Logistics
Welcome to AESQ Supplier Forum

hosted by

GKN Aerospace Engine Systems
LÄTT ATT GÖRA RÄTT
Enabler – Standards – MAKE IT HAPPEN

“Make Operation Boring”
Agenda

8:15  Welcome to GKN and AESQ - Helen Djäknegren, GKN
8:35  Introduction to AESQ - Martin Schaeffner, MTU
9:00  Voice of the Customer - Emile Colongo, Airbus
9:45  Supplier Survey Results - Olivier Castets, Safran
10:00 Break
10:30 Overview of AESQ Standards - Olivier Castets, Safran
11:00 Marketplace #1 - Published Standards - Barrie Hicklin, Honeywell
12:00 Lunch
Agenda

1:00 Benefits of AS13001 DPRV Training Requirements - Catherine Catarina-Graça, Safran

1:20 Benefits of AS13003 MSA - Martin Schaeffner, MTU

1:40 Benefits of AS13004 PFMEA & Control Plans - Ian Riggs, Rolls-Royce

2:10 Future Initiatives - Peter Amsden, Pratt & Whitney

2:30 Break

3:00 Marketplace #2 - Current Projects & Future Initiatives - Barrie Hicklin, Honeywell

4:10 Marketplace Summary - Barrie Hicklin, Honeywell

4:25 Closing remarks - Helen Djäknegren, GKN and Martin Schaeffner, MTU
Facilitators in the Room

- Arconic
- GE Aviation
- GKN Aerospace
- Honeywell
- MTU Aero Engines
- PCC Structural, Inc.
- Pratt & Whitney, A United Technologies Company
- Rolls-Royce
- Safran
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
Commercial Aviation – A Growth Market

In 2036

4.5%/yr Increase in Passenger Traffic

2 X active aircraft worldwide

7,100 billion passenger km in 2016
17,000 billion passenger km in 2036

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!

Statistically two aircraft would crash every week unless reliability is further improved.

Increase in flight movements: 4-5% p.a.
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

→ Aligned to AS9145 APQP & PPAP

Design Risk Assessment

- Risk analysis and control required
- Production risks identified & mitigated ensuring capable & stable manufacturing processes

Product KCs

- Product and Process KCs

- Capable measurement systems required
  
  Measurement systems are capable & repeatable ensuring effectiveness of inspection processes

Process Control required

- Process Control

  Manufacturing processes under variation control produce consistent product at rate

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

AS13004 - PFMEA and Control Plans

AS13003 Measurement System Analysis (MSA)

AS13006 Process Control Methods (Draft)
AESQ Will Drive Progress

• AS13000, AS13001, AS13002, AS13003, AS13004 are all flowed down by all AESQ members and part of your Purchase Order
VOICE OF THE CUSTOMER

EMILE COLONGO, AIRBUS
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?

We still have some work to do
Which Standards Have You Heard Of?

AS13000 Problem Solving
AS13001 Supplier Self Release Training
AS13002 Inspection Frequency
AS13003 Measurement Systems Analysis
AS13004 PFMEA & Control Plans
AS13005 Internal & Supplier Audits
AS13006 Process Control
AS13007 Supplier Management
Which Standards are in YOUR Contracts?
BREAK
“IS GOOD ENOUGH?” - Video
AESQ STANDARDS OVERVIEW

OLIVIER CASTETS, SAFRAN

HELEN DJÄKNEGREN, GKN
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
AS13000 Problem Solving

Original State

Future State

GLOBAL 8D

7-Step Apollo DIVE/Red-X® 8D

Supplier

Supplier

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 Delegated Product Release Verification Training

Original State

- Pratt & Whitney
  - 3 days
- Safran
  - 3 days
- GE Aviation
  - 3 days
- Rolls-Royce
  - 3 days

Total 12 days

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
AS13004 PFMEA & Control Plans

**Original State**

- Varying standards and approaches

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**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)

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**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
AS13003 Measurement Systems Analysis

Original State

Future State

### AESQ Principles

- **✓** Standardise
- **✓** 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

