



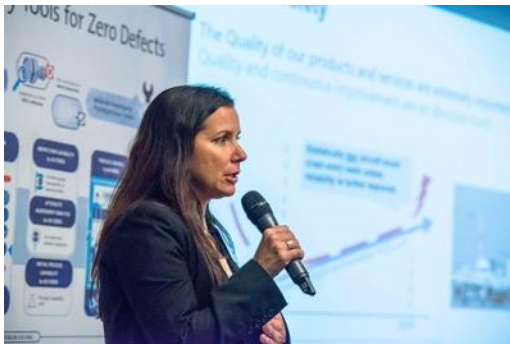
AESQ Supplier Forum – AS13100 Deployment
22 March 2023 | Cincinnati, Ohio, USA

Welcome & Introductions



160+ Individuals Registered from 14 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






Introducing AS13100: AESQ Quality Management Requirements

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

SAE AS13100 AESQ 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 training and reference manuals 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.

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.

 Learn about how SAE AS13100 AESQ Quality Management System Requirements for Aero Engine Design and Production Organizations minimizes requirements and improves overall product quality by focusing on the key quality systems and processes! Through an executive overview and a self-paced course, your organization can gain key knowledge about a common quality language, how to gain compliance to AS13100 and the business value and benefit of the standard. Walk-through each section of the standard and understand the new requirements.

For more information, please visit:
discover.sae.org/AS13100

 **TESTIMONIAL**

"Although created by the Aero Engine Supplier Quality Group in conjunction with the SAE G-22 Aero Engine Supplier Quality Standards Committee, this standard and supporting materials will benefit any organisation, in any industry."

Dr. Ian Riggs
Global Quality Executive
Rolls-Royce & AESQ Chair

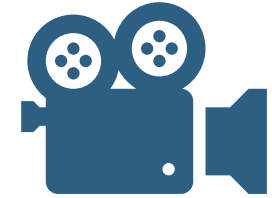
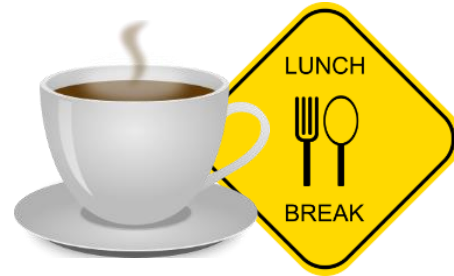
Learn more:
www.sae.org/standards/content/AS13100/



AESQ – Aerospace Engine Supplier Quality Strategy Group

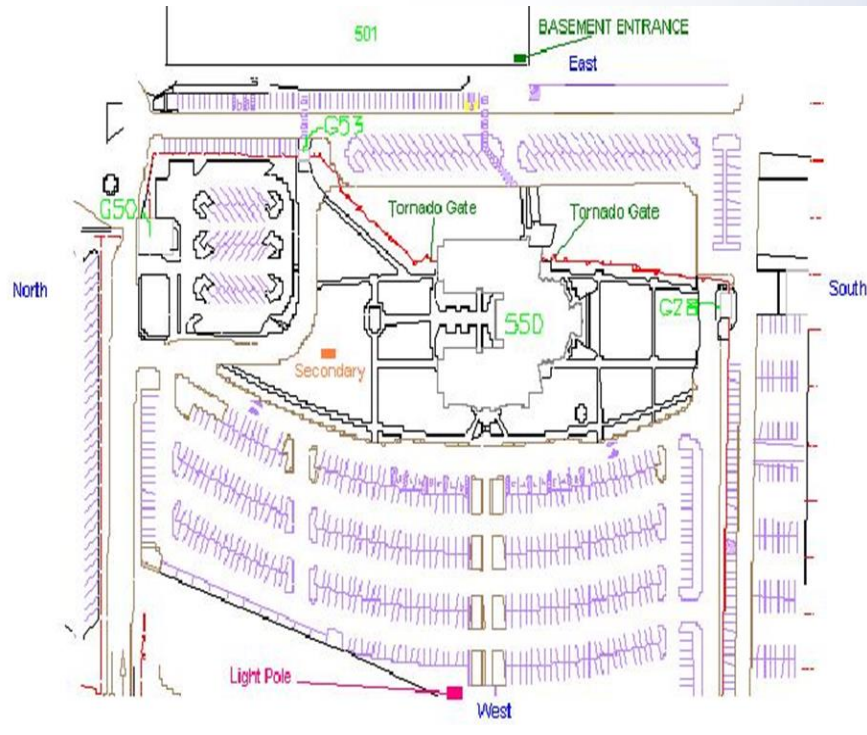
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Housekeeping



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

Emergency procedures



Building evacuation

The **Primary Gathering Point** for a building evacuation (Fire) is the **Light Pole** in the parking lot closest to I 75 marked with **YELLOW, ORANGE, and RED** at the top of the pole.

The **Secondary Gathering Point** for a building evacuation is the **Grassy Area** to the North between the Learning Centre and Gate 50.

Tornado shelter

The location of the **Tornado Shelter** for the Learning Centre is the **Bldg. 501 Basement**. Bldg. 501 is the **RED BRICK** building directly behind or East of the Learning Centre. Emergency gates will open near the North East and South East exits of the Learning Centre if there is a tornado warning issued. You may also exit past the kitchen.

Agenda

Topic	Presenter
Welcome & Introductions	Barbara Negroe, Executive Sourcing Quality Leader, GE Aviation
GE Aerospace Welcome Address	Paul Stadelmann, Acting GM Global Quality, GE Aerospace
AESQ Overview, Vision & Objectives	Lisa Claveloux, Sr. Director, Quality, Pratt & Whitney
AS13100 Standard Overview	Larry Bennett, Consulting Engineer, Global Sourcing Quality, GE Aerospace
Deployment & Transition to AS13100	Jim Wilson, Sr. Manager, Supplier Quality, & Development, Pratt & Whitney Canada Earl Capozzi, Associate Director, Discipline Chief, Quality & Process Engineering/Supplier Quality, Pratt & Whitney
BREAK – 20 MINUTES	

Agenda

Topic	Presenter
Best Practices for Human Factors	Tracey Lockhart, Head of Quality, Manufacturing Engineering and Continuous Improvement, Defense, Rolls-Royce
Breakout Session #1 – Subject Matter Interest Groups (SMIGs)	<ul style="list-style-type: none"> • APQP & PPAP (RM13145) – Ken Hatcher, Raytheon Technologies • Human Factors (RM13010) – Richard Bolingbroke, Timet • Defect Prevention (RM13004) – Jim Barge, GE, and Lisa Rioux, Pratt & Whitney • Compliance Assessment (RM13009) and Quality Audit Methods (RM13005) – Jim Wilson, Pratt & Whitney, • Process Control (RM13006) – Ricardo Banuelas, Head of Continuous Improvement, Rolls-Royce • Sub Tier Management (RM13007) – Larry Bennett, GE Aerospace • Training – Earl Capozzi, Pratt & Whitney and Shari Pobjecky, SAE
GROUP PHOTO & LUNCH – 60 MINUTES	
Training Overview	Earl Capozzi, Associate Director, Discipline Chief, Quality & Process Engineering/Supplier Quality, Pratt & Whitney
Breakout Session #2 – Zero Defects	Lisa Claveloux, Sr. Director, Group Quality, Pratt & Whitney

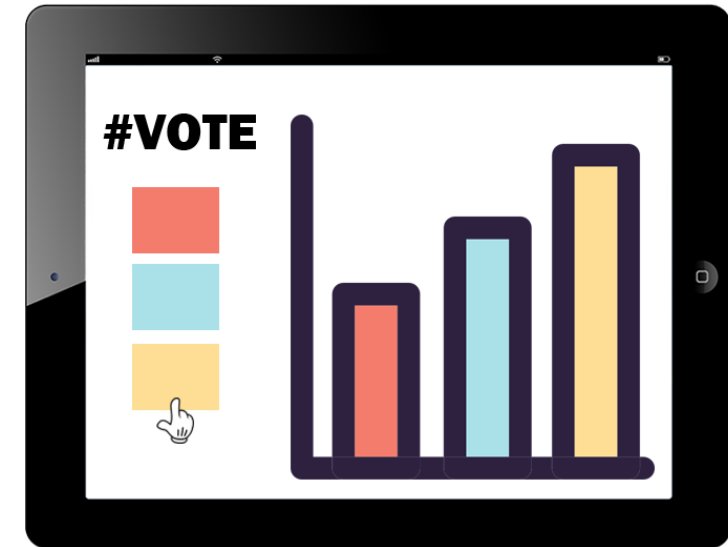
Agenda

Topic	Presenter
BREAK – 20 MINUTES	
AS13100 FAQ Panel	MODERATOR: Barrie Hicklin , Sr. Director, Quality Systems & Regulatory Compliance, Honeywell Aerospace PANELISTS: Larry Bennett , Consulting Engineer, Global Sourcing Quality, GE Aerospace Earl Capozzi , Associate Director, Discipline Chief, Quality & Process Engineering/Supplier Quality, Pratt & Whitney Denis Pottier , Head of the Purchasing Quality Assurance Department, Safran Aircraft Engines Ricardo Banuelas , Head of Continuous Improvement, Rolls-Royce
Voice of Customer	Amy Gowder , President & CEO, GE Aerospace Defense and Systems
AESQ How to Get Involved	Jun Sakai , Chief Engineer, IHI
Summary & Close	Barbara Negroe , Executive Sourcing Quality Leader, GE Aviation

How to Contribute – Live Poll Questions

How to answer live poll questions:

1. Scan the QR Code on your table
2. Enter the Passcode
3. Answer the Question
4. Add any questions during the day in the Slido App (“Like” a question)



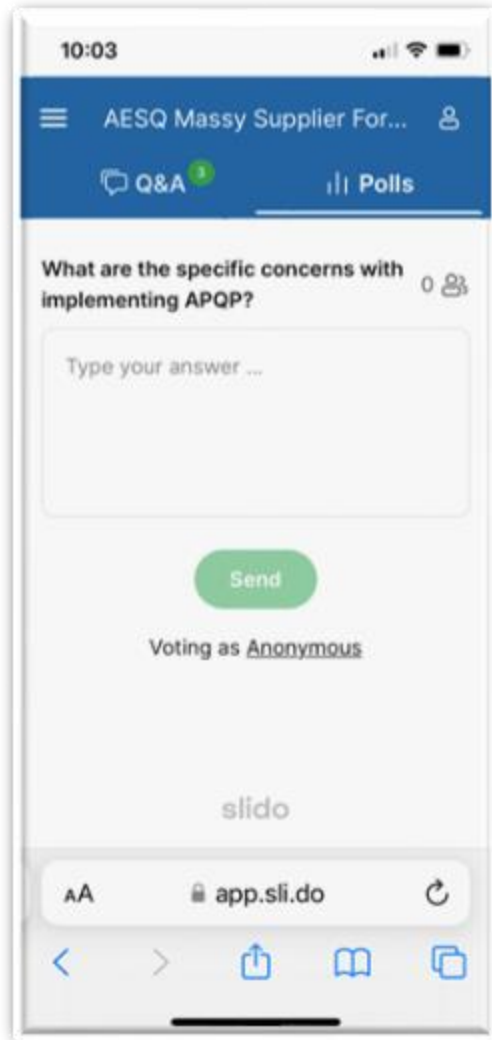
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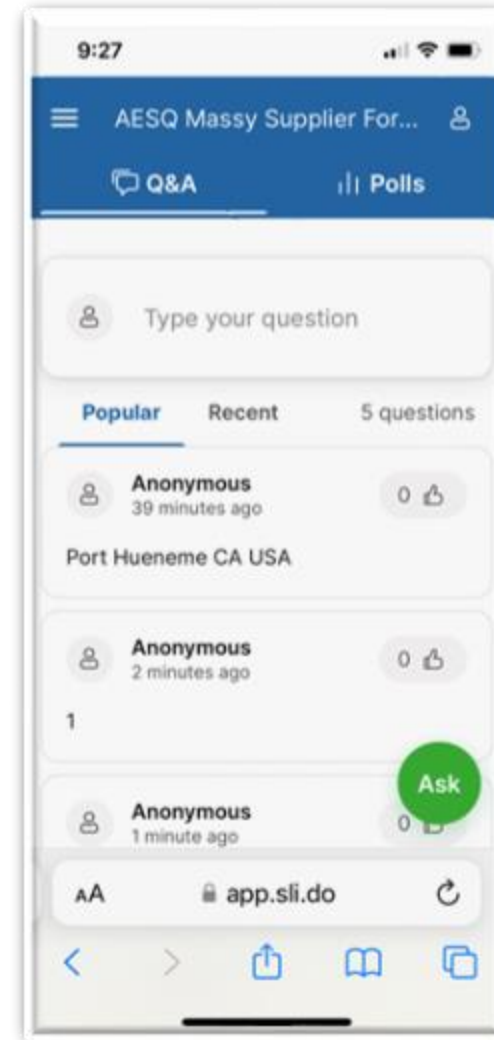
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#3593254**

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How to Use Slido Live Polling App?



Answer Live Poll Questions



Add Your Own Questions

“Like” Questions

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What is the name of the city where you live?

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**Have you attended previous AESQ
Supplier Forums?**

① Start presenting to display the poll results on this slide.

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What function are you in?

① Start presenting to display the poll results on this slide.

WELCOME ADDRESS



PAUL STADELMANN

ASSEMBLY TEST AND MRO QUALITY LEADER
GE AEROSPACE

— GE Aerospace Quality Overview

— March 2023

OUR STRATEGIC FRAMEWORK



OUR PURPOSE

We invent the future of flight, lift people up, and bring them home safely.

OUR VISION

At GE Aerospace, we will be the company that defines flight for today, tomorrow and the future.

OUR PRIORITIES

Develop and empower our people through lean and decentralization

- **Safety first always, then Quality, Delivery & Cost**
- **Fully embed lean principles in our daily work**
- Invest in learning and development for our people

Exceed our customers' expectations

- Support airlines and airframers with the ramp
- Support military partners on capability and readiness
- Be the best partner with ease of doing business

Pioneer the flight technology of today and tomorrow

- Develop technology solutions to better serve the current fleet
- Differentiate ourselves in the future through breakthrough technology
- Create a more sustainable future of flight

OUR BEHAVIORS

Act with Humility Lead with Transparency Deliver with Focus

Safety First

Our People



Our Products

There are Four Major Components to Our Safety Management System (SMS)

1. **Policy** (defines objectives, accountabilities)
2. **Promotion** (safety awareness and training)
3. **Risk Management** (how is safety risk evaluated and mitigated)
4. **Assurance** (compliance with safety processes)

The GE Aerospace SMS Objective is to
“Bring them home safely.”

Zero Defect Culture

Zero disruptions to our associates, to our partners, and to our customers

People



Quality Excellence Program

Kaizen Engagement – Product and Transactional

Process



APQP Deployment and Maturation

Prevention through Risk Assessment and Mitigation

Product



Concession to Conformance

Horizontal Team at Point Problem Solving

Standards



Standards that Enable Excellence

Systemic Process Focus – Seek One Best Way

Zero Defect Culture

- 2022...35% reduction to our associates, partners, and customers...

A continuing journey to ZDC

- 100% Employee Engagement
- 100% First Time Yield
- 100% On Time Delivery
- 100% Customer Satisfaction

“If we did all the things we are really capable of doing, we would literally astound ourselves.”

