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

JENNIFER COX - SPIRIT AEROSYSTEMS

ELIZABETH WALTERS – THE BOEING CO.

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

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)

Based on proven methodology for Product Development

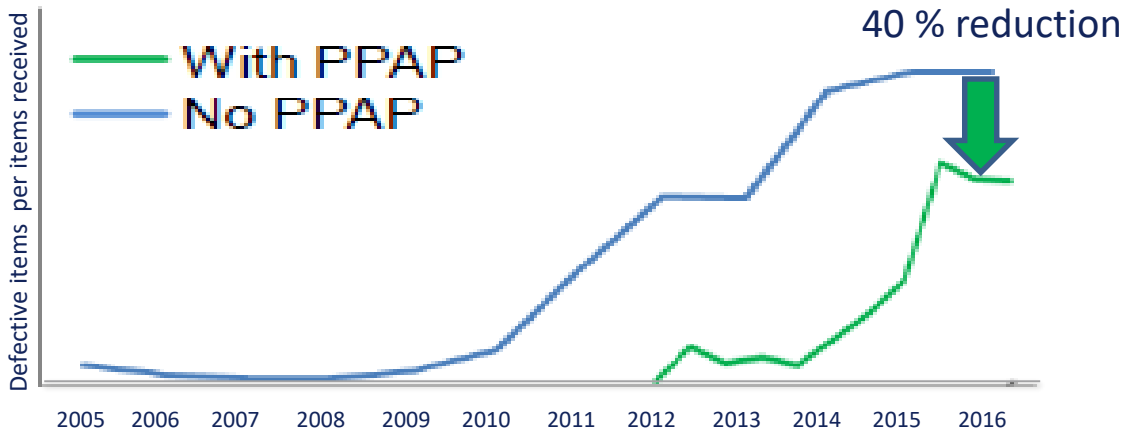
How are 9145 Benefits achieved?

- 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

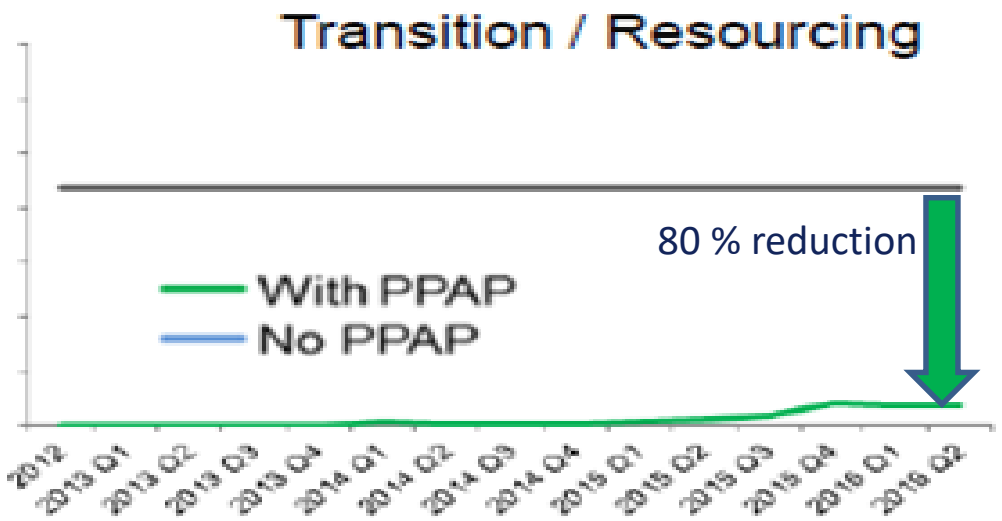
Non-conformances reduced through PPAP
(actual AS&D example)

New Product Introduction



Program to program comparison

Work Transfers



Across programs

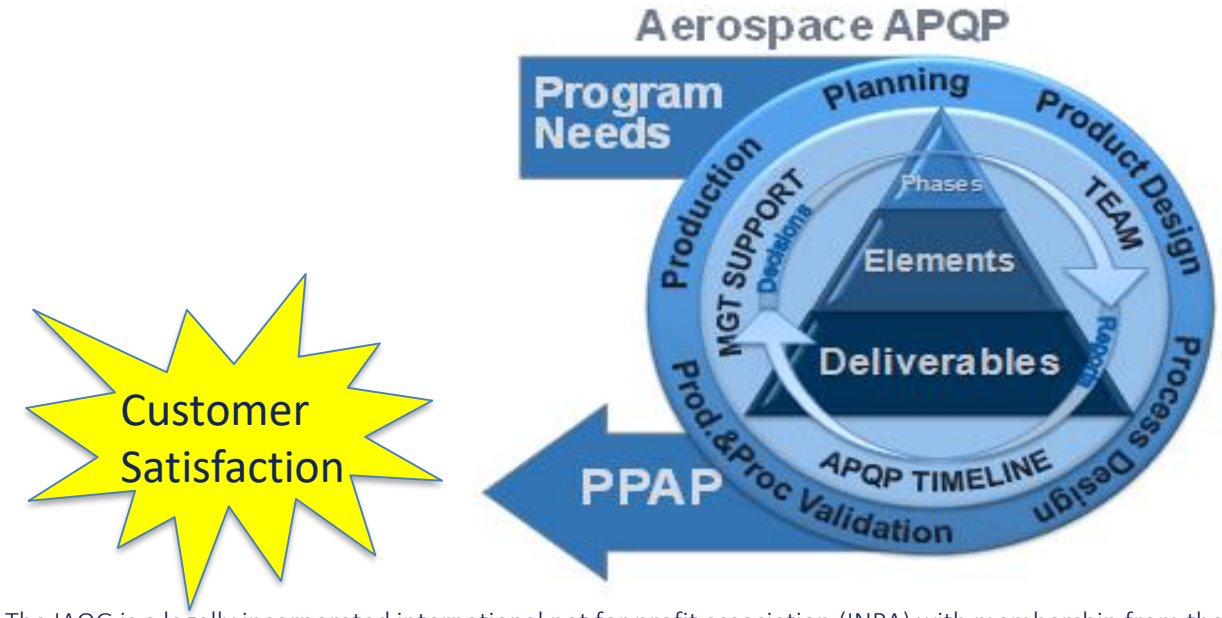
First benefits of APQP can be achieved through PPAP deployment

