirement Highlights: Chapter B APQP & PPAP

AS9145 APQP & PPAP required to manage;

- New Product Introduction
- Product & Design Changes
- Source Changes

Additional Quality Tools identified that are not in AS9145 APQP / PPAP

1. Pre-launch Control Plan
2. Supply Chain Risk Management Process


NEW

SAE INTERNATIONAL

AEROSPACE STANDARD

AS9145™

Issued 2016-11

Technically equivalent writings published in IAQG sectors.

Aerospace Series – Requirements for Advanced Product Quality Planning and Production Part Approval Process

RATIONALE

This standard was created to define the aviation, space, and defense process requirements for Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP). The APQP aspects of this standard define a methodology for ensuring that the product development processes deployed throughout the aviation, space, and defense industries are fully integrated phased processes that extend from concept and design through manufacturing process planning and execution, and on into product use, service, and customer feedback. The PPAP is an output of APQP confirming that the production process has demonstrated the potential to produce products that consistently fulfill all requirements at the customer demand rate.

FOREWORD

To assure customer satisfaction, the aviation, space, and defense industry organizations must produce and continually improve safe, reliable products that equal or exceed customer and regulatory authority requirements. The globalization of the industry and the resulting diversity of regional/national requirements and expectations have complicated this objective. End-product organizations face the challenge of assuring the quality of and integration of product purchased from suppliers throughout the world and at all levels within the supply chain. Industry suppliers face the challenge of delivering product to multiple customers having varying quality expectations and requirements.

The aviation, space, and defense industry established the International Aerospace Quality Group (IAQG) for the purpose of achieving significant improvements in quality, delivery, safety, and reductions in cost, throughout the value stream. This organization includes representation from companies in the Americas, Asia/Pacific, and Europe.

This document standardizes the requirements for the Product Development Process (PDP) through the use of APQP and PPAP methodologies. The establishment of common requirements, for use at all levels of the supply chain, should result in the elimination or reduction of organization unique requirements, and the resulting variation inherent in the multiple expectations.

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SAE values your input. To provide feedback on this Technical Report, please visit http://standards.sae.org/AS9145

Additional Quality Tools identified that are not in AS9145 PPAP

1. DFMEA defined as the Design Risk Analysis tool
2. Defines AESQ Guidance Documents for PPAP elements
3. Initial manufacturing Performance Studies
4. Dimensional / non-Dimensional Results

Defines Submission Requirements for PPAP based on Supplier Performance;

1. Submit Warrant only to customer, Retain evidence at Supplier
2. Submit PPAP evidence to customer and Retain all documents
3. Witness at Supplier

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/supplemental-material

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

AESQ is Working on AS13100 Revision A

- **The AS13100 writing team is currently working on an update of the standard based on user input.**
- **Target date for publication is year end 2023**
- **Updates include:**
  - Clarifications
  - Grammar & Spelling
  - Suggested Improvements

SAE INTERNATIONAL

AEROSPACE STANDARD

AS13100™

Issued 2021-03

AESQ Quality Management System Requirements for Aero Engine Design and Production Organizations

RATIONALE

This standard has been created by the SAE G-22 Aerospace Engine Supplier Quality (AESQ) Technical Committee to harmonize and simplify supplier quality requirements that are in addition to the requirements of 9100 Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations and 9145 Advanced Product Quality Planning and Production Part Approval Process.

Previously the Aerospace Engine Manufacturers based their supplier quality requirements on 9100 but had differing supplemental requirements and guidance albeit with largely the same intent. These supplemental requirements originate from the need to meet Regulatory, Customer, Industry, and Business requirements that are not explicitly covered by 9100 and 9145.

This standard sets out to create a common set of supplemental requirements with common reference materials to improve understanding, efficiency, and performance. While significantly simplifying the businesses of suppliers with multiple customers, the primary intent of this new standard is to improve overall product quality by focusing on the key systems and processes currently deterring consistent aerospace engine product quality.

These common supplemental requirements aim to raise the bar for anticipated performance in these key areas, and therefore detailed guidance is provided to ensure clarity of expectations.

FOREWORD

To assure customer satisfaction, the aviation, space, and defense industry organizations have to produce and continually improve safe, reliable products that equal or exceed customer and regulatory authority requirements.

The globalization of the industry and the resulting diversity of regional/national requirements and expectations have complicated this objective. End-product organizations face the challenge of assuring the quality of and integration of product purchased from suppliers throughout the world and at all levels within the supply chain. Industry suppliers face the challenge of delivering product to multiple customers having varying quality expectations and requirements.

The SAE G-22 Aerospace Engine Supplier Quality (AESQ) Technical Committee was established under the SAE Aerospace Council to develop, specify, maintain, and promote quality standards relating to the aerospace engine supply chain. The principles defined within this standard may be applicable to other segments of the aviation, space, and defense industries.

The AESQ strategy is to promote defect prevention approaches across the supply chain including those associated with Advanced Product Quality Planning and Process Control to enable the supply chain to achieve Zero Defects.

AS13100 Standard

For more information on this standard, visit https://www.sae.org/standards/content/AS13100/

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Deployment Status

UZAM KHAN
SUPPLIER QUALITY EXECUTIVE
ROLLS-ROYCE

JIM WILSON
SR. MANAGER, SUPPLIER QUALITY & DEVELOPMENT
PRATT & WHITNEY CANADA

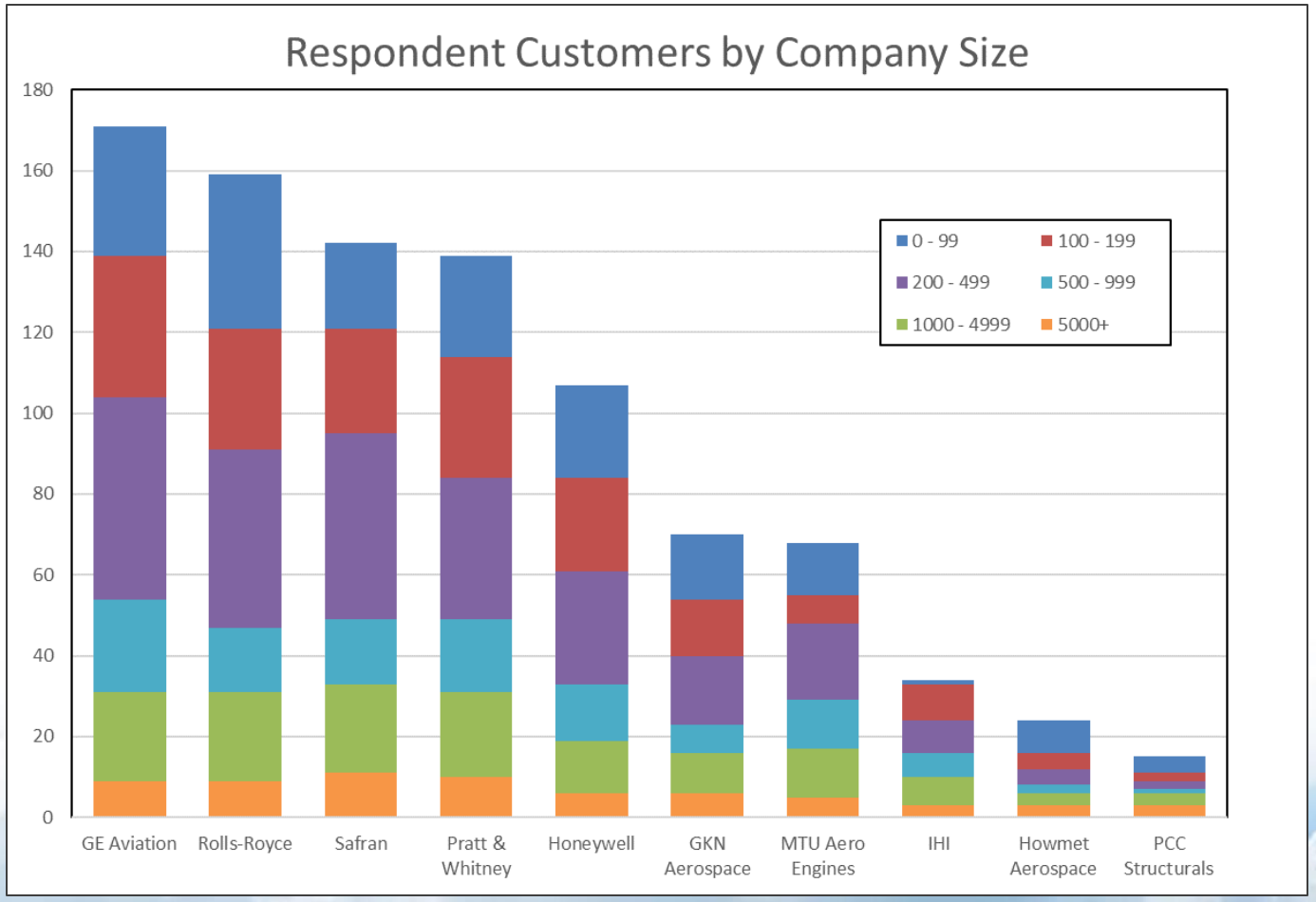
The Deployment Team

To enable the effective and consistent deployment of the AS13100 Standard

Deployment Status and Support	Deployment Strategies	Subject Matter Interest Groups
• Surveys • Insight, Opportunities • Supplier Support • Deployment Webpages	• Deployment Scenarios • Consistency/ Variations in deployment requirements • Consistency in Compliance, incl audit findings	• Each Reference Manual has a SMIG • Webinars • Linked In CoPs • Subject Matter Experts • Input to Writing Team

AESQ Deployment Survey Results

Who Responded?



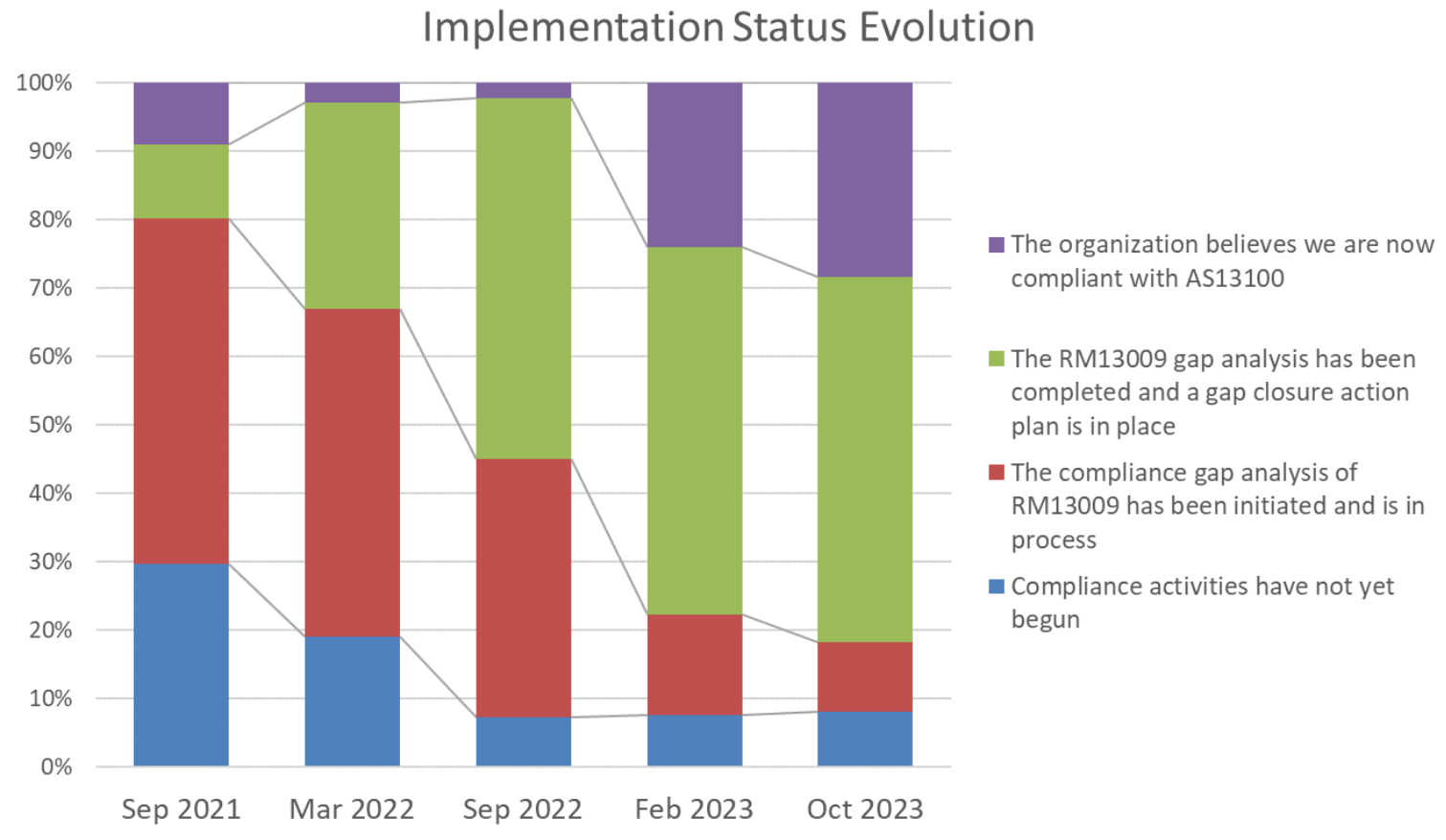
Respondents had an average of 3.7 AESQ customers

238 respondents

47

Deployment Status

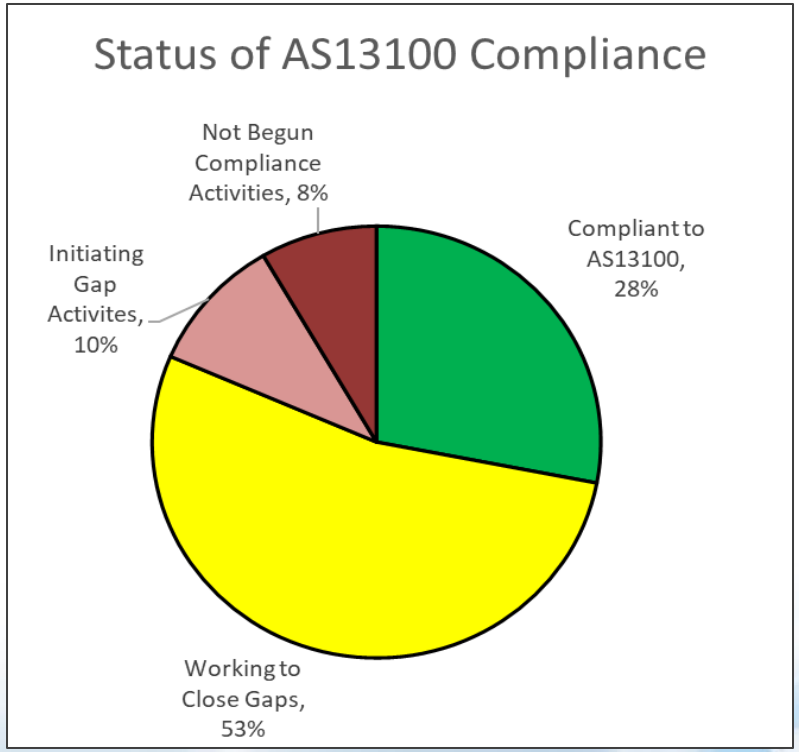
- We have seen a progressive improvement
- A small number of companies still have not started compliance activities…Why?

