# COMMUNICATION PACKAGE FOR NEW SPECIFICATION

## AS13006 – Process Control Methods

# Purpose of AS13006

AS13006 provides the user with an array of practical approaches to process control used to ensure consistent product quality.

The purpose of this standard is to raise the overall capability of the Aero-Engine supply chain, standardize the process control requirements across AESQ suppliers, and build on the requirements for PFMEA and Control Plans (ref. AS13004).

AS13006 aligns with AS9145 - Requirements for Advanced Product Quality Planning and Production Part Approval Process, and AS9103 - Variation Management of Key Characteristics, supported by detailed guidance and case studies.

This standard was developed by a dedicated team from AESQ member companies with expert knowledge and experience in the areas of process control, process improvement, quality systems, and supplier engagement.

# Why has AESQ created AS13006?

- Existing process control standards do not provide practical guidance on how to identify and implement the various process control methods.
- For those who supply multiple customers, it is easier to work to one common standard than many individual company-unique requirements.
- Customers are becoming increasingly dependent on the ability of their supply chains to consistently provide product on time with perfect quality. Robust process control is essential prerequisite to making this happen.
- Process control in aerospace has traditionally been
  - Misunderstood
  - Resisted
  - Considered costly/not applicable at low volumes
  - Immature
  - Inspection driven

# AS13006 Benefits

## Supply Chain Benefits

One common set of requirements that embed best practices for process control at every tier of the supply chain.

- Eliminate customer intervention due to poor quality and/or delivery
- Enables improved collaboration with design authorities
- Enables ability to meet AS9145 requirements
- Enhances ability to predict, plan, and improve
- Improved overall product quality leading to Customer retention, enhanced reputation, and future business opportunities

## Customer Benefits

Improved quality & delivery

Industry that accepts a single standard for process control

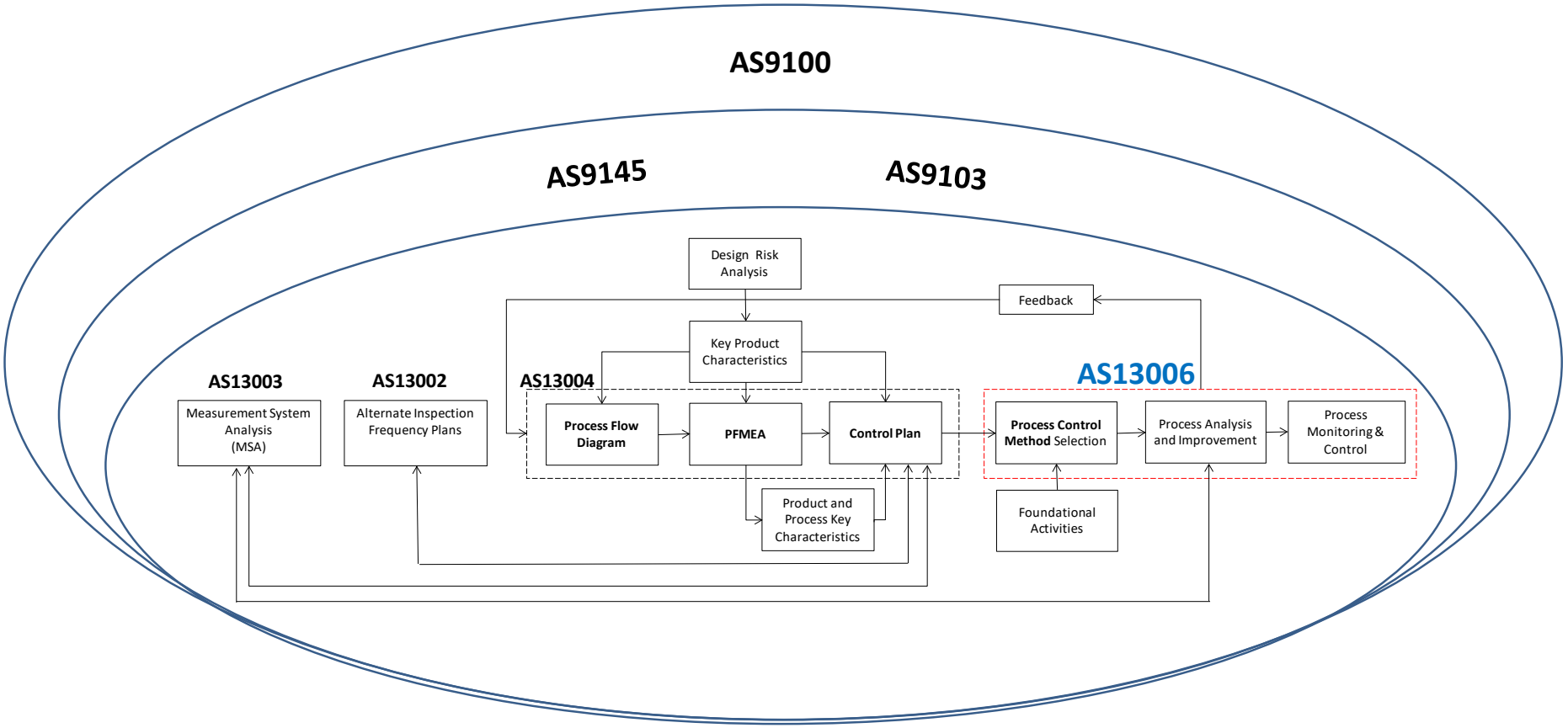
- Consistently better quality
- Less disruption to operations
- Joined up through industrial collaboration
- Customers use the standard themselves to drive their own quality control and improvement
- Easier communication with suppliers with common language from one standard
- Potential to align sourcing based on risk & capability