APQP Overview

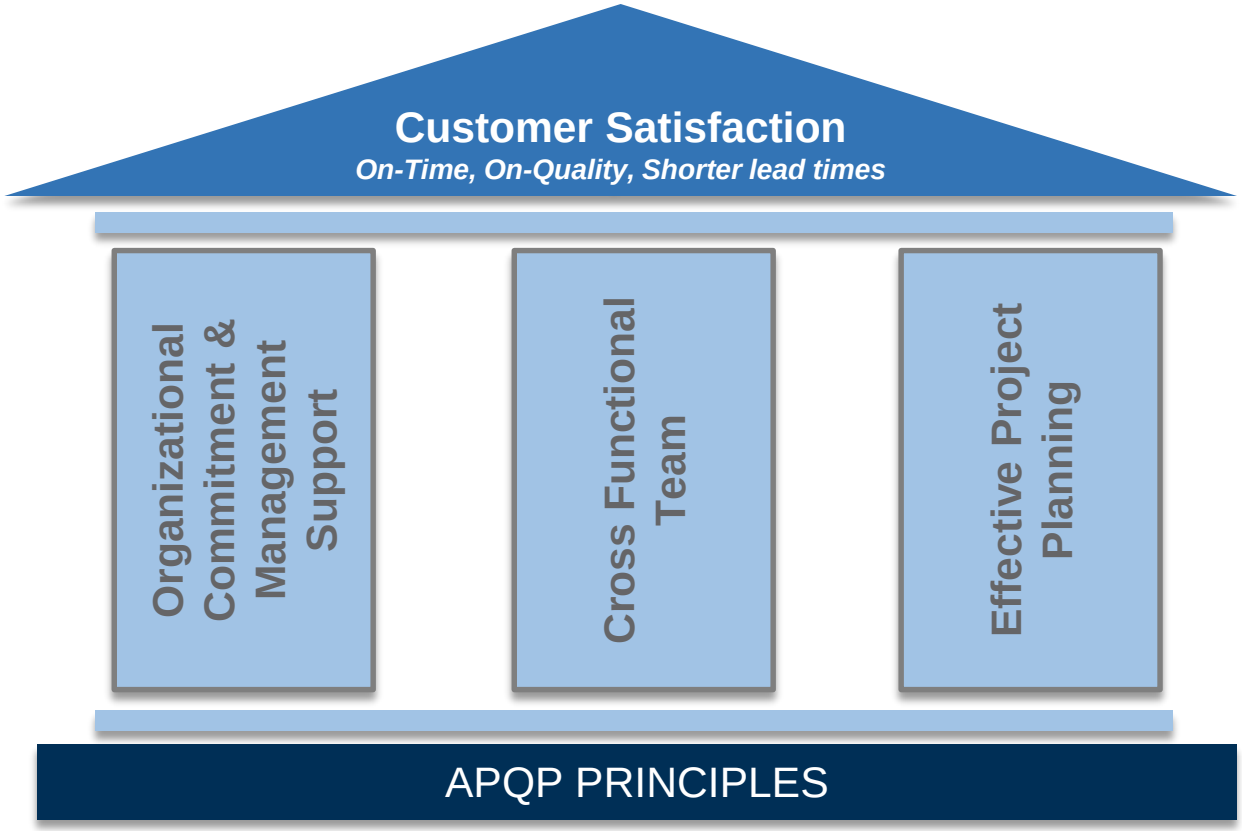
What is Advanced Product Quality Planning?