- Thomas Edison



Lean Mindset

- Embrace problem solving
- Measure performance through the lens of our customer
- Committed to continuous improvement, always in search of a better way

Powering the world's airline fleets with more than 39,000 engines

0:02

Every 2 seconds an aircraft with GE engine technology* is taking off somewhere in the world

3/4 takeoffs

Three out of every four takeoffs are powered by GE*

400,000 people

~400,000 people are in the air right now depending on our engines



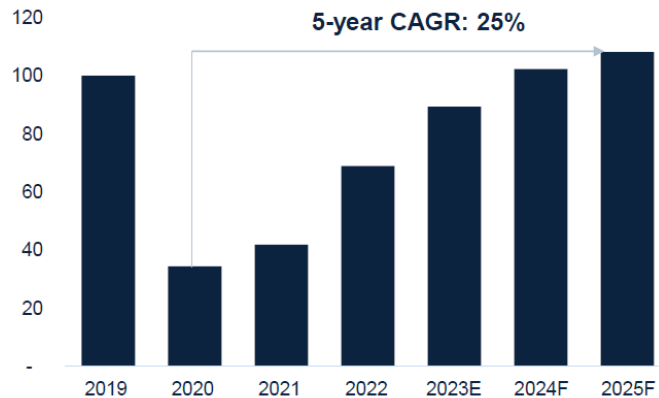
*Includes joint venture engines built by CFM and Engine Alliance
CFM is a 50/50 Joint Venture between GE and Safran Aircraft Engines
Engine Alliance is a 50/50 Joint Venture between GE and PW

Our Challenge...Deliver Aerospace Products With Flawless Quality on Time

Market Dynamics

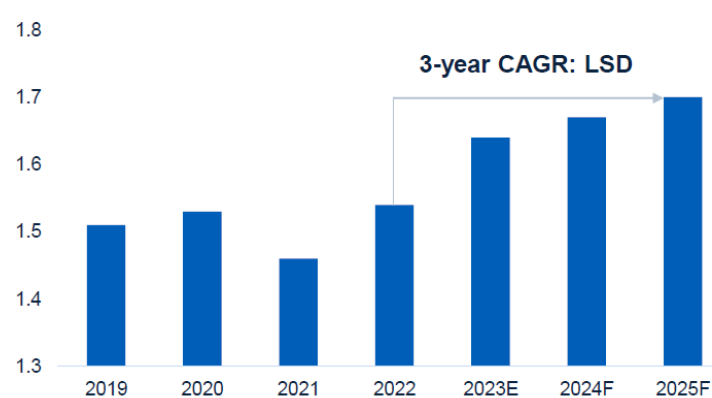
Commercial air travel demand

Revenue passenger kilometers^{a)} % of 2019 levels



Global defense spending^{b)}

(\$ in trillions)



Risks & Headwinds

- Technical Expertise
- Process Standardization
- Training & Development
- Rate Readiness
- Talent and Attrition
- Management of Change
- Maintenance

I'd rather be good than lucky...Quality is the enabler to meet this challenge.



GE Aerospace

(a Source: Oxford Economics

(b Source: US Dept of Defense, Aviation Week forecast, internal GE estimate; addressable market for GE

AERO ENGINE SUPPLIER QUALITY GROUP (AESQ) OVERVIEW



LISA CLAVELOUX
SR. DIRECTOR, QUALITY
PRATT & WHITNEY

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

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 Product Safety & Quality Remained a Key Challenge

AESQ – Aerospace Engine Supplier Quality Strategy Group

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AS13100 Overview

Aerospace Engine Supplier Quality Group

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

Driving to Zero Defects

Guiding Principles

- Simplify & standardize requirements
- Common Quality language
- Build on existing industry standards [AS9100, AS9145]
- Standardized 3rd party training
- Supportive deployment

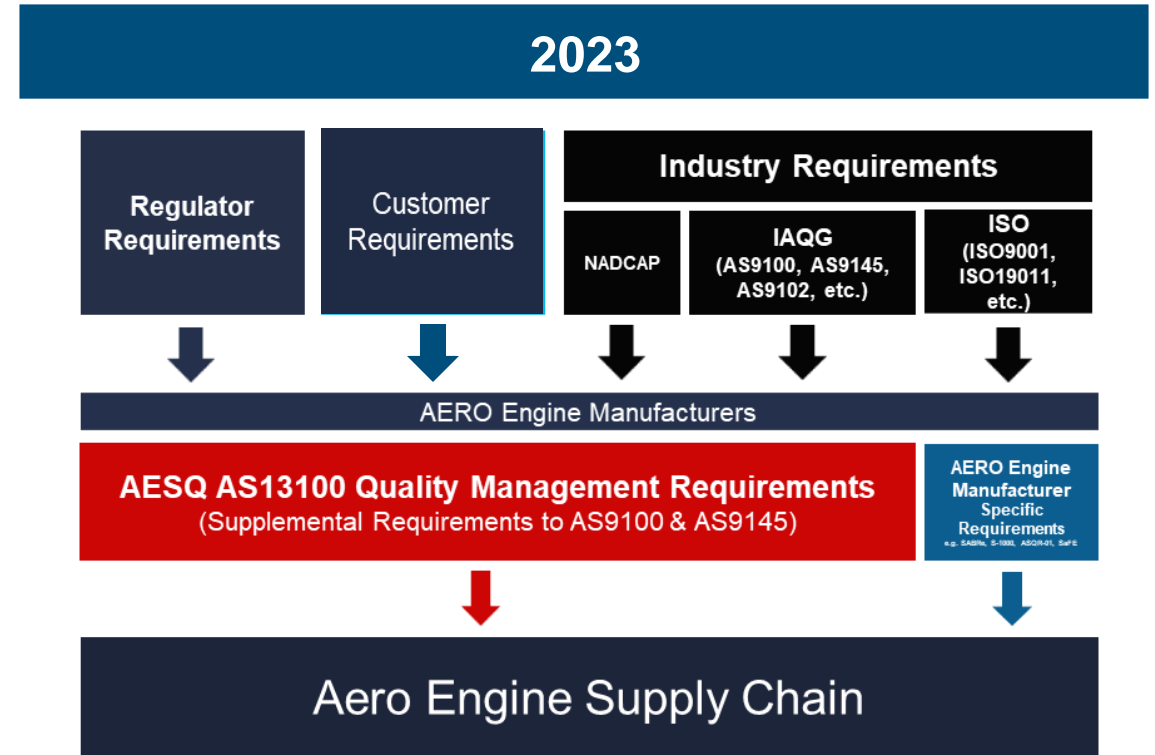
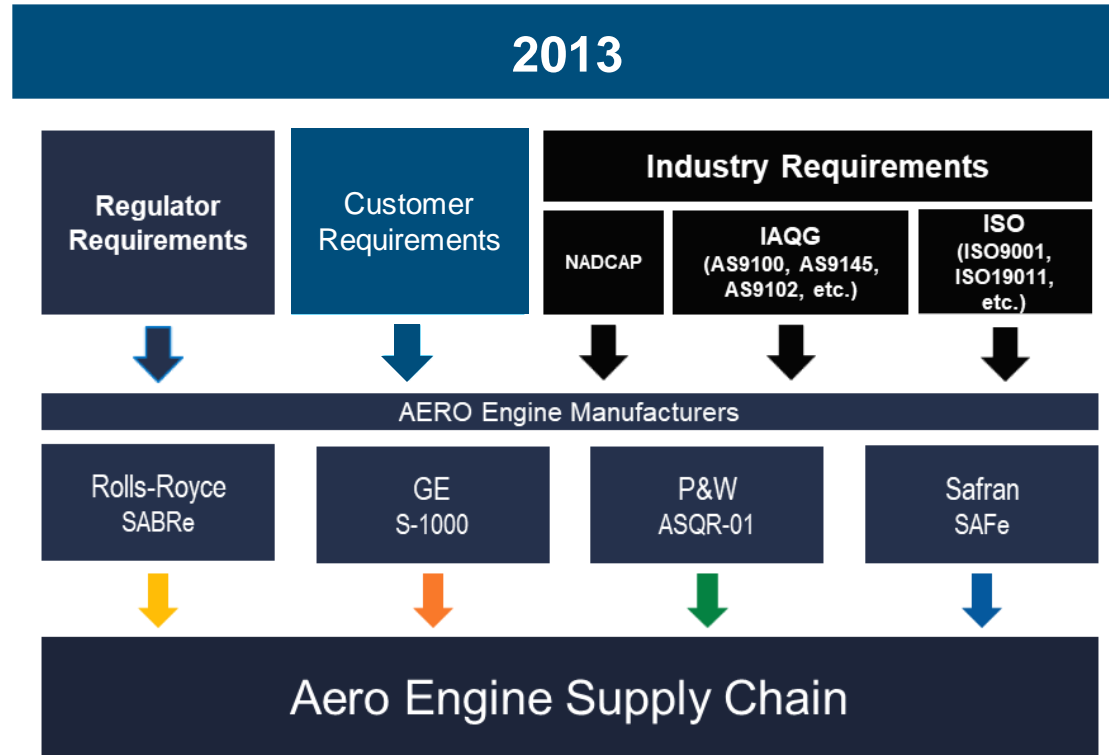


Cincinnati Thermal Spray
Collins Aerospace
Consolidated Precision
Products

Parker Meggitt
Rolled Alloys
Solar Atmospheres
Woodward

AS13100 Overview

Aero Engines requirements flowdown



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

- 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 Strategy Group Company Members



AESQ Members

Cincinnati Thermal Spray

Collins Aerospace

Consolidated Precision Products

Parker Meggitt

Rolled Alloys

Solar Atmospheres

Woodward

AESQ – Aerospace Engine Supplier Quality Strategy Group

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AESQ Strategy 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.

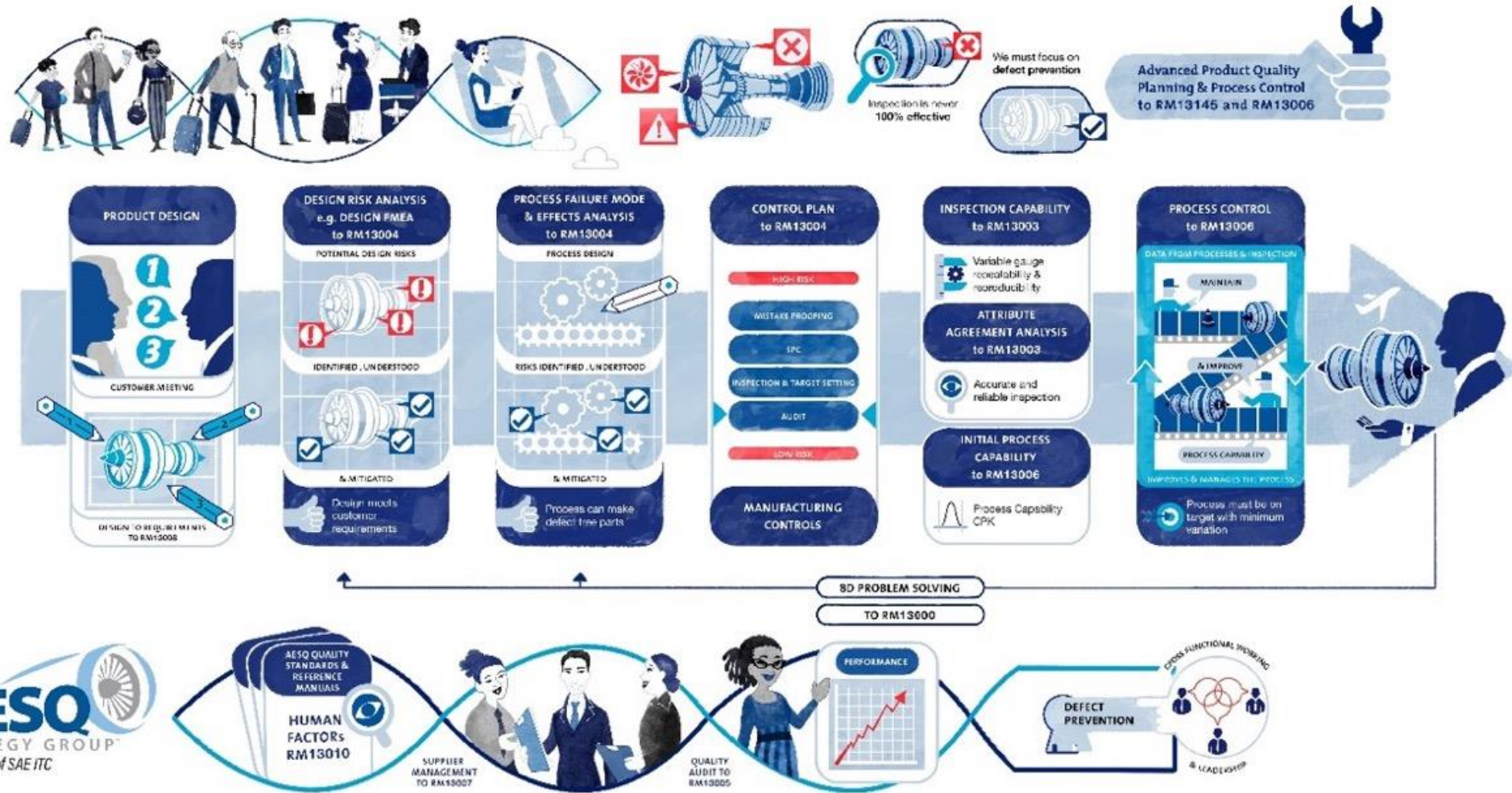


Osa Omoruyi
VP Quality
Howmet Engine Systems

AESQ – Aerospace Engine Supplier Quality Strategy Group

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Defect Prevention Key Quality Tools for Zero Defects



Defect Prevention Tools Must Work as a System

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

AS13100 OVERVIEW STRUCTURE & KEY HIGHLIGHTS



LARRY BENNETT

CONSULTING ENGINEER, GLOBAL SOURCING QUALITY
SUPPLY CHAIN DIVISION
GE AVIATION

AS13100 Creation Process



OEM Unique Requirements

Engine Maker Supplier Requirements pre AS13100 introduction

Harmonized Requirements



Future Engine Maker Supplier Requirements

Overall Number of Requirements reduced by >50%

Starting Point September 2018

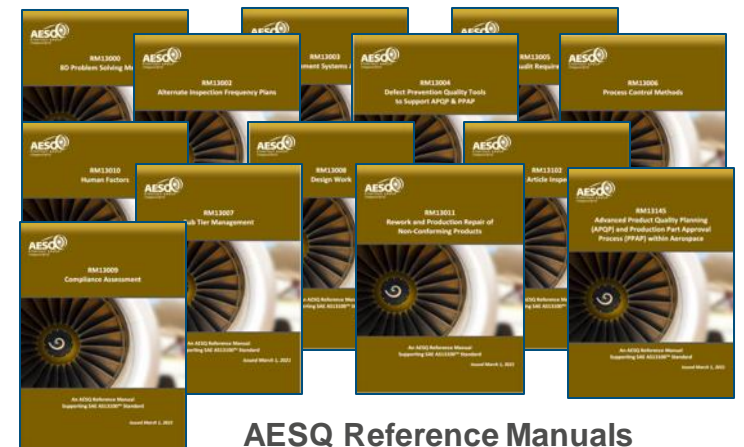


Requirements

Existing & WIP AESQ Standards



Supporting Guidance & Best Practice Material



AESQ Reference Manuals

AESQ – Aerospace Engine Supplier Quality Strategy Group

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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							
	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
Clause Number																								

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 ?