### Practical Case Studies

<table>
<thead>
<tr>
<th>Method</th>
<th>Feature Category</th>
<th>Critical</th>
<th>Major</th>
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<tbody>
<tr>
<td>Resolution</td>
<td></td>
<td>≤10%</td>
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<tr>
<td>Accuracy ratio**</td>
<td></td>
<td>Requirement ≥ 10:1</td>
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<tr>
<td>Accuracy Error / Bias</td>
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<td>≤10%</td>
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</tr>
<tr>
<td>Repeatability</td>
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<td>≤10%</td>
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<tr>
<td>Gauge R&amp;R</td>
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<td>≤10%</td>
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</tr>
<tr>
<td>Computer driven</td>
<td></td>
<td>≤10%</td>
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<tr>
<td>measurement systems</td>
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<td>≤20%</td>
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<td>correlation</td>
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<td>Purchaser requirements may</td>
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<td>override this</td>
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<tr>
<td>Linearity**</td>
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<td>Attribute Study: pass/fail</td>
<td>Kappa ≥ 0.8</td>
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<tr>
<td>Attribute study: ordinal</td>
<td>ICC ≥ 0.75</td>
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AS13002 Inspection Frequency

Original State

100% Inspection
REDUCED Sample
Error Proof AQL

Future State

100% Inspection Level

- Common Method for Inspection Planning
- Guidance on commodity specific planning

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
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

<table>
<thead>
<tr>
<th>AESQ Member</th>
<th>AS13000 Problem Solving</th>
<th>AS13001 DPRV Training</th>
<th>AS13002 Alternate Inspection Frequency Plans</th>
<th>AS13003 MSA</th>
<th>AS13004 PFMEA &amp; Control Plans</th>
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<tr>
<td>Arconic (P&amp;P)</td>
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<td>Accepted</td>
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<td>GE</td>
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<td>Honeywell</td>
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<td>Apr-15</td>
<td>Mar-15</td>
<td>Aug-17</td>
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<td>MTU</td>
<td>Jan-16</td>
<td>Apr-15</td>
<td>Jan-15</td>
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<td>PCC Structurals</td>
<td>Mar-15</td>
<td>Jan-15</td>
<td>Apr-15</td>
<td>Jun-16</td>
<td>1Q 18</td>
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<tr>
<td>Rolls-Royce</td>
<td>Dec-14</td>
<td>Oct-15</td>
<td>Jan-15</td>
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<td>Safran</td>
<td>Jan-15</td>
<td>Jan-15</td>
<td>Jan-15</td>
<td>Jan-15</td>
<td>Aug-17</td>
</tr>
</tbody>
</table>
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
MARKETPLACE #1
PUBLISHED AESQ STANDARDS

BARRIE HICKLIN, HONEYWELL
### Marketplace #1

15 minutes per table

Published Standards (4 Teams)

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>TITLE</th>
<th>FACILITATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS13000</td>
<td>Problem Solving Requirements for Suppliers (8D)</td>
<td>Olivier Castets Helen Djäknegren</td>
</tr>
<tr>
<td>AS13001</td>
<td>Delegated Product Release Verification Training Requirements</td>
<td>Earl Capozzi Catherine</td>
</tr>
<tr>
<td>AS13002</td>
<td>Requirements for Developing and Qualifying Alternate Inspection Frequency Plans</td>
<td>Dave Goldberg Barbara Negroe</td>
</tr>
<tr>
<td>AS13003</td>
<td>Measurement Systems Analysis Requirements for the Aero Engine Supply Chain</td>
<td>Ian Riggs Martin Schaeffner</td>
</tr>
</tbody>
</table>
Sensing Session 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?
LUNCH
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
DPRV Certification following AS9117 DPRV & AS13001

PROCESS TO BECOME A DPRV
2017 Update

Setting up the function

- DPRV course
- PROCESS TO BECOME A DPRV
- 2017 Update
- On site audit
  By Safran QE
- Granting the SAFRAN DPRV stamp
  And the SAFRAN certificate if the audit is conclusive
DPRV DUTIES

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

<table>
<thead>
<tr>
<th>FAULT</th>
<th>DEFINITION</th>
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</thead>
<tbody>
<tr>
<td>C00</td>
<td>CONDITIONING PACKAGING</td>
</tr>
<tr>
<td>P00</td>
<td>DOCUMENTATION</td>
</tr>
<tr>
<td>T00</td>
<td>MARKING / IDENTIFICATION / TRACEABILITY / MANAGEMENT (GENERIC)</td>
</tr>
<tr>
<td>V00</td>
<td>APPEARANCE / VISUAL / FINISH (GENERIC)</td>
</tr>
</tbody>
</table>
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?