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



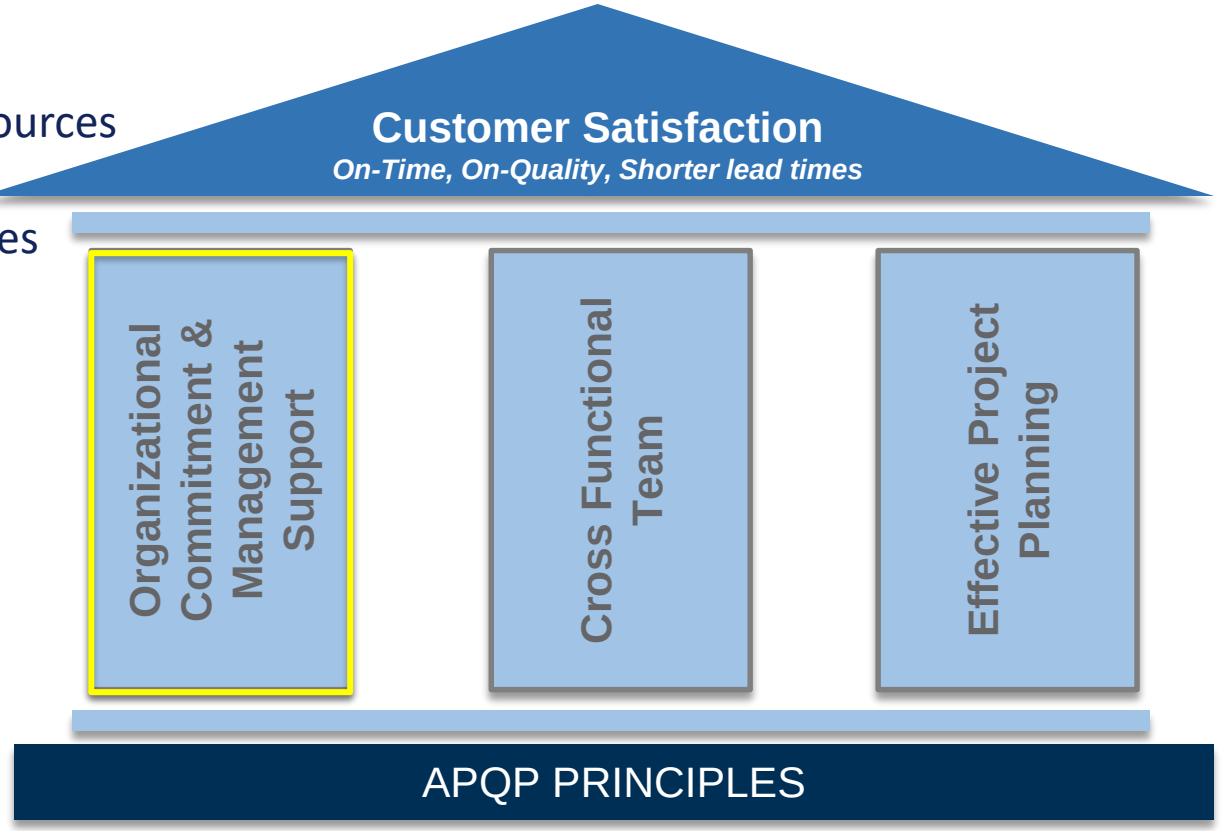
Pillars of success

APQP Principles

Top Management demonstrates commitment by…

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

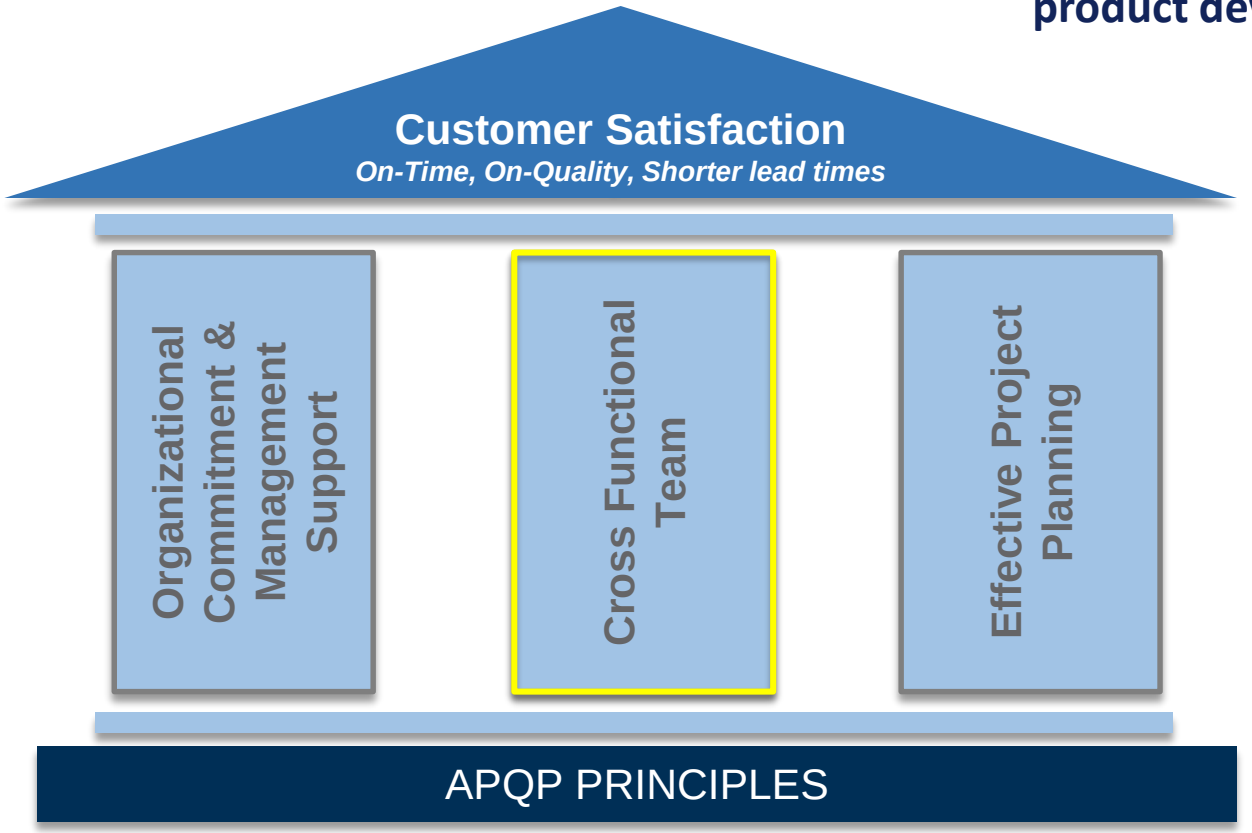
Management engagement & commitment from launch to closure is key!