## Industry Benefits

Benefits to Aerospace Industry and wider society

- Higher reputation for quality
- Benchmark for wider industrial development

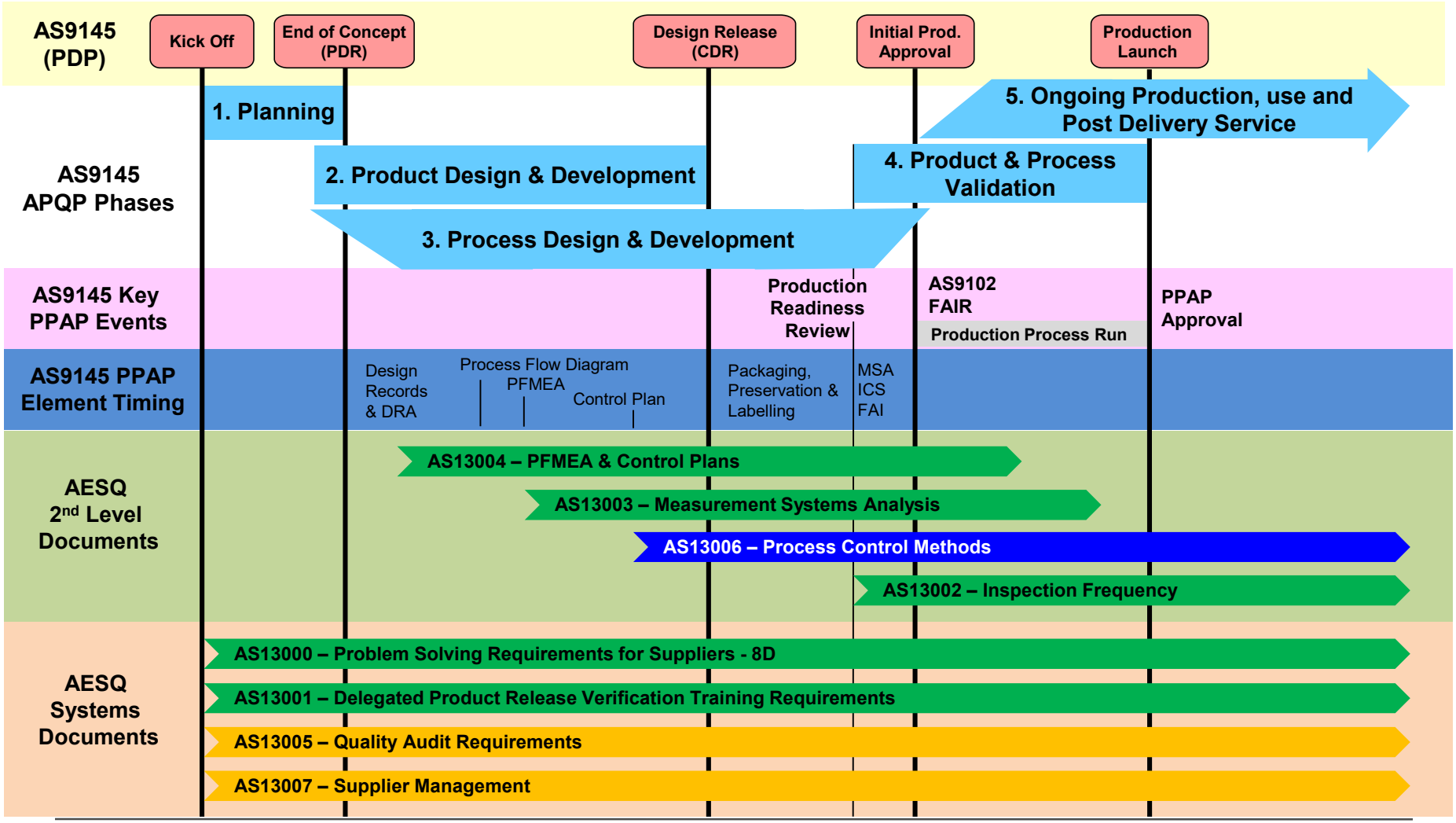
# Relationships to other industry standards




