

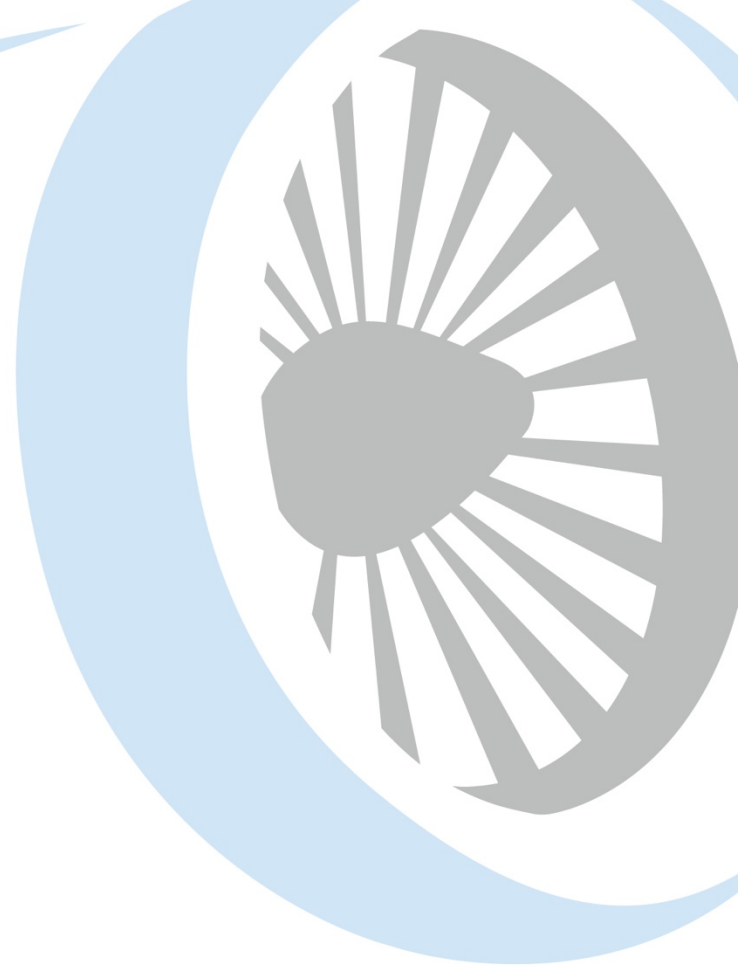


WELCOME

AESQ SUPPLIER FORUM

10 Oct 2018

Tokyo, Japan



LOGISTICS

TETSUYA MIZUTANI
IHI CORPORATION - HOST



WELCOME FROM IHI

HIDEO MORITA

VICE PRESIDENT OF AERO ENGINE,
SPACE & DEFENSE
BUSINESS, IHI



INTRODUCTION TO THE SUPPLIER FORUM

MARTIN SCHAEFFNER

MTU AERO ENGINES AG



Agenda

- 8:15 Welcome to IHI and AESQ – Tetsuya Mizutani, IHI & Hideo Morito, IHI
- 8:30 Introduction to the Supplier Forum – Martin Schaeffner, MTU
- 8:45 Introduction to AESQ - Martin Schaeffner, MTU
- 9:05 Voice of the Customer – Toshihiko Noguchi, ANA
- 9:45 Supplier Survey Results - Olivier Castets, Safran
- 10:00 Break**
- 10:30 Published Standards (facilitated session)- Barrie Hicklin, Honeywell
- 10:35 Overview of AESQ Standards - Olivier Castets, Safran, Helen Djäknegren, GKN
- 10:45 AS13000 Problem solving – Olivier Castets, Safran
- 10:50 AS13000 Feedback – Barrie Hicklin, Honeywell
- 11:05 AS13001 Delegated product release verification training – Earl Capozzi, P&W
- 11:10 AS13001 Feedback – Barrie Hicklin, Honeywell
- 11:25 AS13002 Inspection frequency – Erika Grimm, GE
- 11:30 AS13002 Feedback – Barrie Hicklin, Honeywell
- 11:45 AS13003 Measurement System Analysis – Ian Riggs, Rolls-Royce
- 11:50 AS13003 Feedback – Barrie Hicklin, Honeywell

12:00 Lunch

Agenda

- 1:00 AS13004 PFMEA & Control Plans – Ian Riggs, Rolls-Royce
- 1:05 AS13004 Feedback– Barrie Hicklin, Honeywell
- 1:20 AS13006 Process Control methods – Peter Amsden
- 1:25 AS13006 Feedback – Barrie Hicklin, Honeywell
- 1:45 Benefits of AS13001 DPRV Training Requirements - Catherine Catarina-Graça, Safran
- 2:05 Benefits of AS13004 PFMEA & Control Plans incl. Voice of Supplier - Ian Riggs, Rolls-Royce and Zhu Hong Lei, SAM Suzhou
- 2:55 Break**
- 3:10 Benefits of AS13003 MSA - Martin Schaeffner, MTU
- 3:30 Future Initiatives – Dan Eigenbrode, Pratt & Whitney
- 3:40 AS13005 Quality Audit Requirements – Helen Djäknegren, GKN
- 3:50 AS13007 Supplier Management – Barbara Negroe, GE
- 3:55 AS13005 & AS13007 feedback - Barrie Hicklin, Honeywell
- 4:10 Closing remarks – Tetsuya Mizutani, IHI and Martin Schaeffner, MTU

Introduce Yourself



1. Take the Attendee Name Sheet from your table
2. Introduce yourself to as many people as possible in 5 minutes
3. Share your name, position, company and how far you have travelled to be here today
4. By the time you go home today we hope you can complete the whole sheet.

Code of Conduct



- No Commercialism
- No discussion of cost, pricing plans, pricing policies, product usage surveys, marketing plans or any related topics
- Presentations must focus on technical issues (not on marketing aspects of products) and relate to or support the development or maintenance of G-22 Committee work
- Be aware of and follow ITAR & EAR rules and regulations governing export control
- Discussions should be open and follow the agenda or other legitimate direction agreed upon by consensus of the committee - avoid unauthorized or 'private' meetings

Code of Conduct



- Respect basic meeting etiquette:
 - Only one person speaking at any given time
 - Attack the issue, not the person
 - Be on time...returning from breaks/lunch
 - Respect all ideas & comments
 - No silent skepticism, be candid
 - Do not dominate discussions
 - Stay focused on the meeting & agenda
- Strive for high-quality standards to benefit all stakeholders
 - users, customers, suppliers and the industry as a whole
- Strive for an open atmosphere that promotes a free-flowing interchange of standards technical information

INTRODUCTION TO THE AESQ

MARTIN SCHAEFFNER
MTU AERO ENGINES AG



Commercial Aviation – A Growth Market



7,100 billion passenger km in 2016

17,000 billion passenger km in 2036

In 2036

4.5%/yr Increase in
Passenger Traffic

2 X active aircraft
worldwide

=



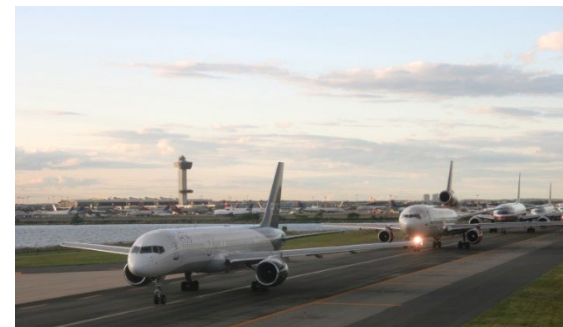
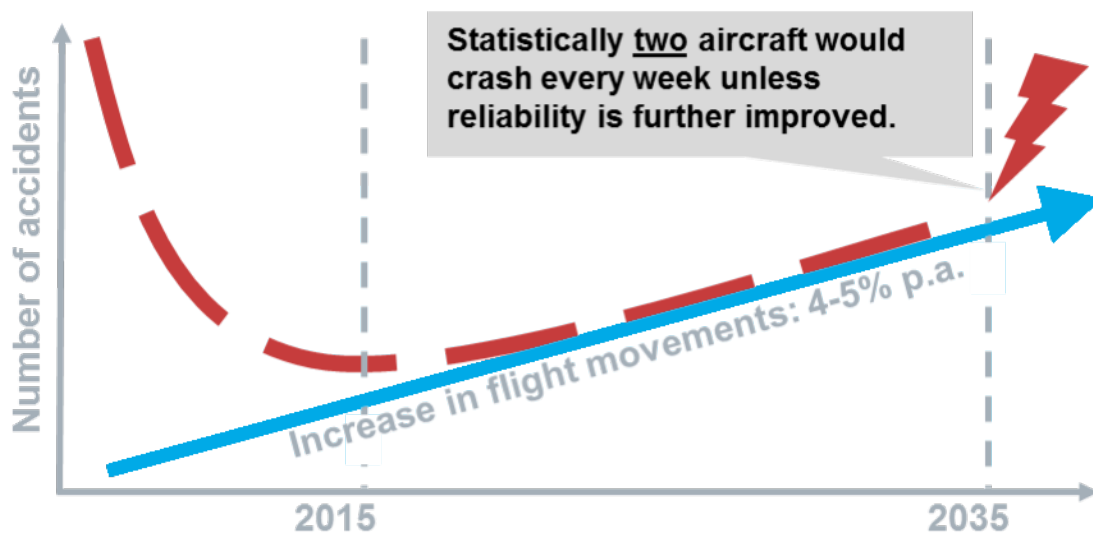
23,000 active aircraft in 2016

45,000 active aircraft in 2036

Quelle: Ascend, IATA, MTU

Aviation Safety

The Quality of our products and services are extremely important
 Quality and continuous improvement are an absolute must!

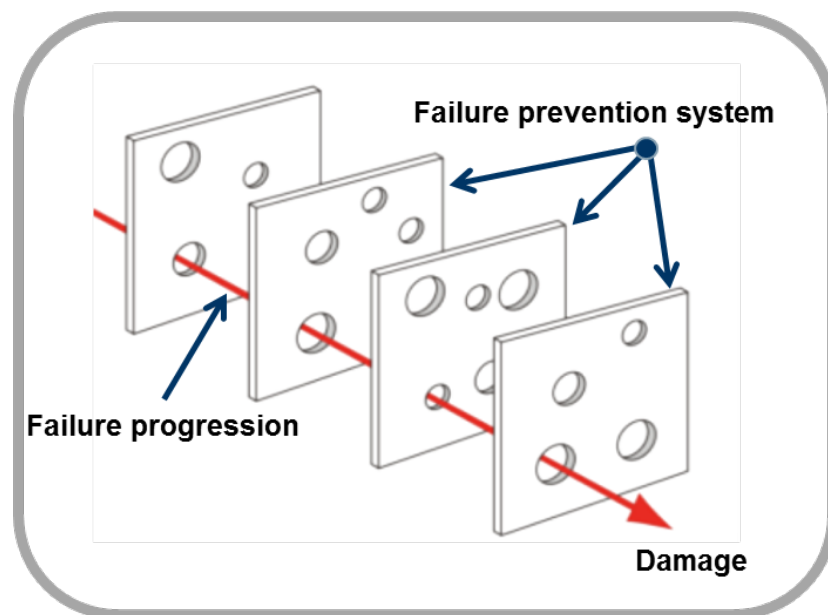


Chain of Events

In many cases, it is not a single malfunction, error or failure that leads to a crash.

It is a **sequence of events** involving

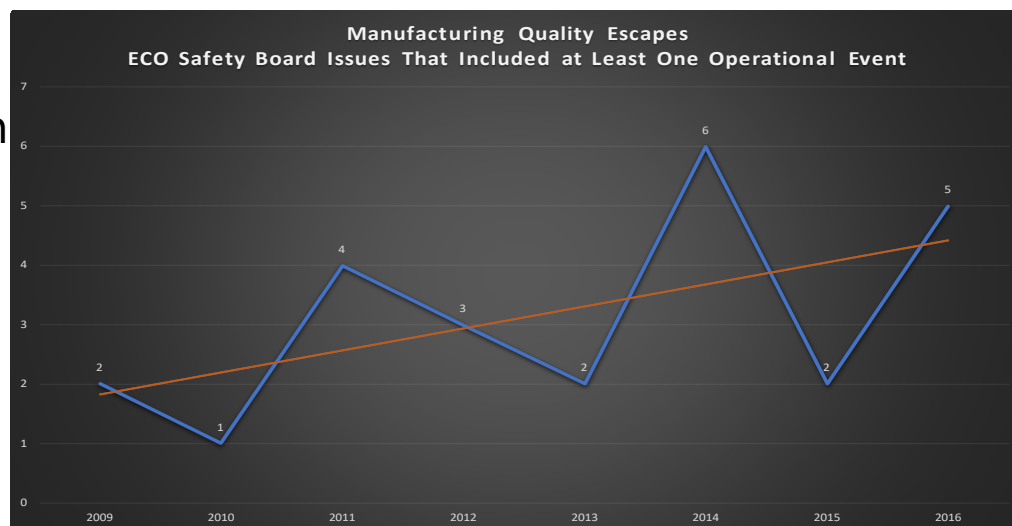
- hidden (latent) failures
- errors of judgment/action
- a failure of the failure prevention systems



Manufacturing Quality Escapes in Turbine Engines

-->An FAA proposal for further investigation and action – January 2018

- The trend of manufacturing quality escape safety board issues that resulted in at least one operational event has been increasing.
- The percentage of total turbofan ADs associated with manufacturing quality escapes has been cyclic since 2004, but 2016 (37%) was the highest percentage in the prior four years, and second only to 2011 (44%).
- The top drivers in turbofan manufacturing quality escape ADs were related to issues with surface finish, incorrect dimensions, and forging (all with 8), followed by incorrect assembly (7).
- Life limited parts (32) made up the vast majority of the turbofan manufacturing quality escape ADs, more than three times the next closest part type.