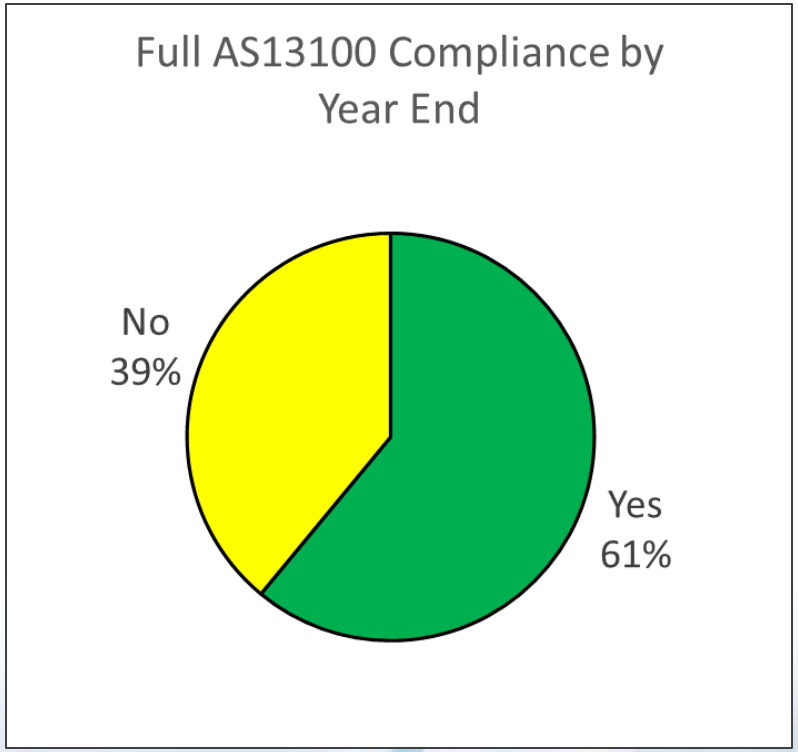


48

Deployment Confidence

- 61% compliant by year end….thank you!
- 39% not compliant….when?
- The ones that have not started…why?

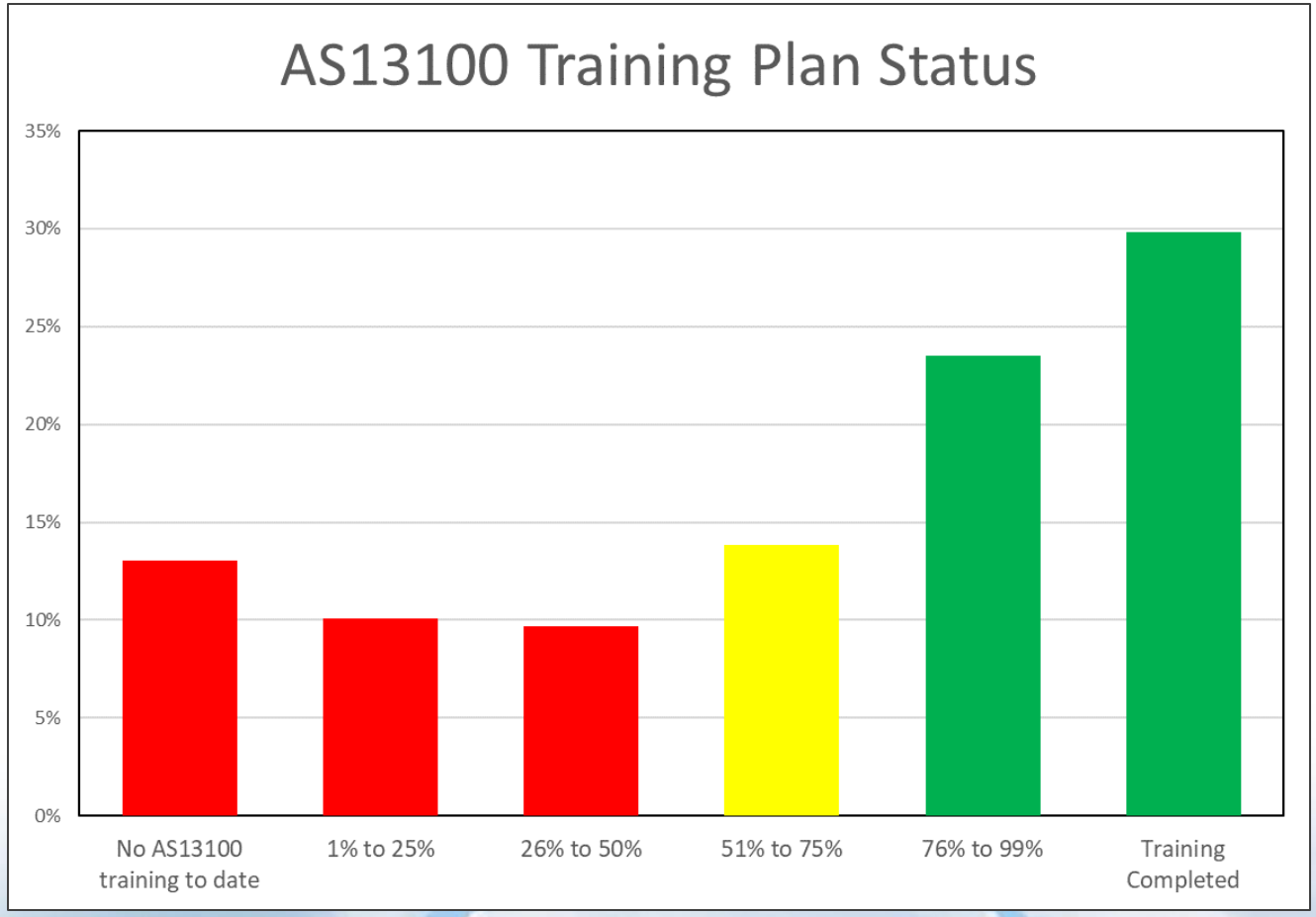




49

Training

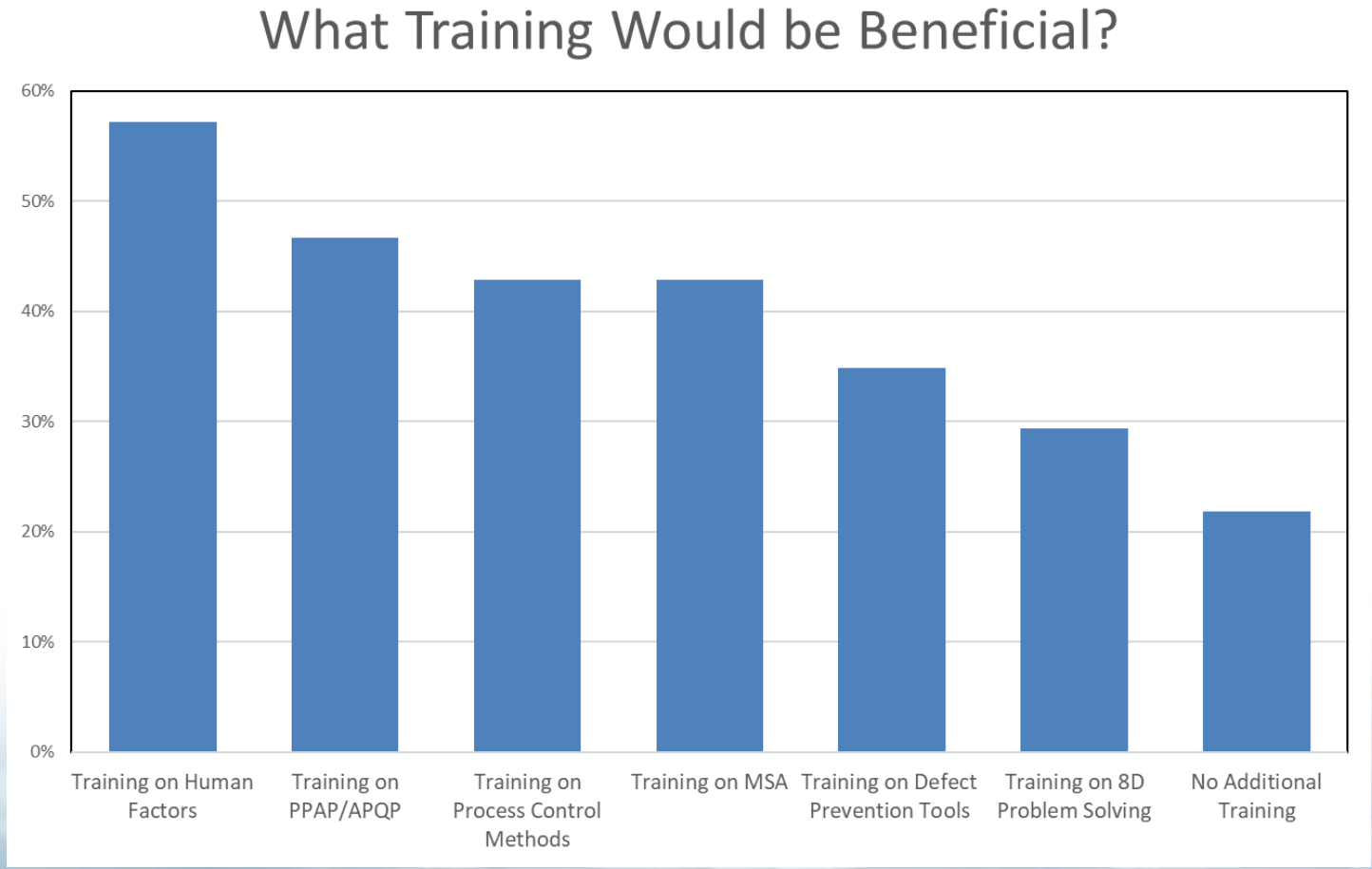
- Core Training;
  - Requirements
  - Foundation
- Needed to really understand and deploy standard
- Minimum numbers proposed
- Some companies have large gaps



50

Additional AESQ Training Support

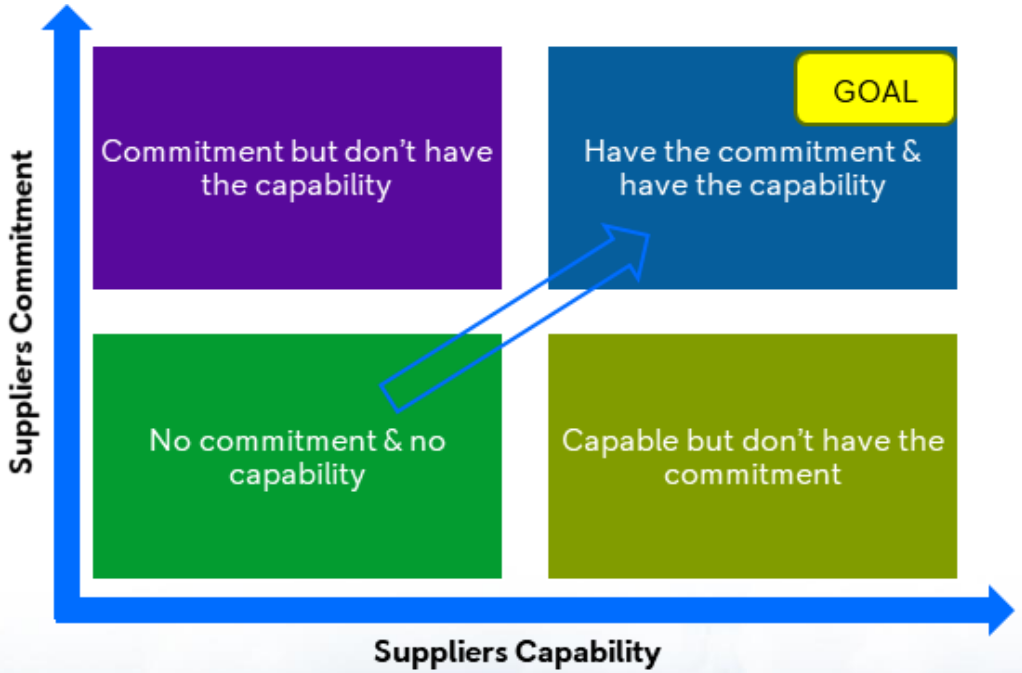
- SAE now provides courses for all key topics
- SMIGs provide webinars and coaching via CoPs
- Many others training providers available



51

Where we would like you to be….

Suppliers Commitment – Having the Leadership, mindset & engagement across the company and being driven to deliver supply chain goals.



Suppliers Organizational Capability – Having the know how, knowledge & resources across the company.

slido

How can the AESQ further support you in effective deployment?

ⓘ Start presenting to display the poll results on this slide.