**AS13006 designed to align and work closely with other industry standards**

# Product Life Cycle & Document Interaction

## AS9145 (APQP/PPAP) & AESQ Standards



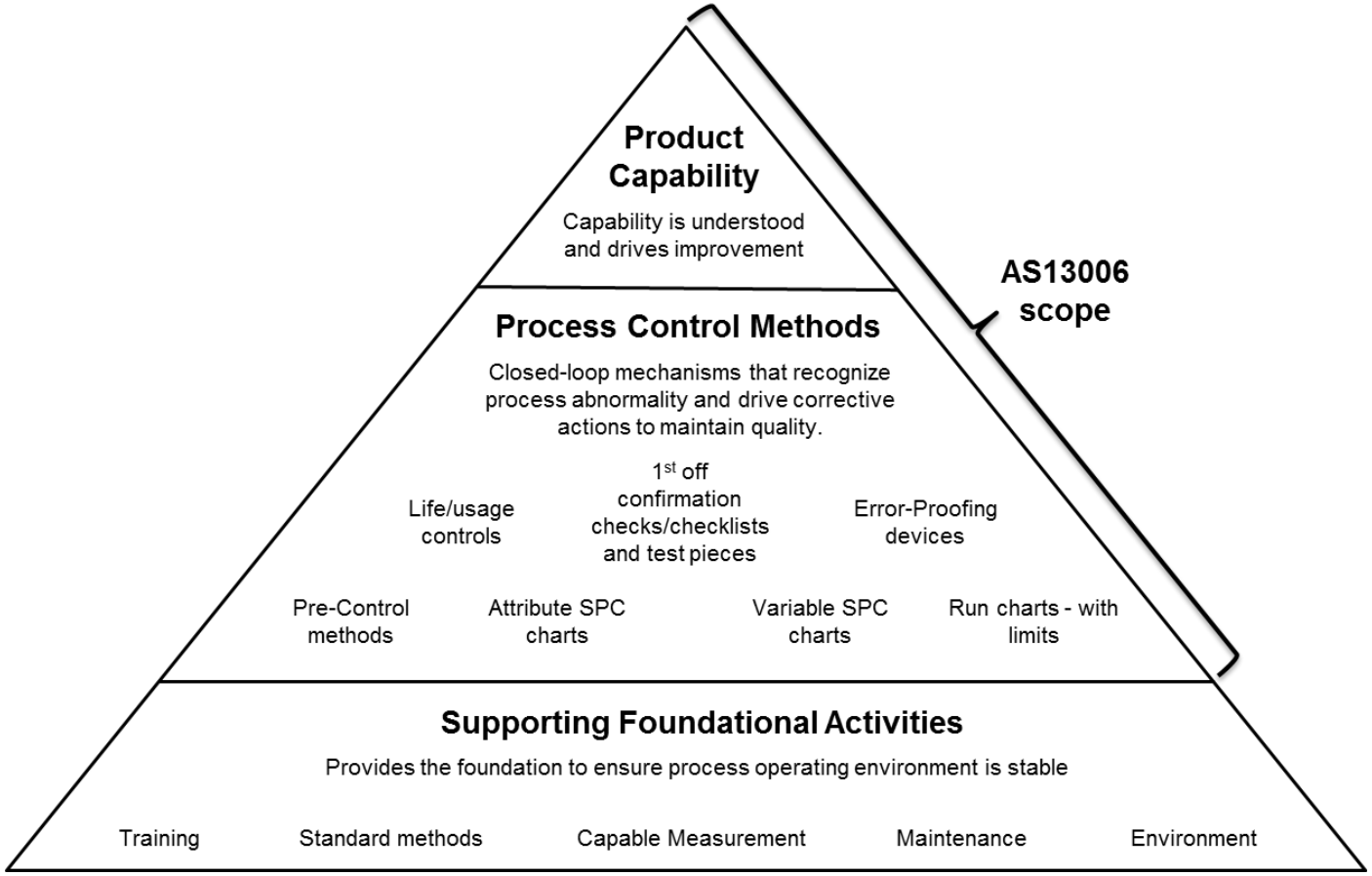
# Deployment Matrix Status

## AESQ Standards - Global Deployment Status

| AESQ Member | AS13000 Problem Solving Requirements for Suppliers | | AS13001 Delegated Product Release Verification Training Requirements | | AS13002 Requirements for Developing and Qualifying Alternate Inspection Frequency Plans | | AS13003 Measurement Systems Analysis Requirements for the Aero Engine Supply Chain | | AS13004 Process Failure Mode and Effects Analysis (PFMEA) and Control Plans | | AS13006 Process Control Methods | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Accepted | Contractual | Accepted | Contractual | Accepted | Contractual | Accepted | Contractual | Accepted | Contractual | Accepted | Contractual |
| Arconic (P&P) | May-15 | June-15 | Feb-16 | Jun-15 | May-17 | Aug-15 | Mar-16 | Sep-15 | Aug-17 | TBD | Upon Release | TBD |
| GE | May-14 | Jun-16 | Oct-14 | Jul-15 | Jan-15 | Jun-16 | Jan-16 | Jun-16 | Aug-17 | Mar-18 | Upon Release | TBD |
| GKN | Jun-14 | Feb-16 | Mar-15 | Mar-16 | Apr-15 | Jul-16 | Mar-15 | Jul-16 | Aug-17 | TBD | Upon Release | TBD |
| Honeywell | Jan-16 | Jan-18 | Mar-15 | Mar-16 | Oct-15 | TBD | Jan-16 | TBD | Aug-17 | TBD | Upon Release | TBD |
| MTU | Aug-15 | Dec-16 | Jan-16 | Mar-16 | 4Q16 | 1Q17 | Jan-16 | Sep-16 | Aug-17 | TBD | Upon Release | TBD |
| PCC Structurals | Mar-15 | N/A | Jan-15 | N/A | May-15 | N/A | Jun-16 | N/A | 3Q 18 | TBD | Upon Release | TBD |
| Pratt & Whitney | Jan-15 | May-15 | Mar-15 | Jul-15 | Apr-15 | Nov-16 | Mar-15 | Nov-16 | Aug-17 | TBD | Upon Release | TBD |
| Rolls-Royce | Dec-14 | Dec-15 | Oct-15 | Dec-15 | Jan-15 | Dec-16 | Jan-15 | Oct-15 | Aug-17 | Dec-17 | Upon Release | TBD |
| Safran | Jan-15 | Oct-15 | Jan-15 | Oct-15 | Jan-15 | Oct-15 | Jan-15 | Oct-15 | Aug-17 | Dec-17 | Upon Release | TBD |