AESQ Vision

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

AESQ Vision

In detail

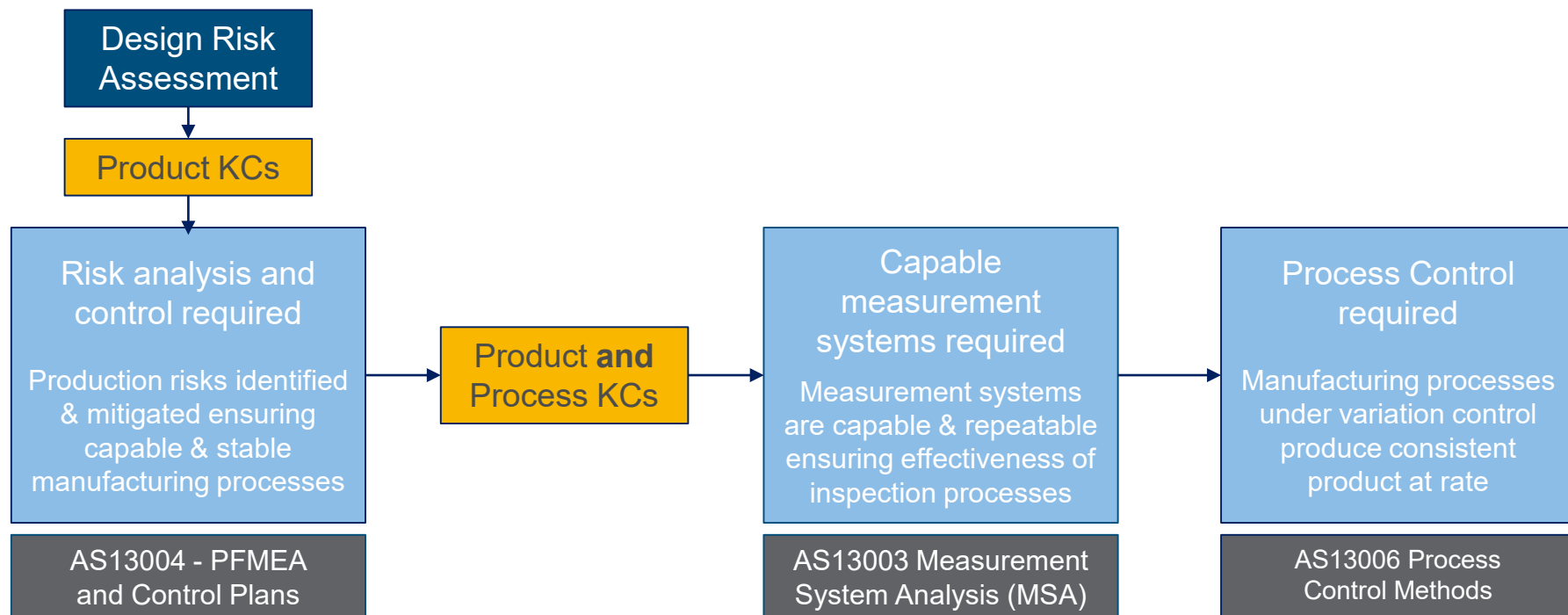
- Create common standards within the engine manufacturers (OEM's) in regard to quality
- Deploy together the written standards throughout our supply chain
- Establish capable quality processes and a culture of continuous improvement

Main targets

- To improve quality within the supply chain
- Improve on time delivery and minimize costs through a reliable quality performance
- Gain efficiency by standardized processes

AESQ Key Quality Elements

→ also aligned to AS9145 APQP & PPAP



Supporting Standards: AS13000 Problem Solving; AS13001 DPRV Training; AS13002 Inspection Frequency; In process → AS13005 Audit; AS13007 Supplier Management

AESQ Will Drive Progress

- AS13000, AS13001, AS13002, AS13003, AS13004 have all been flowed down by all AESQ members and are part of **your** Purchase Order. AS13006 is accepted by all members and will be flowed down shortly. AS13005 and AS13007 will follow soon.



ARCONIC



GE
Aviation



Pratt & Whitney

A United Technologies Company



SAFRAN



Structurals, Inc.



Rolls-Royce

Honeywell



Aero Engines



GKN AEROSPACE

VOICE OF THE CUSTOMER

TOSHIHIKO NOGUCHI, ANA



SUPPLIER SURVEY RESULTS

OLIVIER CASTETS, SAFRAN



Supplier Survey Overview

Collaboration

- Working together to drive quality performance

Feedback

- Provide input on developing standards

Integrated Supply Chain

- Drive efficiency, maximize resources, create synergies

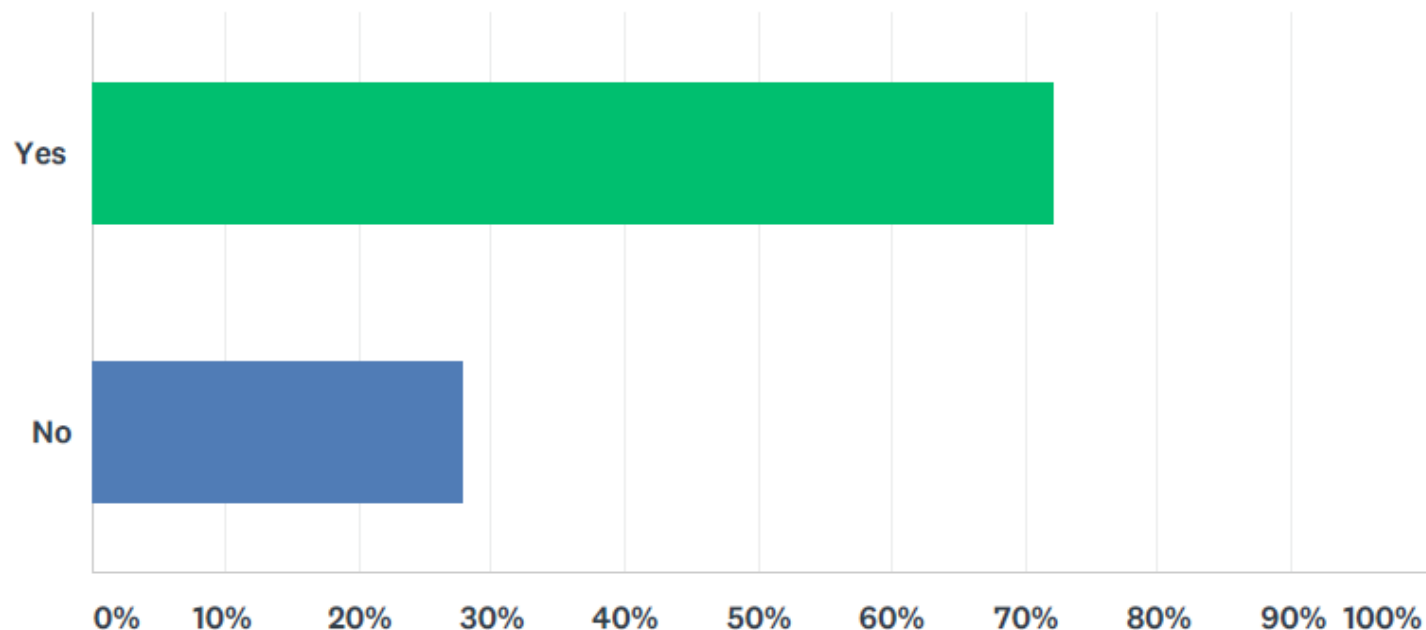
Training

- Coordinated training efforts



Are you Aware of the Published Standards?

Answered: 43 Skipped: 0



We still have some work to do

Which Standards Have You Heard Of?

AS13000 Problem Solving (8D)

AS13001 DPRV Training

AS13002 Inspection Frequency

AS13003 Measurement Systems Analysis

AS13004 PFMEA & Control Plans

AS13005 Quality Audit Requirements

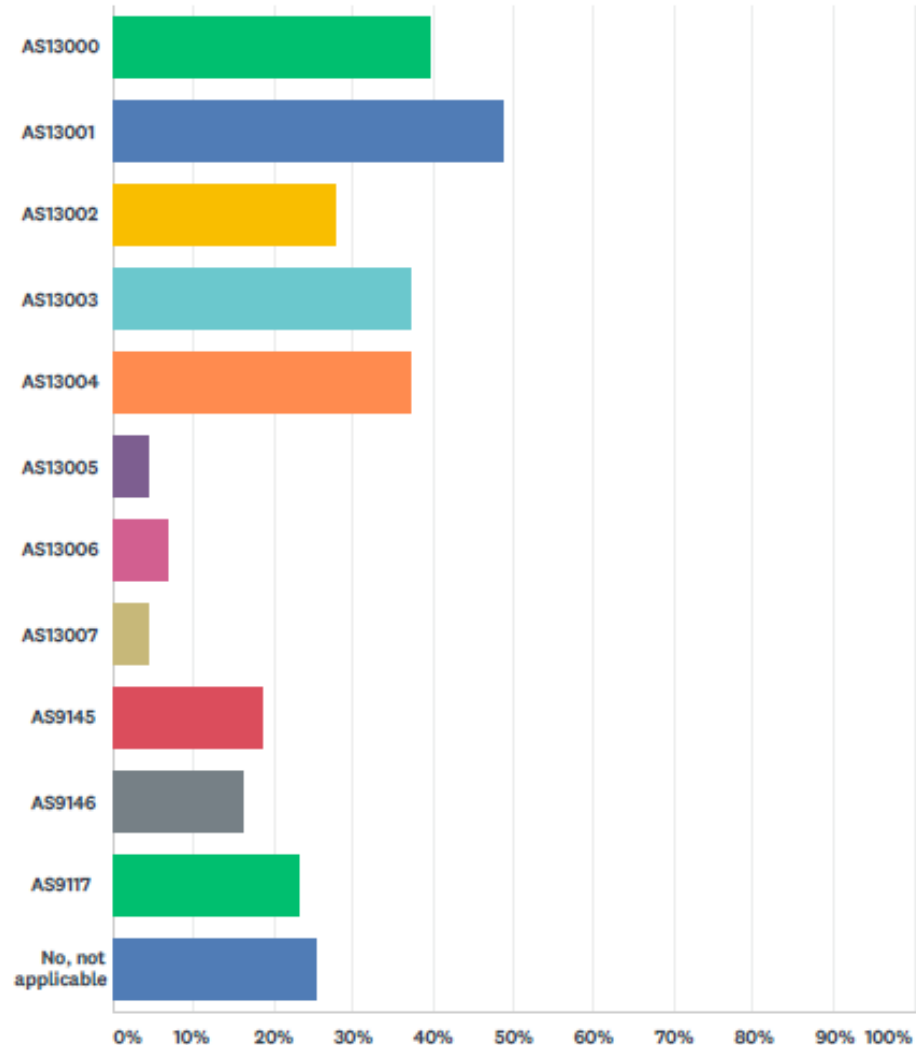
AS13006 Process Control Methods

AS13007 Supplier Management

AS9145 APQP & PPAP

AS9146 FOD prevention

AS9117 Delegated product release verification



Which Standards are in YOUR Contracts?

Answered: 43 Skipped: 0

AS13000 Problem Solving (8D)

AS13001 DPRV Training

AS13002 Inspection Frequency

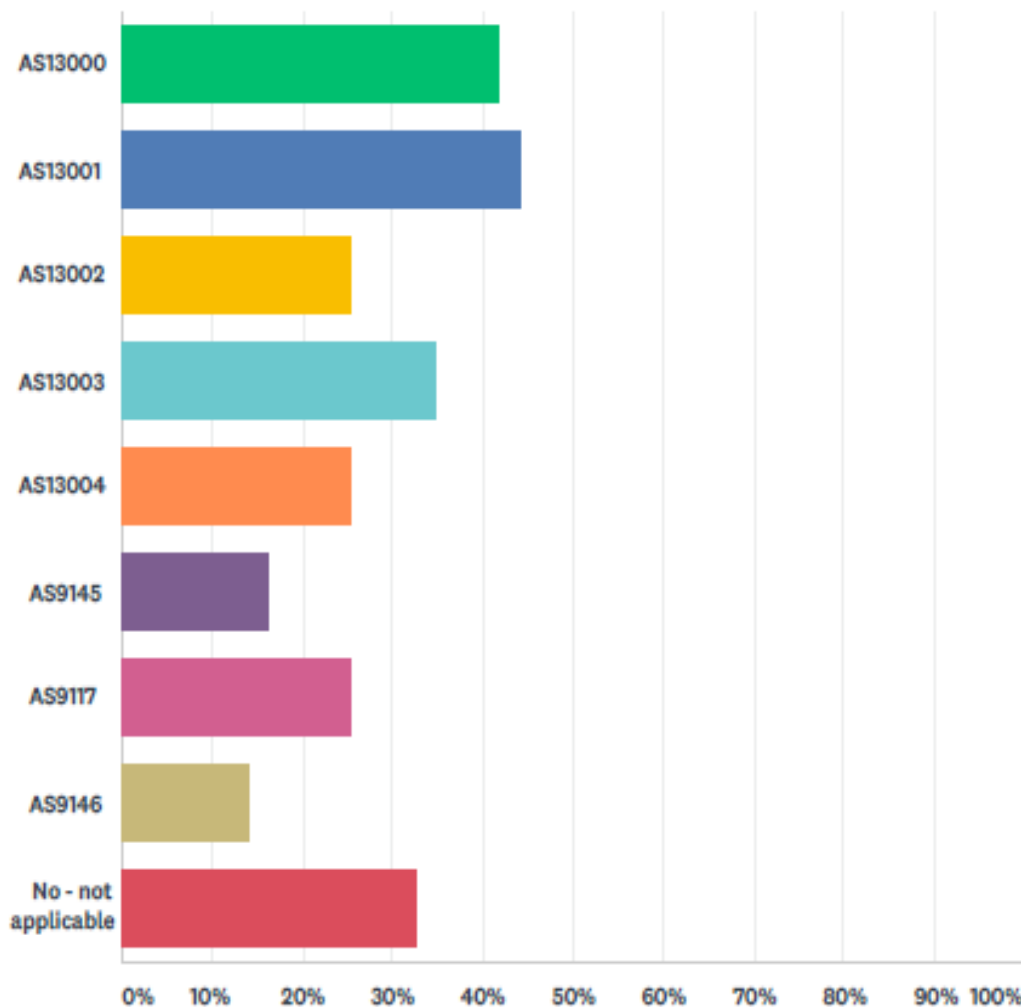
AS13003 Measurement Systems Analysis

AS13004 PFMEA & Control Plans

AS9145 APQP & PPAP

AS9117 DPRV

AS9146 FOD Prevention Program



AESQ STANDARDS OVERVIEW

OLIVIER CASTETS, SAFRAN



HELEN DJÄKNEGREN, GKN





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Search




WHO IS AESQ?

AESQ was founded and formed by major aerospace engine companies to standardize quality requirements across the supply chain.



SUPPLIER FORUMS

The AESQ Supplier Forums are intended to keep stakeholders engaged. Search for a date and location in your area.



NEWS

Find out more about AESQ events and initiatives.

Resources



Supplier Forum



Training



Forms and Examples



Standards

[Supplier Forum Feedback](#)

[Standards Feedback](#)

[General Feedback](#)

AESQ Guiding Principles

- Simplify & Standardize supplier requirements
- Build on existing industry standards
- Common language for Quality
- Standards are simple, prescriptive & auditable
- Promote standardized 3rd party training
- Easy to adopt within existing process/systems



Deliver results rapidly through focused activities

AESQ Standards – Global Deployment



Vision

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

AESQ Standards - Global Deployment Status

	AS13000 Problem Solving Requirements for Suppliers	AS13001 DPRV	AS13002 Developing and Qualifying Alternate Inspection Frequency Plans	AS13003 Measurement Systems Analysis Requirements for	AS13004 Process Failure Mode and Effects Analysis (PFMEA) and Control Plans	AS13006 Process Control Methods
AESQ Member	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted
Arconic (P&P)	May-15	Feb-16	May-17	Mar-16	Aug-17	Sep-18
GE	May-14	Oct-14	Jan-15	Jan-16	Aug-17	Sep-18
GKN	Jun-14	Mar-15	Apr-15	Mar-15	Aug-17	Sep-18
Honeywell	Jan-16	Mar-15	Oct-15	Jan-16	Aug-17	Sep-18
MTU	Aug-15	Jan-16	4Q16	Jan-16	Aug-17	Sep-18
PCC Structurals	Mar-15	Jan-15	May-15	Jun-16	3Q 18	Sep-18
Pratt & Whitney	Jan-15	Mar-15	Apr-15	Mar-15	Aug-17	Sep-18
Rolls-Royce	Dec-14	Oct-15	Jan-15	Jan-15	Aug-17	Sep-18
Safran	Jan-15	Jan-15	Jan-15	Jan-15	Aug-17	Sep-18

Progress Forward



AESQ is now well established and is gathering momentum

Supplier feedback is very positive & they want us to move faster

Broader supplier engagement is being sought to apply more resources

Stronger links with IAQG & PRI are being developed

Stakeholder engagement essential for progress & direction

PUBLISHED STANDARDS

BARRIE HICKLIN, HONEYWELL



Feedback Questions



1. Has the Standard been flowed down by your Customer(s)?
2. Do you have any problems with or suggestions for the Standard?
3. Have you had problems flowing down the Standard to your suppliers?
4. Are there any commodity specific considerations?

