ADVANCED PRODUCT QUALITY PLANNING (APQP) AND PRODUCTION PART APPROVAL PROCESS (PPAP)

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9145 APQP & PPAP

The purpose of this presentation is to:

• Introduce the key concepts of APQP and PPAP and the benefits of application

• Communicate availability of guidance material and training

• Implementation – First steps
APQP and PPAP Webinar Series

Webinar Objectives

• Provide high level understanding
• Introduce APQP and PPAP and show relation to 9145
• Share benefits & best practices
• Provide sources of additional information
Introduction to 9145
What is 9145?

9145 applies Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP) to *Product Development* in the Aviation Space And Defense (AS&D) industry.

### 5-Phase Product Development Process
1. Planning
2. Product Design and Development
3. Process Design and Development
4. Product and Process Validation
5. On-Going Production, Use, and Post-Delivery Service

### Success Drivers
- Management commitment
- Integrated cross-functional teams
- Effective project management
- Defined deliverables & outputs for each phase
Why 9145?

Improve Quality and Reduce Cost

• Early achievement of product maturity
• Reduced overall life-cycle costs
• Prevention tools for risk reduction
• Provides foundation for successful work transfers

Progressive companies have incorporated APQP into their Product Development Process
Companies incorporating APQP into their PDP and flowing these requirements to their suppliers

- Airbus Group
- Boeing
- GE Aviation
- Raytheon
- Spirit Aero
- Rockwell Collins
- Textron
- Honeywell
- Hensoldt
- Lockheed Martin
- Safran Group
- UTC
- Bombardier
- Eaton
- Embraer
- Oshkosh
- Rolls Royce
- Woodward
- MHI
- Parker Aerospace

Not intended to be a comprehensive list
What does 9145 do for AS&D?

Standardizes requirements for Product Development across AS&D

• Integrated multifunctional approach to ensure effective collaboration

• Structured proactive life-cycle approach

• Phased/gated process to ensure on-time quality products

• Strengthens production verification process (PPAP)
How are 9145 Benefits achieved?

• Early understanding of Customer Expectations
• Reduce overall cost by identifying & eliminating risks
• Achieve robust Product and Process Designs
• Minimize required changes
• Effective implementation through program management
• Cross-functional teams collaborate on all aspects of the program
• Meet Customers requirements
• Achieve reliability and cost targets
9145 Benefits from Proactive Approach

Non-conformances reduced through PPAP
(actual AS&D example)

New Product Introduction

40 % reduction

With PPAP
No PPAP


Defective items per items received

Program to program comparison

Across programs

Work Transfers

Transition / Resourcing

80 % reduction


First benefits of APQP can be achieved through PPAP deployment

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APQP Overview
What is Advanced Product Quality Planning?

APQP is a structured phased Product Development methodology that assures Customer satisfaction by:

- Ensuring that all activities are completed on-time and on-quality
- Facilitating effective communication
- Providing timely escalation and resolution of delays and risks
APQP Principles

Pillars of success

- Organizational Commitment & Management Support
- Cross Functional Team
- Effective Project Planning

Customer Satisfaction
On-Time, On-Quality, Shorter lead times
APQP Principles

Top Management demonstrates commitment by...

- Completing APQP training
- Allocating and training resources
- Leading reviews
- Standardizing APQP practices
- Removing roadblocks

Management engagement & commitment from launch to closure is key!

Customer Satisfaction
On-Time, On-Quality, Shorter lead times

Pillars of success

Organizational Commitment & Management Support
Cross Functional Team
Effective Project Planning

APQP PRINCIPLES
APQP Principles

Cross functional teams enable effective communications and faster product development

Customer Satisfaction
On-Time, On-Quality, Shorter lead times

Teams should consist of...
- Engineering
- Procurement
- Manufacturing
- Quality
- Sales
- Suppliers
- Customers
- Customer Support

Pillars of success
Effective project planning and management...

- Schedule tasks, assign responsibility and drive on-time completion
- Continually monitor plan, communicate risks and remove roadblocks
- The APQP plan cascades program key targets through the value stream

Commitment to a firm APQP plan is a critical success factor!

APQP Principles

Customer Satisfaction
*On-Time, On-Quality, Shorter lead times*

Organizational Commitment & Management Support

Cross Functional Team

Effective Project Planning

APQP PRINCIPLES

Pillars of success
PDP and APQP Phase Alignment

Phase Milestones

APQP has 5 phases starting with product concepts and extending through the product life cycle.