**AESQ Members accept the immediate use of AS13006 within their supply chains & strongly encourage organizations to use this new standard in conjunction with related standards AS13002, AS13003, and AS13004 when implementing AS9145.**

# Recognized Process Control Methods

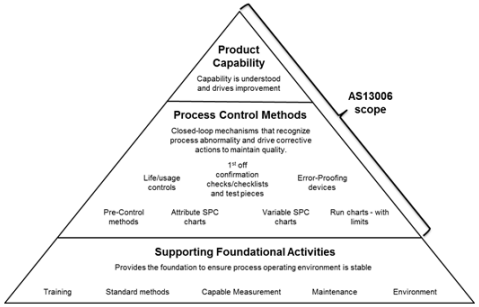


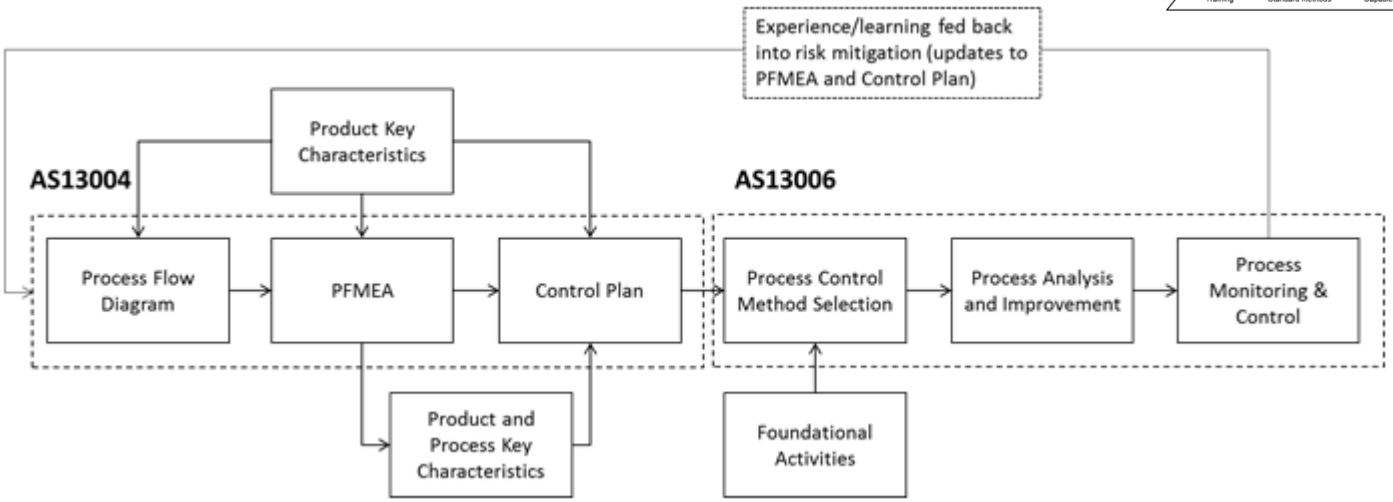

AS13006 drives the use of process control methods and stresses the importance of solid foundational activities.

# Intent by Section

## Process Control Methods Requirements Overview

- *Identifies three main facets: Product Capability, Process Control Methods and Foundational Activities.*
- *Overview of interfaces with other standards and key inputs*

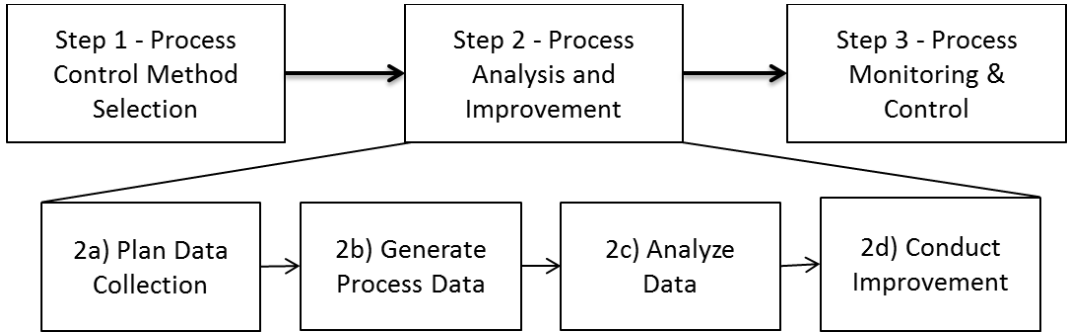


# Intent by Section

## Process Control Activities Overview

1. *Select the appropriate process control method or methods*
2. *Collect data to understand stability and capability, then make improvements*
3. *Apply controls to maintain input variation, stability and capability*