AS13000 PROBLEM SOLVING

OLIVIER CASTETS, SAFRAN



AS13000 Problem Solving

Original State



Future State

GLOBAL 8D



AESQ Principles

- ✓ Standardise
- ✓ Simplify
- ✓ Adopts Existing Industry Standards
- ✓ Prescriptive, Auditable
- ✓ Common Language
- ✓ Supported by 3rd Party Training & Consultancy

Expected Benefits

- Reduced need for Customer training & support
- Improved access to training & consultancy
- Removal of complexity of reporting
- Improved problem solving skills



AS13001A DPRV TRAINING

EARL CAPOZZI, PRATT & WHITNEY



AS13001A Delegated Product Release Verification Training

Original State



Future State



- One Common Training Requirement
- Industry-wide DPRV database through SAE
- Delivered globally by SAE
- Refresher training every 3 years

AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards*
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Reduced costs for customers & suppliers
- Reduced training time for DPRV personnel
- Training provided in region of DPRV personnel
- Customer training limited to on-site

* Rev A aligns with AS9117 - DPRV

AS13002 INSPECTION FREQUENCY

ERIKA GRIMM, GE



AS13002 Inspection Frequency

Original State

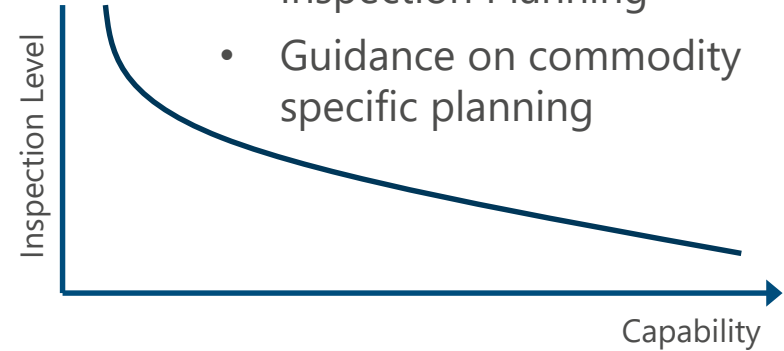
100% Inspection

REDUCED Sample

Error Proof AQL

Future State

100%



AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

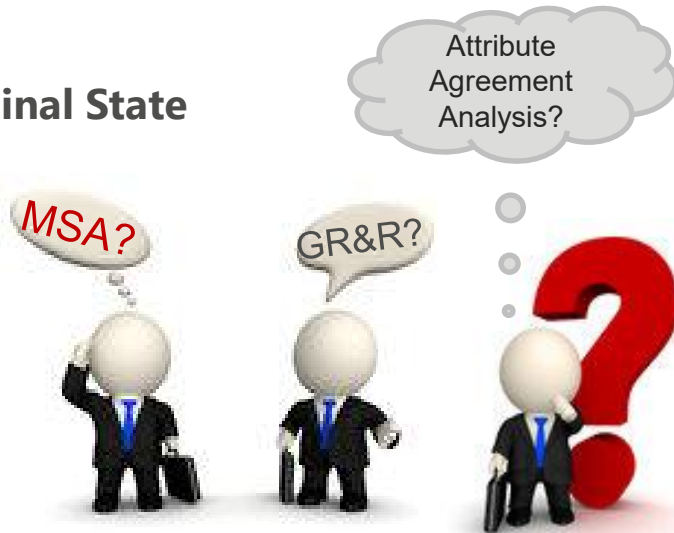
- Standardised Process
- Improved compliance
- Improved Product Quality

AS13003 MSA

DR IAN RIGGS, ROLLS-ROYCE



Original State



Future State

Method	Feature Category			
	Critical	Major	Minor	
Resolution	≤10% of total tolerance ***			Base
Accuracy ratio**	Requirement = 10:1		Requirement = 4:1	Value acce the p
Accuracy Error / Bias	≤10% of total tolerance			Purc overr
Repeatability	≤10% of total tolerance	≤20% of total tolerance	≤30% of total tolerance*	Purc overr
Gauge R&R	≤10% of total tolerance	≤20% of total tolerance	≤30% of total tolerance*	Purc overr

AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Improved knowledge of Measurement Capability
- Clarification of minimum acceptance standards
- Mandates replaces guidance
- Adopts Automotive Industry Action Group 'Blue Book' on MSA
- Improved Quality Performance

AS13004 PFMEA & CONTROL PLANS

DR IAN RIGGS, ROLLS-ROYCE



AS13004 PFMEA & Control Plans

Original State



Varying standards and approaches

Future State



In Scope: Risk Mitigation requirements with execution guidance & recommended timing, supporting AS9145

Out of Scope: DFMEA requirements, any duplication of related Aerospace Standards (e.g. AS9145)

AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Standardised process
- Increased pace of adoption
- Improved compliance to a better standard
- Reduced quality risks
- Ultimately improved quality & delivery

AS13006 PROCESS CONTROL METHODS

PETER AMSDEN,
PRATT & WHITNEY



Original State



Varying standards & approaches

PC requirements not clearly defined/understood
Inconsistent application/flowdown to sub-tiers
Lack of commitment/belief in benefits
Belief low volume environments not applicable

Future State

Common standard & approach
Aligned with AS13002, 13003, 13004, AS9103, AS9145 & AIAG "Blue Books"



In scope: Process Control for all characteristics
Out of scope: Foundational requirements

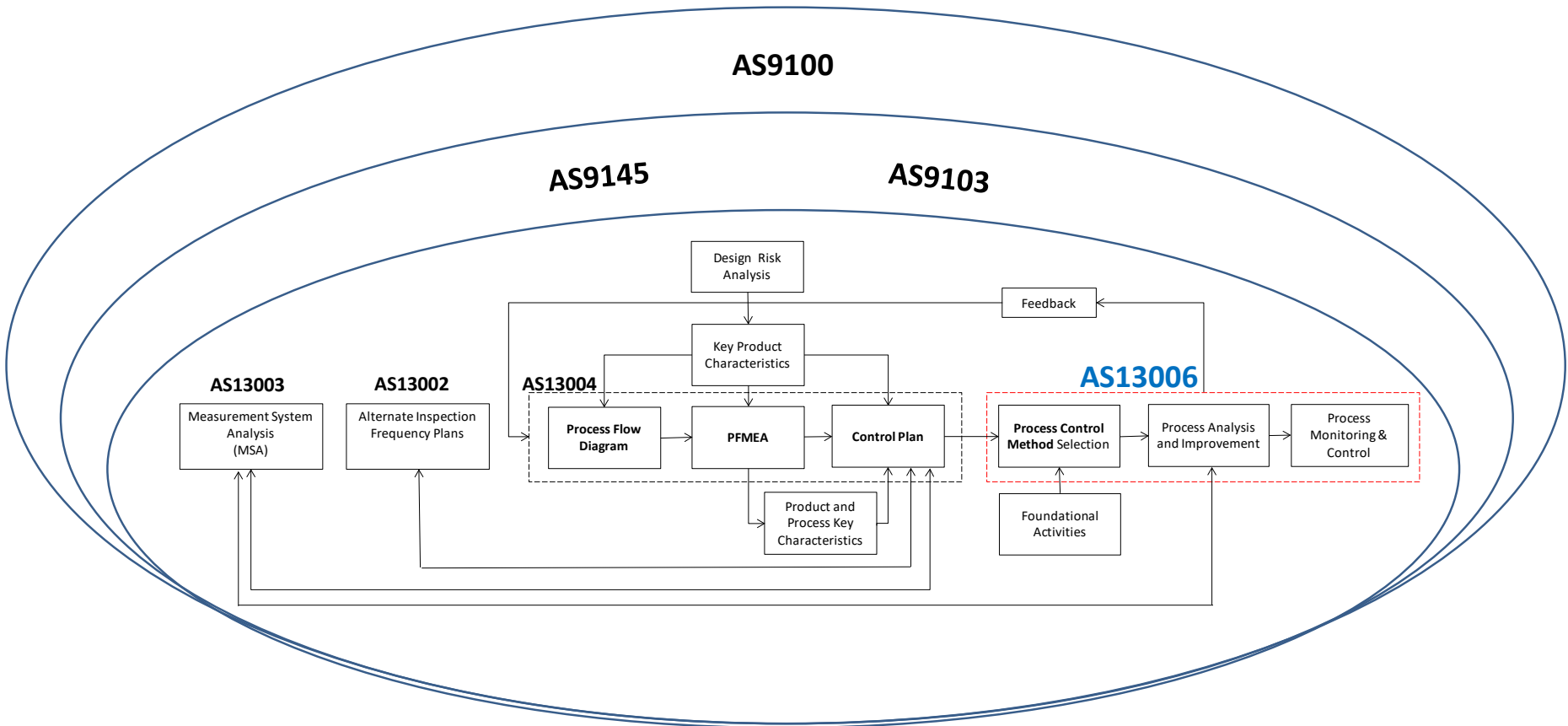
AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- 3rd Party Training & Consultancy

Expected Benefits

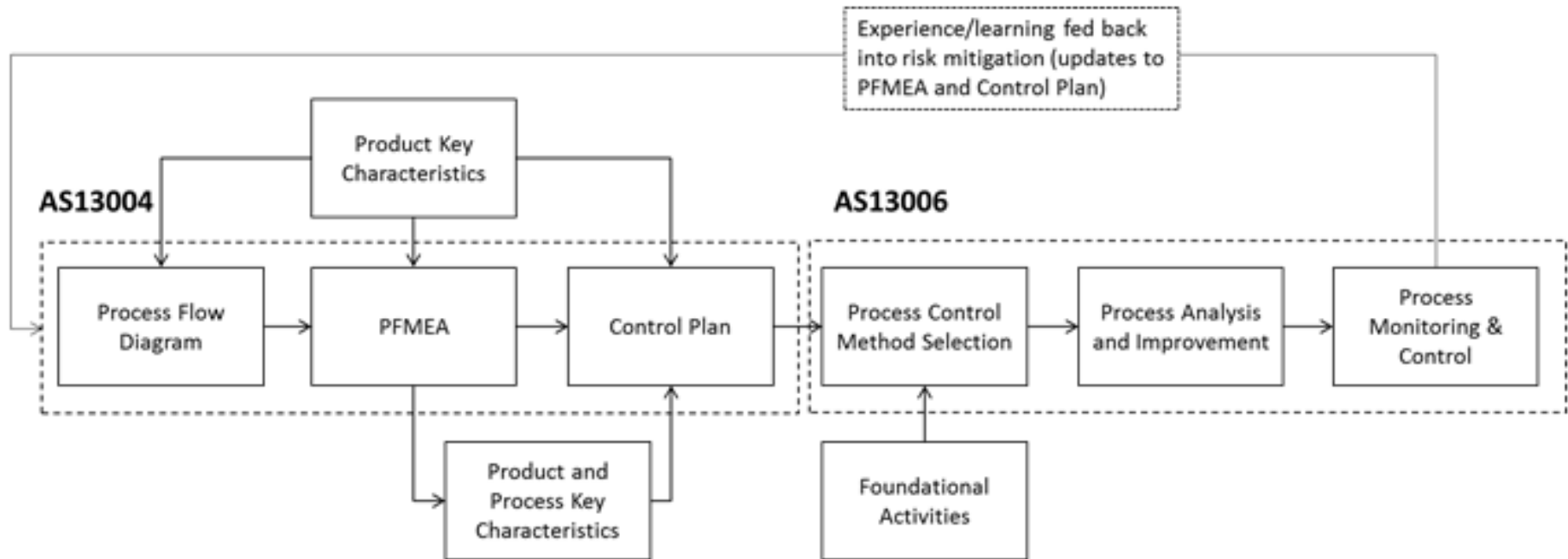
- Improved variation control & reduction techniques, broad-based belief in benefits
- Common prescriptive standard fully aligned with AESQ, AS9103 & AIAG Blue Book Stds
- Focus on accurate data analysis and proactive problem resolution
- Improved Quality Performance, reduced risk

Relationships to other industry standards



AS13006 designed to align and work closely with other industry standards

AS13004 & AS13006 Standard Relationships



Related Standards

AS13000: Problem Solving Requirements (8D)

AS13002: Developing & Qualifying Alternative Inspection Frequency Plans

AS13003: Measurement Systems Analysis Requirements

AS9103: Variation Management of Key Characteristics

AS9145: Advanced Product Quality Planning & Production Part Approval Process

BENEFITS OF THE STANDARDS & SUPPLIER CONTRIBUTIONS TO AESQ

AS13001 DPRV TRAINING

REDUCING NON QUALITY EVENTS BY DEPLOYING DPRV AT
SAFRAN SUPPLIER FACILITIES

CATHERINE CATARINA-GRACA,
SAFRAN



3
MONTHS

1
MONTH

DPRV Certification following AS9117 DPRV & AS13001



PROCESS TO BECOME A DPRV
2017 Update

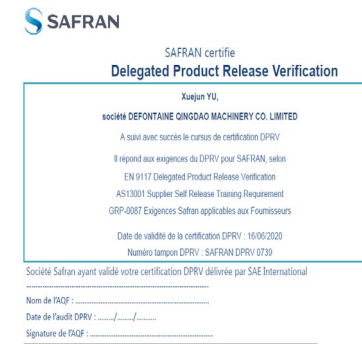


Setting up the function



On site audit
By Safran QE

Granting the SAFRAN DPRV stamp
And the SAFRAN certificate if the
audit is conclusive





1 Check the **documentation**.
(Mainly consistency between the routing sheet and the delivery documents)

2A Perform a **physical check**.
(Marking, visual, ...)

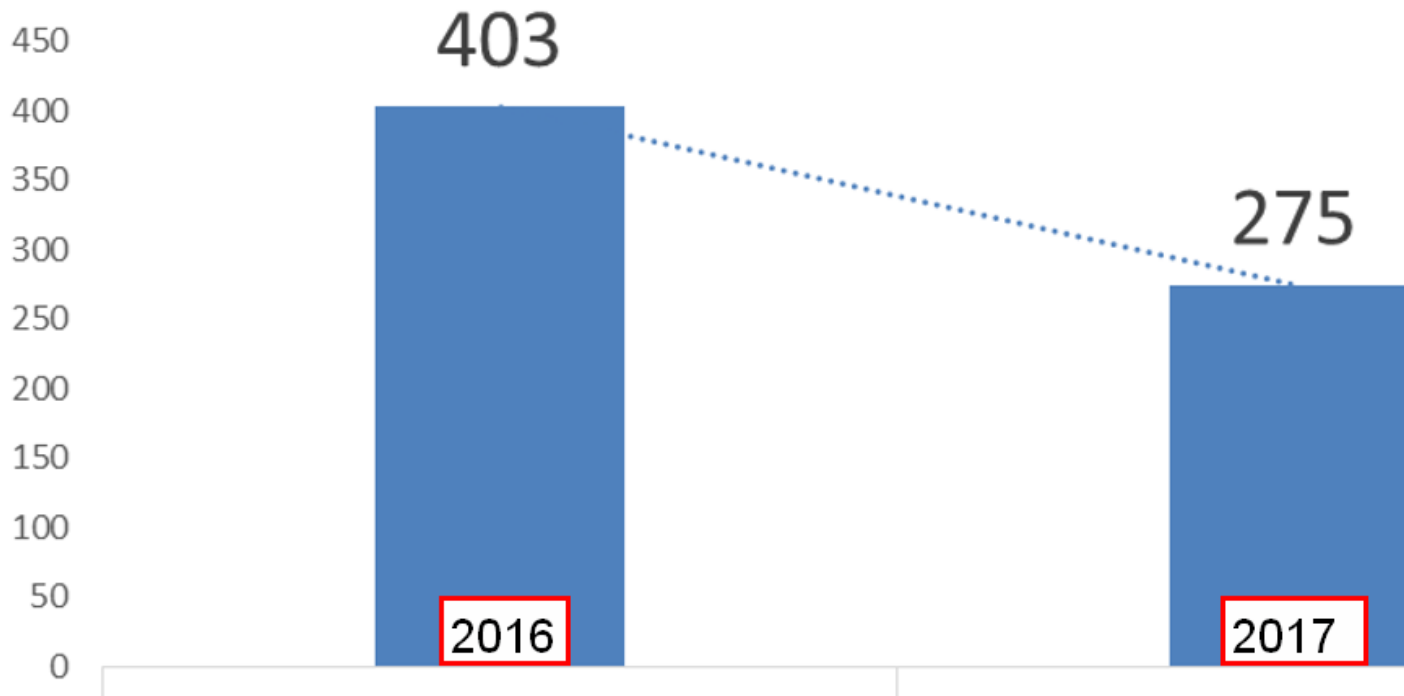
2B Check the consistency between **the packaging and labeling with the specifications** of the item ordered by Safran.