Pause

Return in 25 Minutes

AESQ CONSORTIUM™
A Program of SAE ITC

Using FMEA to Reduce Human Error in Assembly & Test

Steve Roebuck

Head of Certification & Quality Assurance

Assembly & Test Operations

Rolls-Royce

ROLLS ROYCE

Our Large Engine Product Portfolio

Trent XWB-84

Trent XWB-97

Trent 1000-TEN

Trent 7000

30,000 Components

6,000 Manual Operations

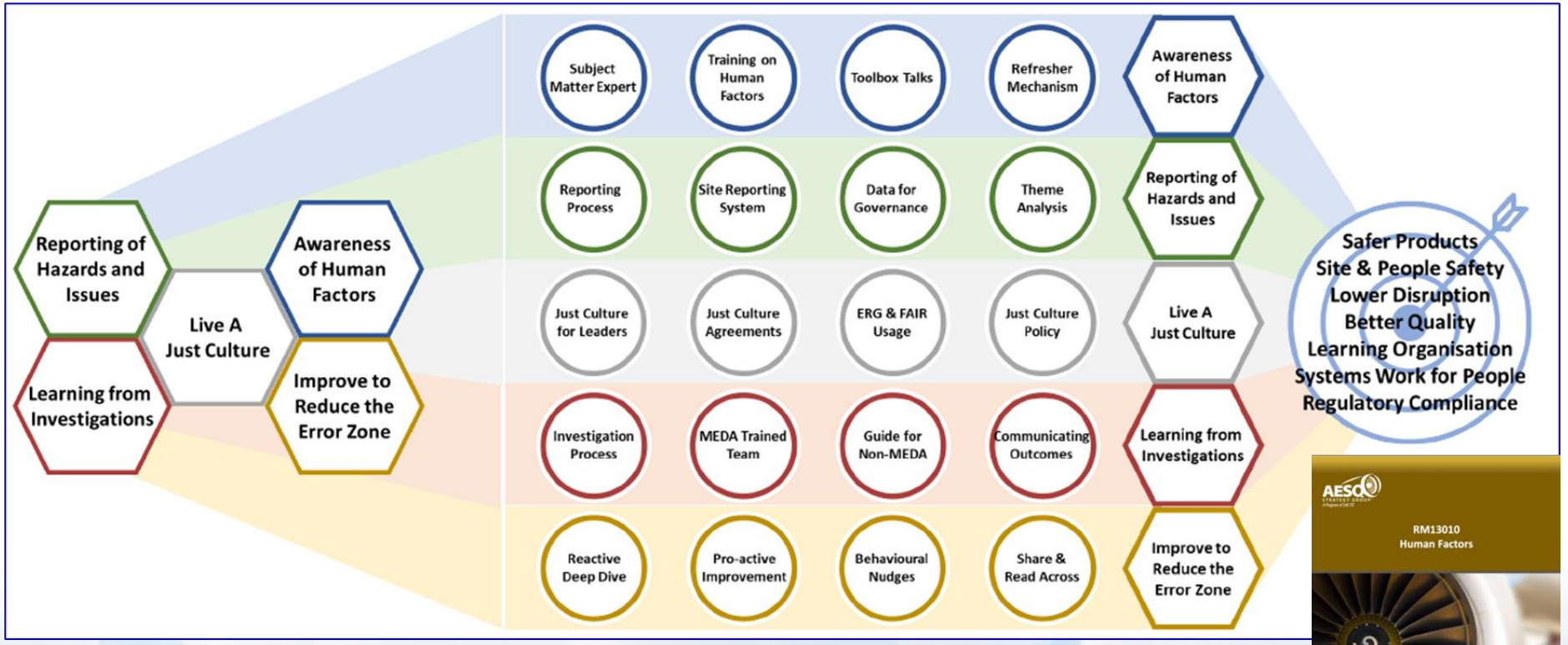
Human Factors play a critical part in assuring Product Quality

slido

What is your knowledge of Human Factors?

ⓘ Start presenting to display the poll results on this slide.

Rolls-Royce HF Deployment Framework



Aligned to AS13100 and RM13010

Human Factors

1 Lack of Communication

2 Complacency

3 Lack of Knowledge

4 Distraction

The Dirty Dozen

5 Lack of Team Work

6 Fatigue

7 Lack of Resources

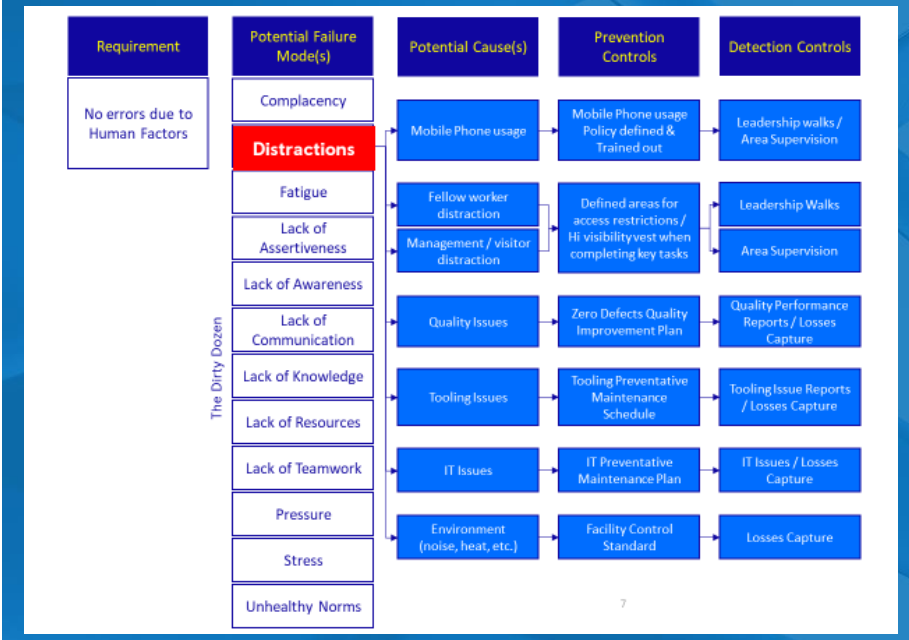
8 Pressure

9 Lack of Assertiveness

10 Stress

11 Lack of Awareness

12 Norms



The potential failure modes in the FMEA are the Dirty Dozen.

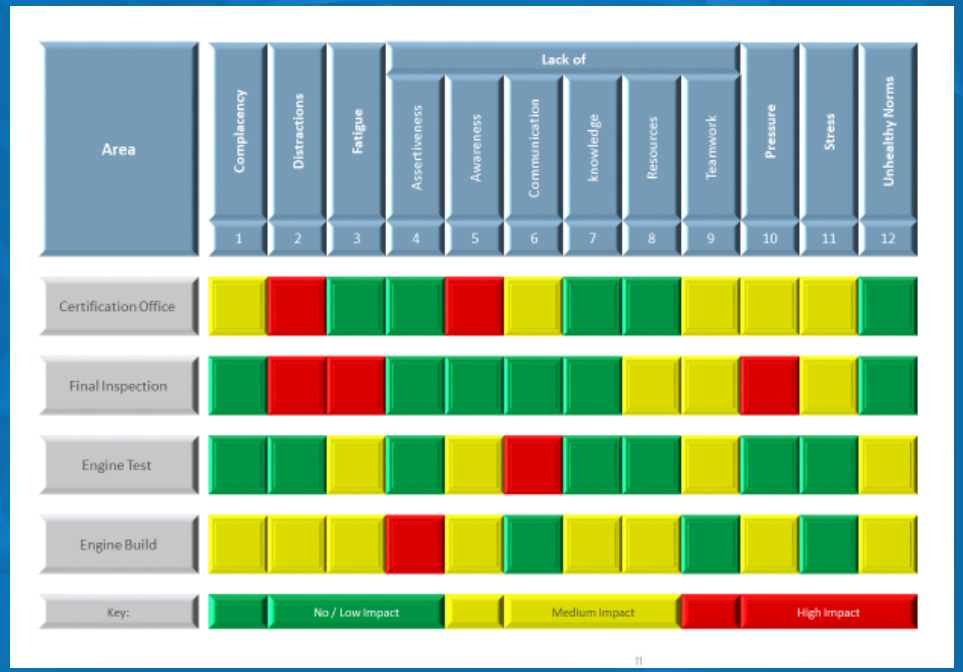
Work through each one with the cross-functional team to identify potential causes (there will be multiple causes per failure mode – example Distractions).

Next work through the Prevention and Detection controls to allow the scoring to be completed.

Once the scoring is completed the Risk Priority Number will identify the high/medium/low risks from a Human Factors perspective.

Improvement actions can than be prioritised to eliminate or reduce the risk ALARP.

Each area/process will have its own unique signature from a risk profile point of view.



Human Factors FMEA

Let's have a go!

Scenario – Final Inspection, Friday 3.30 p.m.

- Engine is due for delivery at 5 p.m on Friday. The Dispatch vehicle is waiting outside. The Ferry is scheduled for 11 p.m.
- One of the inspection team who should be working on the engine has phoned in absent this morning.
- The engine has been delayed due to some open operations found not stamped by previous shift and some other paperwork discrepancies.
- The final paperwork usually takes 2 hours to compile once the engine is finished. The delays mean that the team will only have just over 1 hour to get it all done.
- Senior Logistics Manager is in the area to get constant updates on progress to ensure the engine will be ready to deliver on time to the customer

Which of the Dirty Dozen applies to this Scenario?

slido

Which of these Dirty Dozen applies to this Scenario?

ⓘ Start presenting to display the poll results on this slide.

Key Insights

In a Manual Assembly Environment, Human Factors can have a significant impact on business performance

We have learned that;

a) Including Human Factor risks into the Product PFMEA creates too much ‘noise’ – hence a separate Human Factor FMEA approach is used

b) A reference style Human Factor FMEA approach can be used for high level analysis but each area will have a unique ‘signature’

c) It is a simple concept for the teams to use

d) Can be used pro-actively or reactively

e) Creates cross functional / high value discussions that lead to better insights

f) It drives improvements based on risk

g) Improved awareness of HF and issue reporting (MARS) where deployed

h) Human Factors risks will change over time so the FMEA needs to be periodically reviewed.

Any Questions?

AUBERT & DUVAL
AS13100 Implementation

AESQ Supplier Forum October 26, 2023

Pierre Castagnos
Progress and Customer Quality

Gilles Bresson
Quality System Compliance Manager

Contents

1. Aubert & Duval at a glance: locations and key figures

3 800
Employees

14
sites

553M€
Revenue in 2022

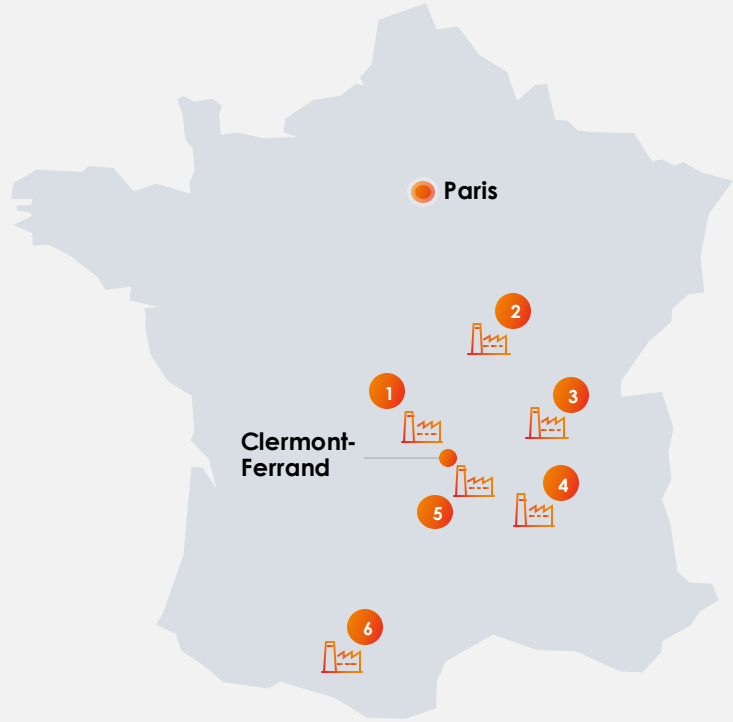
Headquarters: Issy-les-Moulineaux
(Executive management, Finance & adm°, Strategy & marketing, communication, Sales)

Tertiary sites: Clermont-Ferrand
(Operations, Quality, Technique, IS, HR, Export) ; **ADEI** (Belgaum, India: engineering and methods office)

Industrial sites

1. Les Ancizes / EcoTitanium
2. Imphy
3. Heyrieux
4. Firminy
5. Issoire & Interforge
6. Pamiers
7. A&D Spain
8. SQuAD

9 PLANTS IN FRANCE



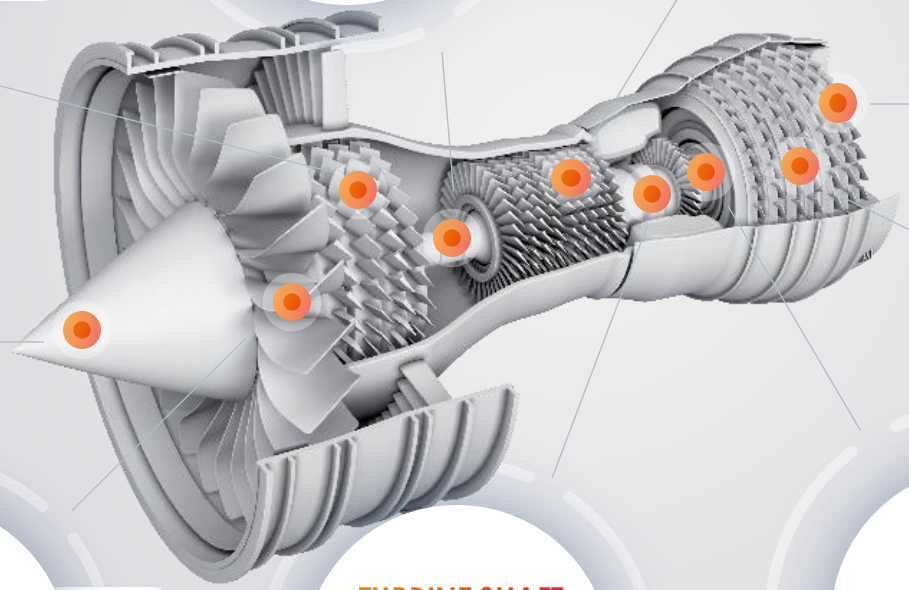
+ 2 IN THE REST OF THE WORLD
(A&D Spain, SQuAD in India)