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**

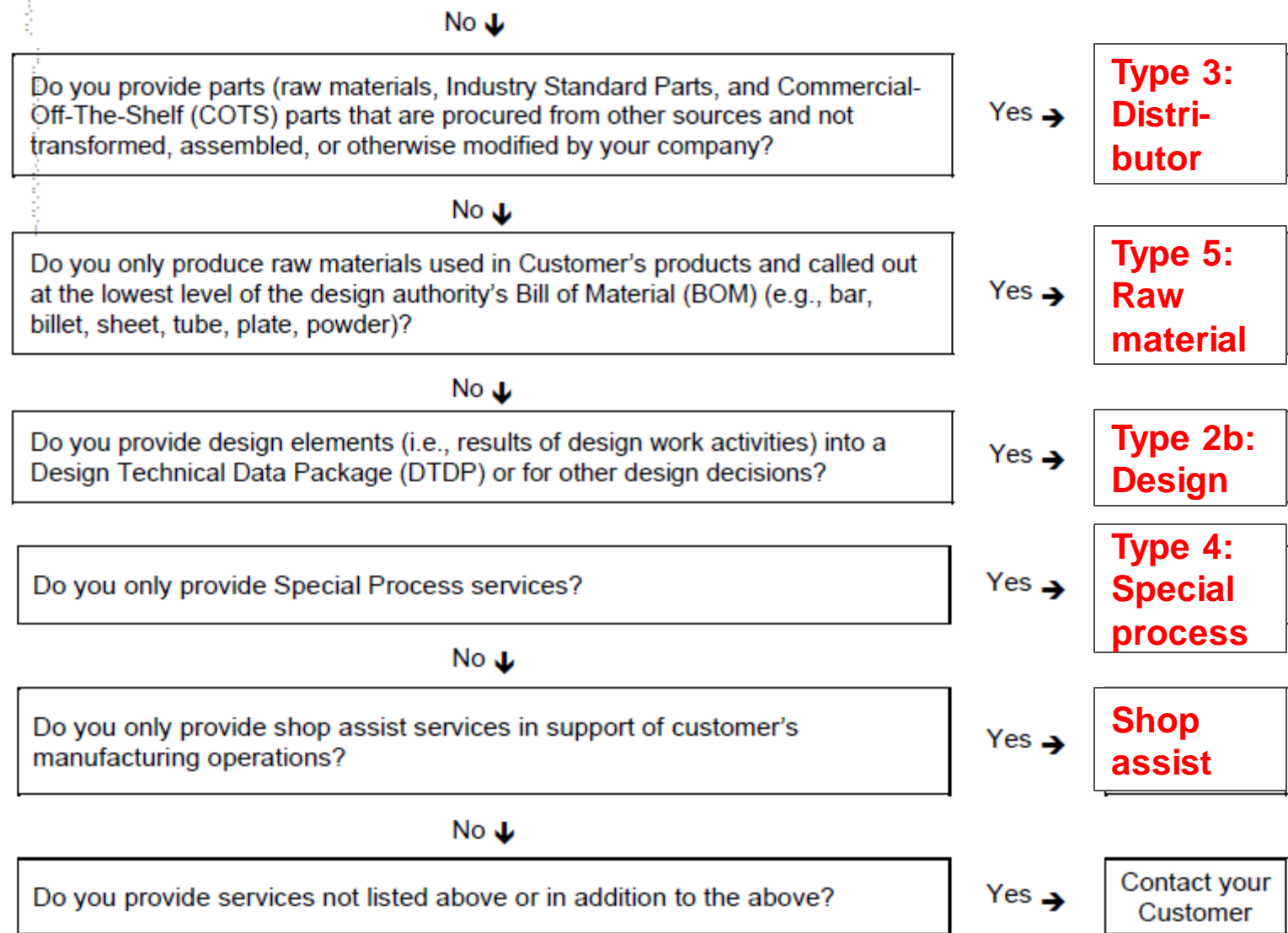
No ↓

Cont 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?

① 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



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



NEW

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

Organization's to produce an Annual Audit Report to summarize performance for Customer Review
(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.

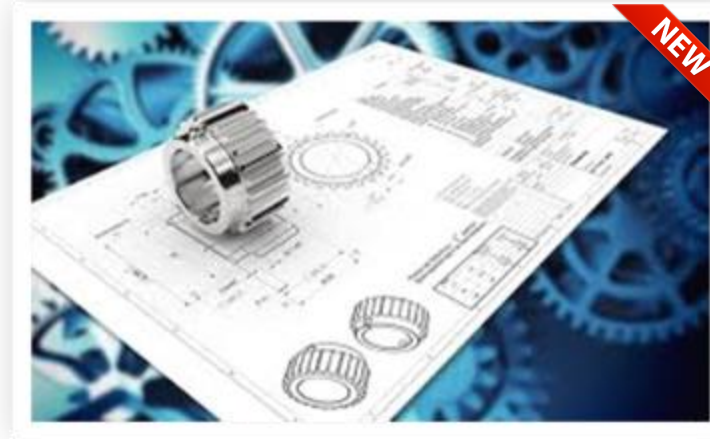
(Section 7.2.1)

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)



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)



Three handheld spectrometers in black, red, blue, and green. Each has a small screen and a lens. A red diagonal banner with the word "NEW" in white is in the top right corner.

The organization shall verify that the correct metallic raw material is used e.g. through the use of **hand held 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)

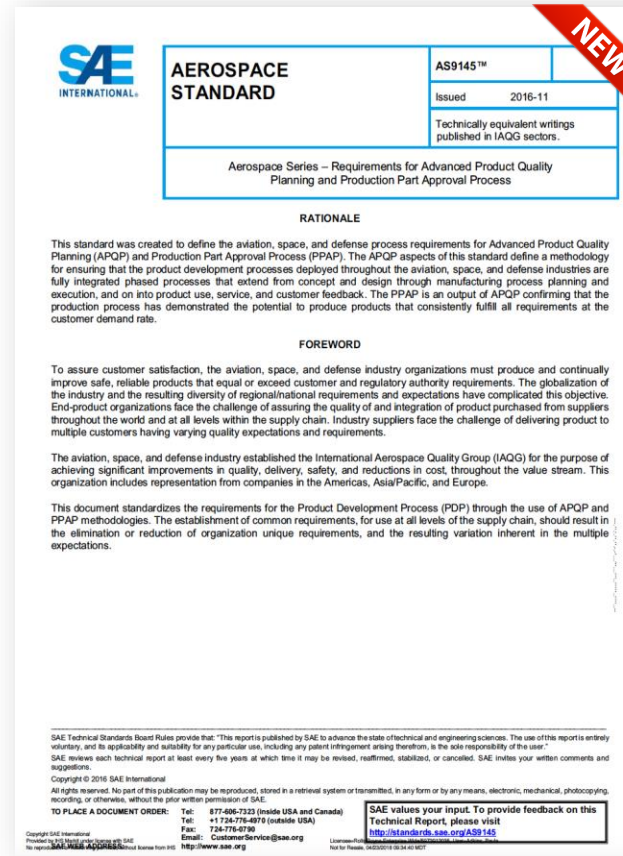
AS13100 Requirement Highlights: Chapter B APQP & PPAP

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



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/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

AESQ – Aerospace Engine Supplier Quality Strategy Group

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AESQ is Seeking Feedback on AS13100

- Clarifications
- Grammar & Spelling
- Suggested Improvements
- Other?

Email: info@aesq.sae-itc.org



The image shows the cover page of the AS13100 Aerospace Standard. At the top left is the SAE International logo. To its right is a table with the following content:

AEROSPACE STANDARD	AS13100™
	Issued 2021-03

Below the table is the title: **AESQ Quality Management System Requirements for Aero Engine Design and Production Organizations**.

The document includes sections for **RATIONALE** and **FOREWORD**. The rationale section explains that the standard was created by the SAE G-22 Aerospace Engine Supplier Quality (AESQ) Technical Committee to harmonize and simplify supplier quality requirements. It also notes that the standard sets out to create a common set of supplemental requirements to improve understanding, efficiency, and performance.

The foreword section states that the standard is intended to ensure customer satisfaction and that the AESQ strategy is to promote defect prevention approaches across the supply chain.

At the bottom of the page, the title **AS13100 Standard** is prominently displayed. Below this, there is a small box with contact information for SAE International, including phone numbers, fax, email, and website. A separate box on the right side of the page provides a link for more information on the standard: <https://www.sae.org/standards/content/AS13100/>.

DEPLOYMENT STATUS



JIM WILSON

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



EARL CAPOZZI

DISCIPLINE CHIEF; QUALITY & PROCESS
ENGINEERING / SUPPLIER QUALITY
PRATT WHITNEY

Where are we?



Implementation Resources

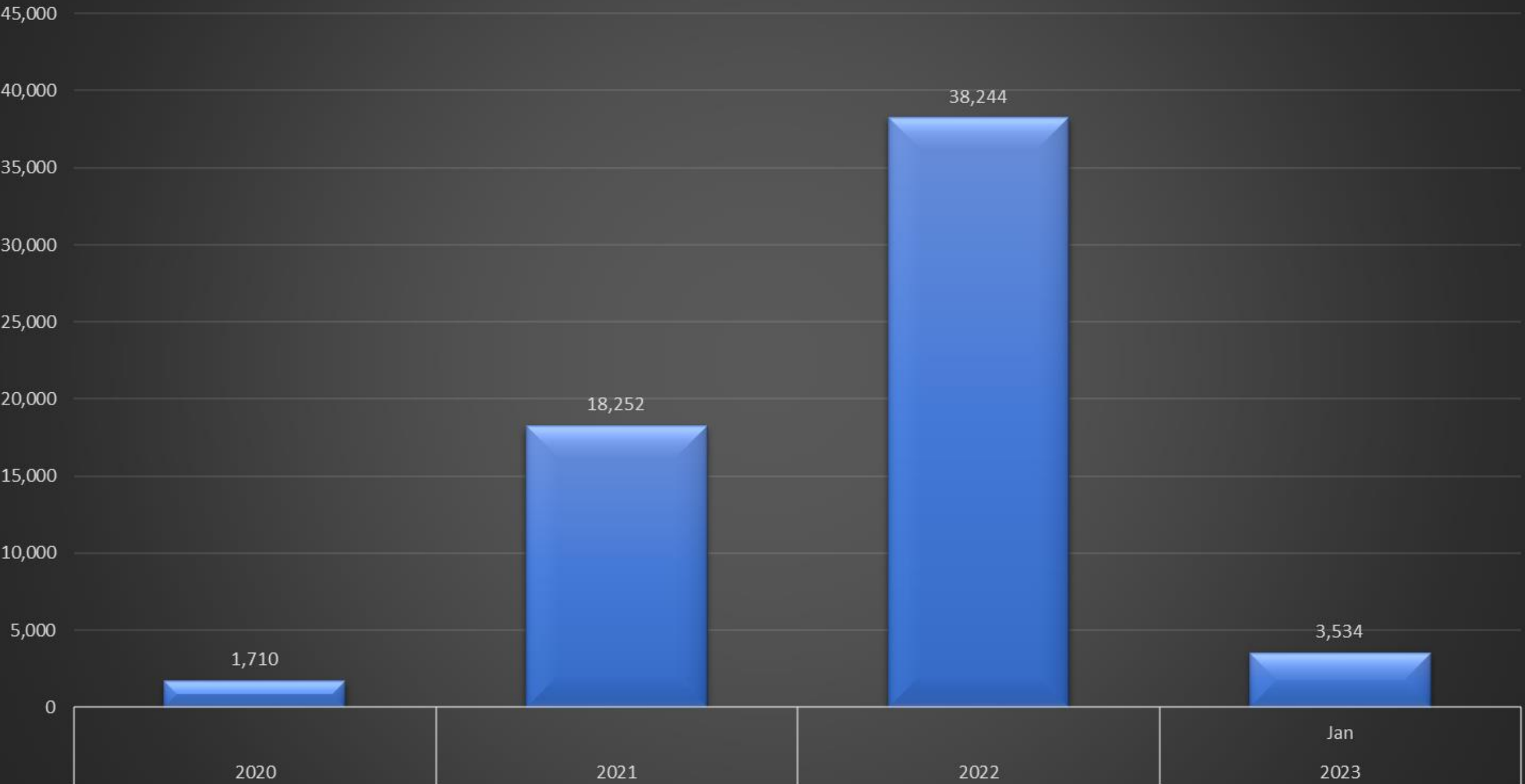


AESQ Subject Matter Interest Groups	
Advanced Product Quality Planning (APQP) & Production Part Approval Process (PPAP)	Defect Prevention Tools to Support APQP & PPAP
Design Work & Production Repair & Rework	Measurement Systems Analysis (MSA)
Sub Tier Management	Process Control Methods
Human Factors	Problem Solving Methods
DPRV Training	Quality Audit Methods
First Article Inspection	

Reference Manual	Associated Forms
RM13000	Problem Solving Methods Including BD <ul style="list-style-type: none"> • BD Interactive Tool (PowerPoint) • BD Reporting Template (Power Point) • BD Word Form (Word) • BD Template (Excel) • BD Template (PowerPoint)