- DEPLOYED
- UNDEPLOYED

Year 2016 vs Year 2017

Deployed events decreased from 100 to 20.
Undeployed events increased from 10 to 30.
• 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
MSA@MTU

Experiences from using the Measurement System Analysis method at MTU

Martin Schäffner

10/03/2017
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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

<table>
<thead>
<tr>
<th>“Method 1”</th>
<th>“Method 2”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the gage precise and accurate enough to rely on it?</td>
<td>What happens in real production line conditions?</td>
</tr>
<tr>
<td>How big is the variance of my measurement?</td>
<td>What happens if the same inspector measures the same part without knowing the results from his last measurements?</td>
</tr>
<tr>
<td>Calculation of the value cg &gt;1,33</td>
<td>Calculation of the value cgk &gt;1,33</td>
</tr>
<tr>
<td>Is there a systematic error in the measurement?</td>
<td>What happens when a different inspector measures the same part without knowing the results from his coworker?</td>
</tr>
</tbody>
</table>

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Hands-on Example

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

- Definition of Key characteristics by manufacturing engineers, metrologists, and designers
- Independent reference measurement (new program)
- 20 CMM measurements under production line conditions
- Evaluation of systematic errors and variances.
- Optimization of the measurement process to eliminate errors which were found until values can be accepted.
- R&R Study to evaluate influences from different inspectors

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Actions defined due to results from the MSA

- 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 µm between reference & production results can be the reason for an incapable system ->

Rules for these special cases are necessary
BENEFITS OF AS13004 – PFMEA

DR IAN RIGGS, ROLLS-ROYCE
Core Product Defect Prevention Tools

Product Design → Process Design → Production & Service

Advanced Product Quality Planning (APQP) & Production Part Approval Process (PPAP)

Design FMEA → Process FMEA AS13004 → Control Plan AS13004 → MSA AS13003 → Capability AS13006 → Error Proofing → Process Control (SPC) AS13006

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

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

We must focus on defect prevention. Inspection is never 100% effective.

Advanced Quality Planning & Process Control

PRODUCT DESIGN
- Customer meeting
- Design to requirements
- Potential design risks
- Identified, understood, mitigated

DESIGN FAIURE MODE & EFFECTS ANALYSIS
- Process design
- Process can make defect free parts
- Risks identified, understood, mitigated

PROCESS FAILURE MODE & EFFECTS ANALYSIS
- Process design
- Manufacturing controls
- Process Capability

CONTROL PLAN
- High risk
- Mitigate, proof, SPC, inspection & target setting, audit, control
- Initial process capability

MANUFACTURING CONTROLS
- Process Capability CPK

INSPECTION CAPABILITY
- Variable gauge repeatability & reproducibility
- Agreement analysis
- Process must be on target with minimum variation

PROCESS CONTROL
- Maintain & improve
- Initial process capability

8D PROBLEM SOLVING

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

Join the Movement

Rolls-Royce

"Zero Defects"
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
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
AS13004 Deployment Case Study

- SAM Suzhou – Precision Machining Supplier based in Suzhou, China
- Circa 300 employees
- Produces Engine Mounts for Rolls-Royce (200+ features)
- Began Process FMEA journey with Rolls-Royce for NPI in April 2017 (in line with AS13004)
- R-R requires PFMEAs to AS13004 to be completed for all NPI, Key Source & Method Changes and Major Quality Escapes
AS13004 Deployment Case Study

Right First Time %

1. Began PFMEA
2. Completed 1st PFMEA
3. Intro. SPC
4. Intro. Error Proofing
5. Completed 16 PFMEAs
SAM Suzhou Success

Key Learning:
• Once trained, they just ‘got on with it’
• They set aside time each week to develop PFMEA
• Once defined they took actions to mitigate the identified risks e.g. SPC, error proofing
• Now deploying PFMEA onto all legacy Rolls-Royce part numbers

In 2018 SAM Suzhou won the Rolls-Royce most Improved Supplier Award. They continue to be Defect Free into Rolls-Royce...
Using Reference PFMEAs

<table>
<thead>
<tr>
<th>Process</th>
<th>Requirements</th>
<th>Potential Failure Modes</th>
<th>Potential Effects</th>
<th>Prevention Controls</th>
<th>Detection Controls</th>
<th>DET</th>
<th>RPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP10 CNC Drilling</td>
<td>Drill <strong>Fuel</strong> Hole 50mm Diameter +/- 1.0 mm</td>
<td>Hole too Big</td>
<td>Fuel leak leading to explosion</td>
<td>9</td>
<td>Oversize tool</td>
<td>Tool presetting</td>
<td>4</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Scrap part</td>
<td>6</td>
<td>Spindle alignment error</td>
<td>Asset Care &amp; Calibration</td>
<td>3</td>
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<tr>
<td></td>
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<td>Concession</td>
<td>4</td>
<td>Spindle alignment error</td>
<td>Asset Care &amp; Calibration</td>
<td>1</td>
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</tbody>
</table>