1. Main markets

	AERONAUTICS AND SPACE	ENERGY	DEFENSE	SPECIALTIES MARKETS
Description	**Structural parts, engine parts, landing gear parts, etc.** **Bulkheads, tank domes, etc.**	**Civil nuclear and land-based turbines**	**Nuclear submarines, artillery, missiles, surface ships**	**Medical, tools, other specialty products and additive manufacturing**
Some of the company's products	Frames, slice joints, high- and low-pressure discs, turbine shafts etc.	Valve bodies, pump shafts, anti-vibration bars, discs, etc.	Large, medium and small caliber tubes, missile bars, nuclear reactor parts, etc.	Injector rods, transmission gears, medical applications, forged blocks, metal powders for additive metal manufacturing
Some of the company's customers	Rolls-Royce, ITP Aero, IHI, Liebherr, Raytheon Technologies, Safran, GE, Airbus, Boeing	Siemens, GE, Framatome	Naval Group, Nexter, Roxel, MBDA	Panerai, PSA Groupe, Woodward, Stainless France, Porsche
Drivers	Commercial aviation, military applications and space exploration	Construction / extension of the operating life of existing power plants and decommissioning of facilities (incl. transportation, landfill) electricity consumption	Military programs	Underlying niche markets (e.g. motorsports, medical uses, etc.)
External A&D revenue (2022)	**63 %** **Of which 30% for Engines**	**30 %**		**7 %**

1. Aerospace

FOCUS ON ENGINES PARTS



LPC/IPC DISK
TI

COMPRESSOR SHAFTS
TI
HPS

HPC DISK
NISA
PM
TI

CONE SHAFT
NISA

SPINNER
AI

LPT DISK
NISA

FAN DISK
TI

TURBINE SHAFT
NISA
HPS

HPT DISK
NISA
PM

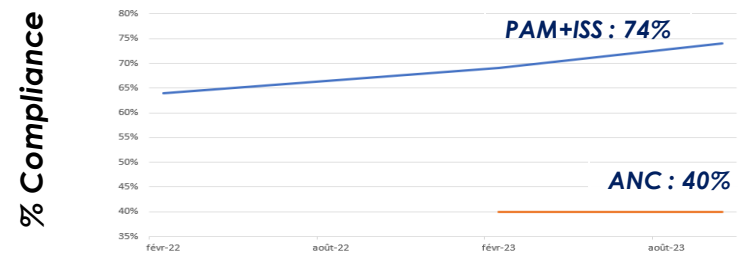
Our quality standards:
AS/EN 9100, AS13100
PRI NADCAP for our special processes and our laboratories

Alloys:
AD730, IN718, M250, U720, TA6V, IN718+, ML340, R65, Ti6246, Waspaloy, ML1014

2. Foundation - Route to AS13100

H2 23 & 24

AS13100 Requirement implementation

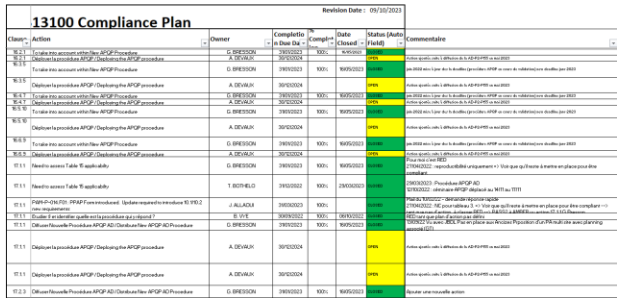


End 2024: Target 100% Compliant

Today : 99% green + orange

May 23

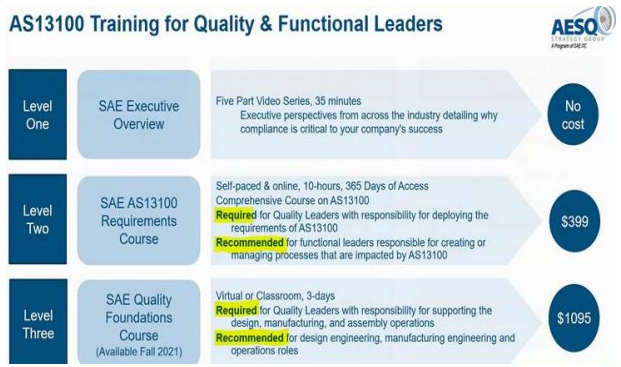
Compliance action plan



May 2023 : Compliance Action plan (Global A&D) → Largely concerned by APQP

H2 22

AS13100 concept diffusion : training as a mindset evolution enabler



H2 2022:
Focus on Training
→ change the mindset

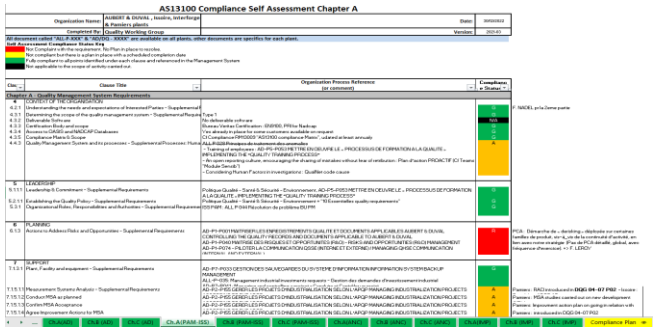
L1 : 35% of management

L2 : 100% of requested population

L3 : 100% of requested population

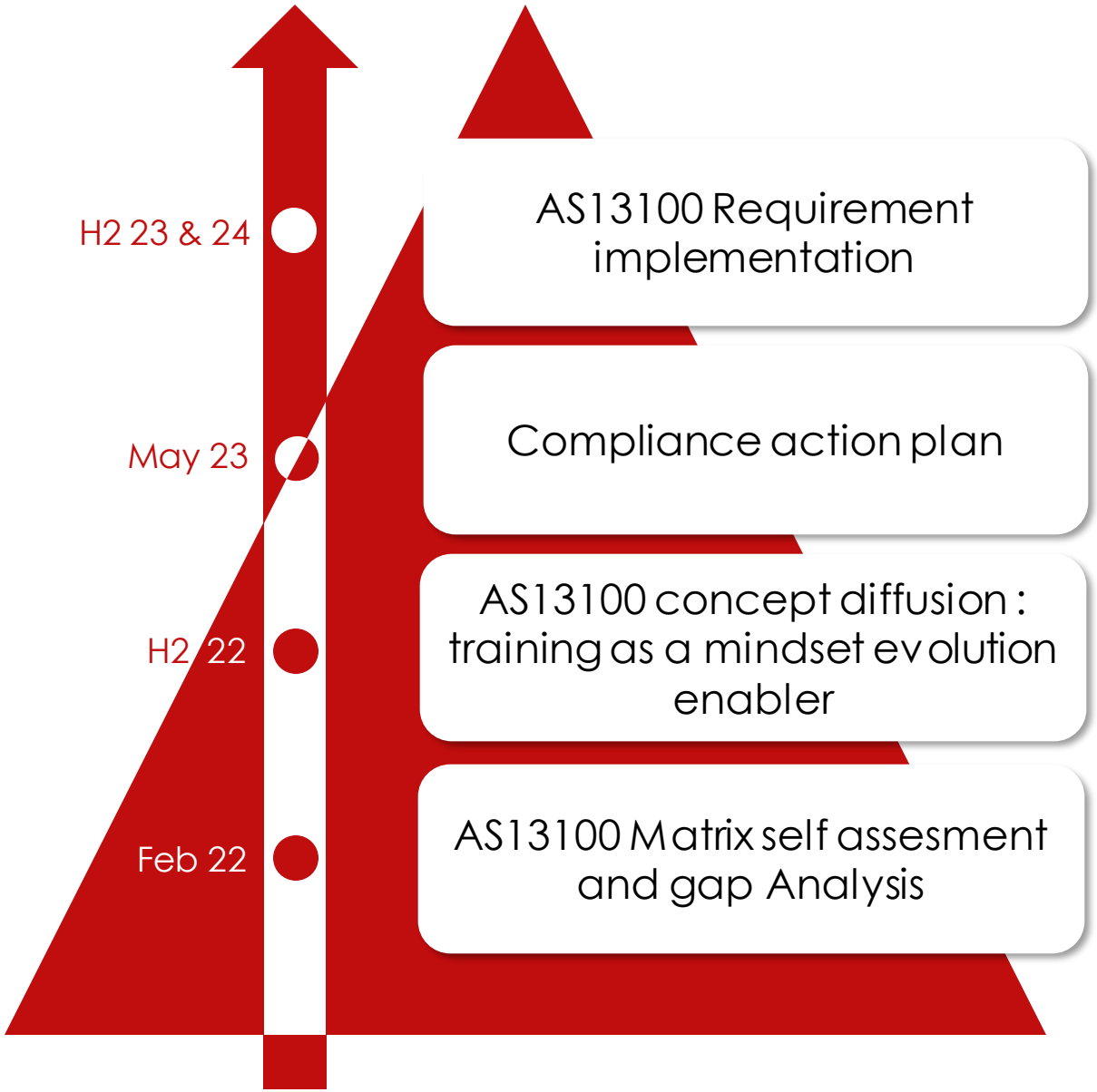
Feb 22

AS13100 Matrix self assesment and gap Analysis



Beg 2022:
Self Assessment with dedicated task group

2. Foundation - Route to AS13100



Benefits:
- Route for standardization
- Available common trainings
- Methodology support
- Re Use of AS13100 standards for other customers

Points of attention:
- Still some customers specific requirements
- Improving skills and mindset takes time
- Availability of resources

2. Foundation - Route to APQP

End of 2019 – POC on Pamiers and Issoire Plants (6 pilots project)

T1 2022 – Decision for FULL APQP

100% Pamiers and Issoire projects and generalization to A&D

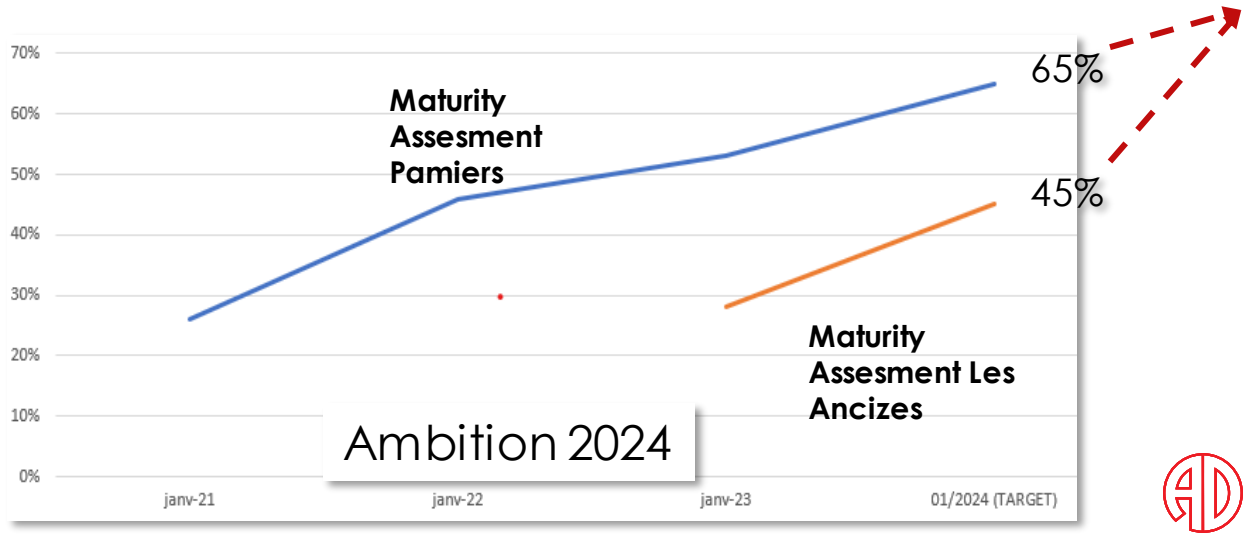
May 2023 – Unique APQP procedure for all Plants

Development Criticity → / Customer Requirement ↓	Low	Medium	High
EN 9145 / AS 13100	C	C	C
EN 9100	I	I	C
Iso 9001	NA	I	I
No	NA	NA	I

Benefits:
- **Ease** project management and structure (flowcharts, FMEA, KC lists, control plans)
- **Allow** better anticipation and **mitigate** risks
- **Strengthen** cross functions collaboration

Points of attention:
- Despite AS13100 **different** customer **templates** remain
- **Measurement System Analysis** is still a challenge
- **Sub-tiers** management : implement APQP but keep pragmatism

Our ambition : Deploy APQP on all major modifications and parts development (NPI) by end of 2024



2. Foundation – Human Factor

Human factor is included in our AS13100 & SMS roadmap :

Examples:

SMS WP 4 : **Promote product Safety** => Train All employees on critical parts , include "dirty dozen" & lessons learnt into our quality management system and software

Organization's are required to include **Human Factors** within the scope of their QMS

(Section 4.4.3, 5.1.1.1, 5.2.1.1 and 7.3.1)

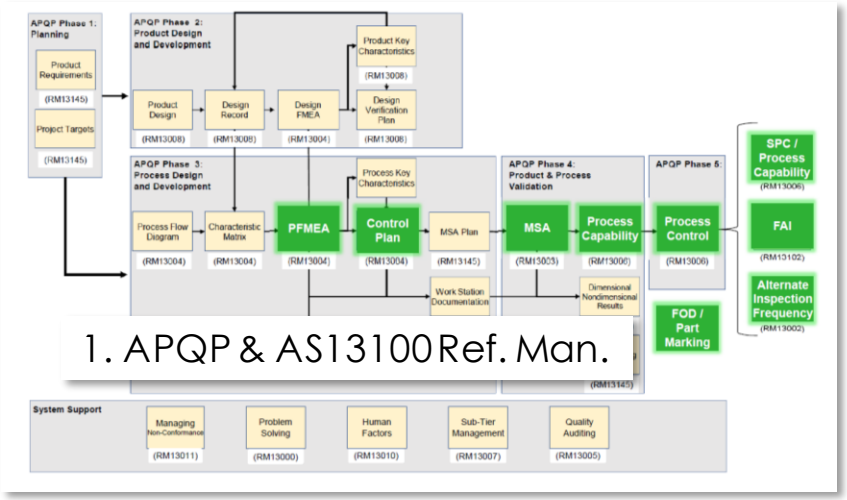
Find alternatives to manual NDT to eliminate risks of errors & increase reliability

> Manual UT : simulation implementation , maximize UT mapping, test virtual reality for mandatory manual checks

> FPI & MPI : develop automation for detection & caracterisazation (optical & thermography)

3. A new Organization designed for a new Quality Plan

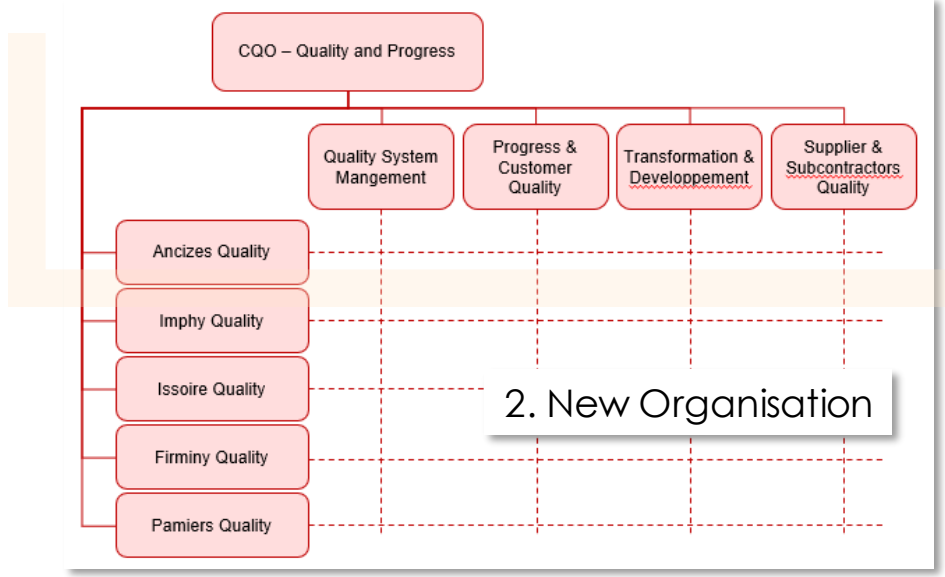
New organisation in place since **08/2023** with CQO leading **Quality & Progress for whole Aubert & Duval**.