Product Development Process (PDP)

Phases of Advanced Product Quality Planning (APQP)

1. Planning
   - Product concept
   - Design validation & verification

2. Product Design and Development
   - Design Release (CDR)
   - Initial Production Approval
   - Production Launch

3. Process Design and Development
   - Kick Off
   - End of Concept (PDR)

4. Product and Process Validation
   - APQP Milestone
   - 1st Article Inspection (FAI)
   - Production Part Approval Process (PPAP)

5. On-going Production, Use and Post-delivery Service
   - Process validation
   - Production Readiness Review

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### APQP – Phase 1

**Phase 1 – Planning**
- Identifies and gathers all the inputs applicable to the product
- Collects the technical and non-technical requirements applicable to the project/product
- Defines the product and project goals
- Ensures that the organization makes the key make-buy decisions
- Establishes timing for deliverables for each APQP element

**Output**
- The product concept is finalized *(milestone A)* and a pre-design is available
- Concurrent product design and process design can start
APQP – Phase 2

Phase 2 – Product design & development

- Turns product specifications into a robust product definition
- Design risk analysis (DFMEA)
- Provides a verified product design
- Team commits to product manufacturability

Output

- Design record and BOM are available
- The product design is verified and validated (milestone B) by the design organization
**APQP – Phase 3**

**Phase 3 – Process design & development**
- Creates a robust manufacturing process that meets requirements in terms of quantity and quality of product
- Defines the means to control the manufacturing process and its outputs

**Output**
- The process is defined, established, verified (Production Readiness Review - **milestone C**) and ready for validation.
**APQP – Phase 4**

**Phase 4 – Product & process validation:**

- Launches the initial production run
- Collects data to demonstrate the manufacturing and assembly processes can produce conforming product at the required rate
- Management determines process readiness for entry into serial production by reviewing the results of:
  - Product and process design as validated by the organization
  - Production readiness evaluation
  - Corrective actions taken for any issues identified to date
Phase 4 – Product & process validation:

Output

- Start of production & FAI (milestone D) verify that the initial product made using all full production means conforms to specified requirements
- First Article Inspection (FAI) is compiled, approved and available for customer review
- Production Part Approval Process (PPAP) (milestone E) is compiled, approved and available for customer review
**APQP – Phase 5**

**Phase 5 – Production**
- Evaluate if project objectives have been achieved
- Record Lessons Learned to drive robust product realization processes
- Implement actions to increase customer satisfaction

**Output**
- Project goals are achieved, including reliability, quality, and customer satisfaction
- On-time, on-quality, on-cost production and service
PPAP Overview
PPAP Overview

PPAP is an aerospace APQP element finalizing “Product and Process Validation”

1. Planning
2 – Product Design and Development
3 – Process Design and Development
4 – Product and Process Validation
5 – On-going Production, Use and Post-delivery Service

PPAP combines First Article Inspection and Process Validation
What is Production Part Approval Process?

PPAP confirms...

that the production process has demonstrated the potential to produce products.....

that consistently fulfill all requirements.....

while operating at the \textit{customer demand rate}
# PPAP Elements & Phase Alignment

PPAP elements are the output and evidence of APQP execution.

<table>
<thead>
<tr>
<th>PPAP ELEMENT</th>
<th>APQP PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design Records*</td>
<td>2</td>
</tr>
<tr>
<td>2. Design Risk Analysis*</td>
<td>2</td>
</tr>
<tr>
<td>3. Process Flow Diagram</td>
<td>3</td>
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<tr>
<td>4. PFMEA</td>
<td>3</td>
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<tr>
<td>5. Control Plan</td>
<td>3</td>
</tr>
<tr>
<td>6. MSA</td>
<td>4</td>
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<tr>
<td>7. Initial Process Capability Studies</td>
<td>4</td>
</tr>
<tr>
<td>8. Packing, Preservation and Labeling Approvals</td>
<td>3</td>
</tr>
<tr>
<td>9. FAIR</td>
<td>4</td>
</tr>
<tr>
<td>10. Customer Specific Requirements</td>
<td>4</td>
</tr>
<tr>
<td>11. PPAP Approval Form (or equivalent)</td>
<td>4</td>
</tr>
</tbody>
</table>

