Automotive Division
The Global Voice of Quality™

Advanced Product Quality Planning and Control Plans

based on *APQP 2nd Edition*

Mark A. Morris

ASQ Automotive Division Webinar

February 8, 2012

M and M Consulting

mark@MandMconsulting.com
www.MandMconsulting.com

Five Fundamental Principles

Cleanliness and safety come first; then accuracy.

Slow accuracy is no longer valuable; therefore speed is the fourth ideal.

Fifth is originality, the ability to develop better methods and better work.

Henry Ford Trade School

ASQ

A Piercing Question

"What was it in your quality system that allowed you to ship us this junk?"

Hank Nichol

ASQ

Agenda

1. Working within a Quality System
2. Fundamentals of Quality Planning
3. AIAG Model for Quality Planning
4. Control Plans
5. Summary and Closure

ASQ

Course Goals

1. To provide a fundamental understanding of the language that guides APQP efforts.

2. To use APQP strategies to determine where to assess special characteristics.

3. To use APQP as a means to achieve robust capable processes for special characteristics.

ASQ

Working within a Quality System

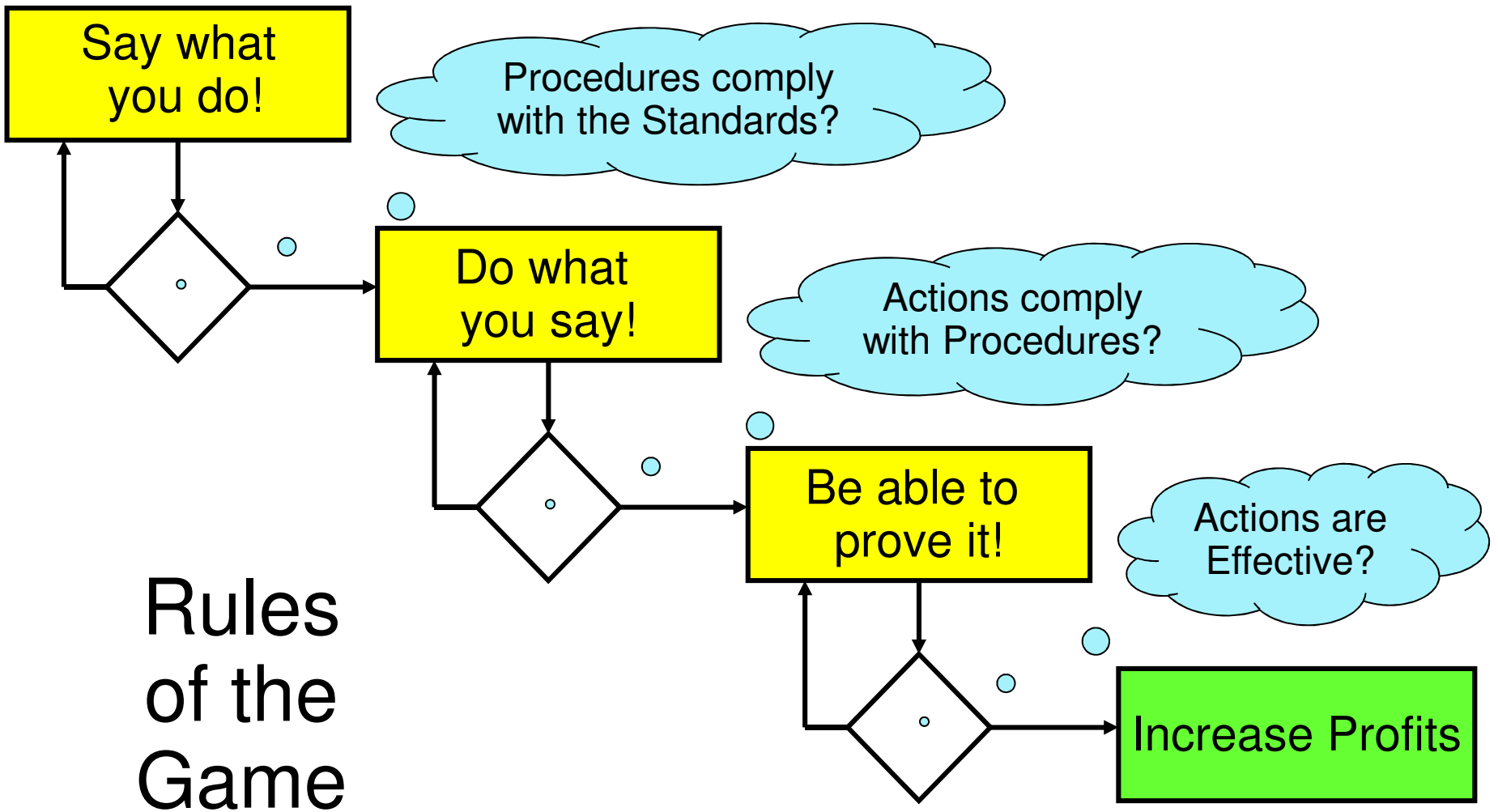
ASQ®
The Global Voice of Quality™

Quality System Requirements

- The ISO Philosophy is based on the following:
  - Say What You Do
  - Do What You Say
  - Be Able to Prove It
- These three points are necessary, but they are not sufficient. Two other points are needed:
  - You Must Meet the Requirements of the Standard
  - It Must be Effective