AESQ Supplemental Materials Downloaded



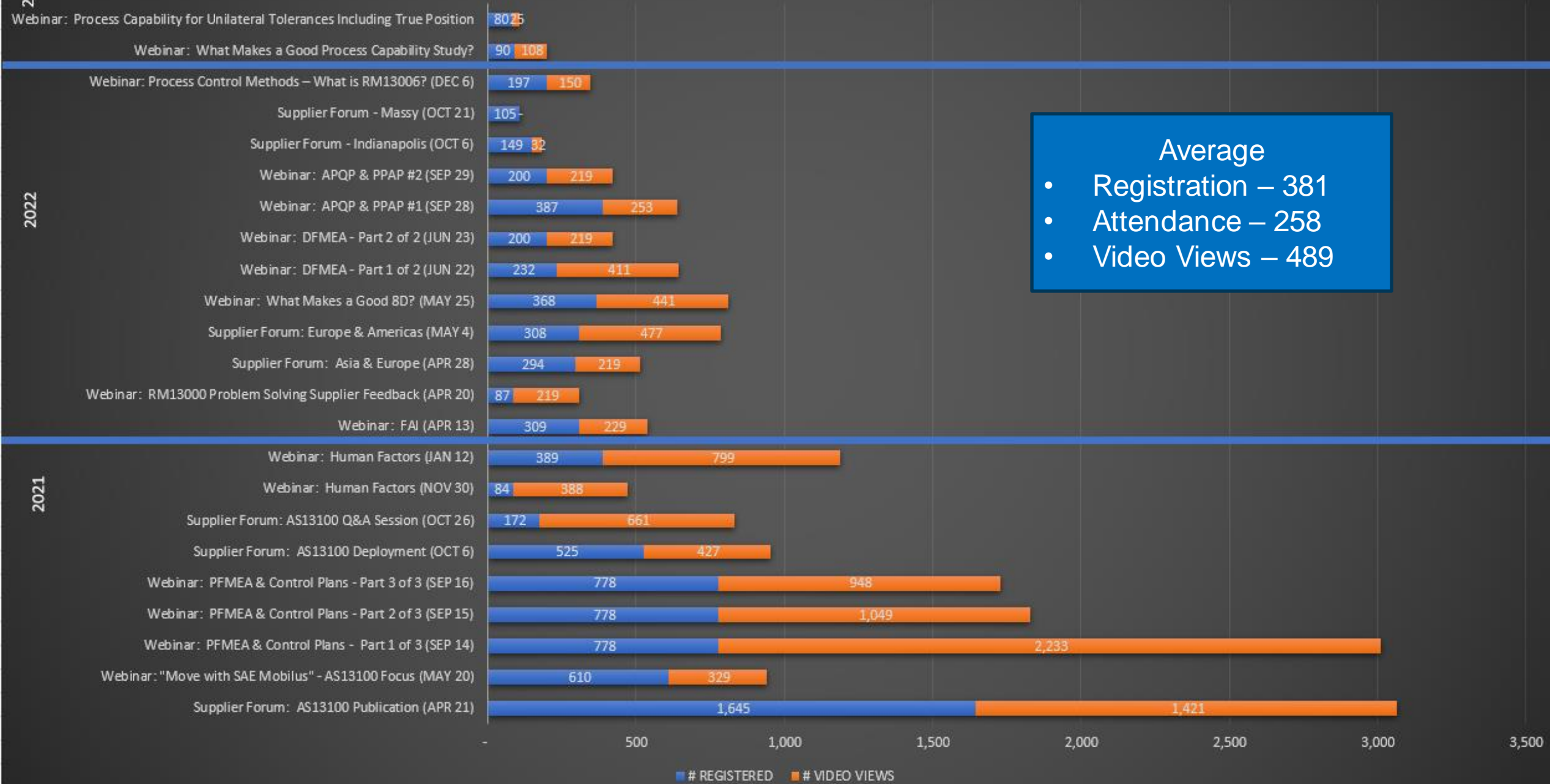
AESQ Event Engagement

Registered + # Video Views

2023

2022

2021



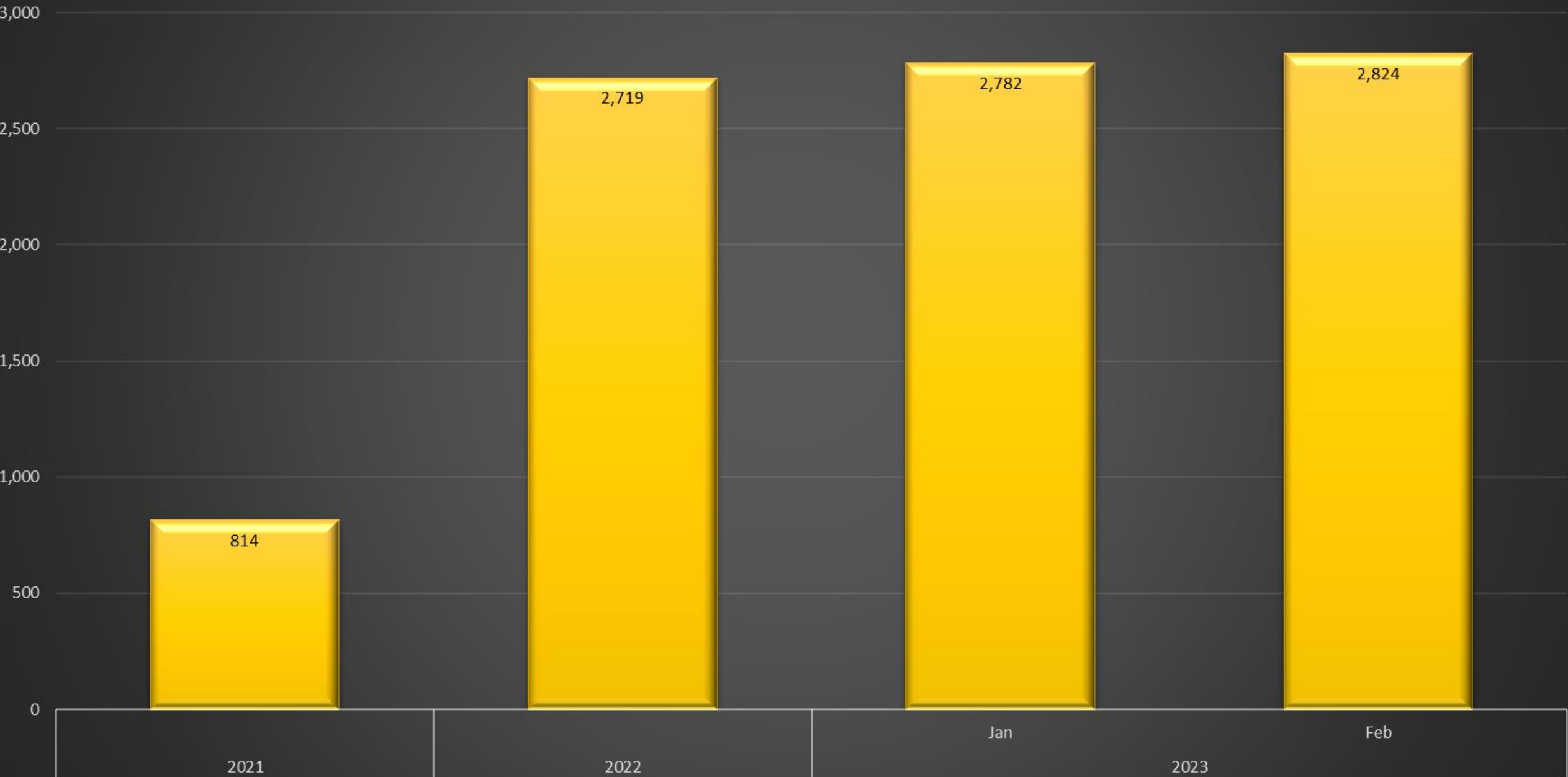
Average

- Registration – 381
- Attendance – 258
- Video Views – 489

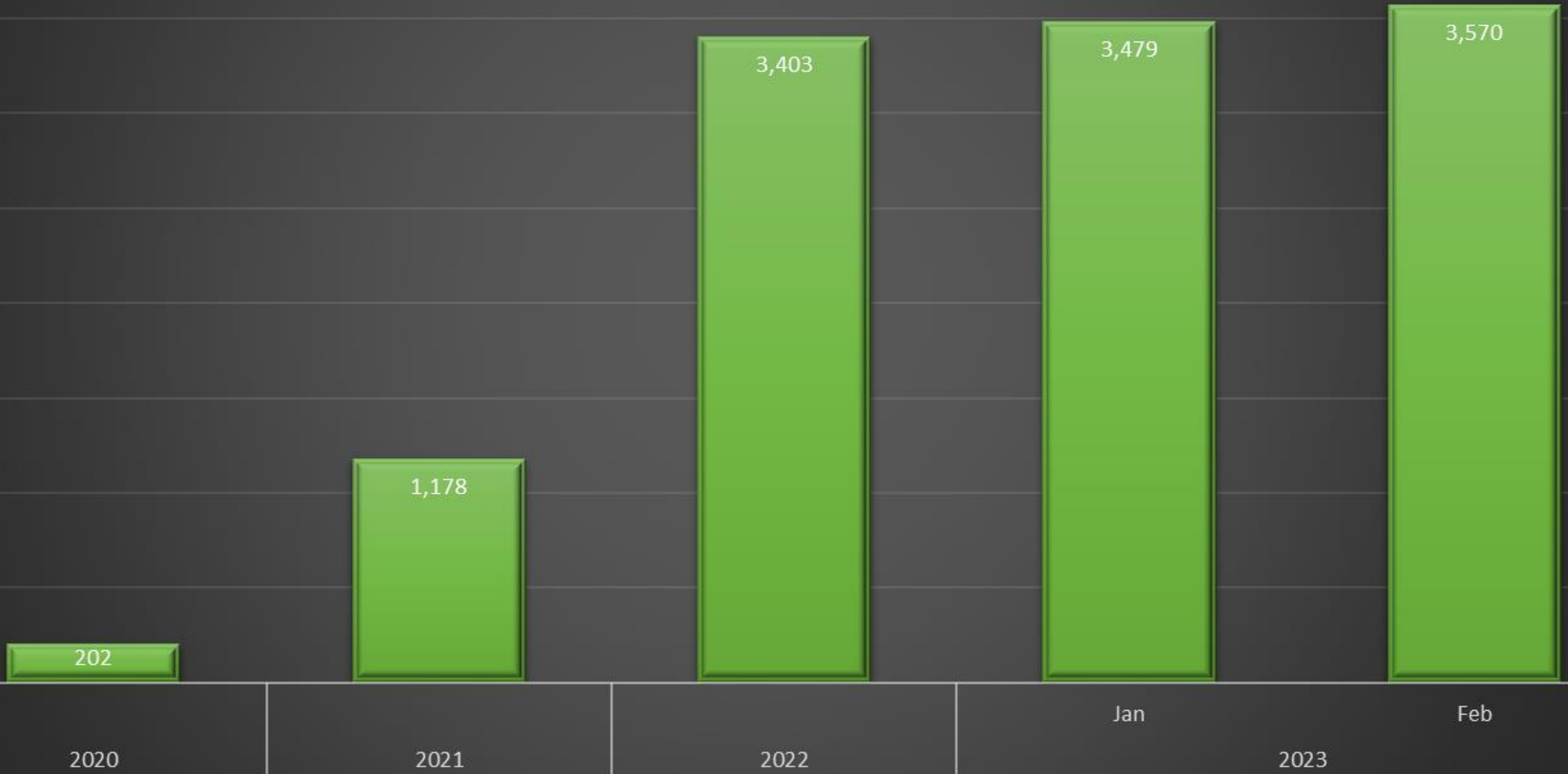
REGISTERED # VIDEO VIEWS

AESQ Communities of Practice on LinkedIn

Subscribers



AESQ Newsletter Subscribers



AESQ Deployment Survey Overview



August 2021: First survey of suppliers on the general knowledge of AS13100 and the AESQ

- 158 respondents
- Familiar with AESQ for existing AS13000 series documents

April 2022: Follow up survey targeted to better understand the aero-engine supply base's AS13100 implementation status

- 482 respondents
- 608 comments and suggestions analyzed

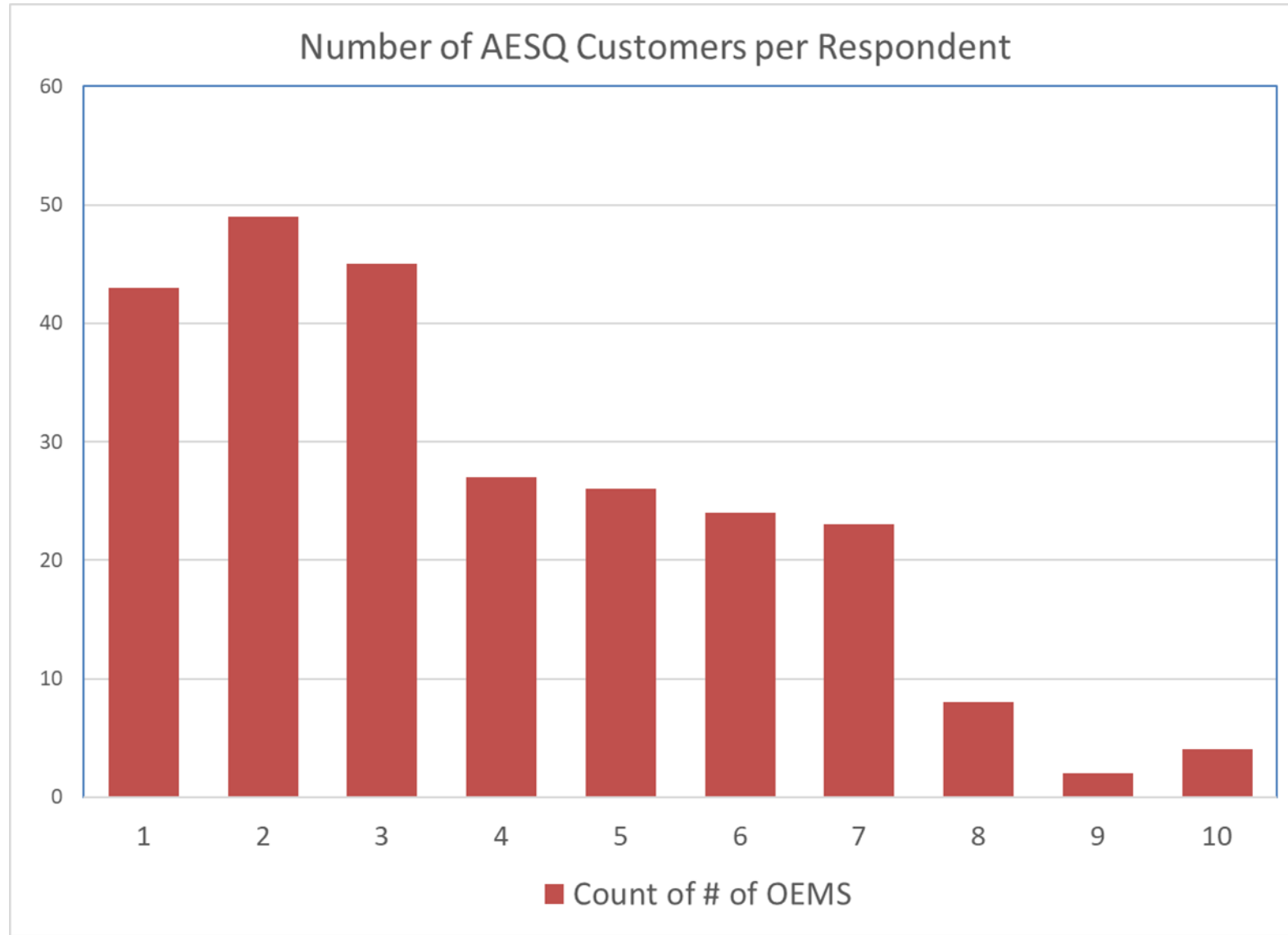
September 2022: Survey targeted to develop plans to help suppliers for Q4

- Same questions from April to build trend and collect feedback on deployment
- 255 respondents