3 Record monitoring in the DPRV **log**.

On Safran Aircraft Engines Quality ERP Check over more than 1000 claims

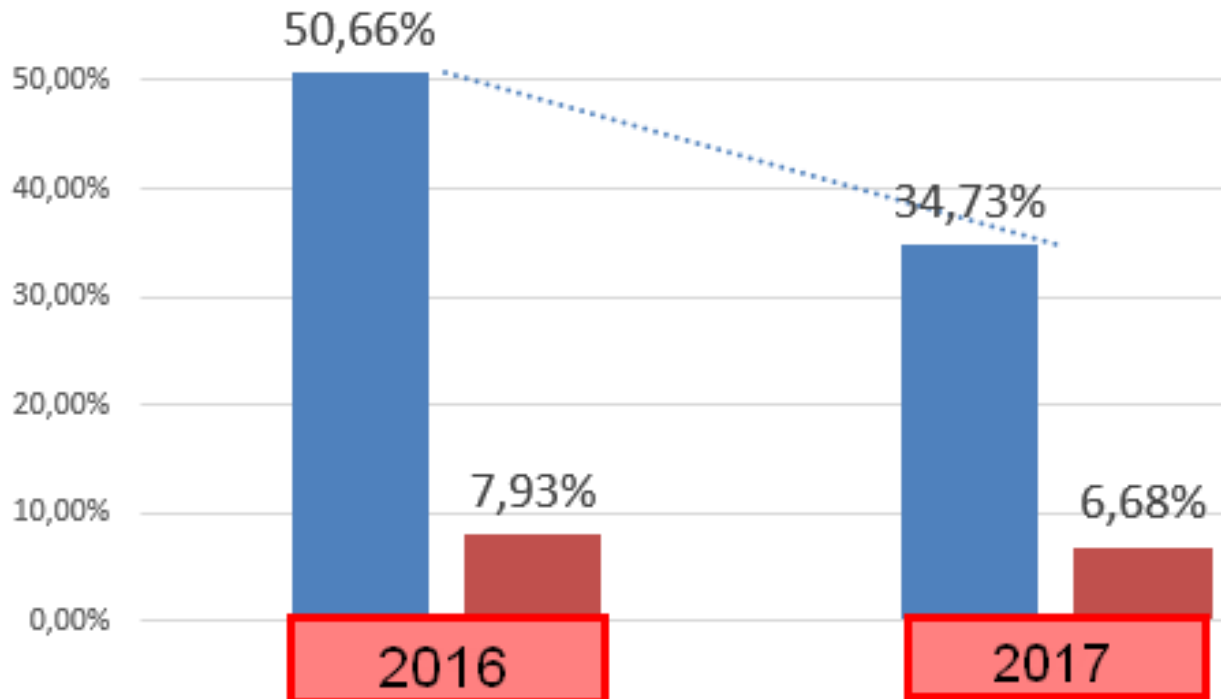
FAULT 	DEFINITION 
C00	CONDITIONING PACKAGING
P00	DOCUMENTATION
T00	MARKING / IDENTIFICATION / TRACEABILITY / MANAGEMENT (GENERIC)
V00	APPEARANCE / VISUAL / FINISH (GENERIC)

Safran Aircraft Engines Claims : DPRV Deployed



Diminishing despite the LEAP ramp up

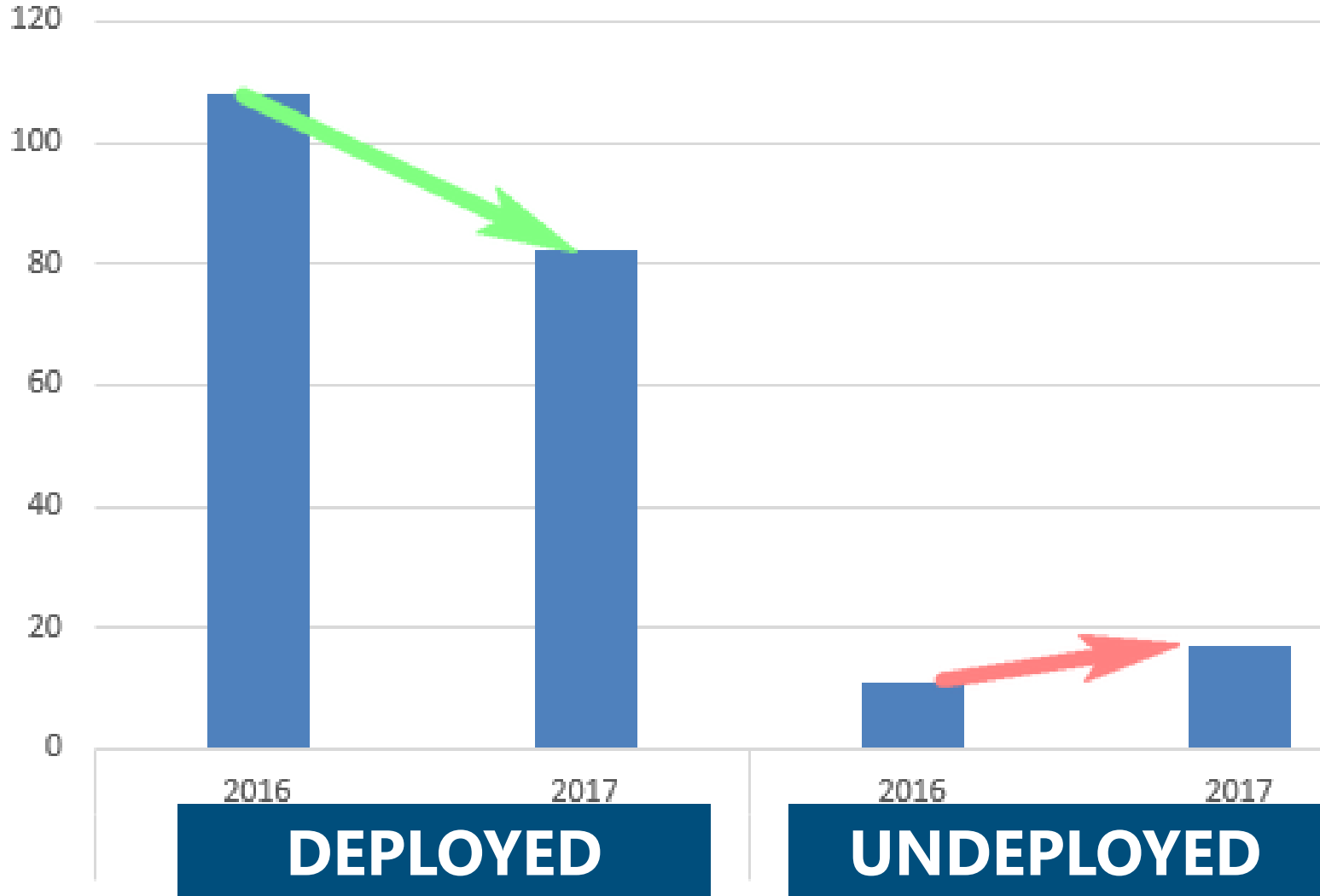
Comparing deployed and non deployed sites



83% of DPRV deployed sites

17% of DPRV undeployed sites

WHAT ABOUT MARKING EVENTS ?



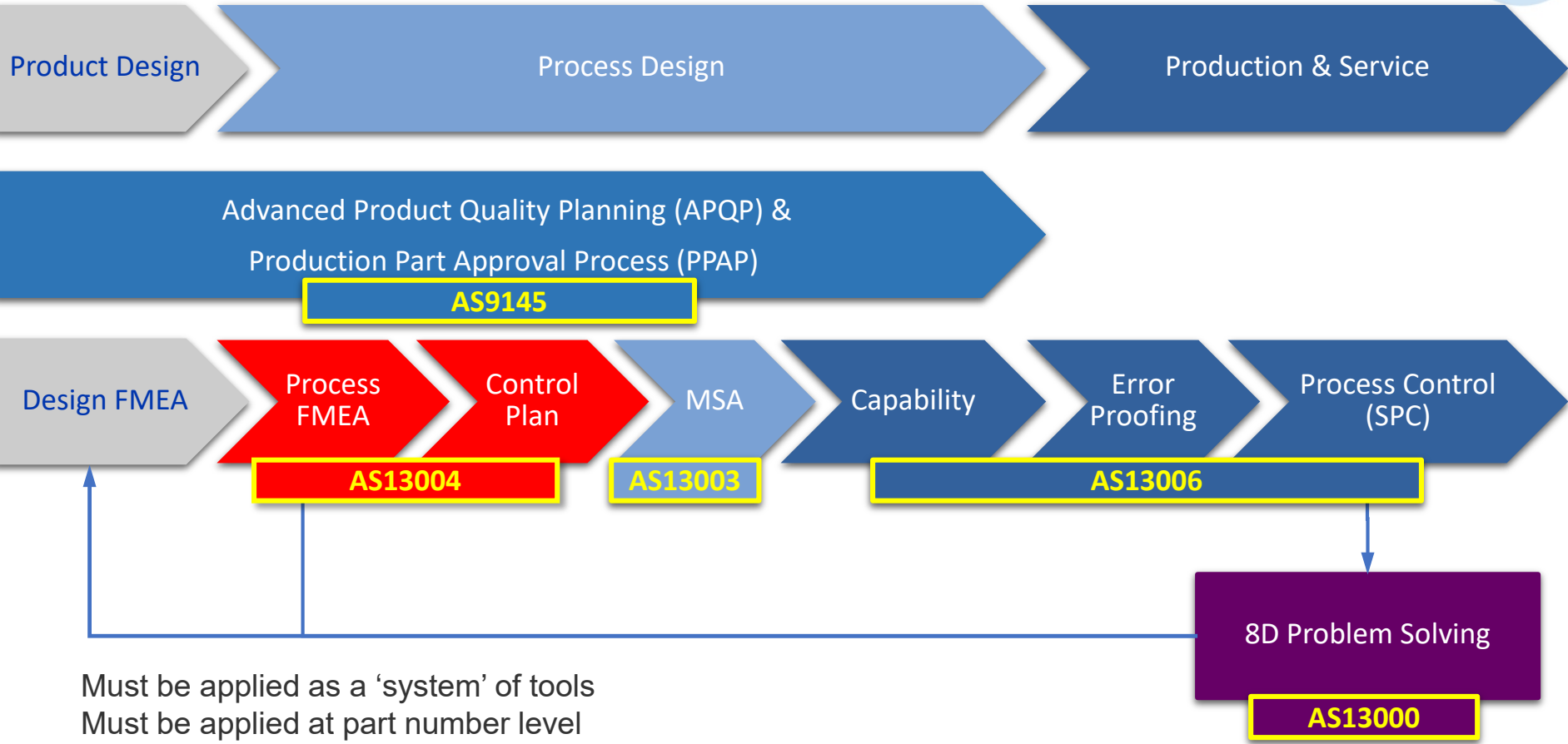
- Communicating on metrics : going ahead with DPRV Deployment
- Specific improvement action plan on « top 10 » SAFRAN impacting suppliers
- Raising awareness on SAFRAN and Safran Aircraft Engines requirements for DPRV managers (8 workshops worldwide) focused on SAFRAN & AESQ standards
- SAFRAN and Safran Aircraft Engines Communication kit are updated twice a year
- Promote Benefits of DPRVs as 9 SAFRAN companies are going live

BENEFITS OF AS13004 – PFMEA & CONTROL PLANS

DR IAN RIGGS,
ROLLS-ROYCE



Core Product Defect Prevention Tools



Must be applied as a 'system' of tools
 Must be applied at part number level
 Effectiveness relies on Cross Functional working

Defect Prevention Key Quality Tools for Zero Defects

Rolls-Royce



“ Strive for perfection in everything. Accept nothing ‘nearly right’ or ‘good enough’ ”

TRUSTED TO DELIVER EXCELLENCE



Inspection is never 100% effective

We must focus on defect prevention



Advanced Quality Planning & Process Control



PRODUCT DESIGN

1
2
3

CUSTOMER MEETING

DESIGN TO REQUIREMENTS

DESIGN FAILURE MODE & EFFECTS ANALYSIS

POTENTIAL DESIGN RISKS

IDENTIFIED, UNDERSTOOD

& MITIGATED

Design meets customer requirements

PROCESS FAILURE MODE & EFFECTS ANALYSIS

PROCESS DESIGN

RISKS IDENTIFIED, UNDERSTOOD

& MITIGATED

Process can make defect free parts

CONTROL PLAN

HIGH RISK

MISTAKE PROOFING

SPC

INSPECTION & TARGET SETTING

AUDIT

LOW RISK

MANUFACTURING CONTROLS

INSPECTION CAPABILITY

Variable gauge repeatability & reproducibility

ATTRIBUTE AGREEMENT ANALYSIS

Accurate and reliable inspection

INITIAL PROCESS CAPABILITY

Process Capability CPK

PROCESS CONTROL

DATA FROM PROCESSES & INSPECTION

MAINTAIN

& IMPROVE

PROCESS CAPABILITY

IMPROVES & MANAGES THE PROCESS

Process must be on target with minimum variation



8D PROBLEM SOLVING



Rolls-Royce



“ Accept nothing ‘nearly right’ or ‘good enough’ ”



jointheMovement



Rolls-Royce

AS13004 Process FMEA & Control Plan



What's New

1. A Process FMEA for **every** part number
2. A Process FMEA that covers **all** Process Steps (those that transform the product)
3. A Process FMEA that covers **all** design features / characteristics*
4. Failure Modes that describe how the PRODUCT can fail to meet Design Intent
5. A Control Plan for **every** part Number

* Rolls-Royce Deployment Requirement

AS13004 Process FMEA & Control Plan



DON'T PANIC!

It is an achievable task, thanks to ;

Computer Software e.g. xFMEA,
DataLyzer, etc.

The use of Reference PFMEAs (see later)

Being part of a Large Network – sharing
lessons learnt



SAM SUZHOU CASE STUDY

Deploying AS13004 to Achieve Zero Defects



Honglei Zhu
Production Manager
SAM (Suzhou) Co. Ltd.

Agenda



Introduction of SAM Group and SAM Suzhou

Zero Defect and PFMEA (AS13004)

RFT improvement

Benefits

Lessons learnt

SAM Suzhou Profile



SAM is a subsidiary of Accuron Technologies and headquartered in Singapore. With nearly 2,000 employees across Asia and Europe servicing the precision and equipment markets, we are equipped with the design and cutting edge manufacturing capabilities to service leading global companies.

Our precision business segment focuses primarily on niche products such as engine mounts, airfoils, engine cases and structural parts. Our equipment business segment is vertically integrated to offer unique engineering solutions from collaborative design and development, to finished equipment assembly.