Pillars of success

APQP Principles

Cross functional teams enable effective communications and faster product development



Teams should consist of…

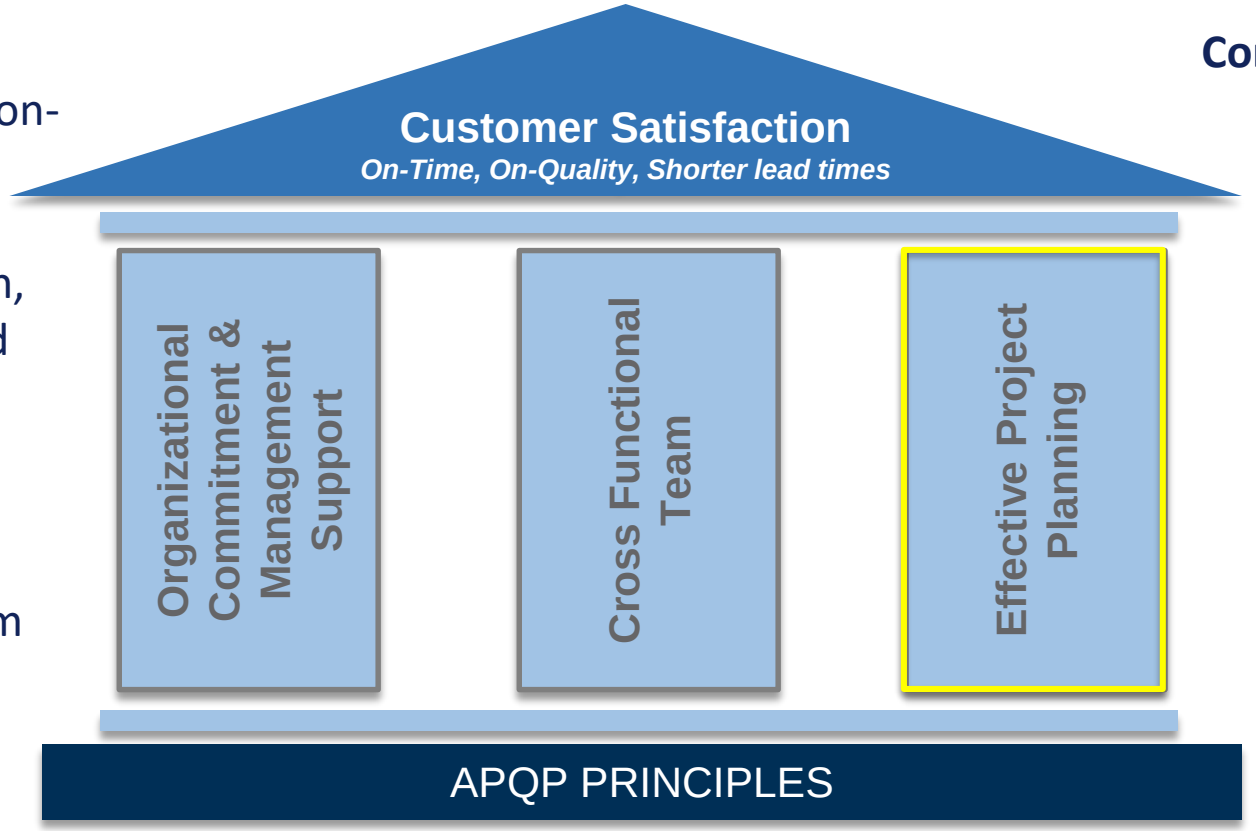
- Engineering
- Procurement
- Manufacturing
- Quality
- Sales
- Suppliers
- Customers
- Customer Support

Pillars of success

APQP Principles

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



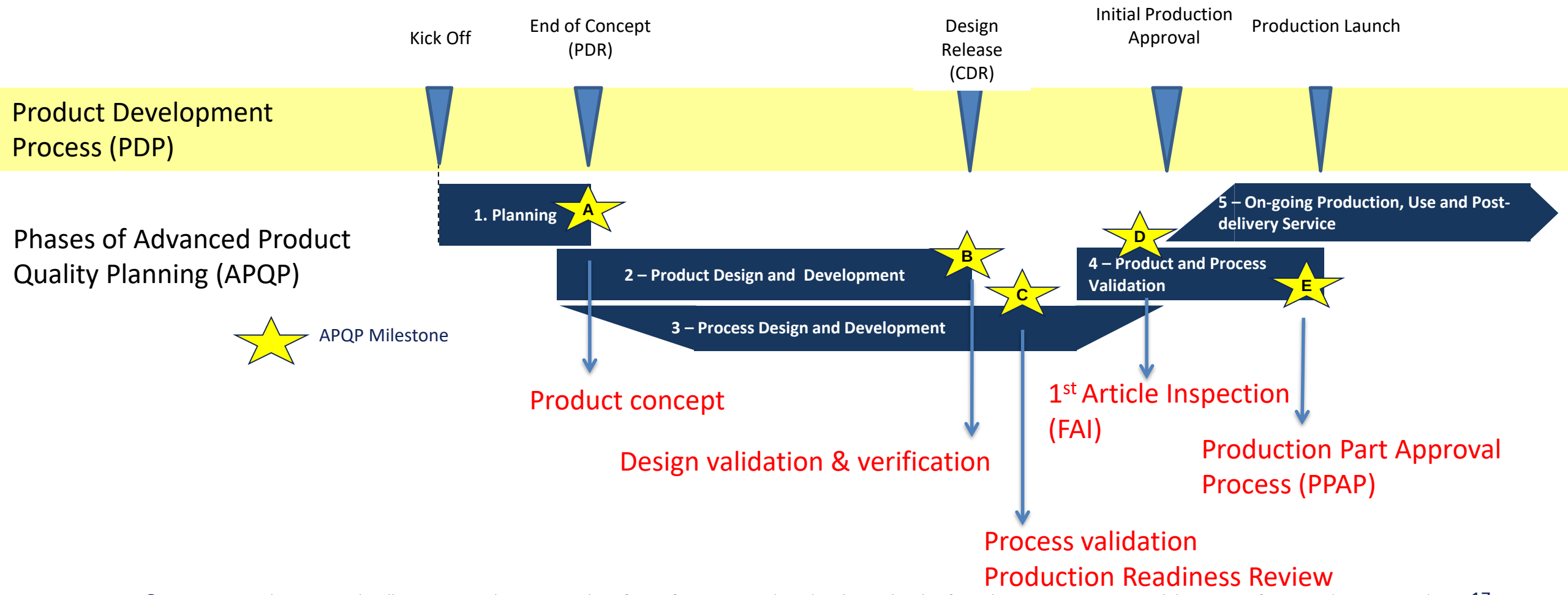
Commitment to a firm APQP plan is a critical success factor!