* Responsibility of design responsible organization
Production Part Approval Process (PPAP)

Compile the PPAP Package → Submit to Customer → Disposition PPAP Submission

PPAP Approval Form - 9145 Appendix D

Maintain the PPAP file throughout product lifecycle
Guidance Material & Training
9145 Aerospace APQP & PPAP
AS Standard Published Nov 2016
SJAC 9145  June 21, 2017
Aerospace APQP SCMH Section 7.2

SCMH 7.2.2
Introduction Presentation

SCMH 7.2.3
APQP Manual

SCMH 7.2.4-7.2.8
Phase Checklists

Tools & Templates
7.2.9 Process Flow Diagram
7.2.10 DFMEA
7.2.11 PFMEA
7.2.12 Element Applicability
7.2.13 Control Plan

SCMH 7.2.14
Maturity Assessment
**Self Assessment - Maturity Matrix**

### What is It?
- A tools used to visually represent an organizations strengths and weaknesses within APQP

### Objective or Purpose
To evaluate and assess the maturity of an organizations Advanced Product Quality Planning philosophy
- Management awareness/commitment
- Organizational alignment and effective communication
- Project/risk management
- Use of tools
- Readiness of external suppliers

### When to Use It
- Prior to deployment within your organization
- Prior to deployment of your external suppliers
- As needed to monitor and develop continuous improvement

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<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
<th>Level 1 (1 pt)</th>
<th>Level 2 (2 pt)</th>
<th>Level 3 (3 pt)</th>
<th>Level 4 (4 pt)</th>
<th>Level 5 (5 pt)</th>
<th>Weight</th>
<th>Score</th>
<th>Comment / Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Advanced Product Quality Planning (APQP) Philosophies &amp; Knowledge of the Requirements</td>
<td>No knowledge of APQP. Not integrated into product development process.</td>
<td>Basic knowledge and awareness of APQP and basic understanding of requirements and tools needed to deploy.</td>
<td>Implementation plans in place for integrating APQP into product development process.</td>
<td>Advanced knowledge of APQP and integration into product development process, strategic communication and objectives during the APQP methodology.</td>
<td>APQP is defined and fully integrated in product development process. Leadership objectives met and tactical objectives implemented. Results analysis driving improvements and closing gaps.</td>
<td>30%</td>
<td>2</td>
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**Management Awareness and Commitment**

**Organizational Alignment and Effective Communication**

**Readiness of External Providers**

**Project and Risk Management**

**Tools: APQP**

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Implementation
First Steps in Deployment

• Benchmark other companies

• Perform the Self-Assessment (Maturity Matrix)
  – Identify strengths and weaknesses

• Training
  – Determine what training is needed based off Maturity Matrix
  – Develop a plan to address training needs

• Incorporate APQP in the Product Development Process
  – Conformance to the standard/customer requirements
APQP Relationship Webinar Series

1. Planning

2. Product Design & Development

3. Process Design & Development

4. Product & Process Validation

5. On-going Production & Post Delivery

*Reference 9145 Table 2 – Production part approval process file contents*
### Upcoming IAQG 9145, APQP & PPAP Webinar Series

<table>
<thead>
<tr>
<th>Webinar Topic</th>
<th>Who Should Attend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Product Quality Planning (APQP) Overview</td>
<td>Top leadership and leaders of all function engaged in product development process</td>
</tr>
<tr>
<td>Design Risk Analysis – Critical Items</td>
<td>Systems, Design, Manufacturing and Quality Engineers</td>
</tr>
<tr>
<td>Control Plan</td>
<td>Design, Manufacturing and Quality Engineers, Operations Management</td>
</tr>
<tr>
<td>Measurement Systems Analysis MSA</td>
<td>Design, Manufacturing and Quality Engineers, Calibration Management</td>
</tr>
<tr>
<td>Process Capability &amp; Control (Variation Management)</td>
<td>Manufacturing and Quality Engineers, Operations Management</td>
</tr>
<tr>
<td>Production Part Approval Process (PPAP)</td>
<td>Manufacturing and Quality Engineers</td>
</tr>
</tbody>
</table>
Comments and Suggestions

Do you have comments about the APQP Guidance?

You may provide feedback via the SCMH, go to [www.iaqg.org/scmh](http://www.iaqg.org/scmh) accept the terms and conditions then click on “Contact Us” or “Take Survey”. 