As an AS9100 certified company, our quality system conforms to the quality requirements of major companies in the aerospace and industrial industries. Our products are supplied from our facilities in China, Germany, Malaysia, Singapore and Thailand to customers world-wide.

Geographical Presence

Sitec Aerospace
Germany – *Bad Tölz* /



SAM Suzhou
China / *Suzhou*

**Headquartered in
Singapore**

Staff Strength

China	410
Europe	264
Malaysia	1027
Singapore	259
Thailand	50

Total **2,010**



SAM Aviatron

Meerket Precision

SAM Precision

Malaysia – *Penang*

SAM Aviatron
Singapore



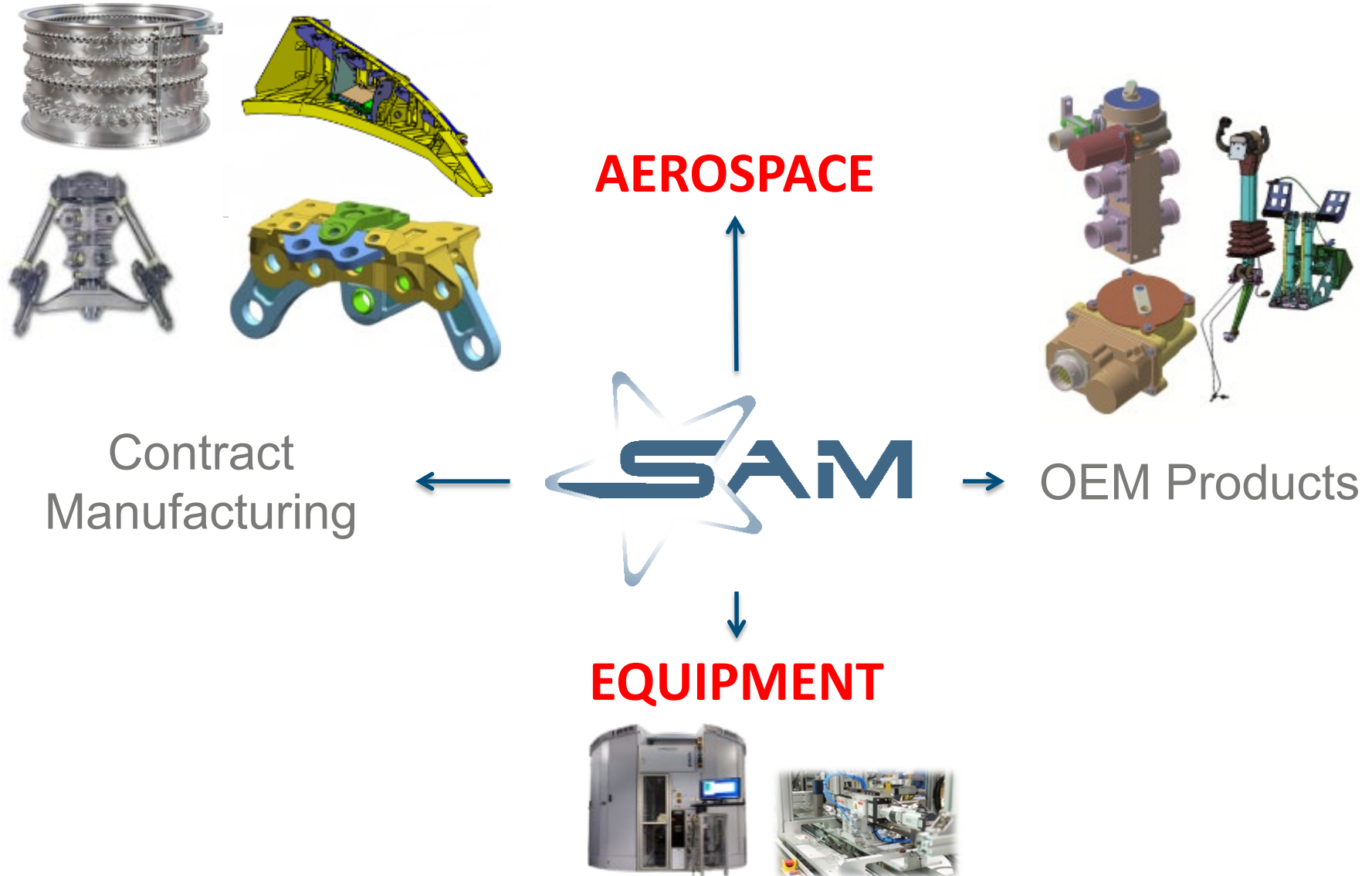
(non-Aerospace)

**Thailand –
Ayuttaya**

AESQ – Aerospace Engine Supplier Quality Strategy Group

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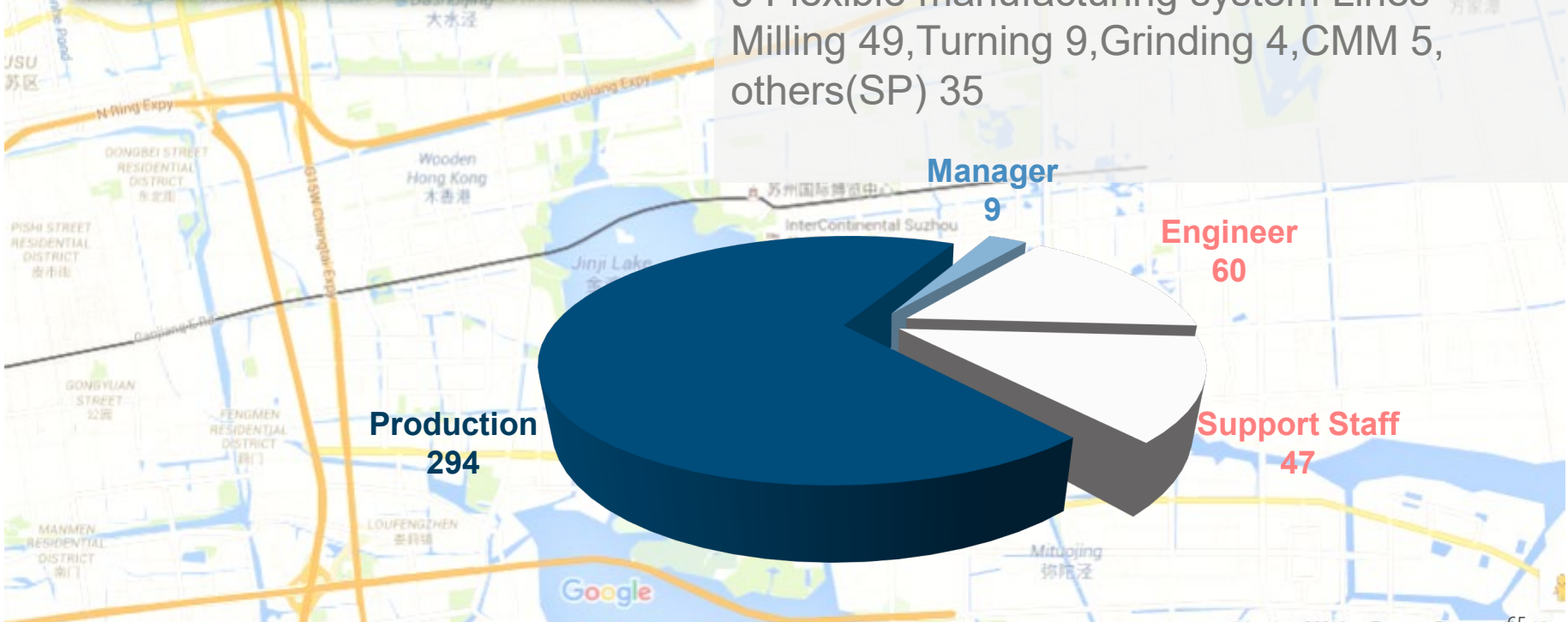
SAM Suzhou Business



SAM Suzhou



- Geographical Location: Suzhou, China, 2 hours to Shanghai
- Incorporated in 1995, 2004 relocated in EPZ
- Factory Size: 150,000 sq ft
- Land Size: 250,000 sq ft
- Location: Export Processing Zone, SIP
- Manpower: 410
- Machine capabilities:
5 Flexible manufacturing system Lines
Milling 49, Turning 9, Grinding 4, CMM 5, others(SP) 35

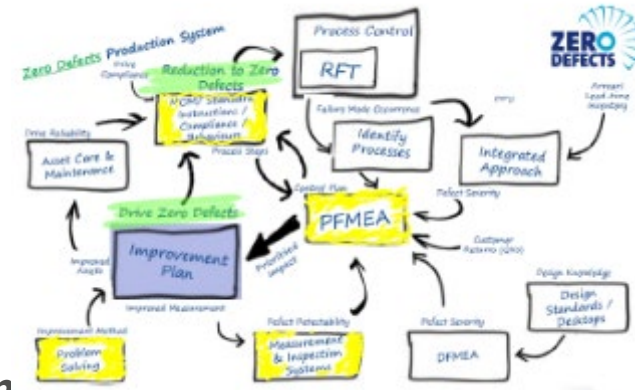


Drive For Zero Defects

In Dec, 2016
SAM was Invited to join the movement

Working Together...

to deliver a competitive supply chain



DRIVE FOR ZERO DEFECT

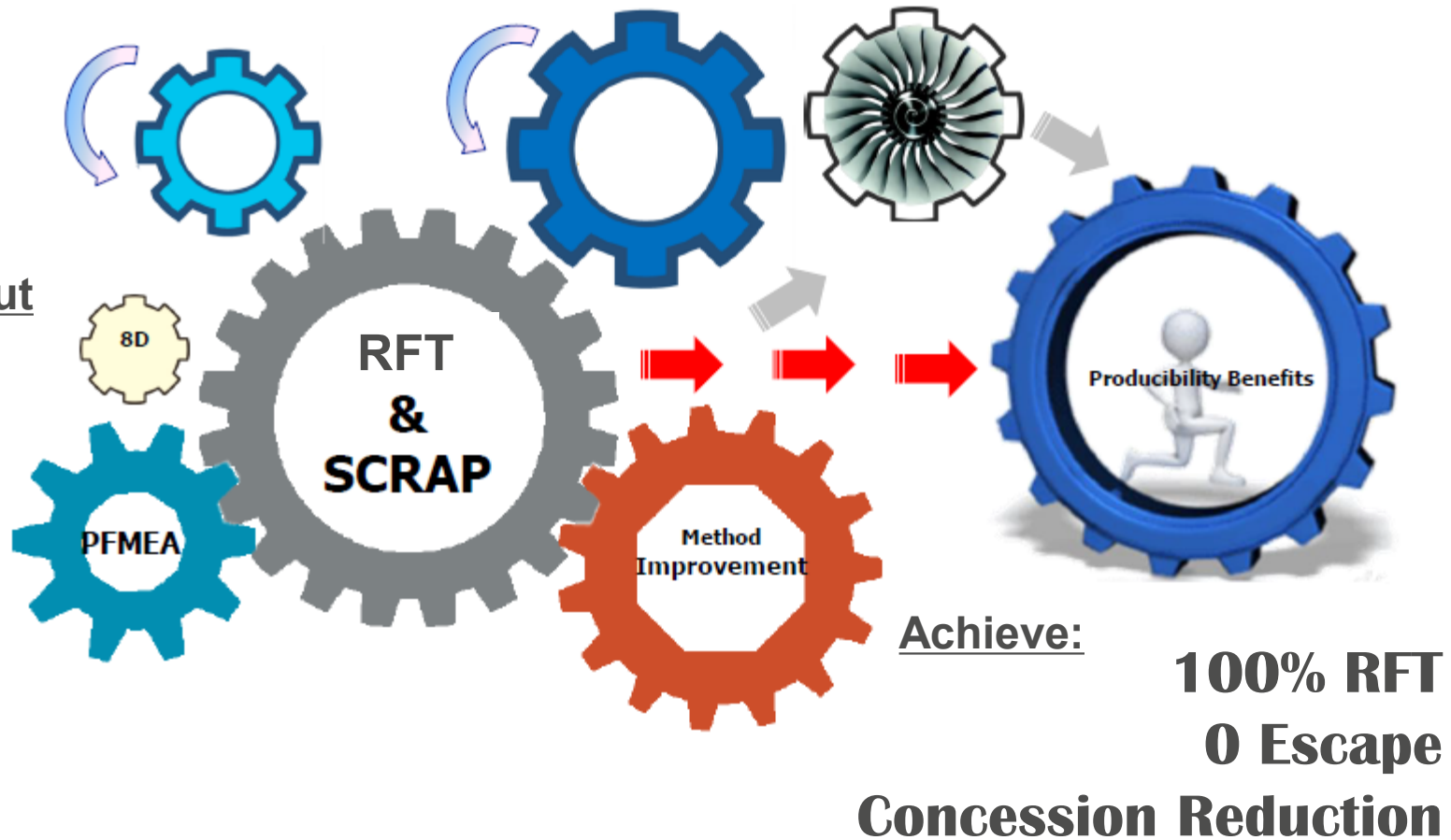
Join the
movement



DfZD Work Stream PFMEA using AS13004

Error Proofing
Awareness
Training
...

PFMEA output



PFMEA Drives RFT& Scrap reduction & Productivity Improvement



By end of September, 2017
PFMEA completed
Part Number:
KH41762 (11)
KH17503 (12) ✓

By end of October, 2017
PFMEA completed
Part Number:
KH34690 (13)
KH28378 (14) ✓

By end of December, 2017
PFMEA completed
Part Number:
KH63599 (15)
KH34693 (16) ✓

By end of June, 2017
PFMEA completed
Part Number:
KH28382 (5)
KH34695 (6) ✓

By end of August, 2017
PFMEA completed
Part Number:
KH28379 (9)
KH11711 (10)

31st July, 2017
“Zero Defect” part
(KH17504) delivery
kick off event

By end of July, 2017
PFMEA completed
Part Number:
KH28383 (7)
KH17500 (8) ✓



On 7th – 10th March, 2017
PFMEA workshop @ SAM
Facilitator: T.Slater / R.Kelsey ✓

In Dec, 2016
Invited to
join the movement ✓



On 5th April, 2017
High Level PFMEA Training
at Rolls Royce Singapore
Facility ✓

On 6th April, 2017
AESQ Forum
PFMEA AS13004
In Singapore ✓

On 20th April, 2017
Team Celebrated
1st Feature PFMEA completed
Part Number:
KH17504 (1) ✓

By end of May, 2017
PFMEA completed
Part Number:
KH41760 (2)
KH28381 (3)
KH17496 (4) ✓