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



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

APQP – Phase 4

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

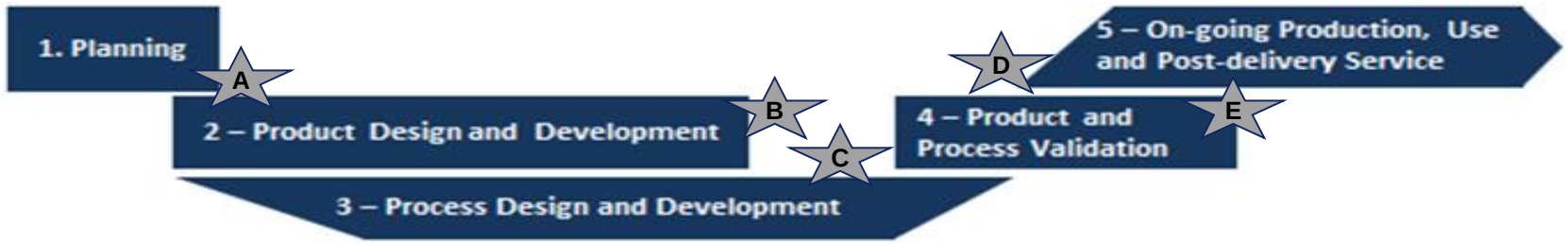
APQP – Phase 5

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”

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 *customer demand rate*

PPAP Elements & Phase Alignment

PPAP elements are the output and evidence of APQP execution

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

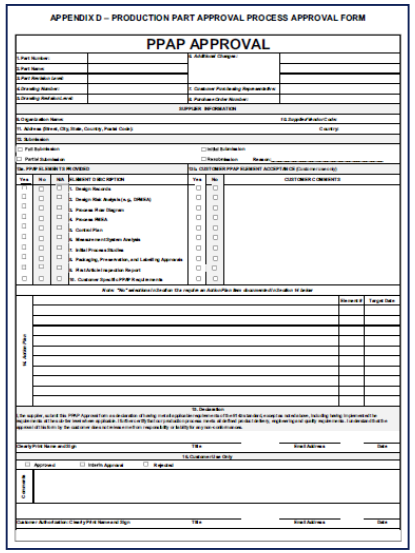
*** Responsibility of design responsible organization**

Production Part Approval Process (PPAP)

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

- Approved
- Interim Approval
- Rejected

PPAP Approval Form - 9145 Appendix D


APPENDIX D – PRODUCTION PART APPROVAL PROCESS APPROVAL FORM

PPAP APPROVAL

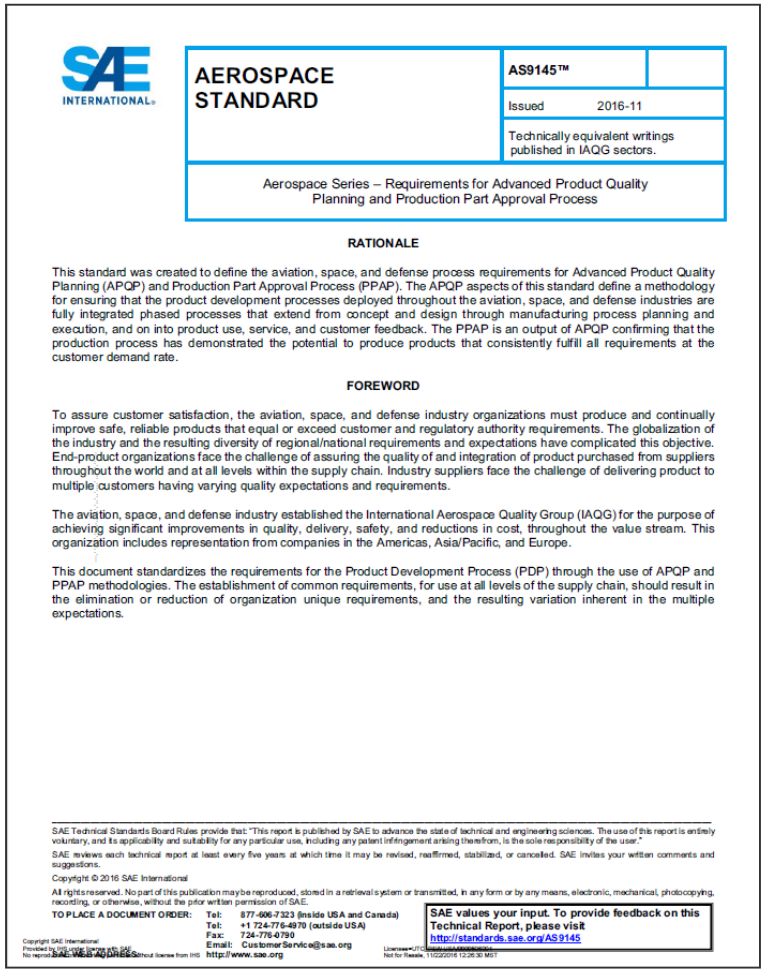
Maintain the PPAP file throughout product lifecycle