February 2023: Post deployment survey to find opportunities

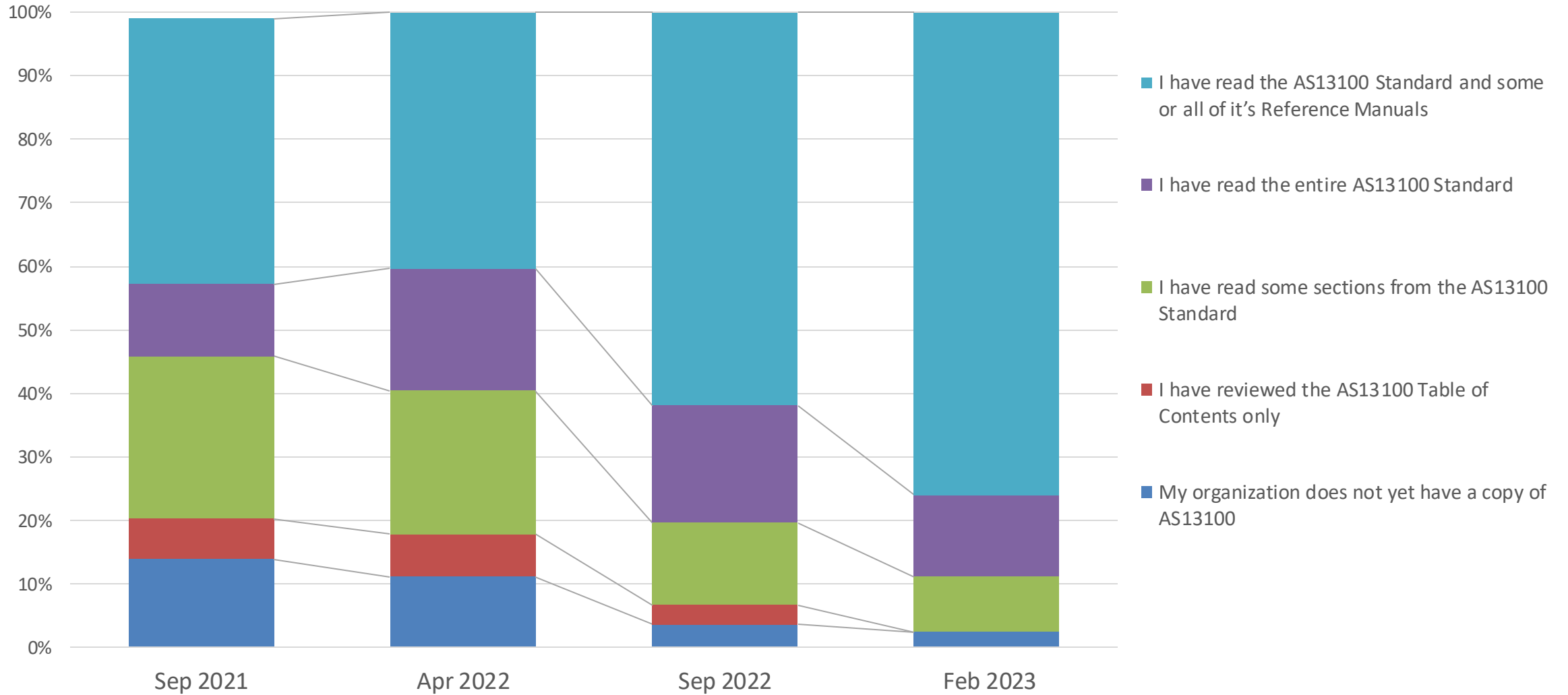
- Continue with similar questions to track evolution
- 251 respondents

Who Responded?

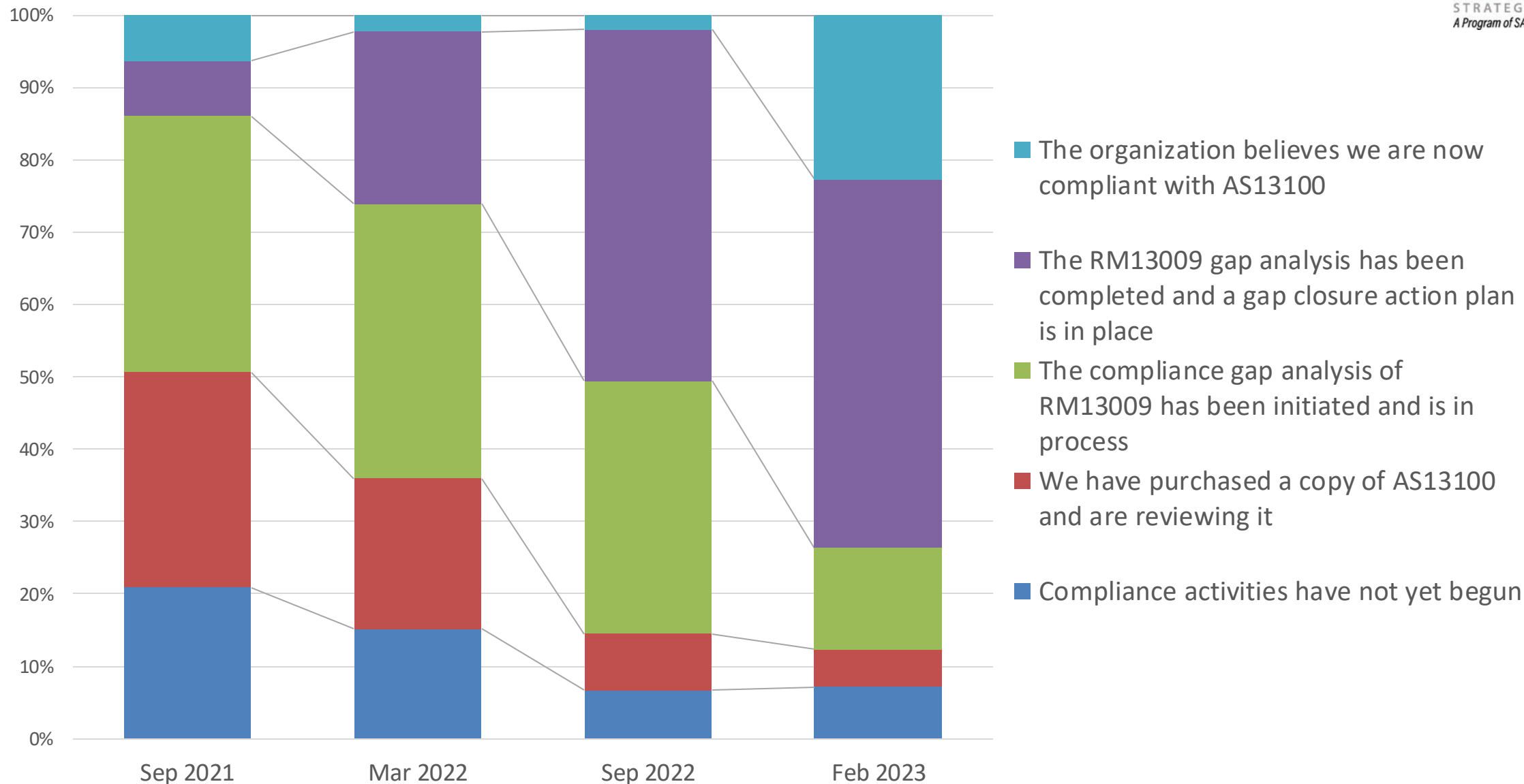


Respondents had an average of 3.75 AESQ customers

Familiarity with the AS13100 standard



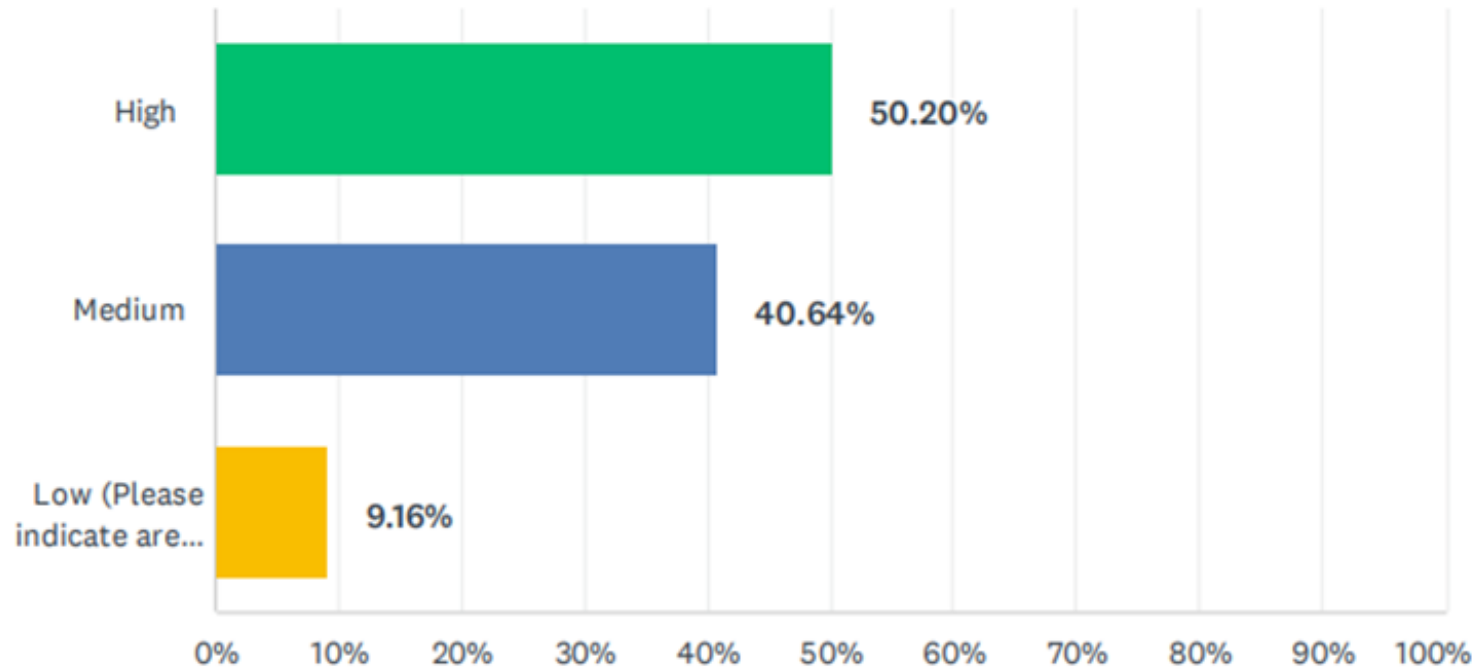
Deployment Status



Deployment Confidence

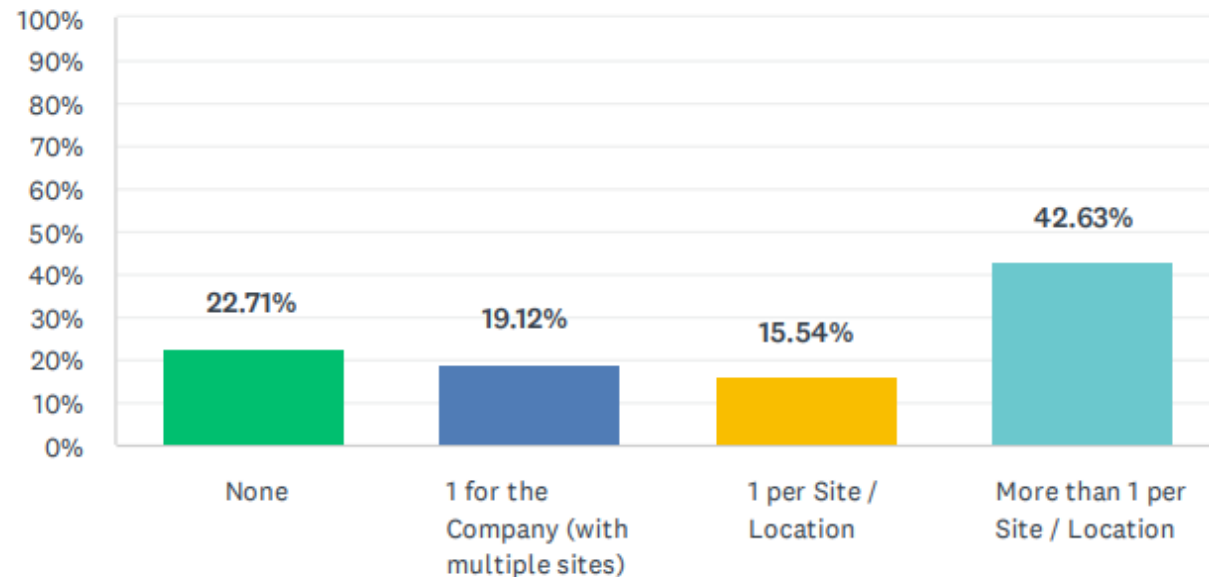
Q5 What level of confidence do you have that your company is/will be fully compliant to AS13100?

Answered: 251 Skipped: 0



Q2 How many individuals at your company have completed the AS13100 Requirement Training?

Answered: 251 Skipped: 0

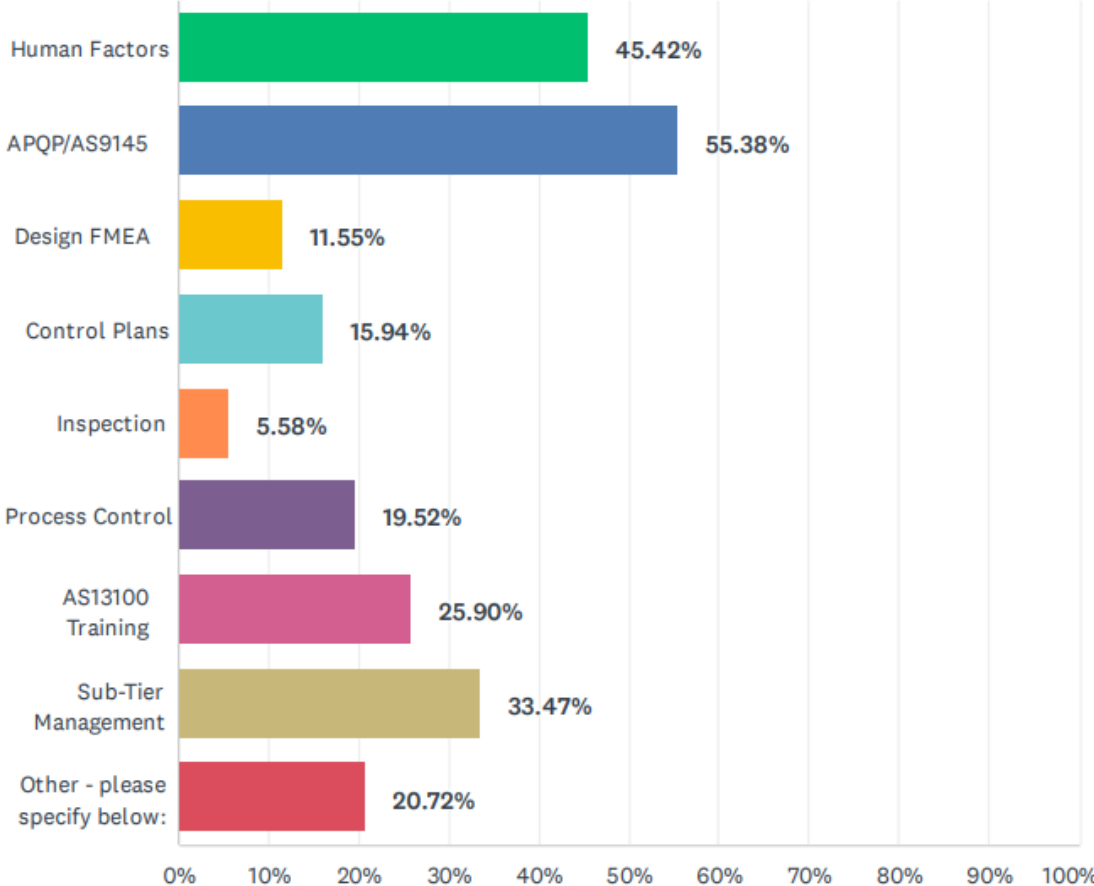


- Requirements training is the online training
- Expectations that it is required to conduct effective gap analysis
- We have set a minimal of 1 per company, but expect more for effective deployment

Biggest Challenges

Q6 What is the biggest challenge to your company being able to comply with AS13100? (check all that apply)