1. APQP & AS13100 Ref. Man.

"An **independent** and **collaborative** Quality & Progress department to :

- **drive** the consolidation of AD's Quality System with regards to certification and customer requirements,
- **improve** synergies & continuity between all sites
- **develop** the progress process according to AD operational excellence standards, in factories and support functions
- **implement** Standards for project management & APQP all along development process."



2. New Organisation

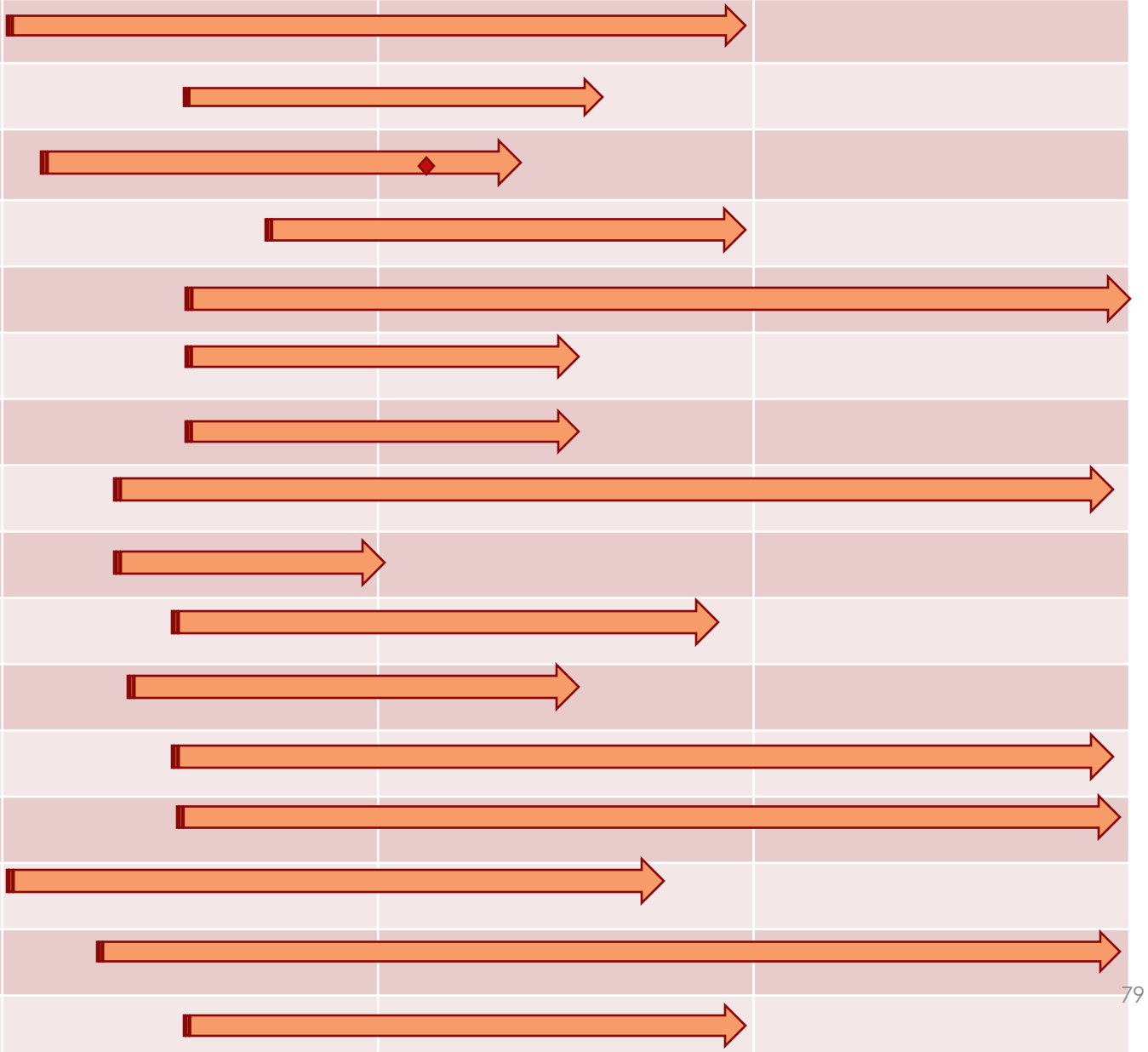
Quality Domain \ Quality Fundation			APQP Phases RM13145 - RM13008 RM13004 - RM13003 RM13006 - RM13002 RM13102	Managing non conformance RM13011	Problem Solving RM13000	Human Factors RM13010	Sub-Tiers Management RM13007	Quality Auditing RM13005
Sites Quality				X				
System Management Quality	Fundametals	Processes						
		Quality Culture						
		Tools						
	Compliance	Audits						X
		Risks						
		SMS				X		
	NDE Expertise							
Progress and Customer Quality					X			
Transformation & Development Quality			X					
Suppliers & SC Quality							X	

3. Compliance Matrix

3. Quality Plan Bricks

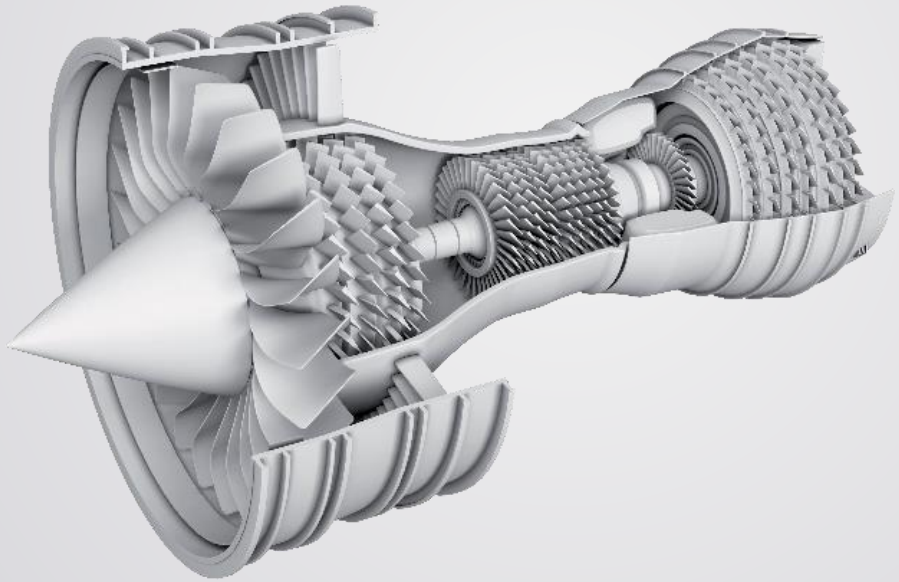
3. Quality Plan Road Map

Quality Bricks		2023	2024	2025
Dev & Indus Control	APQP			
System	SMS & Risk Analysis			
	Nuclear System – ♦ ISO 19443 - Workshop deployment			
	AS13100			
	Aeroexcellence			
	Simplify QMS			
	Quality Processes			
	Audits Professionalization			
Tools	ERP, QUALNET, LIMS, FMEA …			
Delegate & Empower	QRQC			
	FAI & IA			
Human Factors	Safety Centers			
	Operational Monitoring			
	CND & Specific Processes			
Progress Plan	REX, 8D, Collaborated Progress			
Outsourcing Management				



4. Conclusion

AS13100 implementation is a real standardization opportunity even if customers specific requirements still remain.



The training, tools available and the methodological support of our customers effectively support us in the process.

It's a demanding job that takes time and resources, but for which we expect a significant ROI in terms of quality improvement.

AUBERT&DUVAL

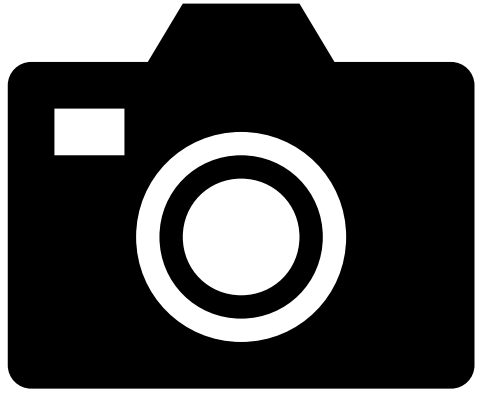
BREAKOUT SESSION #1
Subject Matter Interest Groups (SMIGs)

MELANIE DEROO
QUALITY SYSTEMS ENGINEER
GE AEROSPACE

Breakout Session #1: Subject Matter Interest Groups (SMIGs)

Table	Subject Matter Interest Group (SMIG)	Table Leader
1	Problem Solving (RM13000)	Jun Sakai, IHI
2	Alternative Inspection (RM13002) MSA (RM13003) Process Control (RM13006)	Marnie Ham, GE Miriam Kuehn, MTU
3	Defect Prevention (RM13004)	Ebru Cetin, MTU
4	Compliance Assessment (RM13009) Quality Audit Methods (RM13005)	Jim Wilson, Pratt & Whitney Carol Dunklin, GE
5	Sub-Tier Management (RM13007)	Helen Djäknegren, GKN Markus Braig, MTU
6	Human Factors (RM13010)	Beata Tarczon, MTU
7	FAI (RM13102)	Klaus Dietershagen, MTU
8	Training	Earl Capozzi, Pratt & Whitney

Return in 60 Minutes



Group Photo

Herzlich Willkommen / Welcome / 热烈欢迎/ Bienvenue / Serdecznie witamy

Who we are

Thomas Frank

Senior Vice President Corporate Quality

Alfred Hoepp

Director Supplier Management Forgings and Technology

Flight Safety

Requirements

Boundary Conditions

Standardization

Proactive

Zero Defects

Digitalization

Partnership

Integrated Quality Management System

Management

Technology & Manufacturing Readiness, Technical Reviews, Gating, Audit, Safety Management System

Quality methods / Tools

- Requirements Based Engineering
- Risk Management
- Design for X
- ESW / PDP / DMBG
- Configuration Control
- DFMEA / FMECA
- Classification
- Approval of drawings & standards
- FRACAS / FMR
- Type Certification
- PFMEA
- Control & Inspection Plan

Technology → Design → Verification & Validation

Project Planning

Closed Loop

Production / Assembly / Maintenance, Repair, Overhaul

Product Support

- Error & Incident Management
- Problem solving methods
- Lessons Learned

- Voice of Customer
- PER-Process
- Field Support Council
- Non-Conformance Monitor
- Customer Complaints process
- Inspection Systems
- SPC
- Production Approval
- Repair Source Approval
- CMT

FA/FB

MSA
IPS

Employees

Passion for Quality, Corporate & Error Culture, Training & Learning

Vielen Dank für Ihre Aufmerksamkeit. / Thank you for your attention.

Aerospace Engine Supplier Quality Consortium (AESQ) Training

Shorten Your Path to Zero Defects

EARL CAPOZZI
DISCIPLINE CHIEF; QUALITY & PROCESS ENGINEERING / SUPPLIER QUALITY
PRATT WHITNEY NORTH AMERICA

What Does Training Mean To You?

- **Reduces the time to adoption of AS13100**
  - Simplifies the requirements
  - Delivers most recent insights from experts
  - Saves you money
- **Increases your ability to:**
  - Maintain the right business processes
  - Comply with the standard
  - Understand customer requirements
  - Grow your business
- **Shortens Your Path to *Zero Defects*!**

What Courses Are Available to Suppliers?

SAE AS13100 Quality Requirements Course

- 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
- A good overview of each of the AS13100 requirements
- eLearning: take at your own pace, approximately 15 hours with a final exam

SAE AS13100 Quality Foundations Course

- Required for Quality Leaders with responsibility for supporting the design, manufacturing, and assembly operations via AS13100.
- Recommended for anyone with accountability for the quality of the design, production, assembly and test areas of the organization.
- Instructor led: 3-day course with an exam, offered virtually, in-person or at your company site.

LEVEL ONE

AS13100 Executive Overview

Five-Part Video Series, 35 minutes

- Executive perspectives from across the industry detailing why compliance to AS13100 is critical to your company's success.

LEVEL TWO

AS13100 Requirements

eLearning course, 15 hours

- Guides the user through each section of the AS13100 standard, providing knowledge that supports the requirements and business processes to meet the intent of the standard.