Guidance Material & Training

9145 Aerospace APQP & PPAP

AS Standard Published Nov 2016

SJAC 9145 June 21, 2017



SAE INTERNATIONAL

AEROSPACE STANDARD

AS9145™

Issued 2016-11

Technically equivalent writings published in IAQG sectors.

Aerospace Series – Requirements for Advanced Product Quality Planning and Production Part Approval Process

RATIONALE

This standard was created to define the aviation, space, and defense process requirements for Advanced Product Quality Planning (APQP) and Production Part Approval Process (PPAP). The APQP aspects of this standard define a methodology for ensuring that the product development processes deployed throughout the aviation, space, and defense industries are fully integrated phased processes that extend from concept and design through manufacturing process planning and execution, and on into product use, service, and customer feedback. The PPAP is an output of APQP confirming that the production process has demonstrated the potential to produce products that consistently fulfill all requirements at the customer demand rate.

FOREWORD

To assure customer satisfaction, the aviation, space, and defense industry organizations must produce and continually improve safe, reliable products that equal or exceed customer and regulatory authority requirements. The globalization of the industry and the resulting diversity of regional/national requirements and expectations have complicated this objective. End-product organizations face the challenge of assuring the quality of and integration of product purchased from suppliers throughout the world and at all levels within the supply chain. Industry suppliers face the challenge of delivering product to multiple customers having varying quality expectations and requirements.

The aviation, space, and defense industry established the International Aerospace Quality Group (IAQG) for the purpose of achieving significant improvements in quality, delivery, safety, and reductions in cost, throughout the value stream. This organization includes representation from companies in the Americas, Asia/Pacific, and Europe.

This document standardizes the requirements for the Product Development Process (PDP) through the use of APQP and PPAP methodologies. The establishment of common requirements, for use at all levels of the supply chain, should result in the elimination or reduction of organization unique requirements, and the resulting variation inherent in the multiple expectations.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
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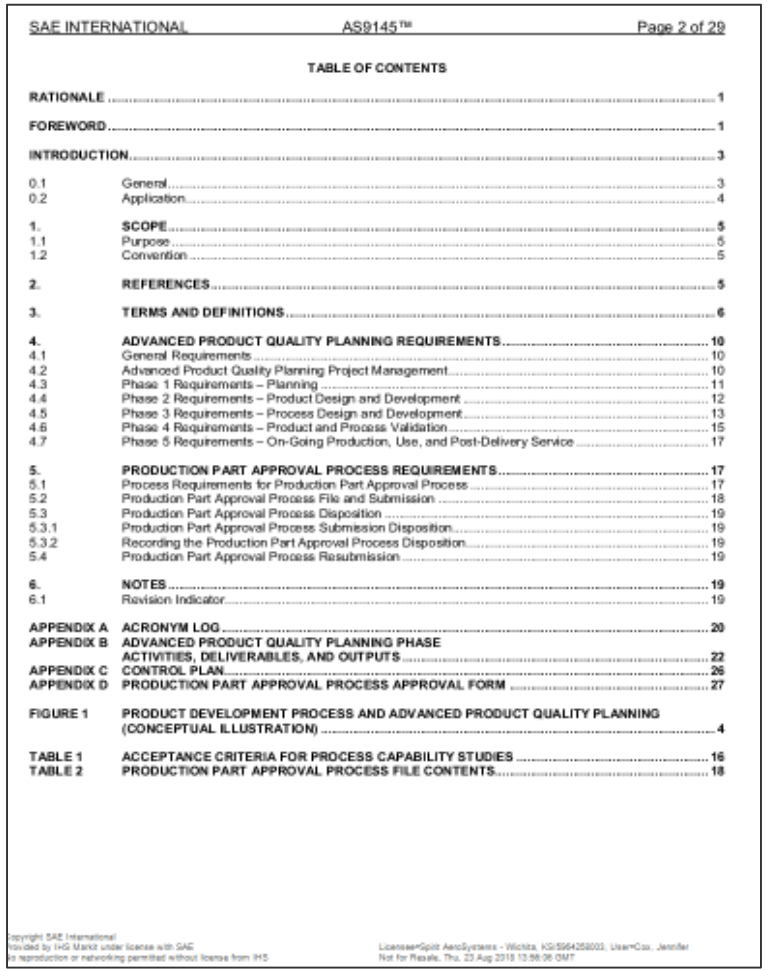
http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://standards.sae.org/AS9145