# Intent by Section

| SECTION | TITLE | INTENT |
|---|---|---|
| 1 | Scope | Defines standard's scope for training, selection of control methods, analysis & improvement and monitoring & control. Applies to all control plan items. Not limited to control of KCs and CIs. |
| 2 | Applicable Documents | List the key documents that interact with the requirements of AS13006. |
| 3 | Terms and Definitions | Defines key terms such as "shall", "should", etc. Key definitions also listed that are pertinent within the standard. |
| 4 | Requirements | Requirements built around three key facets: Foundational Activities, Process Control Methods and Product Capability. The intent here is to guide the user through the initial selection of control methods typically done as part of a PFMEA (ref. AS13004) and their respective reaction plans documented on a Process Control Plan. The user will review the nine control methods described in Table 1 with details in the Guidance Document. |
| Appendixes | Appendix A through F | Intent is to provide details on the relationships between the various related standards, the use of an Assessment Checklist, provide a training syllabus supporting the tools of the standard, and point to comprehensive guidance document that provides case studies, tool usage explanations, and formulae. |

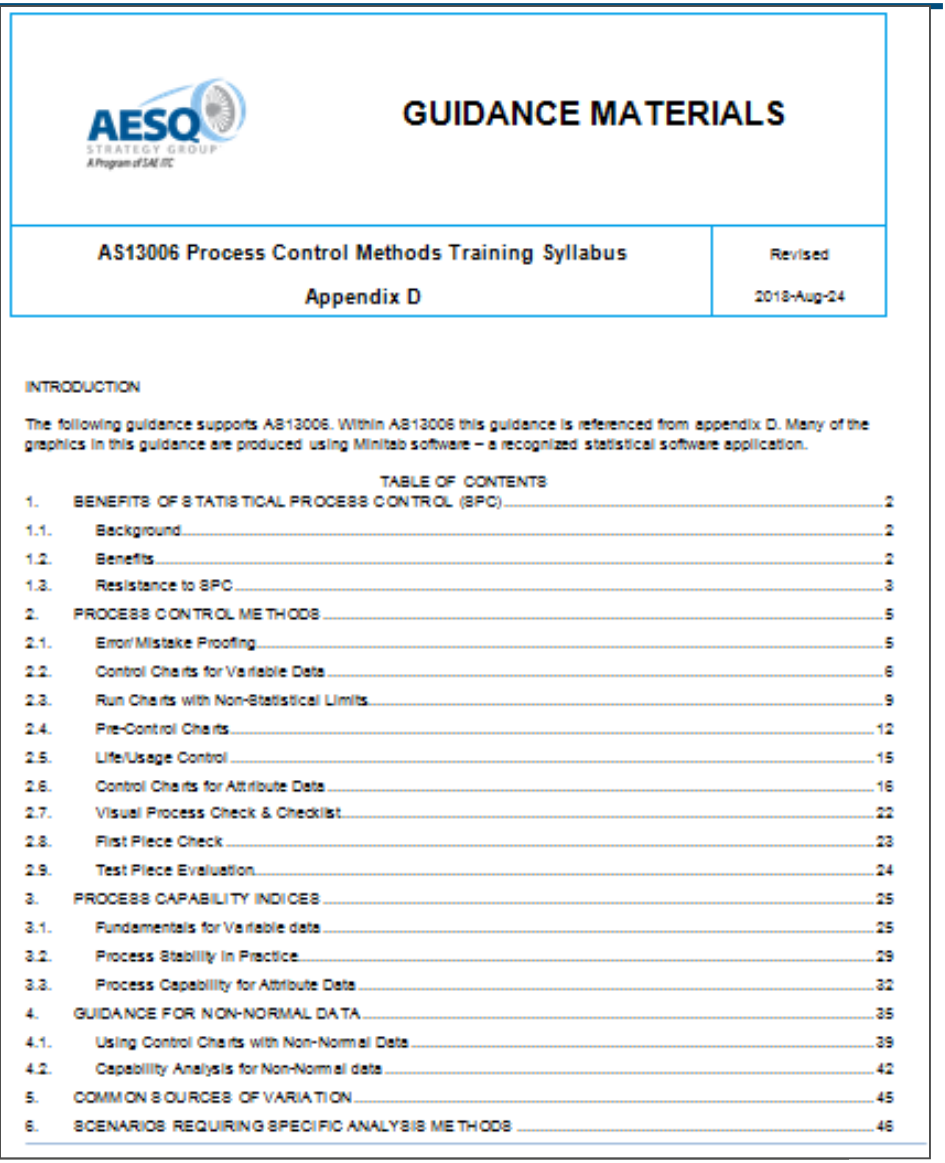
# COMMUNICATION PACKAGE FOR NEW SPECIFICATION

## AS13006 – Appendices outline

# Supporting Guidance Material

Practical information to support the implementation, development, and enhancement of any process control program, such as:

- Benefits of process control and overcoming resistance
- Details on process control methods
- Control charts for applications such as
  - Low volume
  - Part families
  - Groups of identical features
  - Attributes for visual inspection
- Calculating process capability
  - Dealing with marginal stability
  - Managing non-normal data
- Case studies based on aerospace applications
- Associated formulas
- Maturity review



AESQ STRATEGY GROUP
A Program of SAE ITC

**GUIDANCE MATERIALS**

| AS13006 Process Control Methods Training Syllabus<br>Appendix D | Revised<br>2018-Aug-24 |
|---|---|

INTRODUCTION

The following guidance supports AS13006. Within AS13006 this guidance is referenced from appendix D. Many of the graphics in this guidance are produced using Minitab software – a recognized statistical software application.

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# Examples & Case Studies

Examples are used to facilitate understanding and continue the use of common case studies used in other AS130xx standards.