LEVEL THREE

AS13100 Quality Foundations

Virtual or In Person 3 Days

- Live instructors provide an overview of the AS13100 Standard, and a detailed exploration of the guidance provided in the Reference Manuals.

Common Training for DPRV Personnel
Revised!

Virtual or In Person, 3-Days

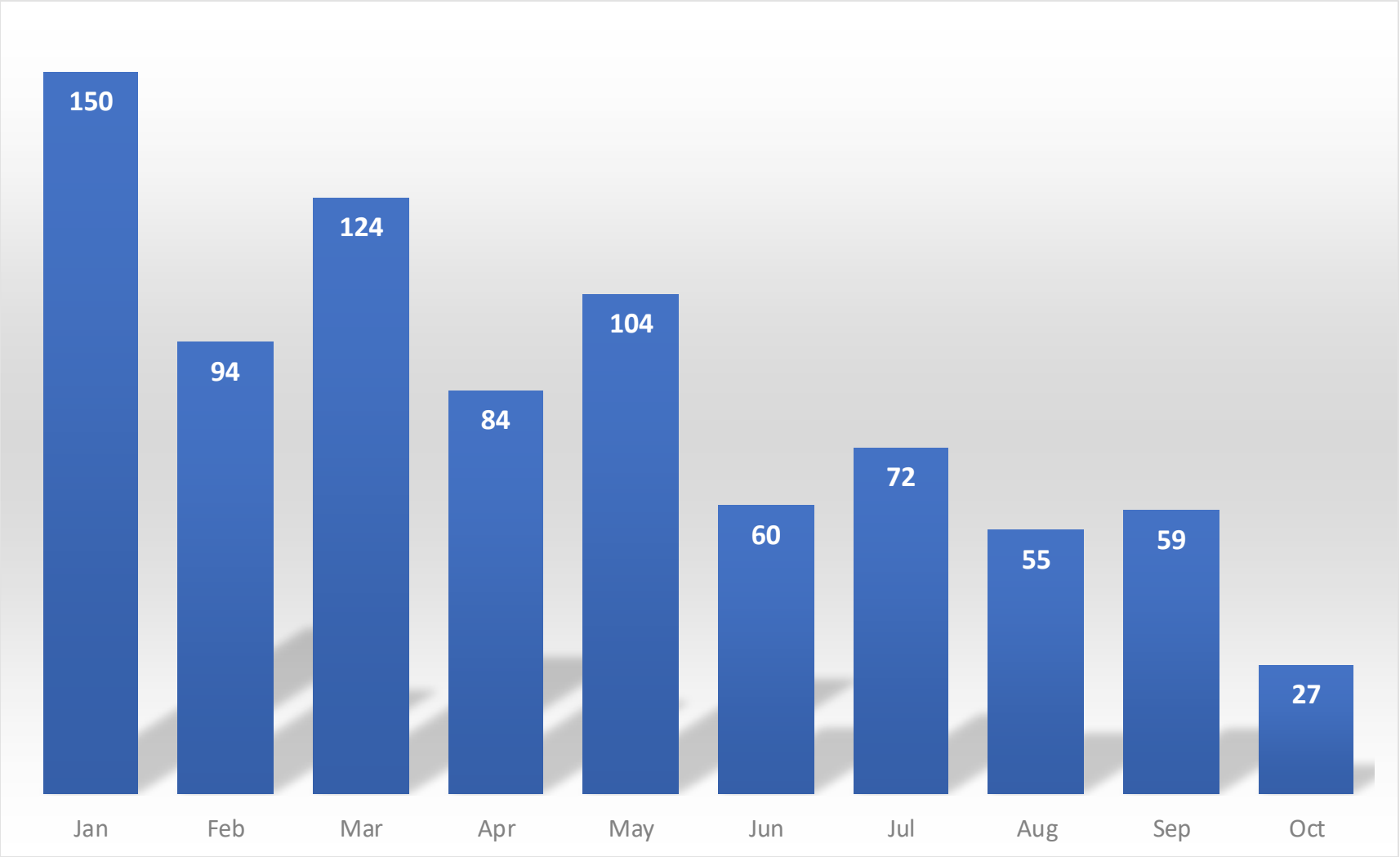
- Live instructor
- AESQ Approved
- Aligned to AS13001 and AS9117
- Certification credentialed by Probitas™
- Completing DPRV training can be beneficial in positioning suppliers to obtain business with top tier suppliers or OEMs

AS13100 Requirements Course Completions YTD 2023

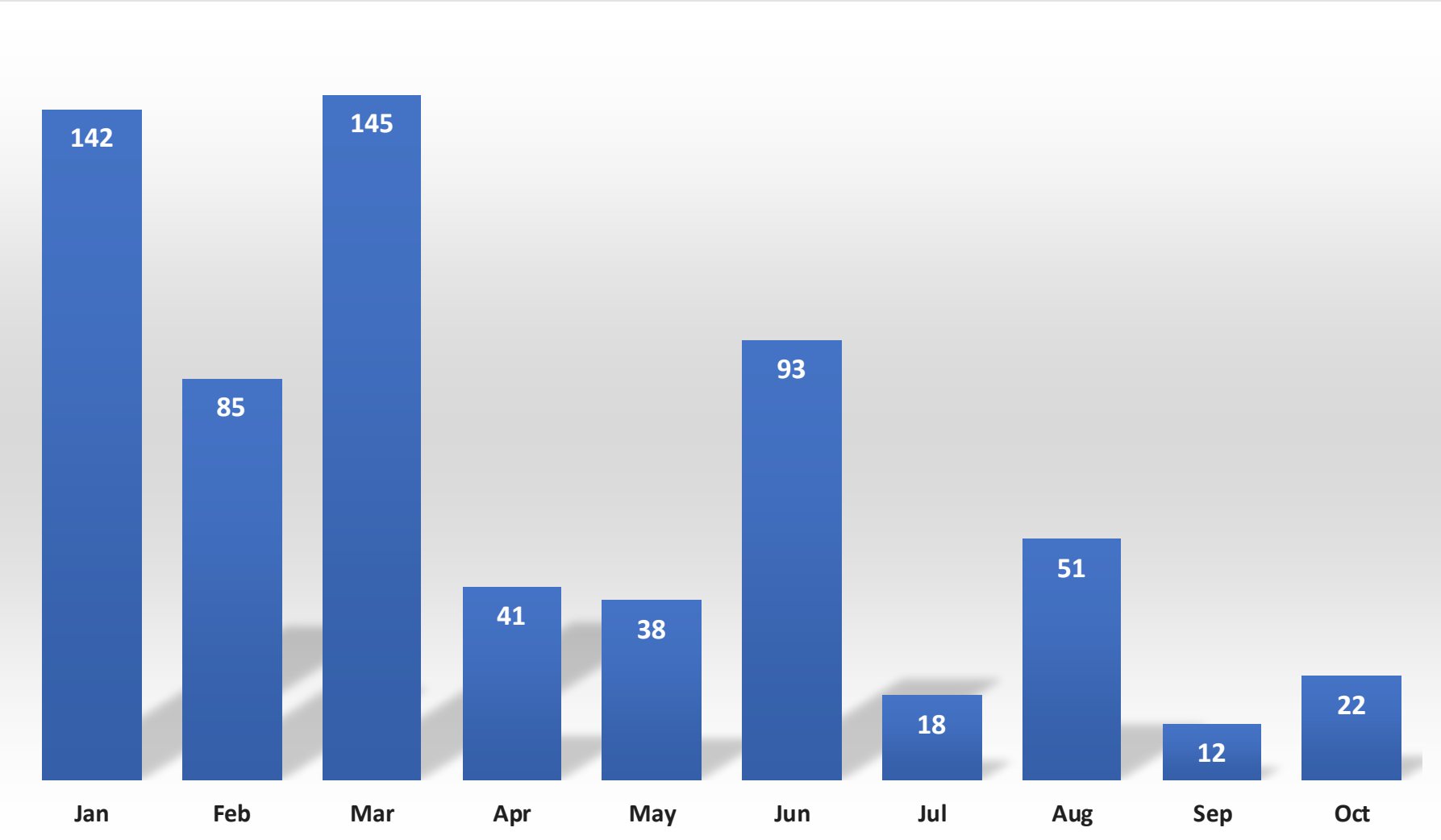
1,972 Completed

914 Suppliers

42 Countries



Quality Foundations Course Completions YTD 2023



1522 Completed

632 Suppliers

42 Countries

Does Your QMS Meet AS13100 Requirements?

SAE offers supplemental trainings:

- RM13000 Problem Solving
- RM13002 Alternative Inspection
- RM13003 MSA
- RM13004 Defect Prevention
- RM13010 Human Factors
- RM13145 APQP/PPAP

https://discover.sae.org/AS13100

BREAKOUT SESSION #2
Zero Defects

UZAM KHAN
SUPPLIER QUALITY EXECUTIVE
ROLLS-ROYCE

Zero Defects Principles

a) Quality is defined as conformance to customer requirements

b) The quality standard (target) is Zero Defects

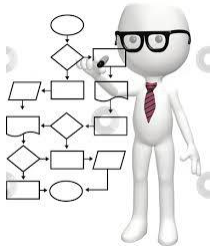
c) Defect prevention not Inspection to ensure Quality

d) Quality is measured through the Cost of non-quality

Getting to Zero Defects…

Chris Customer


Petra Purchase


Mel ME


Den Designer


Leslie Logistics


Quincy Quality


Fran Finance


Izzy Inspector


Olly Operator

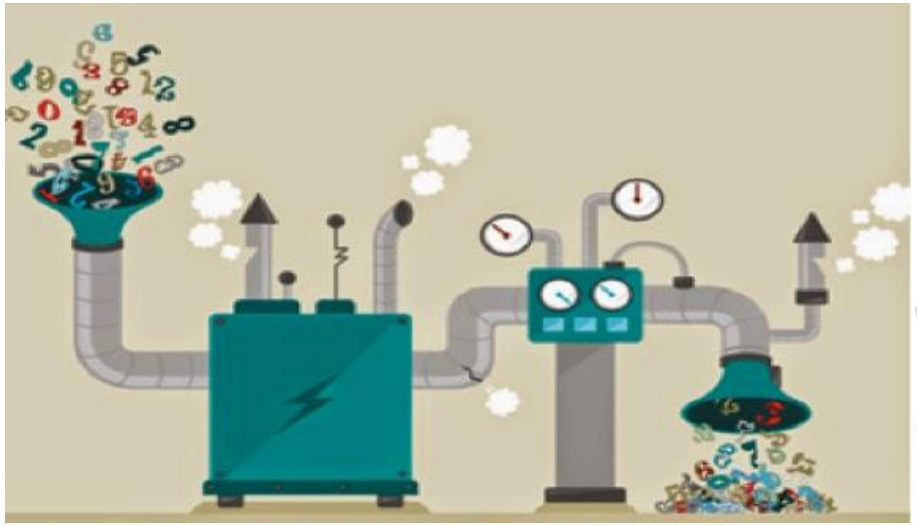
Hillary HR

Arrange these characters into a natural value steam and identify what they need to provide to each other to achieve zero defects

Quality Improvement vs Zero Defects

Traditional Improvement

- Wait for something to happen
- See why it happened
- Try and remove the cause so it can't happen again



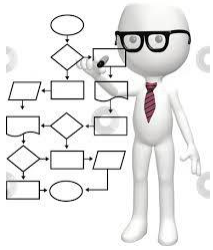
Zero Defects Thinking

- What do we want to happen
- What could go wrong
- Eliminate / reduce the likelihood of it going wrong
- Manage the process and use feedback to ensure it continues to give us the right outcome

Getting to Zero Defects…

Chris Customer

Petra Purchase



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Izzy Inspector

Olly Operator

Hillary HR

Overlay the Zero Defects tools and practices over the value stream

The Quality Value Stream

Chris Customer

Sets the expectation of what the product or service must do to satisfy their requirements

CUSTOMER SPECIFICATION
Clearly defines what the customer wants, embedded in the purchase order

Den Designer

Takes the customer's needs and transforms it into a capable product design that meets the customer's requirements and can be made robustly every time

DFMEA
Identifies the aspects of the product that are important to meeting customer requirements, to prioritise improvements

Mel ME

Takes what's important about the product and makes sure the production process is designed to deliver it, every time

PFMEA
Identifies the aspects of the production process that are important to meeting product requirements, to prioritise improvements

Olly Operator

Complies to instructions, ensuring products conform to requirements every time, with no rework or concessions

CONTROL PLAN
Specifies variables in the manufacturing process that need to be controlled to guarantee that the design features produced are conforming

Izzy Inspector

Verifies the product meets the design intent and can therefore be passed down the value stream

MSA
Ensures that the inspection systems are fit for purpose and capable of measuring the design features

SPC
Real-time graphical means of monitoring and controlling a process so as to prevent non-conformance

Leslie Logistics

Moves the right parts, to the right place in the right amounts just as they are required, without damage/FOD

PACKAGING STANDARDS
Ensures that the product is fully protected during transportation and storage

Quincy Quality

Ensures we comply to the required processes so that we do any job right first time

Audit
Regular checks to ensure that all relevant procedures in the RRMS are being compiled to

Petra Purchase

Ensures that our suppliers deliver conforming product, to schedule

SABRe
"Supplier Management System Requirements" is the supplier-facing mirror of the RRMS and is applicable to all suppliers or partners

Fran Finance

Ensures the business fully understands the costs of non quality so we invest wisely to get to zero defects

CoNQ
The total cost of not achieving Zero Defects; scrap, concessions, inventory, productivity, customer dissatisfaction...