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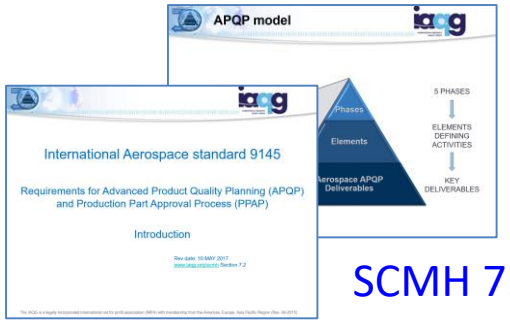
Aerospace APQP SCMH Section 7.2



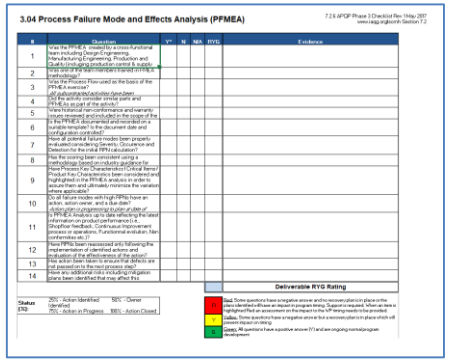
SCMH 7.2.2

SCMH 7.2.3

Introduction Presentation

APQP Manual

Phase Checklists



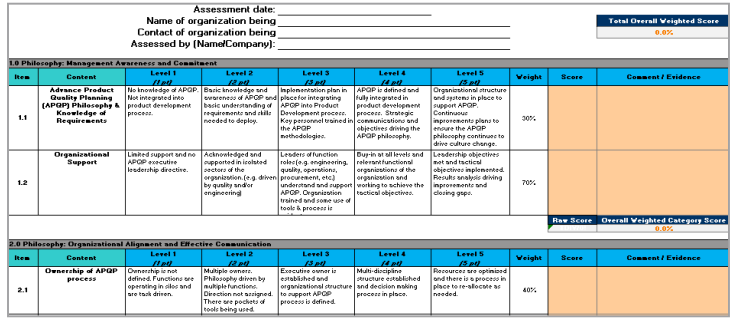
SCMH 7.2.4-7.2.8

Tools & Templates NEW

7.2.9 Process Flow Diagram
7.2.10 DFMEA
7.2.11 PFMEA
7.2.12 **Element Applicability**
7.2.13 Control Plan

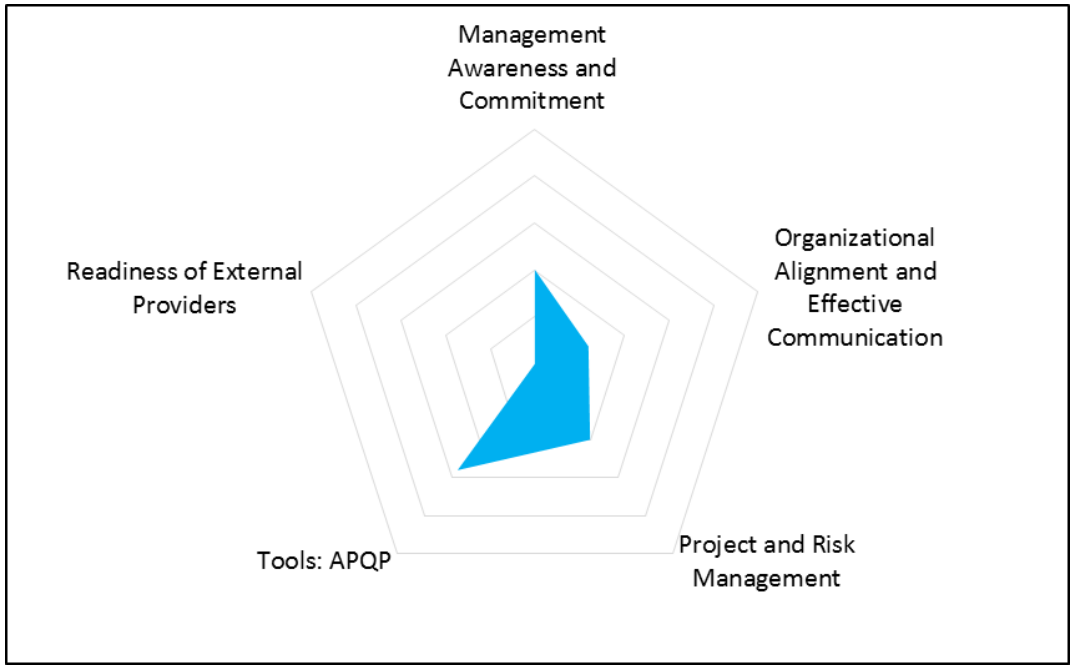
Maturity Assessment NEW

SCMH 7.2.14



Self Assessment - Maturity Matrix

1.0 Philosophy: Management Awareness and Commitment									
Item	Content	Level 1 *(1 pt)*	Level 2 *(2 pt)*	Level 3 *(3 pt)*	Level 4 *(4 pt)*	Level 5 *(5 pt)*	Weight	Score	Comment / Evidence
1.1	**Advance Product Quality Planning (APQP) Philosophy & Knowledge of the Requirements**	No knowledge of APQP. Not integrated into product development process.	Basic knowledge and awareness of APQP and basic understanding of requirements and skills needed to deploy.	Implementation plan in place for integrating APQP into Product Development process. Key personnel trained in the APQP methodologies.	APQP is defined and fully integrated in product development process. Strategic communications and objectives driving the APQP philosophy.	Organizational structure and systems in place to support APQP. Continuous improvements plans to ensure the APQP philosophy continues to drive culture change.	30%	2	
1.2	**Organizational Support**	Limited support and no APQP executive leadership directive.	Acknowledged and supported in isolated sectors of the organization. (e.g. driven by quality and/or engineering)	Leaders of function roles (e.g. engineering, quality, operations, procurement, etc.) understand and support APQP. Organization trained and some use of tools & process is evident.	Buy-in at all levels and relevant functional organizations of the organization and working to achieve the tactical objectives.	Leadership objectives met and tactical objectives implemented. Results analysis driving improvements and closing gaps.	70%	2	
								Raw Score	Overall Weighted Category Score
								40.0%	40.0%