### Case Study Example

2.4.3. Pre-Control Example:

An aerospace manufacturer produces a Fuel Air Bracket (see Figure 2.4-3) with a key feature having an engineering tolerance of 0.386 +/- 0.005 inches. The central 50% of the total tolerance (+/- 0.0025 inches) defines the green zone).

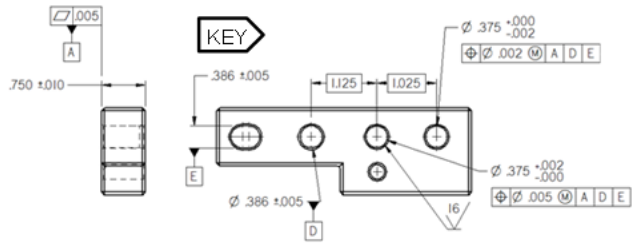


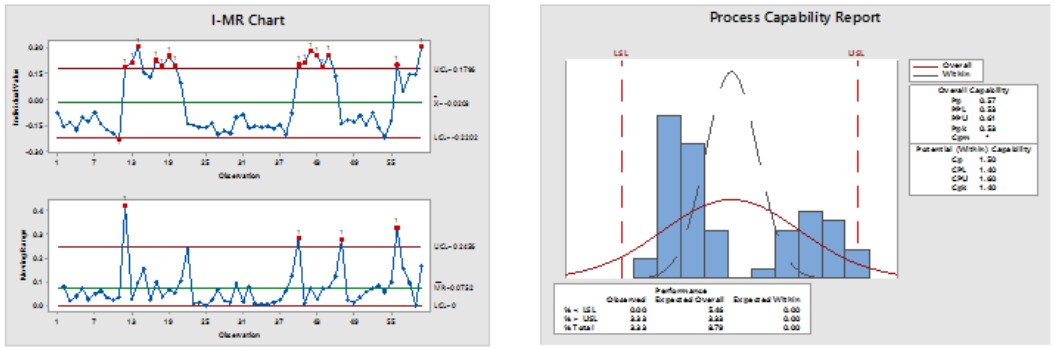

Figure 2.4-3 – FUEL AIR BRACKET EXAMPLE

### Guidance Table Example

Table 2.6-1 – ATTRIBUTE CONTROL CHARTS

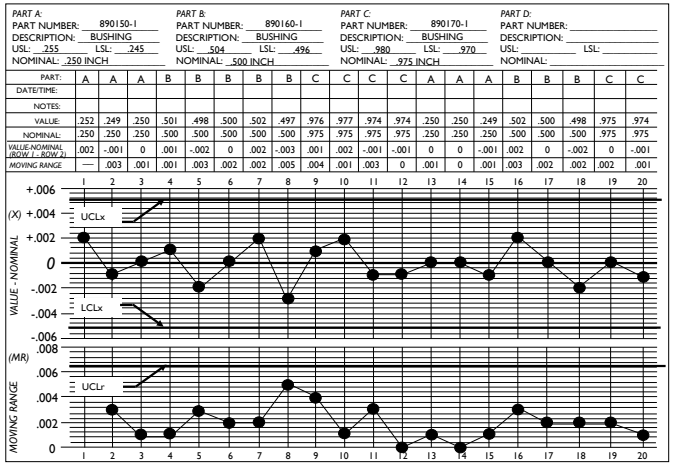
| Scenario | When to use | Control type (which chart) | Example |
|---|---|---|---|
| A process that observes discrete values, such as pass/fail, go/no-go, present/absent, or conforming/ non-conforming. For example a circuit card could consist of a number of solder joints that either conform or do not conform to a set standard | Appropriate: When it is important to control the number or % of defects over a given time period, lot to lot, or unit to unit such as measuring improvement over time, when go/no-go gauges are employed or when visual inspections are used.<br><br>Not Appropriate: Cannot be used for establishing process control or process capability in the same way as variables data | **P-chart** Plot the percent defective – classifying product as good or bad with changing or constant subgroup size | Plot the monthly percent defective rate of a critical supplier; plot the On Time Delivery performance of a critical supplier |
| | | **NP-chart** Plot the number defective – classifying parts as good or bad with constant subgroup size | A machining cell produces fuel control valves in standard lot sizes of 50. Final Inspection performs a 100% inspection of the product and plots the number of valves that are determined to be nonconforming. |

### Specific Control Method Example




Figures 4-4 & 4-5 – A BIMODAL PROCESS DUE TO STEP CHANGES

### Case Study Example




Control of multiple part numbers on one chart

# AS13006 Assessment Checklist

Facilitates the evaluation of organizational compliance to identify continuous improvement opportunities

Assessment checklist can be used to evaluate the process control health of the company in meeting AS13006

Supplier to build into their internal audit program

Used annually as a minimum

Conducted by someone proficient in process control methods (refer to training syllabus on next slide)