Hillary HR

Ensure we are able to recruit and/or develop capable people

Training Plans
Ensure that everyone is capable of doing the jobs they are required to do

Pause

Return in 25 Minutes

AS13100 FAQ Panel

BARRIE HICKLIN
SR. DIRECTOR, QUALITY SYSTEMS & REGULATORY COMPLIANCE
HONEYWELL

BARBARA NEGROE
EXECUTIVE SOURCING QUALITY LEADER
GE AEROSPACE

EARL CAPOZZI
DISCIPLINE CHIEF, SUPPLIER QUALITY
PRATT & WHITNEY AMERICA

FLORENCE AUGEARD
SUPPLIER QUALITY ASSURANCE MANAGER
SAFRAN AIRCRAFT ENGINES

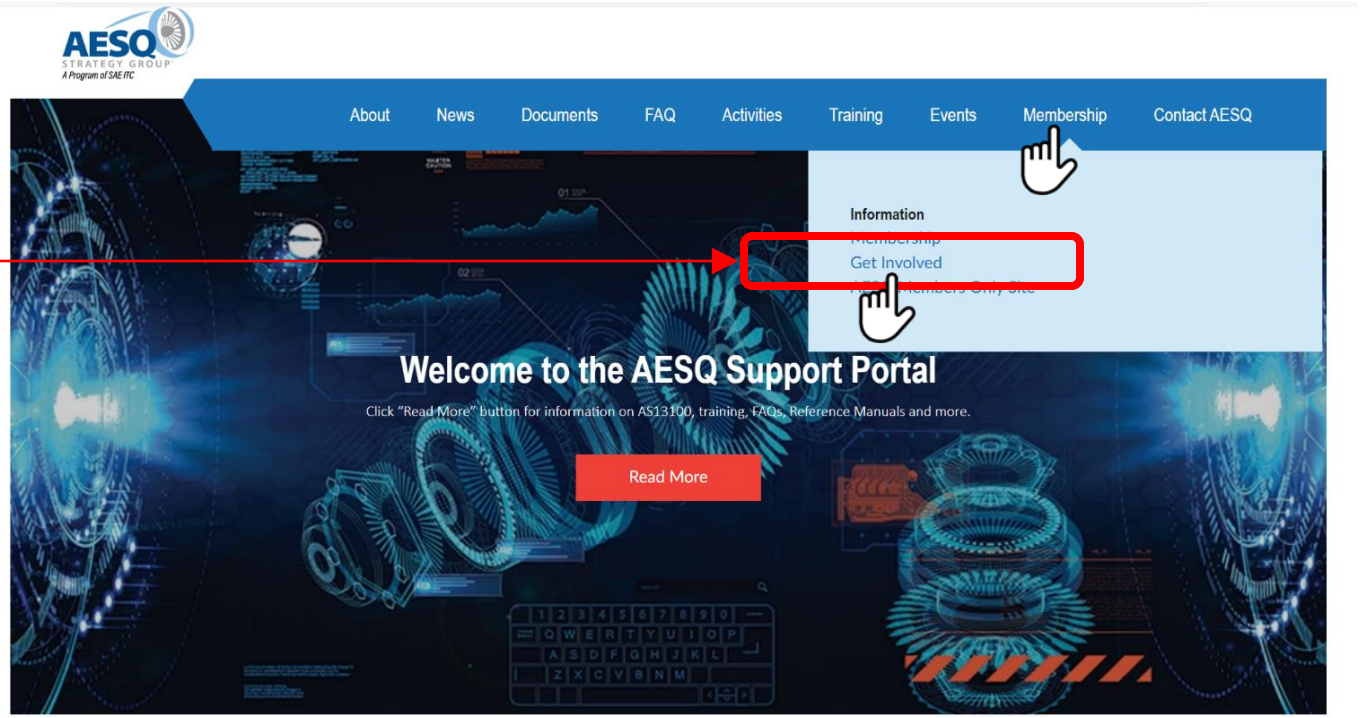
DR. MARNIE HAM
CONSULTING ENGINEER
GE AEROSPACE

AESQ
How to Get Involved?

JUN SAKAI
CHIEF ENGINEER
IHI CORPORATION

“Get Involved” with AESQ

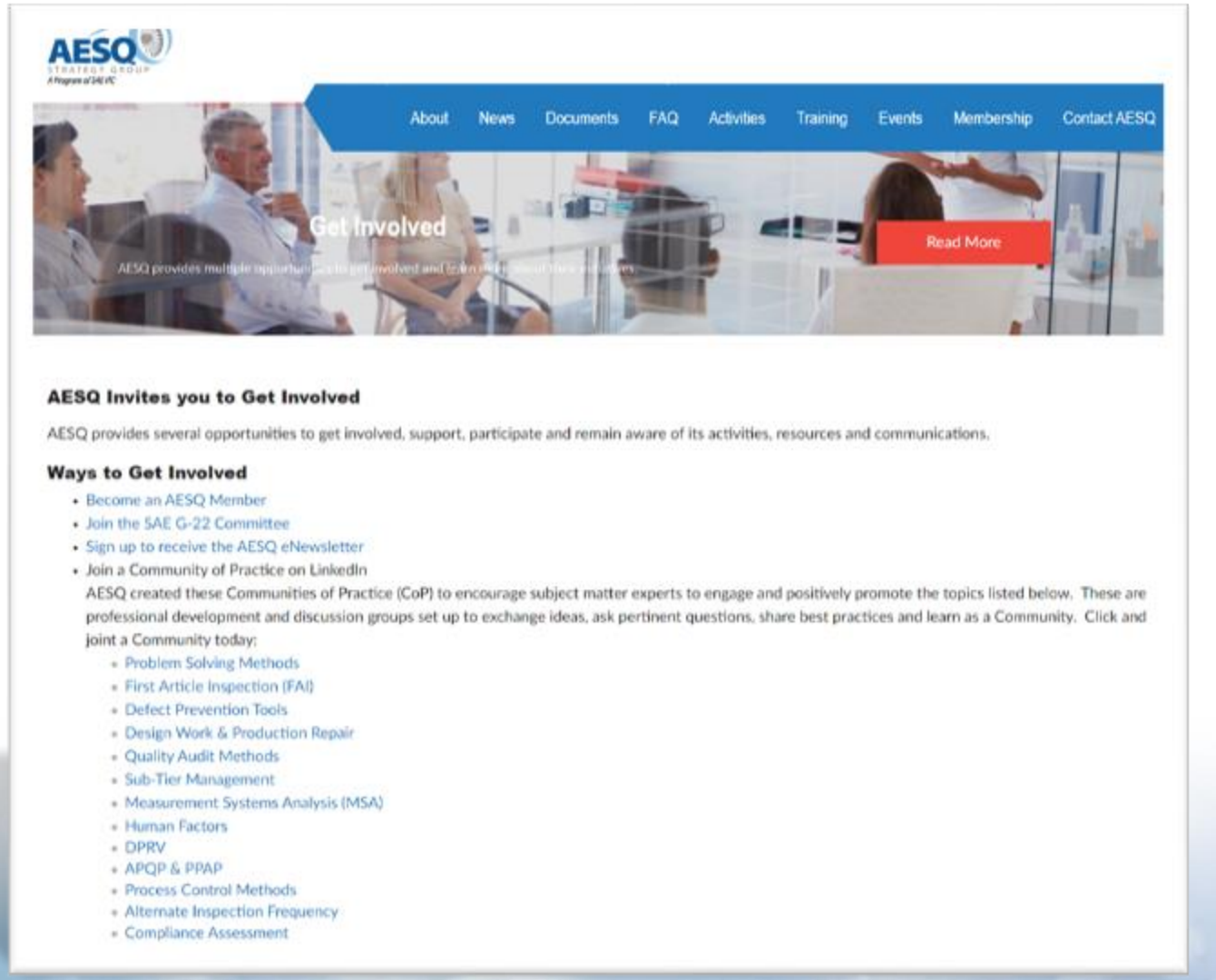
- **Go to AESQ Homepage**
  https://aesq.sae-itc.com/
- **Click “Get Involved”**



“Get Involved” – Options

1. **Become an AESQ Member**
2. **Join the SAE G-22 Standards Committee**
3. **Subscribe to AESQ’s Newsletter**
4. **Join a Community of Practice on LinkedIn**

Click on each link for further information



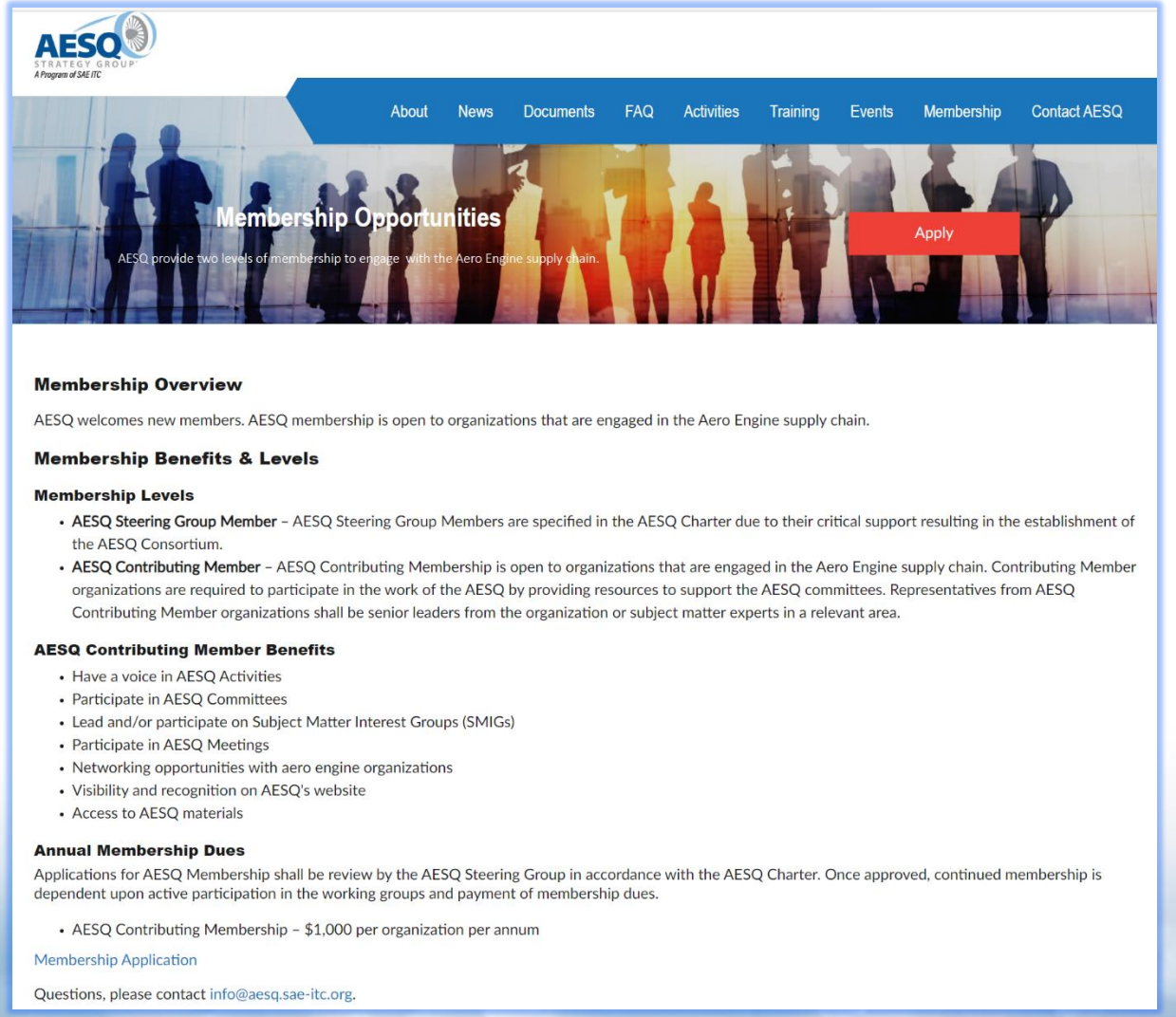
“Get Involved” – AESQ welcomes new members

AESQ membership is open to organizations that are engaged in the Aero Engine supply chain.

AESQ Contributing Member –

- Have a voice in AESQ activities
- Participate in AESQ Committees
- Lead and/or participate on Subject Matter Interest Groups (SMIGs)
- Participate in AESQ meetings
- Networking opportunities with aero engine organizations
- Gain visibility and recognition on AESQ’s website
- Access to AESQ Materials (posters, stickers, etc.)

Click Apply and submit member application form



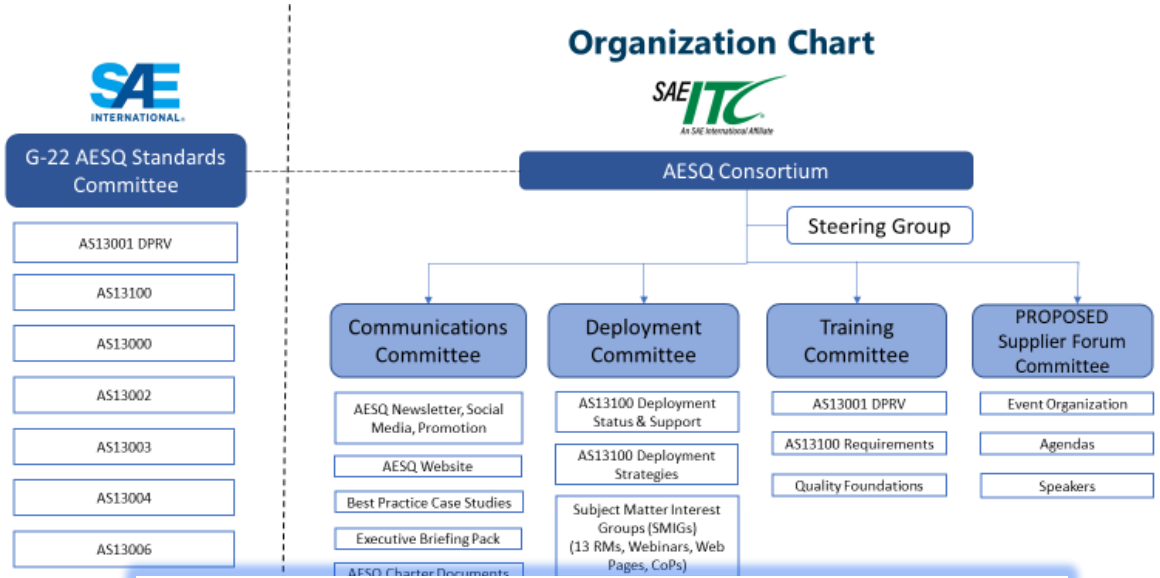
“Get Involved” – Join the SAE G-22 Committee

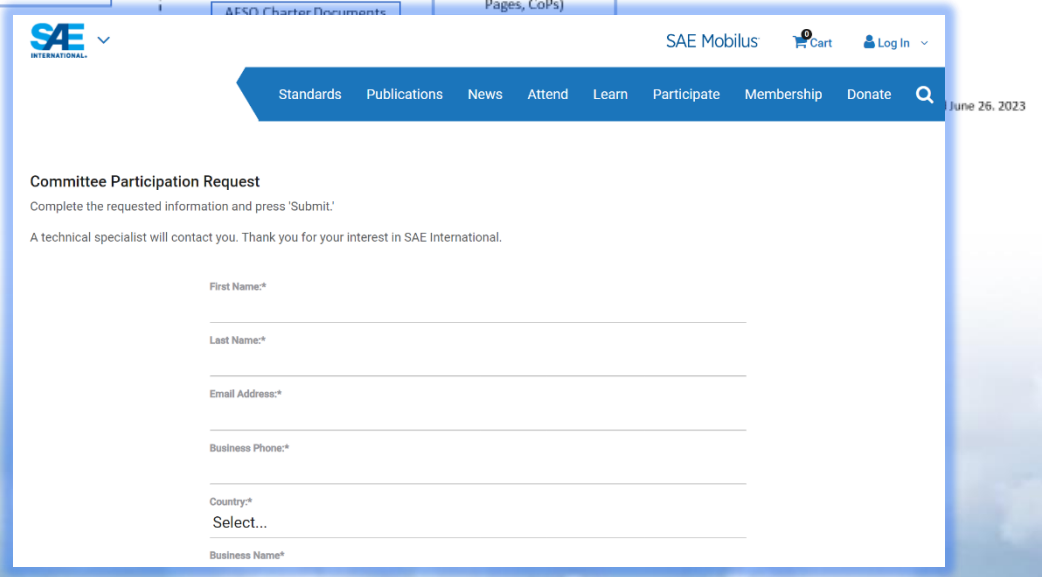
G-22 AESQ Standards Committee is established to develop, specify, maintain and promote quality standards specific to the Aero Engine supply chain. (i.e.AS13xxx series)

G-22 committee is open for individuals from the Aero Engine supply chain;

- Have technical knowledge and expertise.
- Participate in writing of quality standards by providing comment on all document ballots.