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

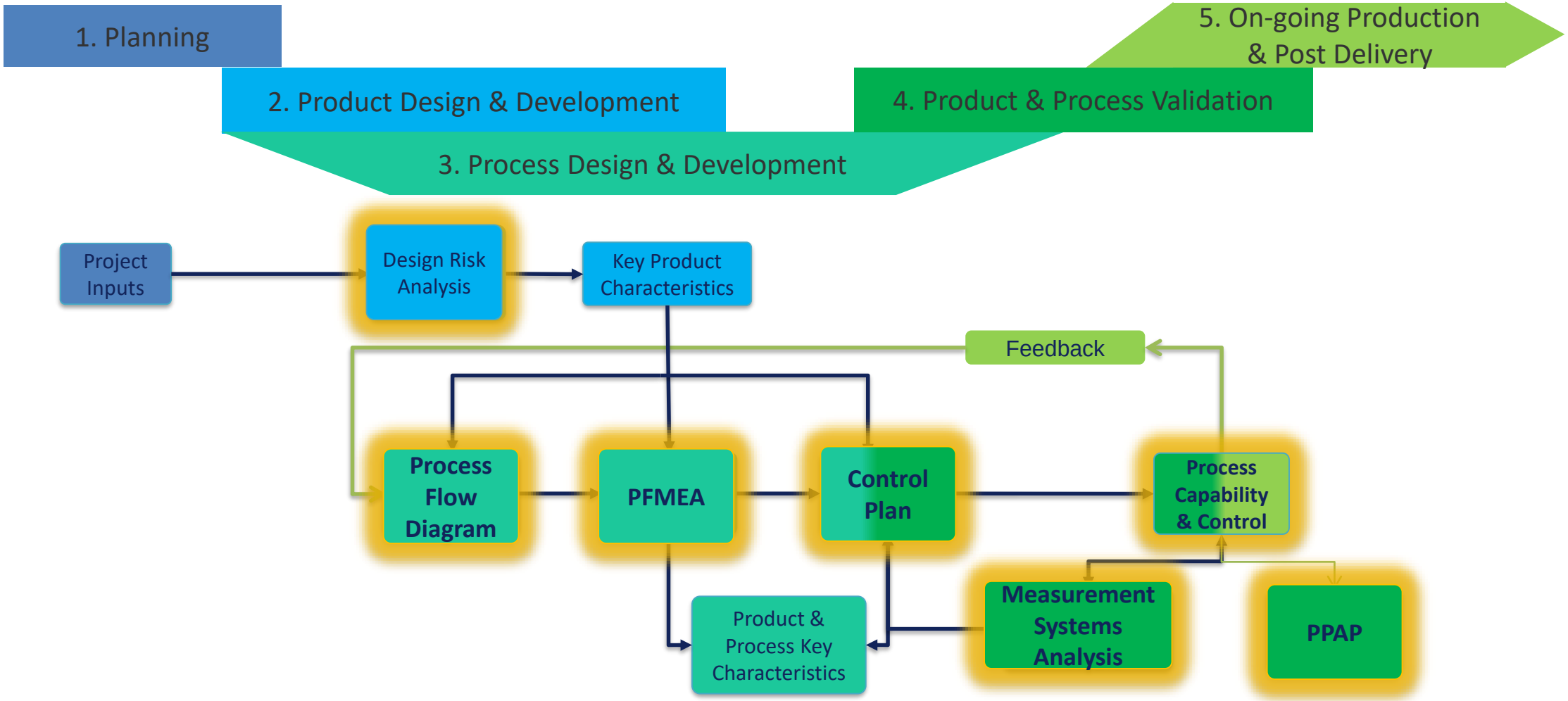
- Prior to deployment within your organization
- Prior to deployment of your external suppliers
- As needed to monitor and develop continuous improvement

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



Reference 9145 Table 2 – Production part approval process file contents

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Upcoming IAQG 9145, APQP & PPAP Webinar Series

Webinar Topic	Who Should Attend
Advanced Product Quality Planning (APQP) Overview	Top leadership and leaders of all function engaged in product development process
Design Risk Analysis – Critical Items	Systems, Design, Manufacturing and Quality Engineers
Process Flow/ Process Failure Modes and Effects Analysis (PFMEA) – Process Characteristics	Design, Manufacturing and Quality Engineers, Operations Management
Control Plan	Design, Manufacturing and Quality Engineers, Operations Management
Measurement Systems Analysis MSA	Design, Manufacturing and Quality Engineers, Calibration Management
Process Capability & Control (Variation Management)	Manufacturing and Quality Engineers, Operations Management
Production Part Approval Process (PPAP)	Manufacturing and Quality Engineers

Comments and Suggestions

Do you have comments about the APQP Guidance?

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