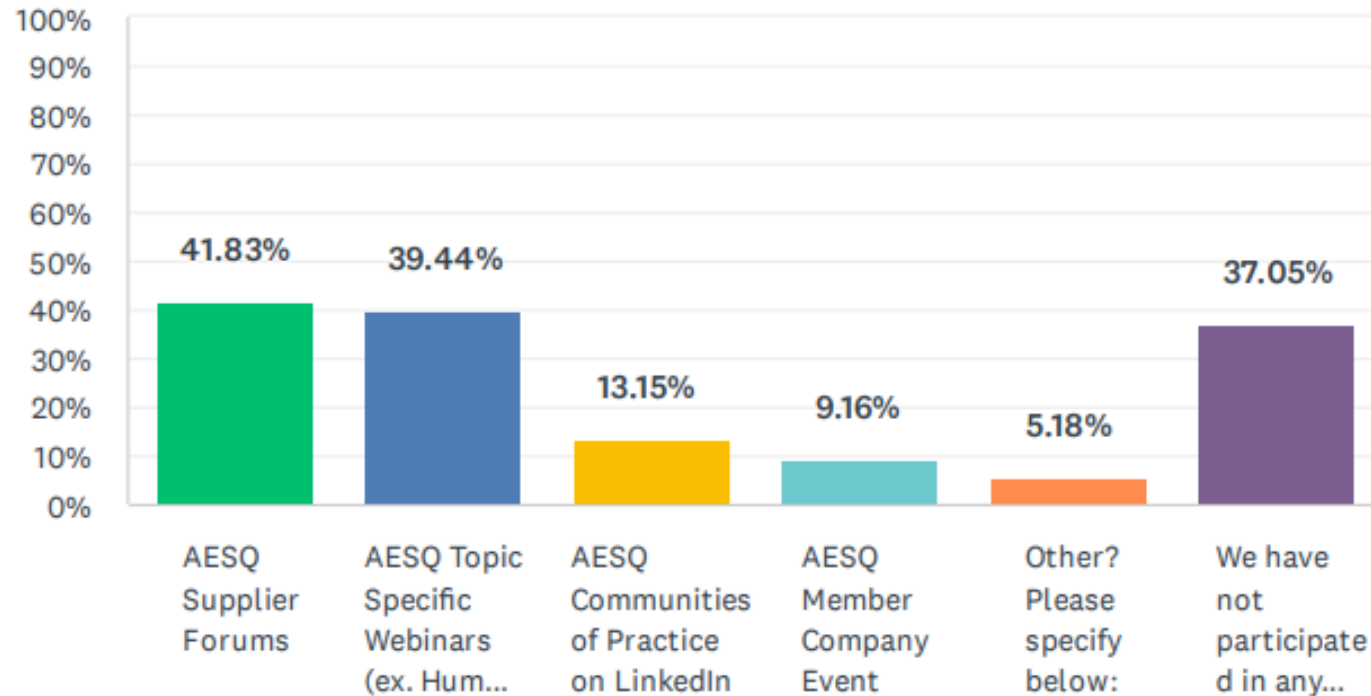
Answered: 251 Skipped: 0



Engagement with AESQ

Q7 Have you participated in any of the following AESQ events or activities? (select all that apply)

Answered: 251 Skipped: 0



AESQ – Aerospace Engine Supplier Quality Strategy Group

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slido



How can the AESQ further support you in effective deployment?

① Start presenting to display the poll results on this slide.



Break Time
Return in 20 Minutes



Using FMEA to Reduce Human Error in Assembly & Test



Tracey Lockhart

Head of Quality , Manufacturing
Engineering and Continuous Improvement

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Our Product Portfolio

Civil Large



Defense



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What is your knowledge of Human Factors?

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

slido



What is your knowledge of FMEA?

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

**30,000
Components**



**6,000
Manual
Operations**

Human Factors play a critical part in assuring Product Quality



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RR Deployment Framework



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Aligned to the AESQ AS13100 Standard and RM13010 Reference Manual.



Human Factors

The Dirty Dozen



Lack of Communication



Complacency



Lack of Knowledge



Distraction



Lack of Team Work



Fatigue



Lack of Resources



Pressure



Lack of Assertiveness



Stress



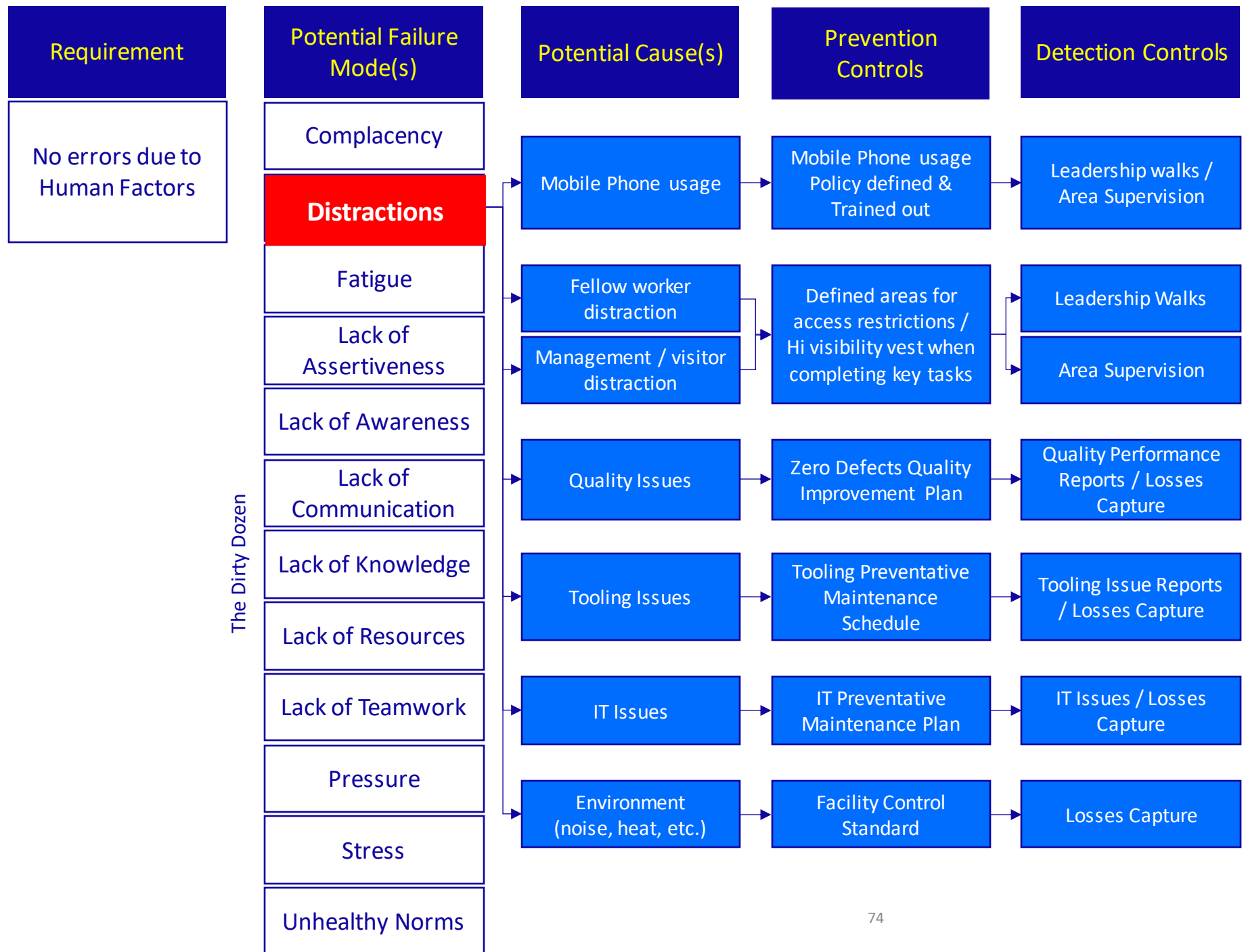
Lack of Awareness



Norms

Human Factors

Using the FMEA Approach



(Simplified FMEA template for illustration purposes only. Some columns are missing e.g. the scoring is not included)



Human Factors FMEA

Let's have a go!

Scenario – Final Inspection, Friday 2.30 p.m.

- Engine due for delivery at 5 p.m. Truck waiting outside. Pickup scheduled for 11 p.m.
- The Prince of Wales is due to visit at 3 p.m. and have a picture taken in Final Inspection next to this finished Engine
- Two of the inspection team who should be working on the engine have phoned in sick this morning
- The final paperwork usually takes 3 hours to compile once the engine is finished. The delays mean that the team will only have 2 hours 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
- The Senior Communications Manager is also in the area to ensure that everything is ready for the royal visit



slido



Which of these Dirty Dozen applies to this Scenario?

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

Human Factors FMEA

Heat Map

Area	Complacency	Distractions	Fatigue	Lack of						Pressure	Stress	Unhealthy Norms
				Assertiveness	Awareness	Communication	Knowledge	Resources	Teamwork			
				1	2	3	4	5	6			
Manufacturing	Red	Red	Green	Yellow	Red	Red	Yellow	Green	Green	Red	Yellow	Red
Certification Office	Red	Red	Yellow	Yellow	Red	Red	Green	Green	Yellow	Red	Yellow	Red
Customer Delivery Centre	Red	Red	Red	Yellow	Red	Red	Yellow	Green	Red	Yellow	Yellow	Yellow
Engine Test	Red	Yellow	Green	Yellow	Red	Yellow	Green	Green	Green	Red	Red	Red
Engine Build	Red	Red	Yellow	Red	Red	Green	Red	Red	Yellow	Yellow	Yellow	Red

Each area will have its own, unique human factor risk profile however some risks will be similar across multiple areas



Human Factors FMEA - Improvement Examples

Lack of Awareness

Human Factors Toolbox Talk

MARS Raised - 75264 BLA Issue

Delay in Resolution of EDR2024 due to not resolving that was identified from Technical Control unit 06/09/2022

A Build List Amendment was highlighted as part of the performance and was requested by the COC team on 01/09/2022. Unfortunately a change request was raised the BLA was not updated into the system and this was picked up Friday morning

The BLA was re-requested on Friday 02/09/2022 and accepted and overnight for the system to update.

Unfortunately the Certification Team being under pressure and trying to be proactive around the engine off on Friday evening to save time Saturday which prevented the system being updated again.

A different Certification Engineer picked up the engine assembly meeting and was unsure what had happened on the Friday evening due to a poor memory.

The error was spotted Monday morning and notified to enable a final verification and Form 1 on Monday 05th September

Team Discussion

What were the Human Factors?

Pressure

Lack of awareness

Lack of communication

Corrective Actions

- MARS report raised 05/09
- Team Briefed 07/09
- BLA improvement workshop due 13/09
- Certification Office Human Factors FMEA updated - 07/09
- Engine Status Review to be improved - due 12/09

Swiss Cheese Model

Toolbox Talks

Lack of Teamwork / Pressure



Team Building Away Days

Lack of Communication

Shift Handover

Search items

In Progress

22111	In Progress	21/12/2022 10:45	Fuels received, pack to work.	Medium Priority
Trent XWB-84	To Work			
N/A	In Progress	21/12/2022 10:36	STI 4988 statement on T1000 Test Req'd template deleted as 4988 has	Low Priority
Trent 1000	For Info			
10076	In Progress	21/12/2022 09:48		Medium Priority
Trent 1000	To Overcheck			
11145	In Progress	21/12/2022 09:48	F/C 817 ent pin found on engine harness, Hardware request sent	Medium Priority
Trent 1000	For Info			

New Electronic Shift Handover System (MS Power Apps)

Distractions



Behavioral Nudges

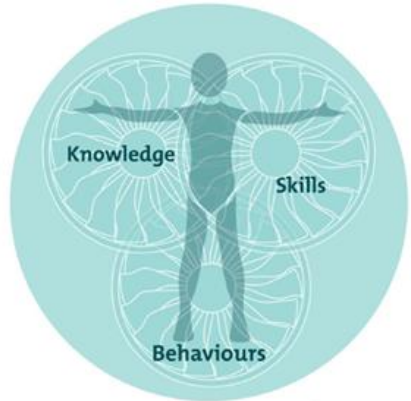
Complacency/Norms

Item	Compliance
1	Green
2	Green
3	Green
4	Green
5	Green
6	Green
7	Green
8	Green
9	Green
10	Green
11	Green
12	Green
13	Green
14	Green
15	Green
16	Green
17	Green
18	Green
19	Green
20	Green
21	Green
22	Green
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85	Green
86	Green
87	Green
88	Green
89	Green
90	Green
91	Green
92	Green
93	Green
94	Green
95	Green
96	Green
97	Green
98	Green
99	Green
100	Green

Enhanced Compliance Checking



Key Insights



Aerospace Culture

- In a Manual Assembly Environment Human Factors can have a significant impact on business performance
- The structured approach of FMEA has proven to be an important tool to identify Human Factor Issues to drive preventive action
- 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 an easy concept for the teams to use
 - d) It necessitates the engagement with the wider workforce to validate the findings
 - e) Creates cross functional / high value discussions that lead to better insights
 - f) It drives improvements based on risk
 - g) Improved awareness and issue reporting where deployed (>200% increase)



Any Questions



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BREAKOUT SESSION #1

SUBJECT MATTER INTEREST

GROUPS



BARRIE HICKLIN

SR. DIRECTOR, QUALITY SYSTEMS
& REGULATORY COMPLIANCE
HONEYWELL

Breakout Session #1: Subject Matter Interest Groups

90 Minutes (15 minutes per session)

Table	Title	Leader
1	Quality Audit (RM13005) Compliance Assessment (RM13009)	Jim Wilson, Pratt & Whitney
2	Human Factors (RM13010)	Richard Bolingbroke, Timet
3	APQP & PPAP (RM13145)	Ken Hatcher, Raytheon Technologies
4	PFMEA Defect Prevention (RM13004)	Jim Barge, GE, and Lisa Rioux, Pratt & Whitney
5	Process Control (RM13006)	Ricardo Banuelas, Rolls-Royce
6	Training (AS13100 & AS13001 DPRV)	Earl Capozzi, Pratt & Whitney and Shari Pobjecky, SAE
7	Sub Tier Management (RM13007)	Larry Bennett, GE Aerospace

Breakout Session #1 – Subject Matter Interest Groups

90 Minutes Total (15-Minute Sessions)

Front Desk

RM13009
Compliance
RM13005
Quality Audit

RM13006
Process
Control

RM13004
PFMEA
Defect
Prevention

RM13145
APQP/PPAP

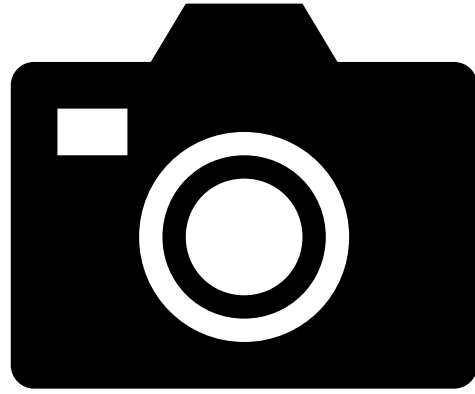
RM13010
Human
Factors

RM13007
SubTier
Management

Training

Doors

Return in 60 Minutes



Group Photo



AESQ AS13100 TRAINING OVERVIEW



EARL CAPOZZI

DISCIPLINE CHIEF; QUALITY & PROCESS
ENGINEERING / SUPPLIER QUALITY
PRATT WHITNEY

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

AESQ Approved AS13100 Trainings

Delegated Product Release Verification (DPRV)

DPRV personnel shall be trained and certified in accordance with AS13001 Delegated Product Release Verification Training Requirements (7.2.3)

Required for DPRV certification and recertification since 2015

AESQ Approved AS13100 Requirements Course

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 Mgmt. Standards.