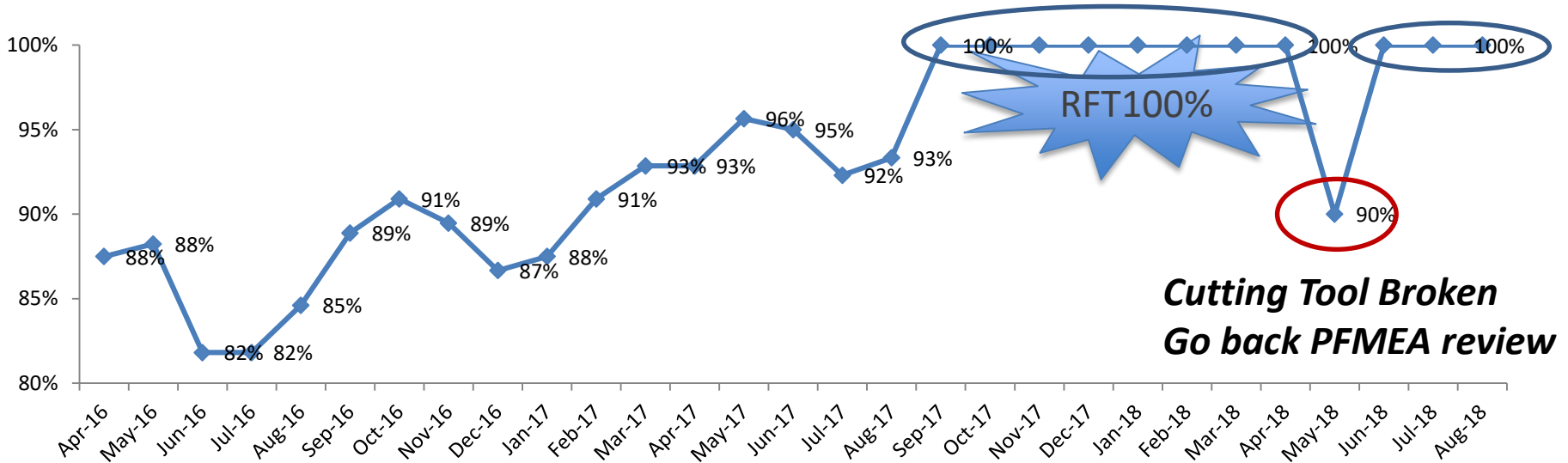
Working Together

PFMEA Roadmap to XWB Engine Mounts

RFT improvement case study

RFT Tracking for p/n: KH17504

1. ZD delivery part kick off event end of Jul, 2017;
2. Achieve the 100% RFT by end of Q3, 2017;
3. Achieved 100% RFT in Sep 17 – Apr 18 (7 months) & Jun 18 – Aug 18 (3 months)



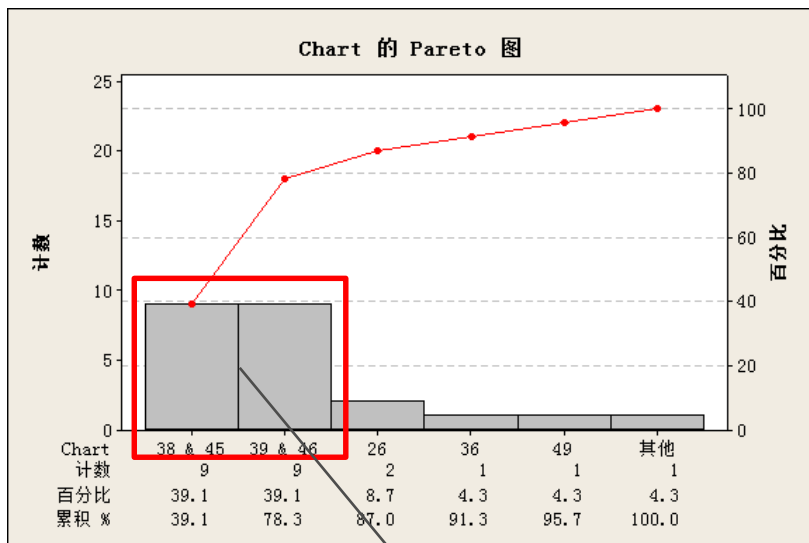
**Cutting Tool Broken
Go back PFMEA review**

Recommend Actions:

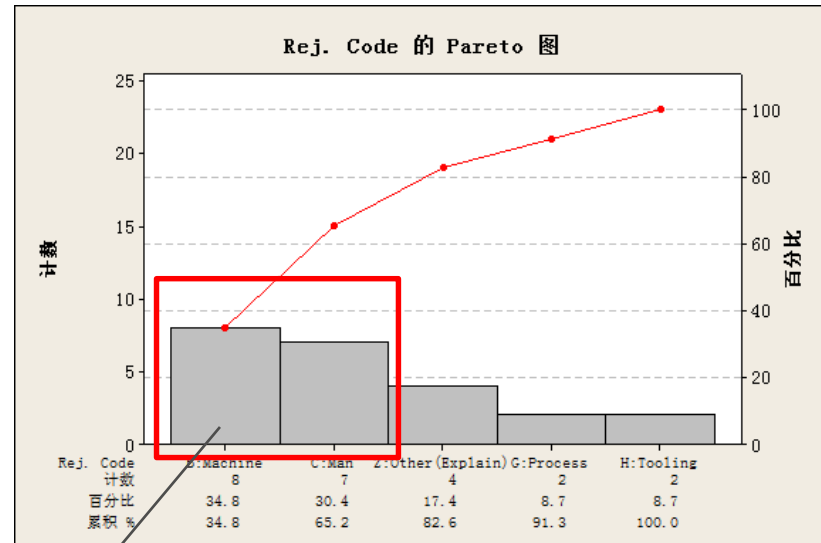
1. Change cutting method to Reaming;
2. Move to H M/C (with RFID, less human touch, close door machining);
3. Enhance 5S management; Handling Trolley Improvement Project;
4. Enhance Supplier Engagement;
5. Case study for cutting tools improvement;

Lessons learnt from AS13004

P/N: KH17504 Pareto Chart by NON-Conforming Chart



P/N: KH17504 Pareto Chart by Rejection Code



The cause of non-conformance effect are the input of PFMEA.

Requirements	Potential Failure Mode	Potential Effect(s) of	Potential Cause
CCF @ 37.0215	0.0125	0.0125	Above top limit
			wrong tooling
			wrong N/C programme
			N/C program error
			wrong tool setting

➔ Action & Action Result

Lessons learnt from AS13004

Process Failure Mode and Effects Analysis (PFMEA)																								
Production - SAM Suzhou							Key Contact / Phone			Date (Orig.)		2017/3/9		Date (Rev.)		2018/4/19								
Part Number				KH17504			Core Team			Customer Approval Date														
Drg Sheet (A2)	Feature Num (A3)	Operation	Step	Process Function/Description	Requirements			Potential Failure Mode	Potential Effect(s) of Failure	Severity	Classification	Potential Cause(s) of Failure	Prevention Controls	Occurrence	Detection Controls	Detection	RPN	Recommended Action	Responsibility & Target Completion Date	Action Results				
					Dim (B1)	Tol (-) (B2)	Tol (+) (B3)													Actions Taken Completion Date	Severity	Occurrence	Detection	RPN
SH3	38 & 45	170	Reaming	E	CCF Ø 37.0215	0.0125	0.0125	Above top limit	[Customer Effect]5 Increased wear of pin - early scrappage/repair [Manufacturing / Assembly Effect]5 A proportion of production run may have to be reworked off line and accepted	5	CCF	wrong tooling	tool ID visual check, tool presetter check,	3	bore gauge in station by operator	5	75							
SH3	39 & 46	170	Reaming	E	CCF j Ø 0.05m E CCF j Ø 0.10m A Bm-Cm	NA	0.05 0.1			6		wrong tool setting	tool presetter routine, qualified operators,	3	in station dimensional check	5	90	Move to Heller M/C to implement automated tooling control routine	Action Owner Xu Hua Target date December-2018	6	5	2	60	

Key success factors:

- Supporting from Design engineer for Design Risk Analysis
- Update PFMEA frequently (nonconformance data as an input)
- Create action plan to mitigate risks
- Refer to previous product history, customer feedback, etc

Lessons learnt from AS13004

Vendor Code:228537
Supplier Name:SAM (Suzhou) Co., Ltd.

PROCESS CONTROL PLAN

Document No.	Part No.(s)	Issue number	Issue date	Approval (stamp/sign)
KH17504 CP001	KH17504	1	24/05/2018	
Document Category (circle / delete)		Part Classification		
Pre-Prod.	Prod.	Sensitive		

PROCESS		MACHINE, FIXTURE, TOOLS FOR MFG / MEASUREMENT	CHARACTERISTICS			SPECIAL / KEY CHAR. CLASS	METHODS						REACTION PLAN / REFERENCE	
EC/M EC	OP. NUMBER		PROCESS NAME / OPERATION DESCRIPTION	NO.	PRODUCT		PROCESS	PRODUCT / PROCESS SPEC. / TOLERANCE	EVALUATION / MEASUREMENT TECHNIQUE	SAMPLE SIZE	SAMPLE FREQ.	RESP.		CONTROL METHOD
EC	170	Milling	MC-MN4H69	38&45	CCF Ø 37.0215±0.0125	Tip condition	CCF	Free of damage / wear	Visual	All	100%	Operator	MOM	Inform leader
EC	170	Milling	MC-MN4H69	39	CCF j Ø 0.05m E	Work offset	CCF	Within 0.03mm	Probe check	All	100%	Operator	MOM	Inform leader
EC	170	Milling	MC-MN4H69	42	CCF i 0.50 B-C	Work offset	CCF	Within 0.03mm	Probe check	All	100%	Operator	MOM	Inform leader
EC	170	Milling	MC-MN4H69	46	CCF j Ø 0.10m A Bm-Cm	Work offset	CCF	Within 0.03mm	Probe check	All	100%	Operator	MOM	Inform leader
EC	170	Milling	MC-MN4H69	49	Ra 0.8	Coolant concentration		10%+/-5%	test paper	All	100%	Operator	MOM	Inform leader

Key success factors:

- Control the process inputs to obtain the desired product outputs
- Use of error proofing
- Verify output at the earliest possible operation within the process

SAM SUZHOU CASE STUDY

Deploying AS13004 to Achieve Zero Defects



Honglei Zhu
Production Manager
SAM (Suzhou) Co. Ltd.

SAM Suzhou Success



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HOW TO BE EFFICIENT BY USING REFERENCE PFMEA

How to Create and Manage Part Specific
Process FMEAs using a Reference FMEA
Database



Using Reference PFMEAs

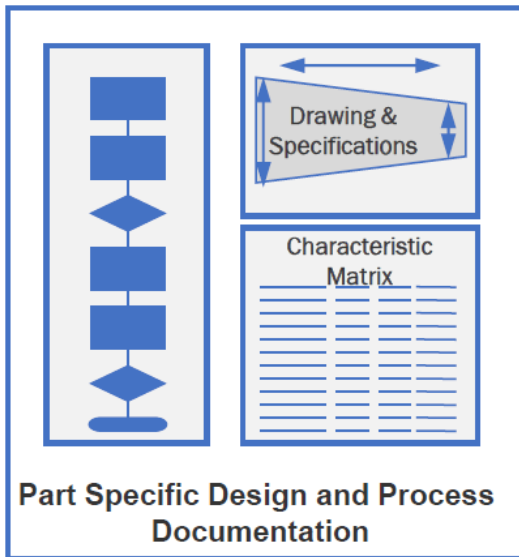
Process	Requirements	Potential Failure Modes	Potential Effects	SEV	Potential Causes	Prevention Controls	OCC	Detection Controls	DET	RPN
OP10 CNC Drilling	Drill Fuel Hole 50mm Diameter +/- 1.0 mm	Hole too Big	Fuel leak leading to explosion	9	Oversize tool	Tool pre-setting	4	Bore mic at OP 50	7	252
			Scrap part	6	Spindle alignment error	Asset Care & Calibration	3	Weekly ball bar check	8	216
OP20 CNC Drilling	Drill Air Hole 50mm Diameter +/- 3.0 mm	Hole too Big	Slight increase in noise level	3	Oversize tool	Tool pre-setting	2	Bore mic at OP 50	7	56
			Concession	4	Spindle alignment error	Asset Care & Calibration	1	Weekly ball bar check	8	32

Blue Boxes show the (partial) content of a Reference PFMEA for Hole Drilling where the Failure Mode is 'Hole Too Big'

Creating a Part Specific PFMEA using Reference FMEAs



Reference PFMEA Database



'Shell' Part Number PFMEA

Process	Requirements	Potential Failure Modes	Potential Effects	SEV	Potential Causes	Prevention Controls	OCC	Detection Controls	DET	RPN
OP10										
CNC Drilling										
OP20										
CNC Milling										
OP30										
CNC Grinding										

A 'shell PFMEA is created for each operation and every feature / specification required to produce a specific part number using the Process Flow Diagrams, Characteristics Matrix and Drawing / Specifications.

Completing the Part Number Specific PFMEA



Process	Requirements	Potential Failure Modes	Potential Effects	SEV	Potential Causes	Prevention Controls	OCC	Detection Controls	DET	RPN
OP10 CNC Drilling	Drill Fuel Hole 50mm Diameter +/- 1.0 mm	Hole too Big	Fuel leak leading to explosion	9	Oversize tool	Tool pre-setting	4	Bore mic at OP 50	7	252
			Scrap part	6	Spindle alignment error	Asset Care & Calibration	3	Weekly ball bar check	8	216
OP10 CNC Drilling	Drill Air Hole 20mm Diameter +/- 3.0 mm	Hole too Big	Slight increase in noise level	3	Oversize tool	Tool pre-setting	2	Bore mic at OP 50	7	56
			Concession	4	Spindle alignment error	Asset Care & Calibration	1	Weekly ball bar check	8	32

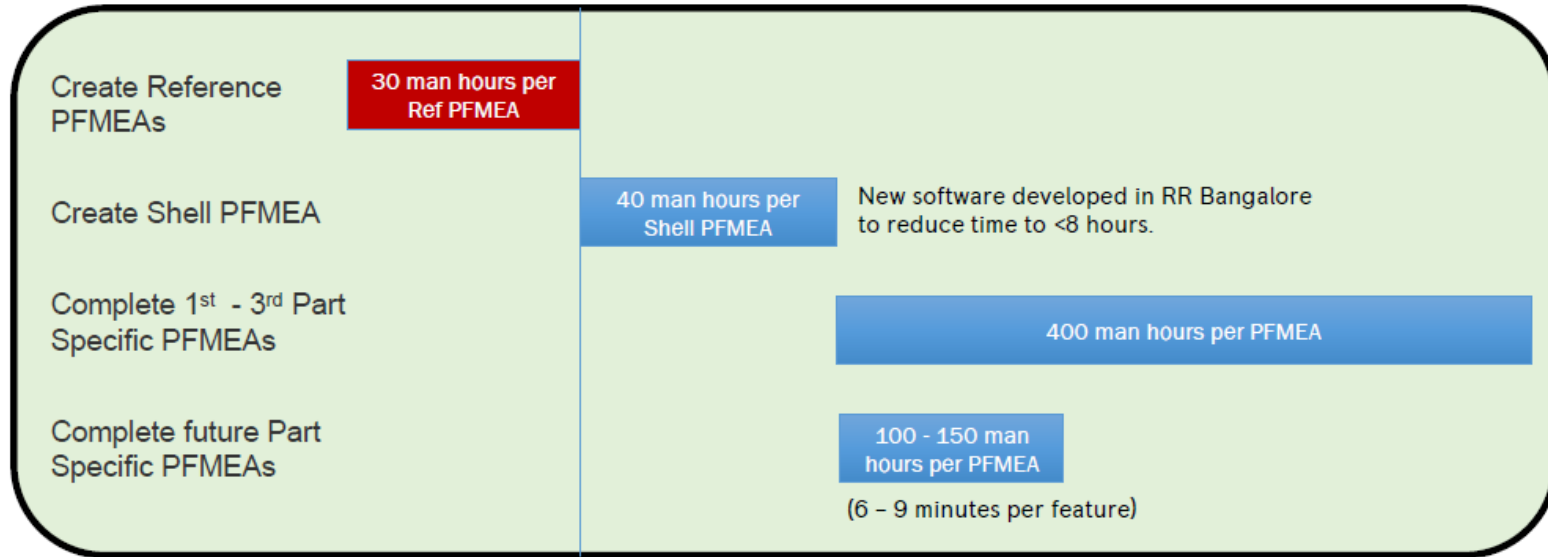
Additions and subtractions

Additions and subtractions

The team may need to add in additional Failure Modes, Potential Causes and/or Control information based on their knowledge of the specific part numbers. Some information in the Reference PFMEA may not be relevant so can be deleted.