**AS13006 - Process Control Methods Appendix B - Assessment Checklist**

| Export Control | Data not technical | Jurisdiction | Classification |
|---|---|---|---|
| Form Rev. 29 Aug 2018 | | | |

| Company: | | Date | |
|---|---|---|---|
| Location: | | By: | |

| Checklist Ref. Number | Category | Clause Ref. | Question | Complies Yes | Complies No | Complies N/A | Comments |
|---|---|---|---|---|---|---|---|
| 6 | 4.2 Applicability | 4.2.1 | Has this standard been applied to products and processes in conjunction with a control plan? | | | | |
| 7 | | 4.2.2 | Is the default application of process control, product specific? | | | | |
| 8 | 4.3 Organizational (Quality) System Requirements | 4.3.1 | Is there a documented process within the organization's quality management system to meet the requirements of this standard and to manage, coordinate and validate variation management activities? | | | | |
| 9 | | 4.3.2 | Does your organization have a documented audit procedure to confirm compliance to this standard and address shortcomings? | | | | |
| 10 | | 4.3.3 | Have records of these assessments been maintained for customer review? | | | | |
| 11 | | 4.3.4 | Has your organization ensured the flow down of this standard to any associated suppliers that manufacture and/or process products related to application of this standard? | | | | |
| 12 | 4.4 Training and Competency | 4.4.1 | Does your organization employ or have access to a Process Control practitioner who can lead the deployment of this standard and was trained by a competent training provider, using material that contains the minimum Training Syllabus in Appendix C? | | | | |
| 13 | 4.5 Process Control Prerequisites | 4.5.1 | Have the measurement systems used been proven capable in accordance with customer requirements (reference AS13003)? | | | | |
| 14 | | 4.5.2 | Has the organization identified key product and process characteristics, in addition to customer defined KCs and CI's? | | | | |
| 15 | | 4.5.3 | Has the organization created Control Plans which include all KC's and CI's or equivalent prior to the execution of this standard? | | | | |
| 16 | 4.6 Process Control Method Selection | 4.6.1 | Has your organization determined the appropriate Process Control Methods for each item on the Control Plan? | | | | |
| 17 | | 4.6.3 | Where the type of risk to be mitigated justifies the need for more than one Process Control Method, have the methods been declared separately in the Control Plan? | | | | |
| 18 | | 4.6.5 | Has your organization created and deployed any work instructions necessary to operate the controls declared in the Control Plan? | | | | |
| | | | **Plan data collection** Has your organization planned data collection in order to demonstrate the effectiveness of the controls used (i.e., process stability and capability), considering: | | | | |

# Training Syllabus

Details the minimum content that a Process Control Methods training syllabus needs to contain to support continued  competence in the application of this standard

Partial syllabus shown

Refer to Appendix C for the full training syllabus

***Table 1 – Training Syllabus***

| THEME | OUTCOMES | MINIMUM CONTENT |
|---|---|---|
| The importance of Process Control | Appreciation of customers' needs and the benefits to the organization, industry and society<br><br>Learning Objective: Learner will be able to describe the importance of process control including how it benefits company, industry, and society. | • Examples and discussion on process control failures<br>• Reputational impact<br>• Effect on the Aerospace industry<br>• Benefits of achieving design nominal (Taguchi's Loss Function)<br>• Understanding and importance of a closed loop control system<br>• Effectiveness of in process control over end-of-line inspection |
| Process Control in Context of Quality Planning | Understanding of the linkages between the quality planning activities<br>Learning Objective: Learner will be able to explain the purpose of Control Plans, what they contain, and their use in developing work instructions.<br>Learning Objective: Learner will be able to describe how Control Plans link to Process FMEA. | • Linkage between PFMEA, Control Plans, and work instructions<br>• Purpose and content of a Control Plan |

# Press release by SAE for AS13006

**New SAE International Standard Established AS13006, "Process Control Methods" to be implemented on manufacturing processes throughout the Aerospace Engine Supplier Quality member supply chain**

**WARRENDALE, Pa. (Sept. xx, 2018) – SAE International announces the publication of AS13006: Process Control Methods.**

**Aerospace engine manufacturers and their suppliers currently have differing requirements for the identification and implementation of effective process control methods used to mitigate process risk or to manage Customer and supplier defined Key Characteristics.**

**This new standard establishes a common practice and methodology in defining the appropriate process control methods used to monitor, alert, detect and prevent causes of failure modes that could result in delivery disruptions to end Customers. AS13006 works cohesively with AS13004, "PFMEA and Control Plans" as part of risk identification and mitigation but also as a stand-alone document. A separate guidance document available on the AESQ website (XXXXX) provides specific case studies and detailed explanations for the nine process control methods described in the specification.**

**Also, AS13006 fully aligns and supports the SAE standard "AS9145 Requirements for Advance Product Quality Planning and Production Part Approval Process", which was developed by the IAQG/SAE G-14 AAQSC Committee.**

**The nine members of the AESQ Strategy Group (GE Aviation, GKN, Honeywell, MTU Aero Engines, PCC Structurals, Pratt & Whitney, Rolls-Royce, Safran, Arconic) will accept the immediate use of AS13006 within their supply chains and strongly encourage organizations to use these latest two standards when implementing AS9145. Although designed for the aerospace engine supply chain, AS13006 may be applied effectively by other segments of the aviation, space, and defense industries.**

**The SAE G-22 AESQ Committee and the IAQG/SAE G-14 AAQSC Committee worked together cooperatively to ensure proper alignment of these standards.**

**To learn more about this new document, visit http://standards.sae.org/wip/as13006/.**

- AS13006 released on 3rd Sept 2018
- Going out to all aerospace publications and SAE member companies
- Describes the purpose of the standard
- Lists the AESQ companies that participated in its creation
- Communicates the other key standards AS13006 interacts with