Recommended for functional leaders responsible for creating or managing processes that are impacted by AS13100 Requirements (7.2.4)

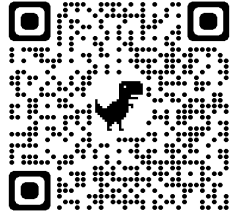
AESQ Quality Foundations Course

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** course.

Recommended for design engineering, manufacturing engineering and operations roles. (7.2.4)

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
 - Training FAQs address who should enroll in AESQ trainings.
- No Charge**

LEVEL
TWO

AS13100
Requirements



On-demand virtual course, 10 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
- Recommended for functional leaders responsible for creating or managing processes that are impacted by AS13100

\$399

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
- Recommended for design engineering, manufacturing engineering and operations roles

\$1095

SAE AS13100 Quality Requirements Course Overview

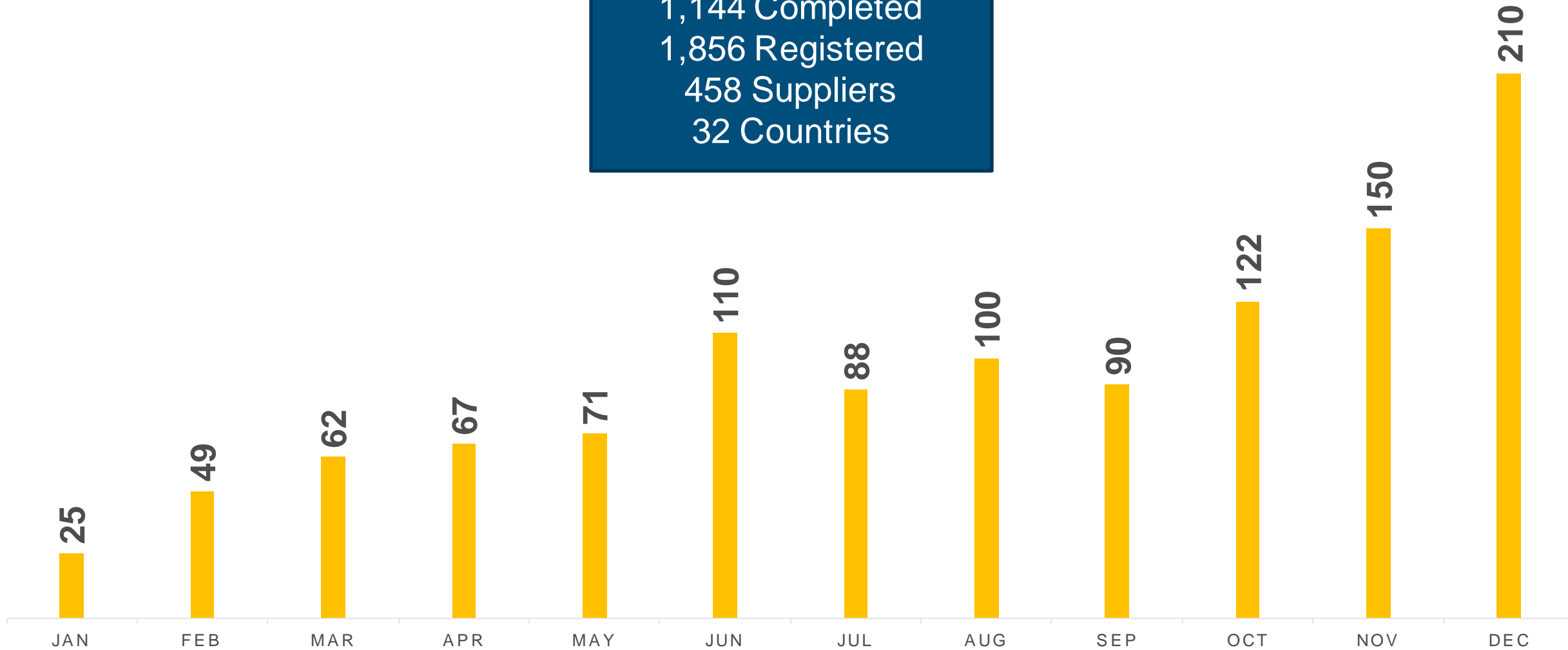
- ✓ **Required** for Quality Leaders with responsibility for deploying the requirements of AS13100
- ✓ **Recommended** for functional leaders responsible for creating or managing processes that are impacted by AS13100
- ✓ Provides knowledge and insight for each of the AESQ supplemental requirements
- ✓ Provides knowledge that helps the learner assess, design, maintain and comply with the business processes, which keep you compliant and adds value to the business

SAE AS13100 Quality Foundations Course Overview

- ✓ **Required** for Quality Leaders with responsibility for supporting the design, manufacturing, and assembly operations via AS13100
- ✓ Quality Leaders who have completed a recognized OEM training course are exempt from the SAE course.
- ✓ **Recommended** for anyone with accountability for the quality of the design, production, assembly and test areas of the organization.
- ✓ Joins key quality systems, processes and methodologies to show how they work systemically to focus on Defect Prevention. Provides deeper insight into each of the AESQ supplemental Reference Manuals.

AS13100 Requirements Course Participation 2022

1,144 Completed
1,856 Registered
458 Suppliers
32 Countries

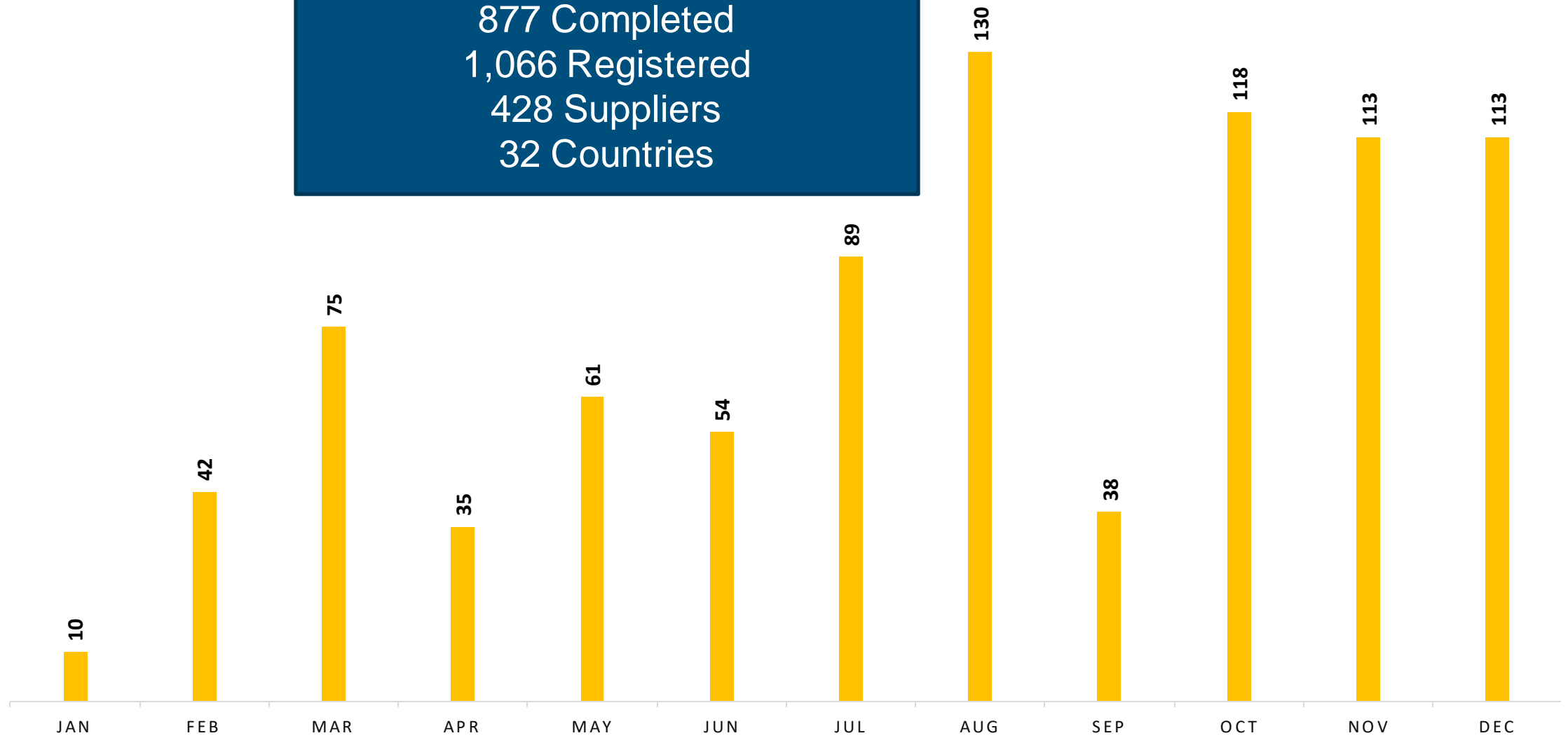


AS13100 Requirements Course Completions 2023

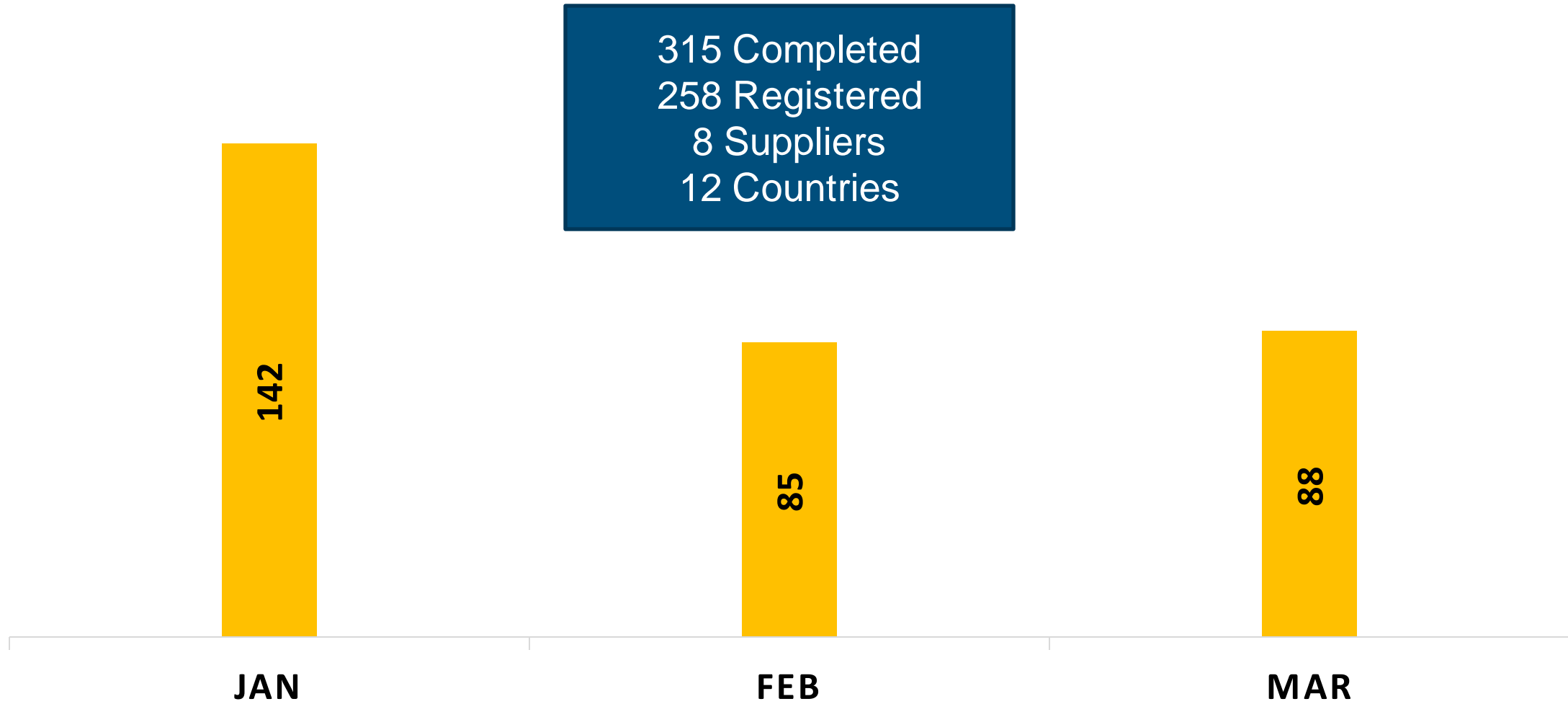


Quality Foundations Course Participation 2022

877 Completed
1,066 Registered
428 Suppliers
32 Countries



Quality Foundations Course Completions 2023



Does Your QMS Meet AS13100 Requirements?



Trainings are available in multiple formats and can also be delivered privately to your organization.

<https://aesq.sae-itc.com/training>

<https://discover.sae.org/AS13100>



Developed in partnership with the AESQ and the G-22 writing committee SMEs

BREAKOUT SESSION #2

ZERO DEFECTS FOR EVERYONE



LISA CLAVELOUX
SR. DIRECTOR, QUALITY
RAYTHEON TECHNOLOGIES
PRATT & WHITNEY DIVISION

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

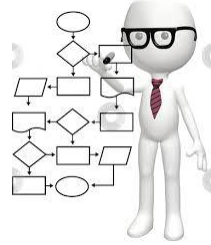
Getting to Zero Defects...



Chris Customer



Petra Purchase



Mel ME



Den Designer



Leslie Logistics



Quincy Quality



Fran Finance



Izzy Inspector



Olly Operator



Hillary HR

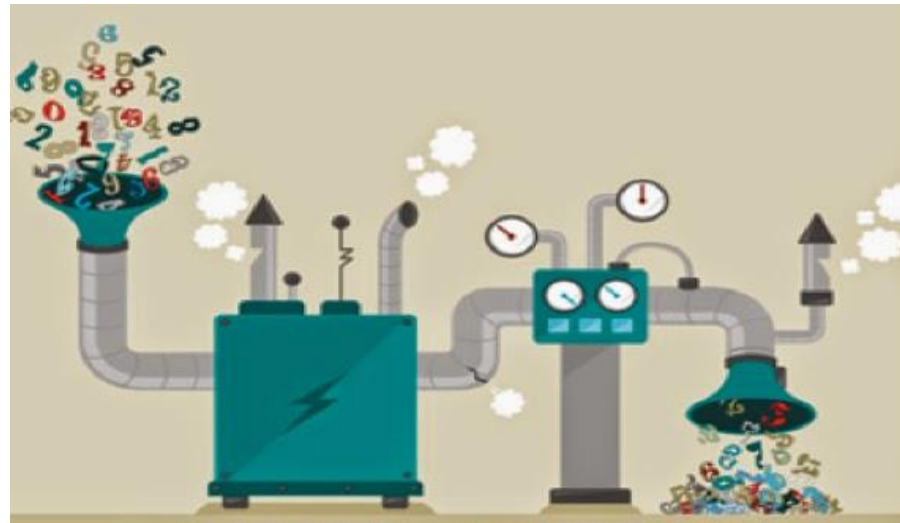
Arrange these characters into a natural value stream and identify what they need to provide to each other to achieve zero defects

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



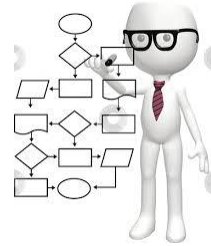
Getting to Zero Defects...