How long does it take to complete an AS13004 Process FMEA?



Estimates are for a medium complexity machined part (1000 features)

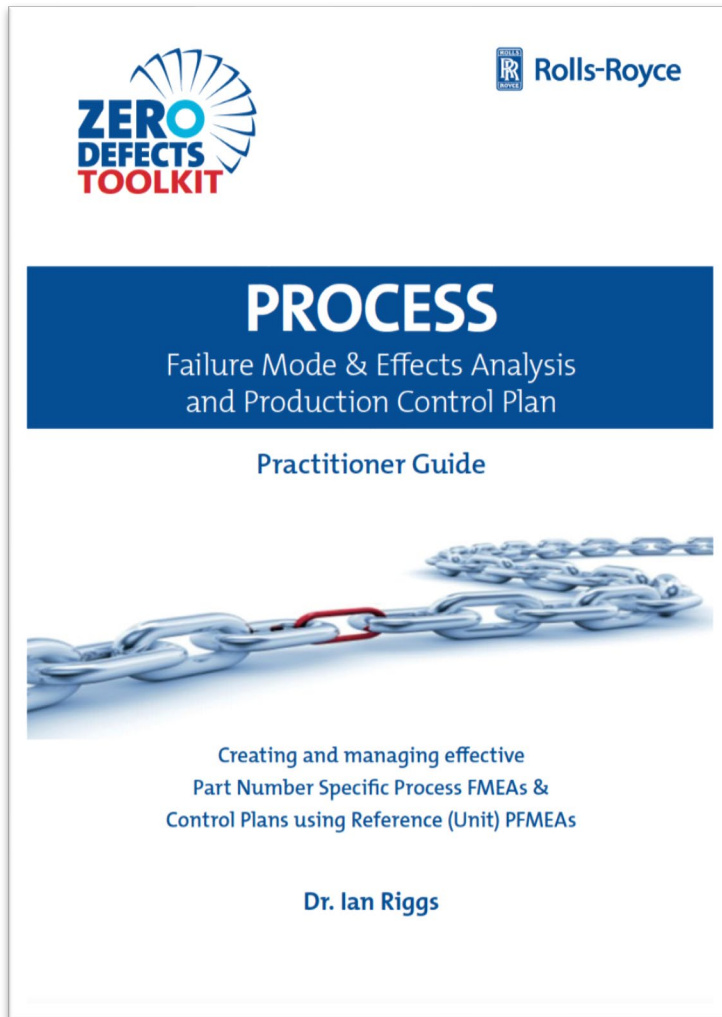
Reference PFMEAS once created will be used for all future PFMEAs and only updated when necessary. This is a 'one off' activity.

Initial Part Specific PFMEAs will take longer as the cross functional team discuss issues for the first time e.g. what would happen if....?

Initial PFMEAs should be treated as a learning exercise.

It will probably take 3 – 5 PFMEAs for the team to optimise the process.

How Rolls-Royce can help



Process PFMEA Practitioner Guide for developing PFMEAs & Control Plans to AS13004 including the creation and use of Reference FMEAs is available free of charge (electronically or hard copy) from Rolls-Royce

Rolls-Royce will make its Reference PFMEAs available to external businesses to promote the deployment of AS13004.

We recommend that suppliers invest in a suitable FMEA software tool to manage the level of data created efficiently

We have developed Global PFMEA training to support this approach with Smallpeice Enterprises and Industry Forum ([see AESQ website for details](#))

Supplier Success Examples



GKN Newington
Trent 7000 Fan Case
Defect Free at Product
Introduction

SAM Suzhou
XWB Engine
Mounts
Defect Free



AESQ – Aero Engine Supplier Quality Strategy Group

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It *really* is that easy.....



It *really* is that effective.....



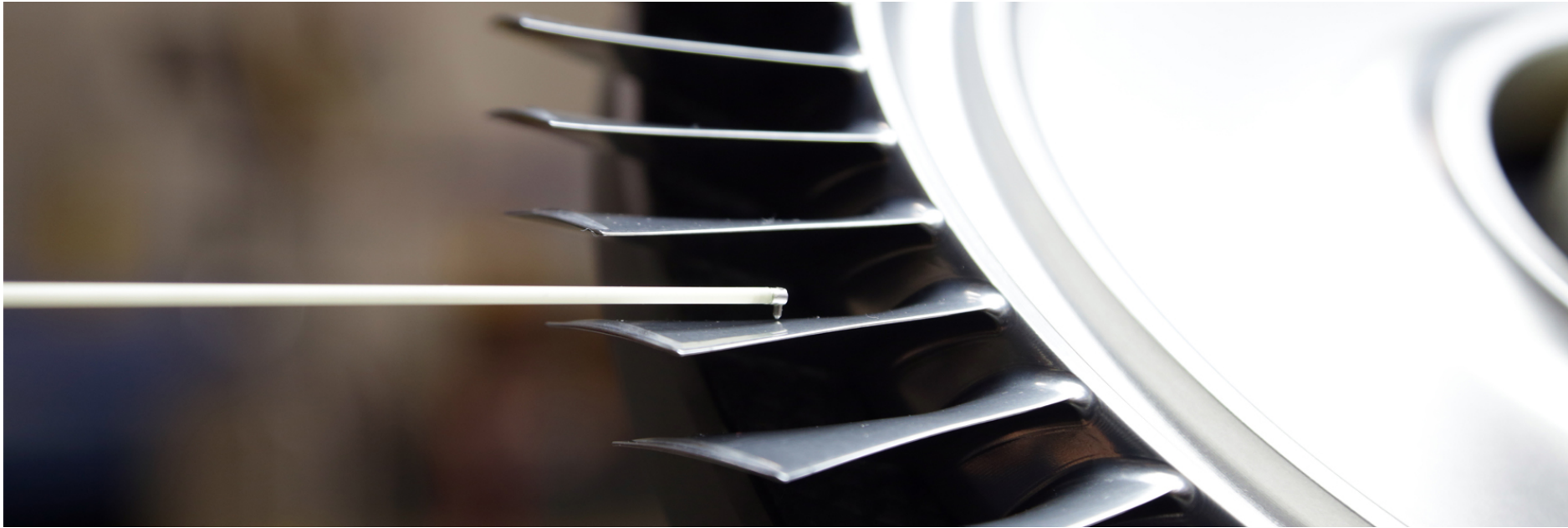
Good luck.



AS13003 MSA

MARTIN SCHAEFFNER, MTU





MSA@MTU

Experiences from using the Measurement System Analysis method at MTU

4/4/2017

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General Approach

What is the intent?

The goal is to make sure that every measurement system (gage + outside influences) used is suitable for the intended task → representing “real” part quality!

The AS13003 method summarizes different tools and delivers a standardized approach.

Mainly used in: *PPAP; approval of new measurement technology; stabilizing production processes*

Guiding Questions

“Method 1”

Is the gage precise and accurate enough to rely on it?

How big is the variance of my measurement?

Calculation of the value $cg > 1,33$

Is there a systematic error in the measurement?

Calculation of the value $cgk > 1,33$

“Method 2”

What happens in real production line conditions?

What happens if the same inspector measures the same part without knowing the results from his last measurements?

What happens when a different inspector measures the same part without knowing the results from his coworker?

%
GR&R
Total
Variance

Hands-on Example

Case, Turbine

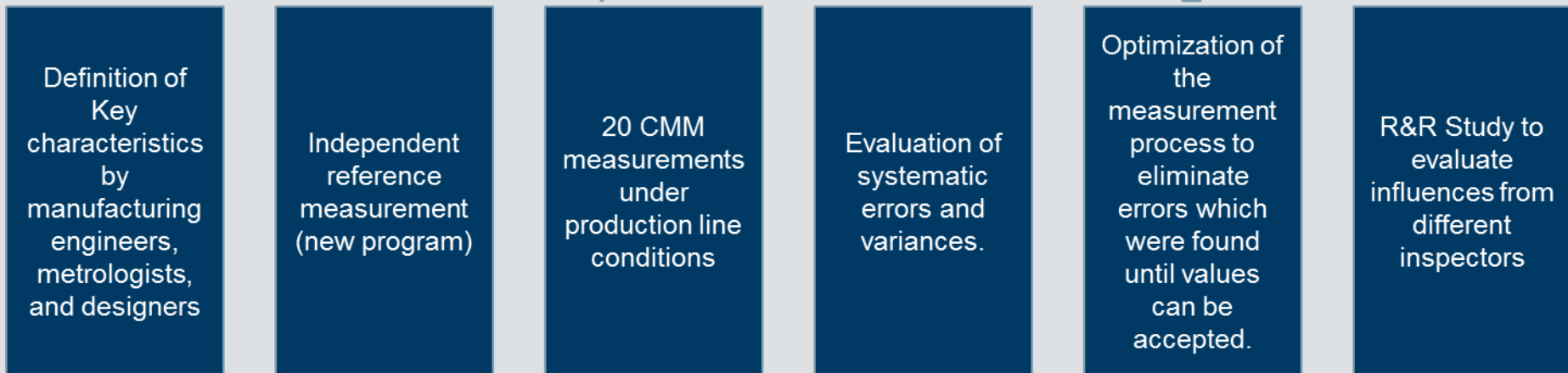
Background

- Thin-walled part with tight tolerances
- The measurement results were suspected to be unstable due to issues with the fixture and clamps.

→ MSA performed according to AS13003



Approach



Actions defined due to results from the MSA

Case, Turbine

- characteristics showed problems with accuracy and repeatability

→ a test on a more accurate CMM showed a huge improvement

- form tolerances problems with repeatability even though the machine was changed

→ The cause was found in changing the measuring fixture

- The parallelism tolerance between the upper and lower flange was still not in

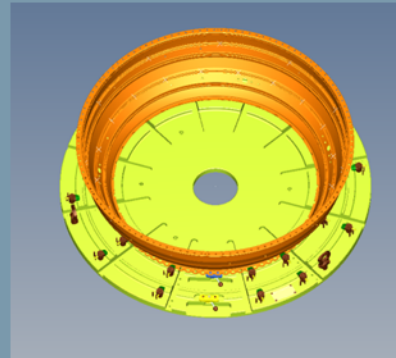
→ Together with engineering the reference plane was changed



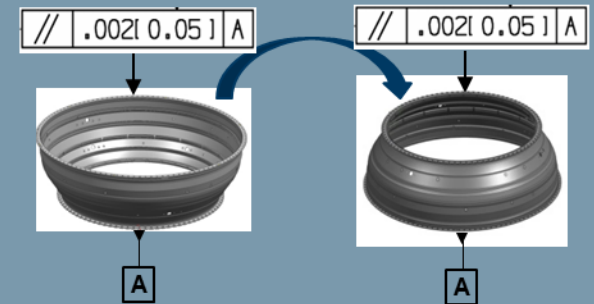
Standard CMM for this part family



New CMM



Rework of the measuring fixture



Change made to the drawing

Lessons Learned up to now

- By using the MSA method you get a reliable and understandable statement if you can rely on your results or not
→ don't touch your production processes before you are sure about your measurement
- Cg & Cgk database is a great support to discuss drawing requirements with the design organization
- An MSA helps to eliminate influences coming from different measurement strategies
- A CMM measurement is not always reliable – accuracy and inspector variance matters
- High quality of existing measurement programs as in most cases only a few characteristics show a significant variance
- A comparison to an independent reference measurement gives a valuable insight into the production line measurement;
→ not easy to achieve due to the small tolerances and the expectation to be more precise
- For tighter tolerances the method is very challenging and even a difference of $1/10 \mu\text{m}$ between reference & production results can be the reason for an incapable system -> Rules for these special cases are necessary

FUTURE INITIATIVES

BARRIE HICKLIN, HONEYWELL



Feedback Question



What topics would you like us to work on in the future?