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

- CNC Drilling
- CNC Milling
- CNC Grinding
- E Beam Welding
- TIG Welding
- Casting
- Part Marking
- Cleaning
- Chemical Etch

‘Shell’ Part Number PFMEA

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

<table>
<thead>
<tr>
<th>Process</th>
<th>Requirements</th>
<th>Potential Failure Modes</th>
<th>Potential Effects</th>
<th>Potential Causes</th>
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<tbody>
<tr>
<td>OP10 CNC Drilling</td>
<td>Drill Fuel Hole 50mm Diameter +/- 1.0 mm</td>
<td>Hole too Big</td>
<td>Fuel leak leading to explosion</td>
<td>Oversize tool</td>
<td>Tool presetting</td>
<td>4</td>
<td>Bore mic at OP 50</td>
<td>7</td>
<td>252</td>
</tr>
<tr>
<td>OP10 CNC Drilling</td>
<td>Drill Air Hole 20mm Diameter +/- 3.0 mm</td>
<td>Hole too Big</td>
<td>Slight increase in noise level</td>
<td>Oversize tool</td>
<td>Tool presetting</td>
<td>3</td>
<td>Bore mic at OP 50</td>
<td>7</td>
<td>56</td>
</tr>
<tr>
<td>OP10 CNC Drilling</td>
<td>Concession</td>
<td>4</td>
<td>Spindle alignment error</td>
<td>Asset Care &amp; Calibration</td>
<td>Weekly ball bar check</td>
<td>8</td>
<td>216</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 we 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 (see Guidebook for details).

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 Guidebook for details).
It really is that easy.....

It really is that effective.....

Good luck.
FUTURE INITIATIVES

PETER AMSDEN, PRATT & WHITNEY
# Product Life Cycle & Document Interaction

## AS9145 (APQP/PPAP) & AESQ Standards

### AS9145 APQP Phases

<table>
<thead>
<tr>
<th>AS9145 (PDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kick Off</td>
</tr>
<tr>
<td>End of Concept (PDR)</td>
</tr>
</tbody>
</table>

### AS9145 PPAP Phases

<table>
<thead>
<tr>
<th>AS9145 Key PPAP Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Release (CDR)</td>
</tr>
<tr>
<td>Initial Prod. Approval</td>
</tr>
<tr>
<td>Production Launch</td>
</tr>
</tbody>
</table>

### AS9145 PPAP Element Timing

<table>
<thead>
<tr>
<th>AESQ 2nd Level Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Records &amp; DRA</td>
</tr>
<tr>
<td>Process Flow Diagram</td>
</tr>
<tr>
<td>PFMEA</td>
</tr>
<tr>
<td>Control Plan</td>
</tr>
<tr>
<td>Packaging, Preservation &amp; Labelling</td>
</tr>
<tr>
<td>MSA</td>
</tr>
<tr>
<td>ICS</td>
</tr>
<tr>
<td>FAI</td>
</tr>
</tbody>
</table>

### AESQ Systems Documents

<table>
<thead>
<tr>
<th>AESQ Systems Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS13000 – Problem Solving Requirements for Suppliers - 8D</td>
</tr>
<tr>
<td>AS13001 – Delegated Product Release Verification Training Requirements</td>
</tr>
<tr>
<td>AS13005 – Quality Audit Requirements</td>
</tr>
<tr>
<td>AS13007 – Supplier Management</td>
</tr>
</tbody>
</table>

### AS9145 Key PPAP Events

<table>
<thead>
<tr>
<th>AS9145 Key PPAP Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS9102 FAIR</td>
</tr>
<tr>
<td>Production Process Run</td>
</tr>
<tr>
<td>PPAP Approval</td>
</tr>
</tbody>
</table>

### AESQ – Aerospace Engine Supplier Quality Strategy Group

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AS13005 Quality Audit Requirements

Original State
Internal and supplier audit requirements in many documents

S-1000
SABRe
ASQR
SAFE
ISO19011
Nadcap
EASA
FAA
AS9101
AS9100
TC

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
### AS13006 Process Control Methods

#### 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”

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

#### In scope:
- Process Control for all characteristics

#### Out of scope:
- Foundational requirements

#### 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
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
AS13007 Supplier Management