Chris Customer



Petra Purchase



Mel ME



Den Designer



Leslie Logistics



Quincy Quality



Fran Finance



Izzy Inspector



Olly Operator



Hillary HR

Overlay the Zero Defects tools and practices over the value stream

The Quality Value Stream

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

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

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

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 complied 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

AESQ – Aerospace Engine Supplier Quality Strategy Group

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Break Time
Return in 25 Minutes

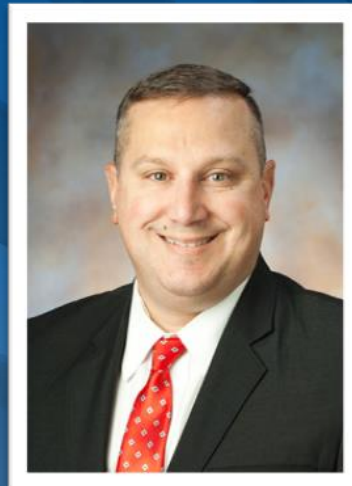
AS13100 FAQ PANEL SESSION



Barrie Hicklin
Honeywell



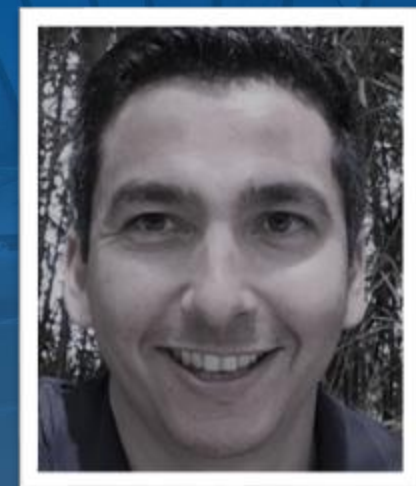
Larry Bennett
GE Aerospace



Earl Capozzi
Pratt & Whitney



Denis Pottier
Safran Aircraft
Engines



Ricardo Banuelas
Rolls-Royce

VOICE OF THE CUSTOMER



AMY GOWDER
PRESIDENT & CEO
DEFENSE AND SYSTEMS
GE AEROSPACE

AESQ

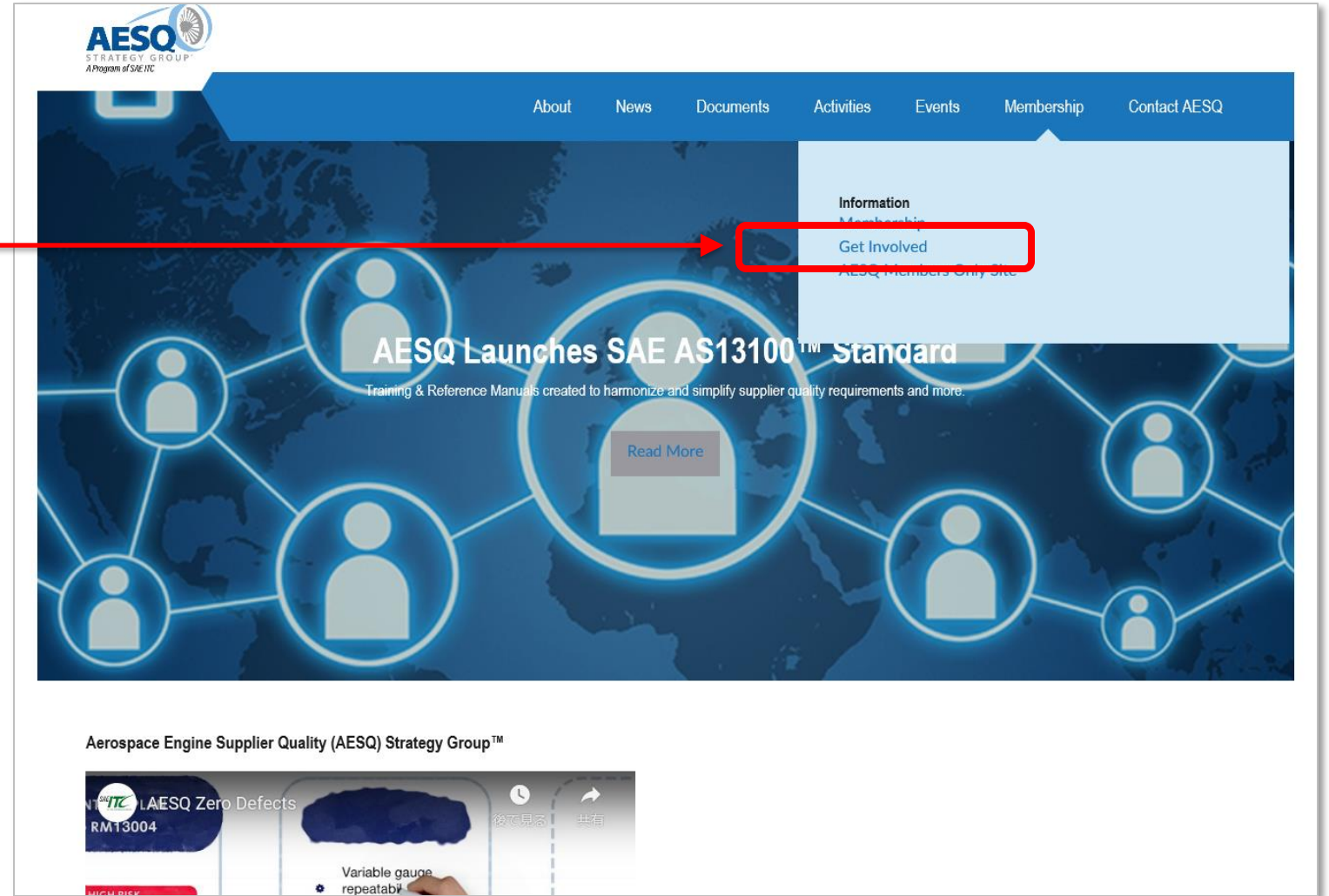
HOW TO GET INVOLVED



JUN SAKAI
CHIEF ENGINEER
IHI

“Get Involved” with AESQ

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



“Get Involved” Options

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

Click on the appropriate link for additional information

Get Involved

AESQ provides multiple opportunities to get involved and learn more about their activities.

[Read More](#)

AESQ Invites you to Get Involved

AESQ provides several opportunities to get involved, support, participate and remain aware of its activities, resources and communications.

Ways to Get Involved

- [Become an AESQ Member](#)
- [Join the SAE G-22 Committee](#)
- [Sign up to receive the AESQ eNewsletter](#)
- [Join a Community of Practice](#)

AESQ created these Communities of Practice (CoP) to encourage subject matter experts to engage and positively promote the topics listed below. These are professional development and discussion groups set up to exchange ideas, ask pertinent questions, share best practices and learn as a Community. [Click and join a Community today:](#)

- Problem Solving Methods
- First Article Inspection (FAI)
- Defect Prevention Tools
- Design Work & Production Repair
- Quality Audit Methods
- Sub-Tier Management
- Measurement Systems Analysis (MSA)
- Human Factors
- DPRV
- APQP & PPAP
- Process Control Methods

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

- Issued monthly
- Learn about AESQ’s current activities
- Complete online form to begin receiving



AESQ – Aerospace Engine Supplier Quality Strategy Group

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“Get Involved” – Become an AESQ Member

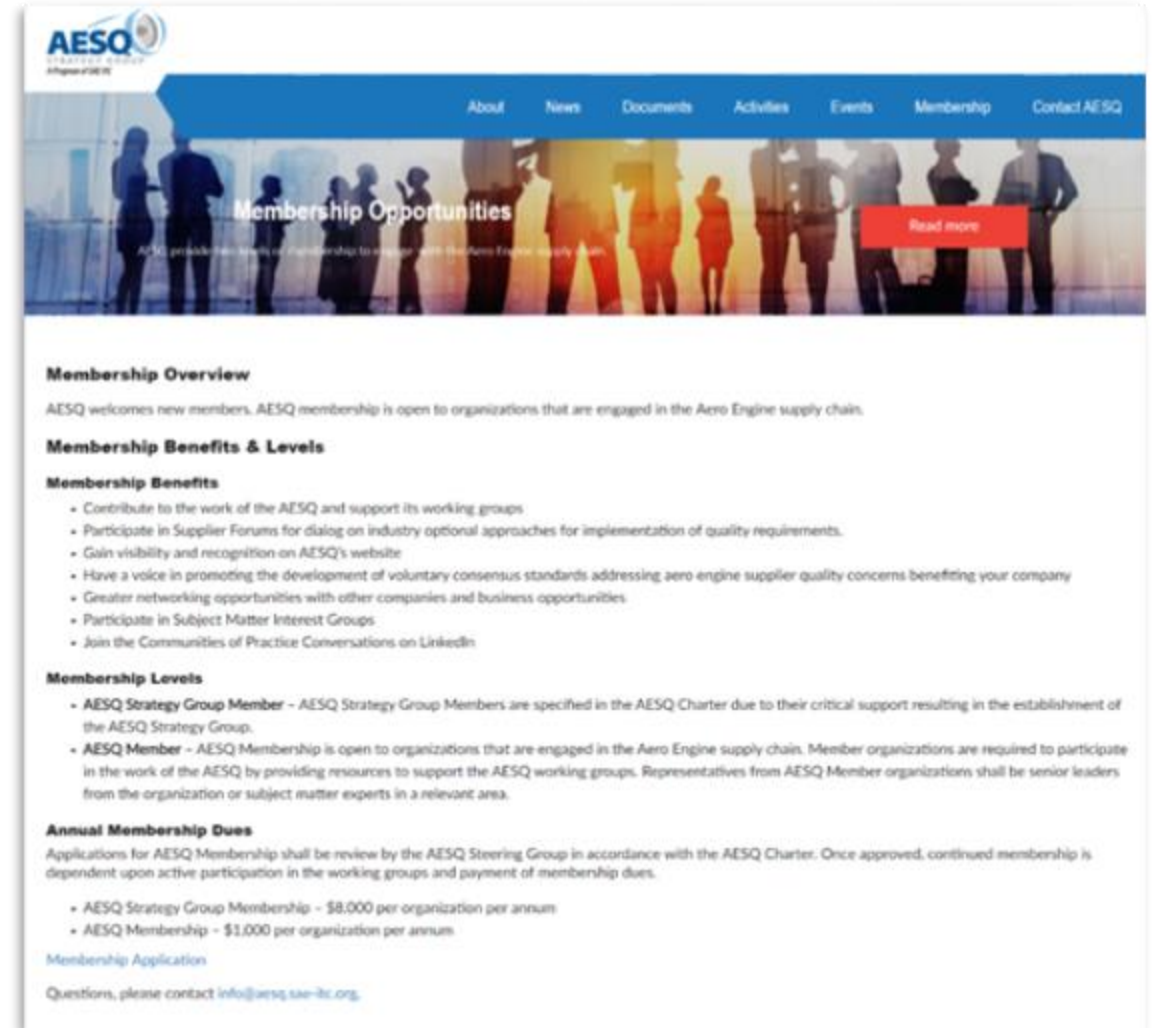
2 Membership Levels:

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.
- Opportunity to participate in the work of AESQ by providing resources to support AESQ working groups and Subject Matter Interest Groups (SMIGs).
- Representatives shall be senior leaders from the organization or subject matter experts in a relevant area.

Complete Membership Application at bottom of page



The screenshot shows the AESQ website's membership page. At the top, there is a navigation menu with links for About, News, Documents, Activities, Events, Membership, and Contact AESQ. Below the menu is a large banner image of people in a meeting, with the text "Membership Opportunities" and a "Read more" button. The main content area is titled "Membership Overview" and includes sections for "Membership Benefits & Levels", "Membership Benefits", "Membership Levels", and "Annual Membership Dues".

Membership Overview
AESQ welcomes new members. AESQ membership is open to organizations that are engaged in the Aero Engine supply chain.

Membership Benefits & Levels

Membership Benefits

- Contribute to the work of the AESQ and support its working groups
- Participate in Supplier Forums for dialog on industry optional approaches for implementation of quality requirements.
- Gain visibility and recognition on AESQ's website
- Have a voice in promoting the development of voluntary consensus standards addressing aero engine supplier quality concerns benefiting your company
- Greater networking opportunities with other companies and business opportunities
- Participate in Subject Matter Interest Groups
- Join the Communities of Practice Conversations on LinkedIn

Membership Levels

- **AESQ Strategy Group Member** – AESQ Strategy Group Members are specified in the AESQ Charter due to their critical support resulting in the establishment of the AESQ Strategy Group.
- **AESQ Member** – AESQ Membership is open to organizations that are engaged in the Aero Engine supply chain. Member organizations are required to participate in the work of the AESQ by providing resources to support the AESQ working groups. Representatives from AESQ Member organizations shall be senior leaders from the organization or subject matter experts in a relevant area.

Annual Membership Dues
Applications for AESQ Membership shall be review by the AESQ Steering Group in accordance with the AESQ Charter. Once approved, continued membership is dependent upon active participation in the working groups and payment of membership dues.

- AESQ Strategy Group Membership – \$8,000 per organization per annum
- AESQ Membership – \$1,000 per organization per annum

Membership Application
Questions, please contact info@aesq.sae-itc.org.

“Get Involved” – Join a Community of Practice

Communities of Practice	Members
Problem Solving Methods	301
First Article Inspection (FAI)	278
Defect Prevention Tools	421
Design Work & Production Repair	142
Quality Audit Methods	277
Sub-Tier Management	189
Measurement Systems Analysis (MSA)	230
Human Factors	172
DPRV	214
APQP & PPAP	404
Process Control Methods	157
Compliance Assessment	21
Alternate Inspection Frequency	30

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

The image displays two LinkedIn group pages side-by-side. The left page is for the 'AESQ Human Factors (RM13010) Community of Practice' with 50 members. It features a post by Emma Blackburn about safety and a poll titled 'Creating the APQP Project Plan' with 41% of members selecting 'Cross functional team working'. The right page is for the 'AESQ APQP & PPAP (RM13145) Community of Practice' with 191 members. It features a post by Karl Evans about a webinar and a poll with the same 41% result for 'Cross functional team working'.

“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
- Watch the “Zero Defects” Video



SUMMARY & CLOSE



BARBARA NEGROE
EXECUTIVE SOURCING QUALITY LEADER
GE AVIATION

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

EΥΧΑΡΙΣΤΩ TÄNAN HVALA GRACIAS DZIĘKUJĘ
GRAZIE ありがとう MERCI TACK

THANK YOU DIAKUIU
PALDIES

ACIU TACK DANKE DANK U WEL ДЗЯКУЮ
СПАСИБО 谢谢 OBRIGADO diolch KIITOS
TESEKKUR EDERIM

AESQ Thanks You for Attending!



AESQ – Aerospace Engine Supplier Quality Strategy Group

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