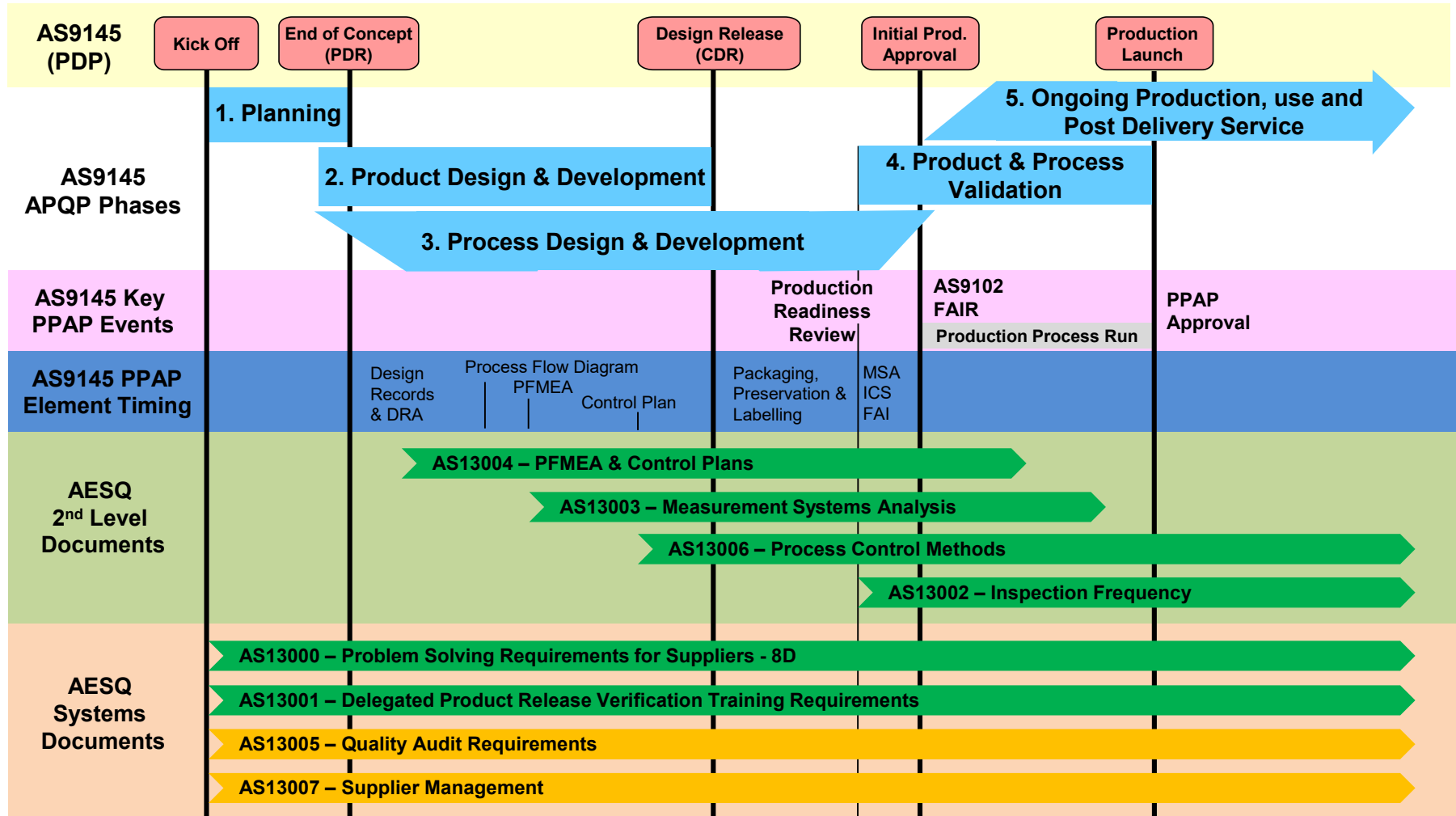
FUTURE INITIATIVES

DAN EIGENBRODE,
PRATT & WHITNEY

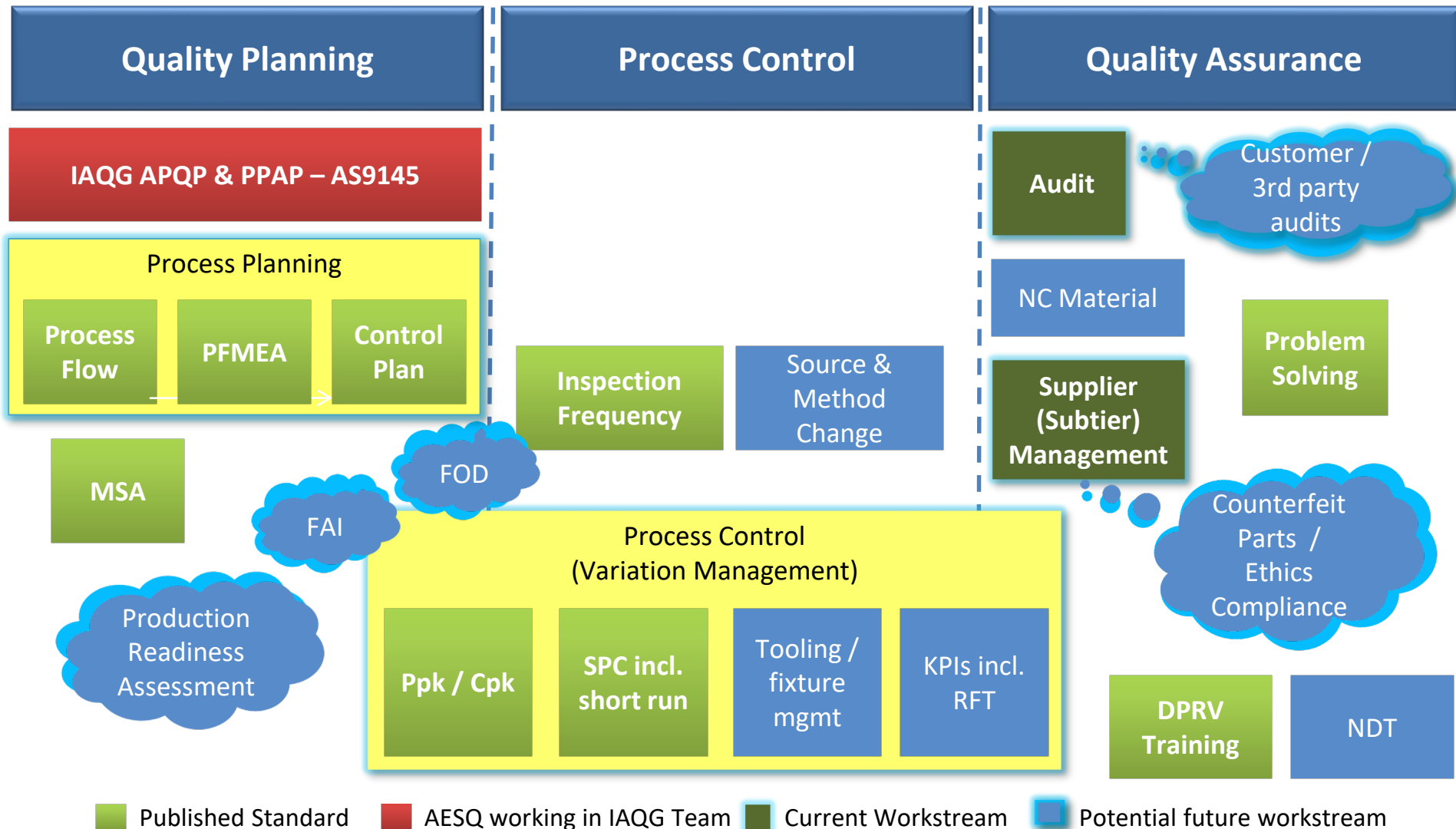


Product Life Cycle & Document Interaction

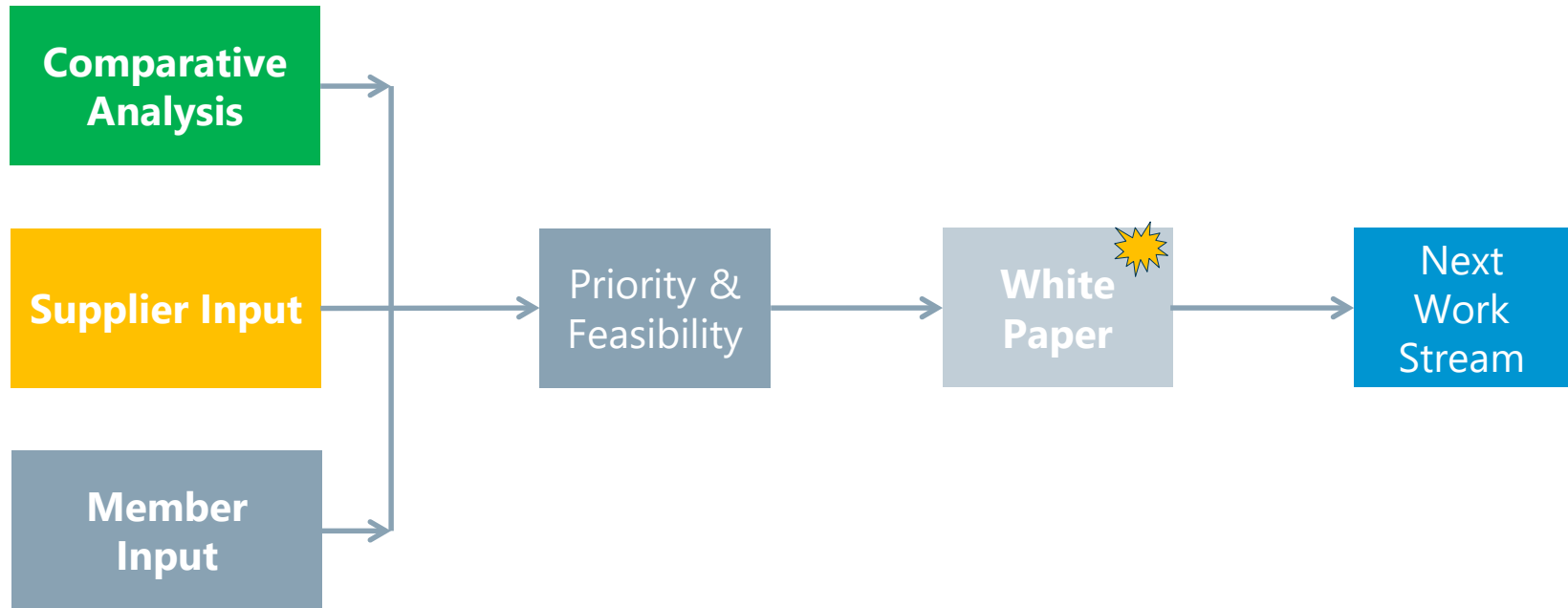
AS9145 (APQP/PPAP) & AESQ Standards



Existing & Future Workstreams



AESQ Strategic Process Map



Assimilation & prioritization of future AESQ initiatives for standardization and step improvements in quality

White Paper Projects

Work in Progress

FAI Study Topics

Interpretation
(partial / full FAI)

Form 3

Ballooning

Submission

Planning FAIR



Non-Conforming Material Study Topics

Guidance (8D)

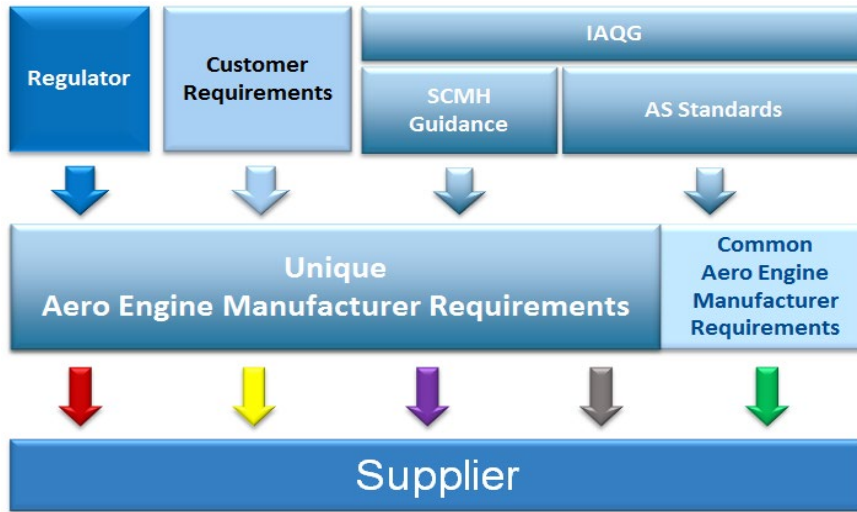
Standardize Forms

Common IT Hub

Common processes
for repair and
repetitive concession
requests

AS13100 AS9100 Supplemental Requirements

Original State



Future State



AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Reduces/Eliminates top level OEM Requirements
- "Raises the Bar" for Quality Expectations
- Common Aero-Engine Manufacturer Language

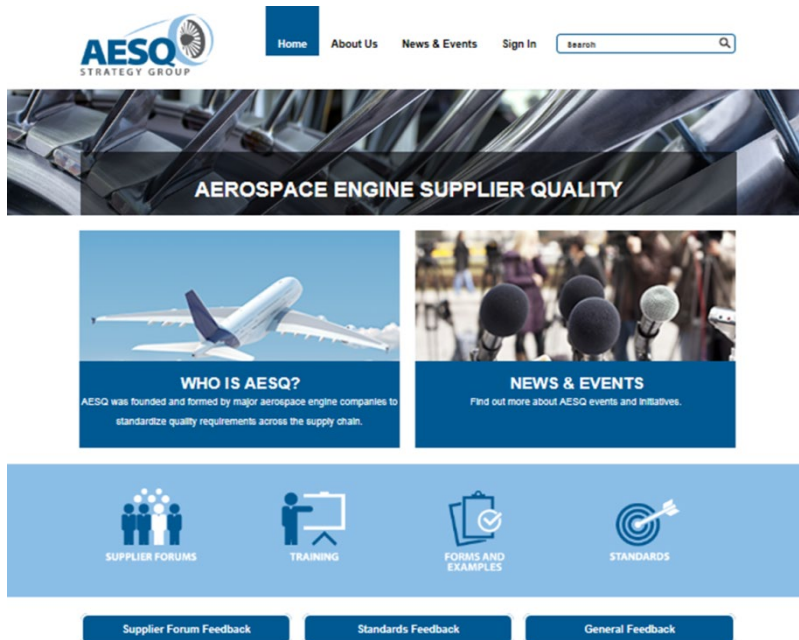


SUPPLIER CONTRIBUTION TO AESQ WORK

AESQ – Aerospace Engine Supplier Quality Strategy Group

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How You Can Participate



- Attend our AESQ Supplier Forums
- Provide feedback on current standards & those in development
- Share best practice deployment stories and impact of standards via the AESQ Website
- Help identify new areas of standardization & future work

aesq.saeitc.org/

Challenge your customers about deployment of standards
AESQ members are committed to deploy

AS13005 QUALITY AUDIT REQUIREMENTS

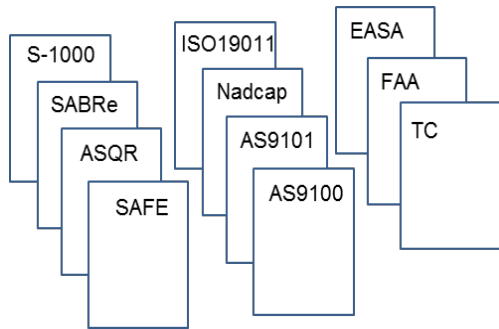
HELEN DJÄKNEGREN, GKN



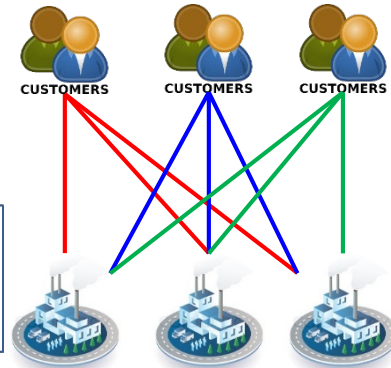
AS13005 Quality Audit Requirements

Original State

Internal and supplier audit requirements in many documents



Every Customer Audits Every Supplier



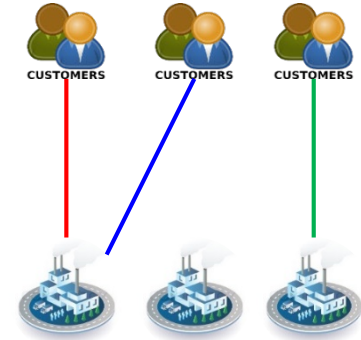
Internal Audits for Many Requirements

Future State

Aerospace Standard AS13005

- Audit types & checklists
 - System
 - Production process
 - Product
 - Special process
- Auditor qualification, KPI's
- Supplier Surveillance Audit
 - Selecting suppliers
 - Selecting scope, approach
- Audit outcome

Risk Based Supplier Audit



One Common Requirement for Internal Audit

AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Lean & effective internal audit process provides confidence in state of compliance throughout Aero-Engine supply chain
- Improved rigor of audit approach
- Suppliers chosen for audit based on performance and risk
- Reduced and/or eliminated unnecessary and/or duplicate audits => Cost reduction / resources liberated by customer and supplier.
- Reduced supplier audits for performing suppliers (low risk) that demonstrate compliance to internal audit requirements
- Recognizes existing 3rd party certification

AS13007 SUPPLIER MANAGEMENT

BARBARA NEGROE, GE AVIATION



AS13007 Supplier Management

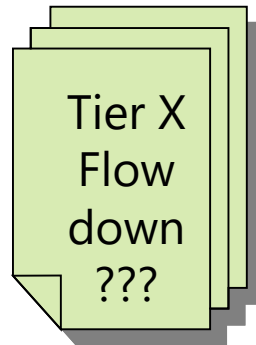


AS13007 Supplier Management

Original State



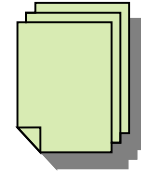
Varied
Customer-Specific
Requirements



Future State



Fewer Customer-Specific
Requirements



In scope: Raw material & finished hardware
Out of scope: Distributors & MRO suppliers

AESQ Principles

- Standardise
- Simplify
- Adopts Existing Industry Standards
- Prescriptive, Auditable
- Common Language
- Supported by 3rd Party Training & Consultancy

Expected Benefits

- Simplify language for organizations to manage suppliers
- Ability to use the standard throughout all tiers of the supply chain
- Standard will simplify and reduce the number of methods the suppliers must use to meet Customer requirements (i.e. simplify/make common the "how to")

CLOSING REMARKS MARTIN SCHAEFFNER & TETSUYA MIZUTANI

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

AESQ Vision



In detail

- Create common standards within the engine manufacturers (OEM's) in regard to quality
- Deploy together the written standards throughout our supply chain
- Establish capable quality processes and a culture of continuous improvement

Main targets

- To improve quality within the supply chain
- Improve on time delivery and minimize costs through a reliable quality performance
- Gain efficiency by standardized processes

AESQ Will Drive Progress

Spread the Word



ARCONIC



GE
Aviation



Pratt & Whitney

A United Technologies Company



SAFRAN



Structurals, Inc.



Rolls-Royce

Honeywell



Aero Engines



GKN AEROSPACE

Provide feedback on the AESQ website

RETURN HOME SAFELY