# What's next/FAQs

**Q: When does this standard become a requirement?**

***A**: AESQ member companies will phase this standard into their customer requirements over the coming months and advise suppliers directly. It should be noted that suppliers can gain benefits from earlier adoption of this standard. There is no need to wait for contractual obligation.*

**Q: Do I only apply this document when AS13004 is invoked?**

***A**: NO - this specification applies when invoked on a PO from any of the AESQ OEMs. It is best implemented in conjunction with AS13004 but can also be implemented as a stand-alone document.*

**Q: Must all Key Characteristics be controlled using SPC techniques?**

***A**: NO: KCs represent important features affecting safety, form, fit and function. Control of these features can be accomplished using any of the methods prescribed in AS13006 and the accompanying Guidance Document. However, process capability must first be demonstrated regardless of the process control method selected. See Appendix D, AS13006 Guidance Document, section 3.*

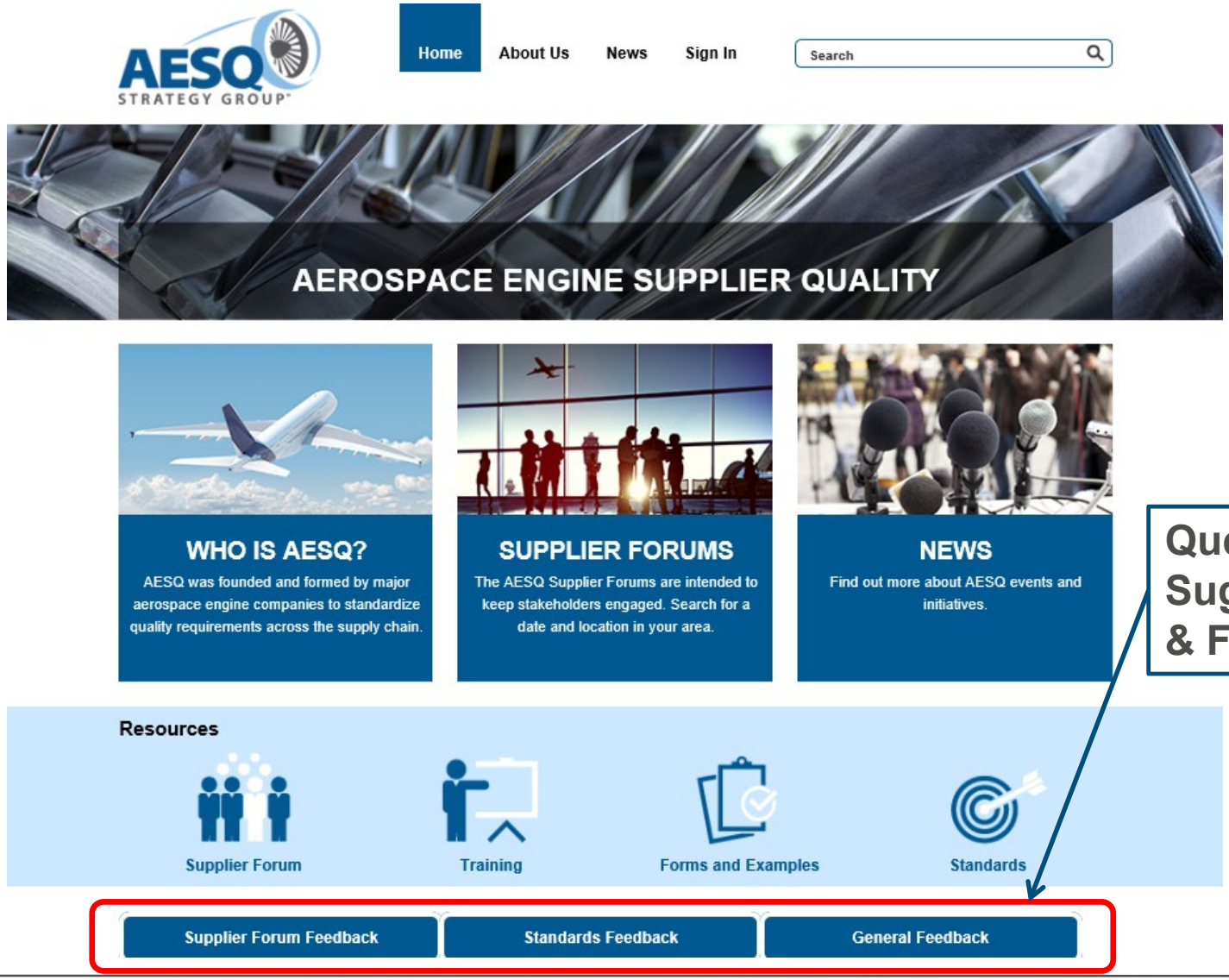
**Q: Are suppliers required to select their own Key Characteristics?**

***A**: YES: Where this makes sense. Lower-level KC selection by a supplier can be very applicable for features that impact upper-level OEM KCs, also as a means to mitigate high process risks determined during PFMEA activities.*

**Q: How can suppliers receive training for the implementation of these process control requirements?**

***A**: Some training providers are aware of the AS13006 standard and are preparing to support the industry through training. AESQ member companies will be able to direct to training providers in your area. For sourcing of training please refer to the AS13006 training syllabus to ensure such training is comprehensive in its content.*

# AESQ WEBSITE - aesq.saeitc.org




**Questions, Suggestions & Feedback**