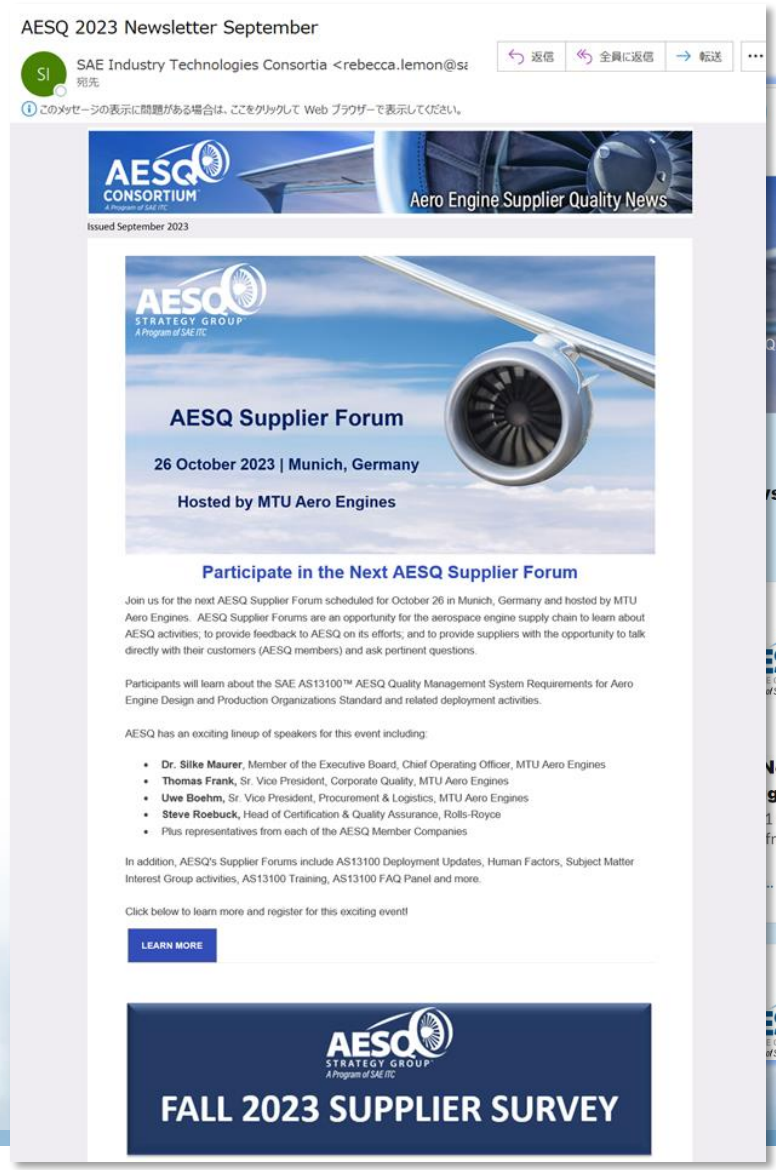
Click on “Join the SAE G-22 Committee” link and submit Committee Participation Request.

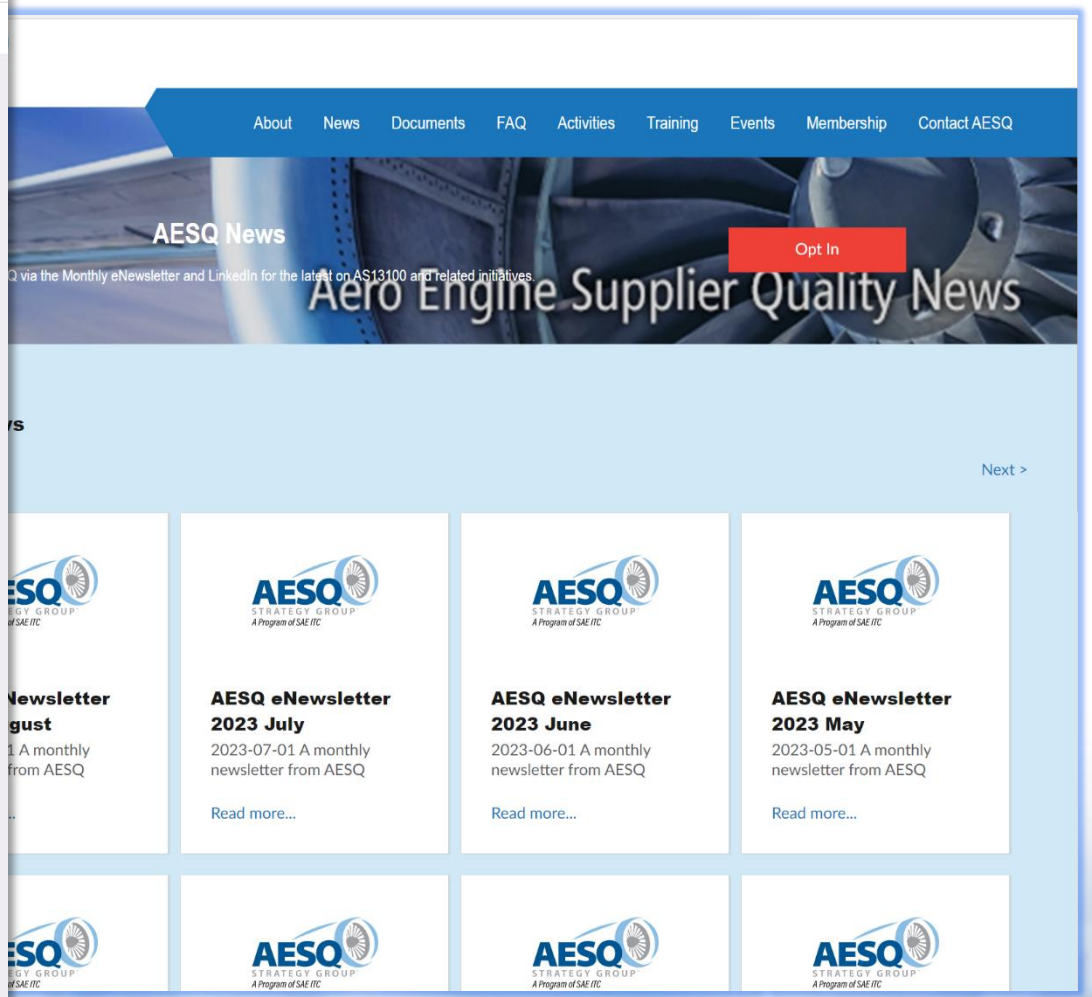




“Get Involved” – Subscribe to Receive AESQ’s Newsletter

- Issued monthly
- Learn about AESQ’s current activities
- Submit AESQ Email Request Form to begin receiving

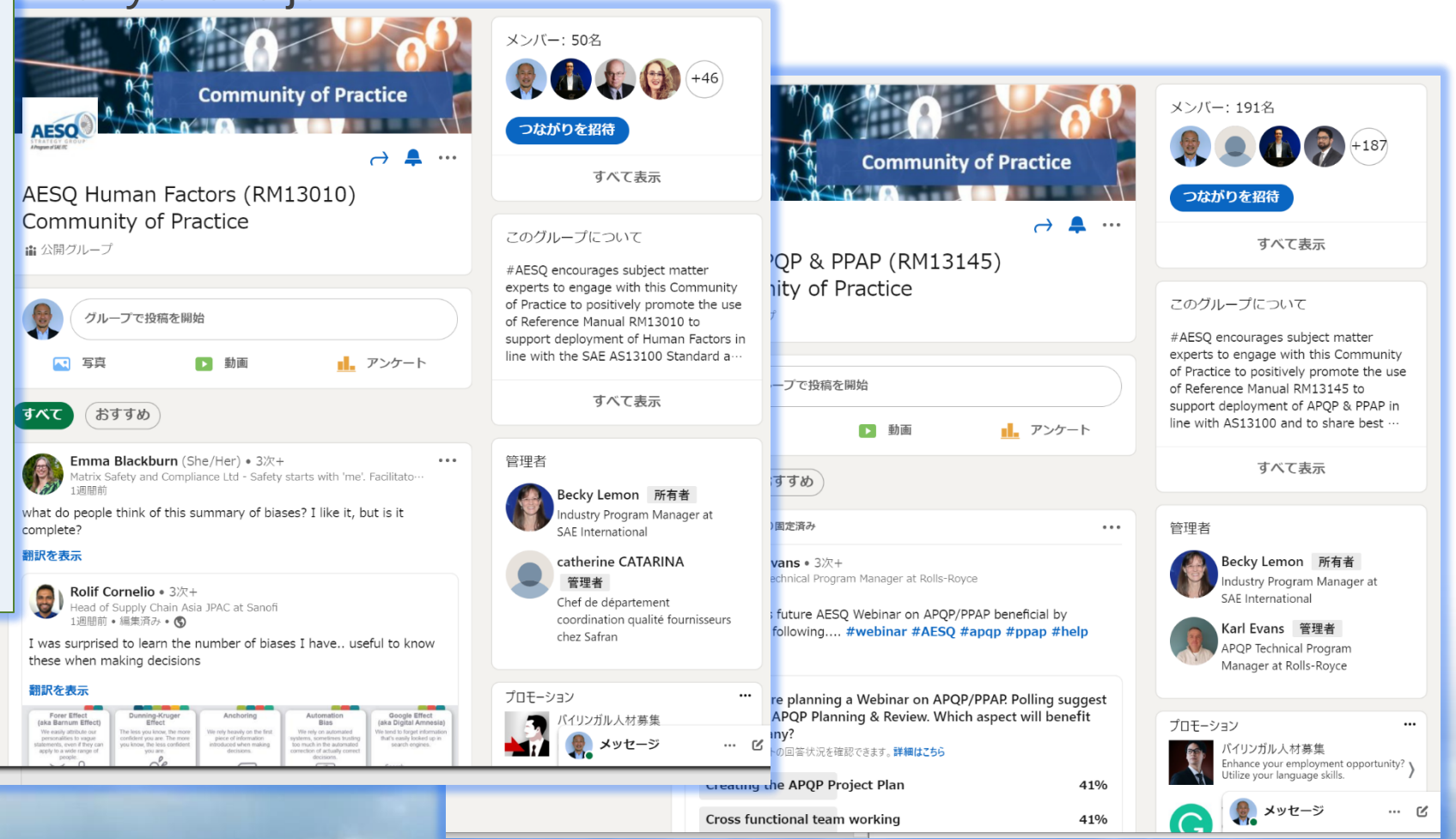




“Get Involved” – Join a Community of Practice

Communities of Practice Members	
• Problem Solving Methods	394
• First Article Inspection (FAI)	328
• Defect Prevention Tools	591
• Design Work & Production Repair	189
• Quality Audit Methods	339
• Sub-Tier Management	233
• Measurement Systems Analysis	300
• Human Factors	260
• DPRV	269
• APQP & PPAP	527
• Process Control Methods	292
• Compliance Assessment	49
• Alternate Inspection Frequency	64

LinkedIn Groups for each Community of Practice are open for anyone to join.



AESQ LinkedIn

“Get Involved” – Additional Options

- Attend AESQ Events (Supplier Forums, Webinars) or Watch Videos Online
- Take a AS13100 Training Course
- Download AESQ Reference Manuals (RMs) & Templates
- Send your comment by e-mail; info@aesq.sae-itc.org

Summary & Close

LISA CLAVELOUX
SR. DIRECTOR, QUALITY
PRATT & WHITNEY

WHAT DOES SUCCESS LOOK LIKE?

- Leaders advocating for process control- speaking the language
- Common tool usage, processes control is the way we work
- Developing proficiency through common Industry training
- Culture of product safety and quality felt into the tiers of the supply base
- Continuous Improvement of the AS13100 standard- feedback from supply base, OEM's, customers

Mindset Shift – Belief that Zero Defects is Achievable


AESQ
CONSORTIUM
A Program of SAE ITC
ΕΥΧΑΡΙΣΤΩ
TÄNAN
HVALA
GRACIAS
DZIĘKUJĘ
TACK
GRAZIE
ありがとう
MERCI
THANK YOU
DIAKUIU
PALDIES
ACIU
TAK
DANKE
DANK U WEL
ДЗЯКУЮ
СПАСИБО
谢谢
OBRIGADO
diolch
KIITOS
TESEKKUR EDERIM
AESQ Thanks You for Attending!