- Lots of sub-tier surprises?
- Is the variation and risk understood?
- Is the risk owned?
- How is it managed?
- How will it be improved?
AS13007 Supplier Management

Original State

Varied Customer-Specific Requirements

Future State

Single AESQ Standard

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”)
Existing & Future Workstream

Quality Planning
- IAQG APQP & PPAP – AS9145
- Quality Planning
  - IAQG APQP & PPAP – AS9145
  - Process Planning
    - Process Flow
    - PFMEA
    - Control Plan
- MSA

Process Control
- Process Control
  - Inspection
    - Frequency
  - Source & method Change
  - Tooling / fixture mgmt
  - KPIs incl. RFT
  - Supplier (Subtier) Management
- Supplier (Subtier) Management
- Audit
- NC Material

Quality Assurance
- Problem Solving
- Counterfeit Parts / Ethics Compliance
- DPRV Training
- NDT

Production Readiness Assessment
- FAI
- FAI
- Production Readiness Assessment
- FOD
- FOD

Published Standard
- AESQ working in IAQG Team
- Current Workstream
- Potential future workstream

AESQ – Aerospace Engine Supplier Quality Strategy Group
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**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
AESQ Strategic Process Map

Assimilation & prioritization of future AESQ initiatives for standardization and step improvements in quality
SUPPLIER CONTRIBUTION TO AESQ WORK
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
BREAK
MARKETPLACE #2

BARRIE HICKLIN, HONEYWELL
15 minutes per table

Standards in Development & Future Initiatives (4 Teams)

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>TITLE</th>
<th>FACILITATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS13005</td>
<td>Quality Audit Requirements</td>
<td>Helen Djäknegren &amp; Catherine Catarina-Graca</td>
</tr>
<tr>
<td>AS13004</td>
<td>PFMEA &amp; Control Plans</td>
<td>Peter Amsden</td>
</tr>
<tr>
<td>AS13006</td>
<td>Process Control Methods</td>
<td>Dave Goldberg</td>
</tr>
<tr>
<td>AS13007</td>
<td>Supplier Management</td>
<td>Thomas Schmitt &amp; Barbara Negroe</td>
</tr>
<tr>
<td></td>
<td>Future Standards</td>
<td>Dele Awofala &amp; Martin Schaeffner</td>
</tr>
</tbody>
</table>
Answer these questions for each Workstream developing a Standard

1. What are the main challenges or difficulties?
2. What misalignments are apparent between your customers?
3. What are your concerns and recommendations (including training)?
4. Are there any commodity specific considerations?
MARKETPLACE SUMMARY

BARBARA NEGROE, GE AVIATION
## Marketplace Summary Session 1

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>KEY FEEDBACK</th>
<th>FACILITATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS13000 (Problem Solving)</td>
<td>• How to find internal sponsorship? • Small or large issue – can be applied</td>
<td>Olivier Castets, Helen Djäknegren</td>
</tr>
<tr>
<td>AS13001 (DPRV)</td>
<td>• Point of contact at OEMs • Translation – language issue</td>
<td>Earl Capozzi, Catherine</td>
</tr>
<tr>
<td>AS13002 (Inspection Frequency)</td>
<td>• Special processes not covered (NDT) • Order of implementation (13006)</td>
<td>Dave Goldberg, Barbara Negroe</td>
</tr>
<tr>
<td>AS13003 (MSA)</td>
<td>• Guidance material will be helpful • Deployment details not available in standard (“how” part is missing)</td>
<td>Ian Riggs, Martin Schaeffner</td>
</tr>
</tbody>
</table>
## Marketplace Summary Session 2

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>KEY FEEDBACK</th>
<th>FACILITATORS</th>
</tr>
</thead>
</table>
| AS13005  (Quality audit requirements) | • Risk Analysis  
  • Industrial assessment instead of audit? | Helen Djäknegren Catherine |
| AS13004 (PFMEA & Control Plans) | • Make drafts available  
  • Concern about design authority not providing information for PFMEA | Peter Amsden Dave Goldberg |
| AS13006 (Process control methods) | | |
| AS13007 (Supplier management) | • Add Ethics category  
  • A common/std form for all suppliers | Thomas Schmitt Barbara Negroe |
| Future | • Include part marking  
  • Contract review – acknowledgment & spec review | Dele Awofala Martin Schaeffner |
CLOSING REMARKS
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
LÄTT ATT GORA RÄTT
AESQ Will Drive Progress

Spread the Word

Provide feedback on the AESQ website
SAFE RETURN HOME