ASQ

Quality System Requirements



Rules of the Game

ASQ

Motivation and Intent

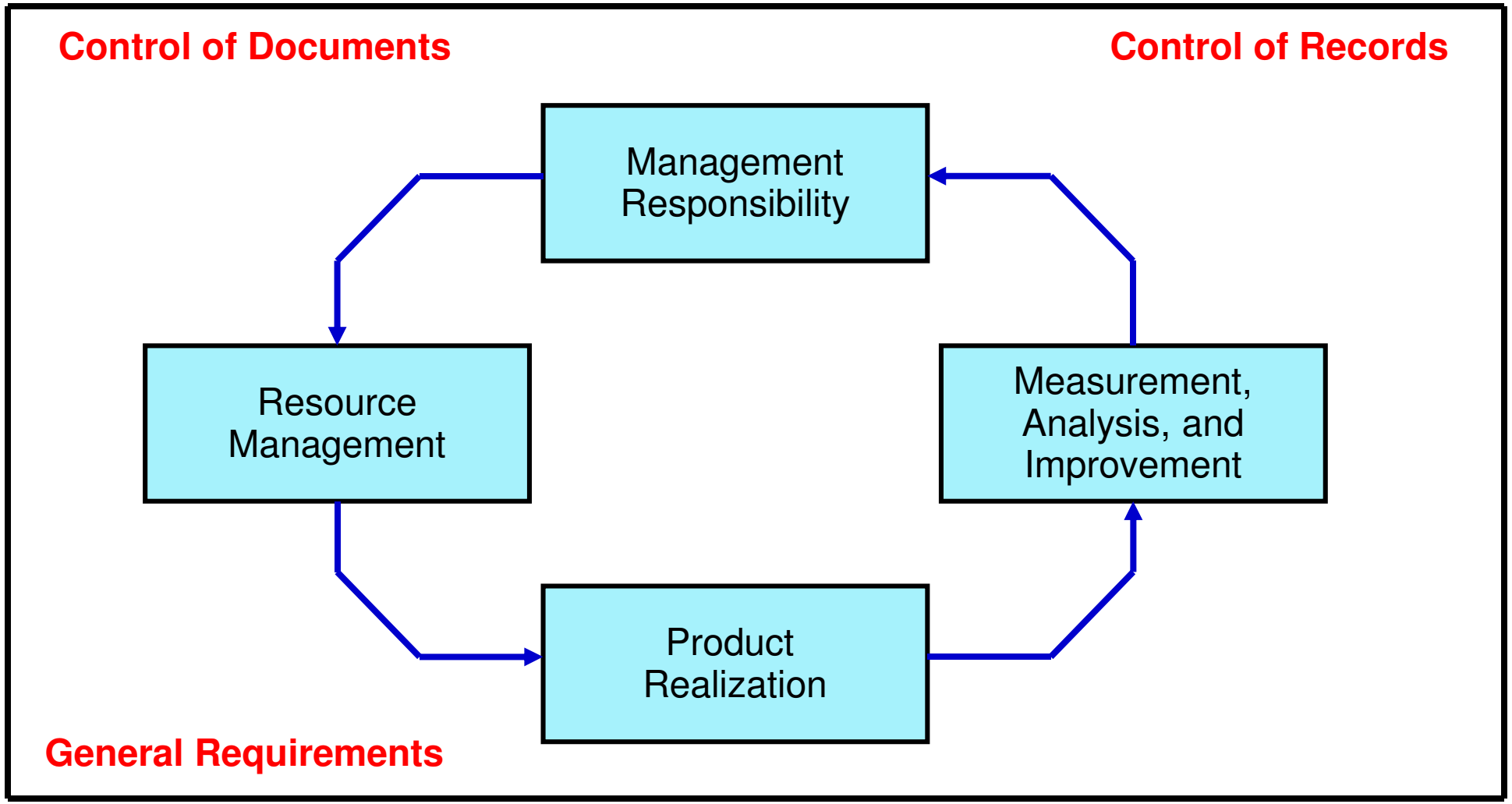
- There are two things a Quality System must do if it is to pay for itself:
  - Increase Marketability
  - Reduce the Frequency of Errors

ASQ

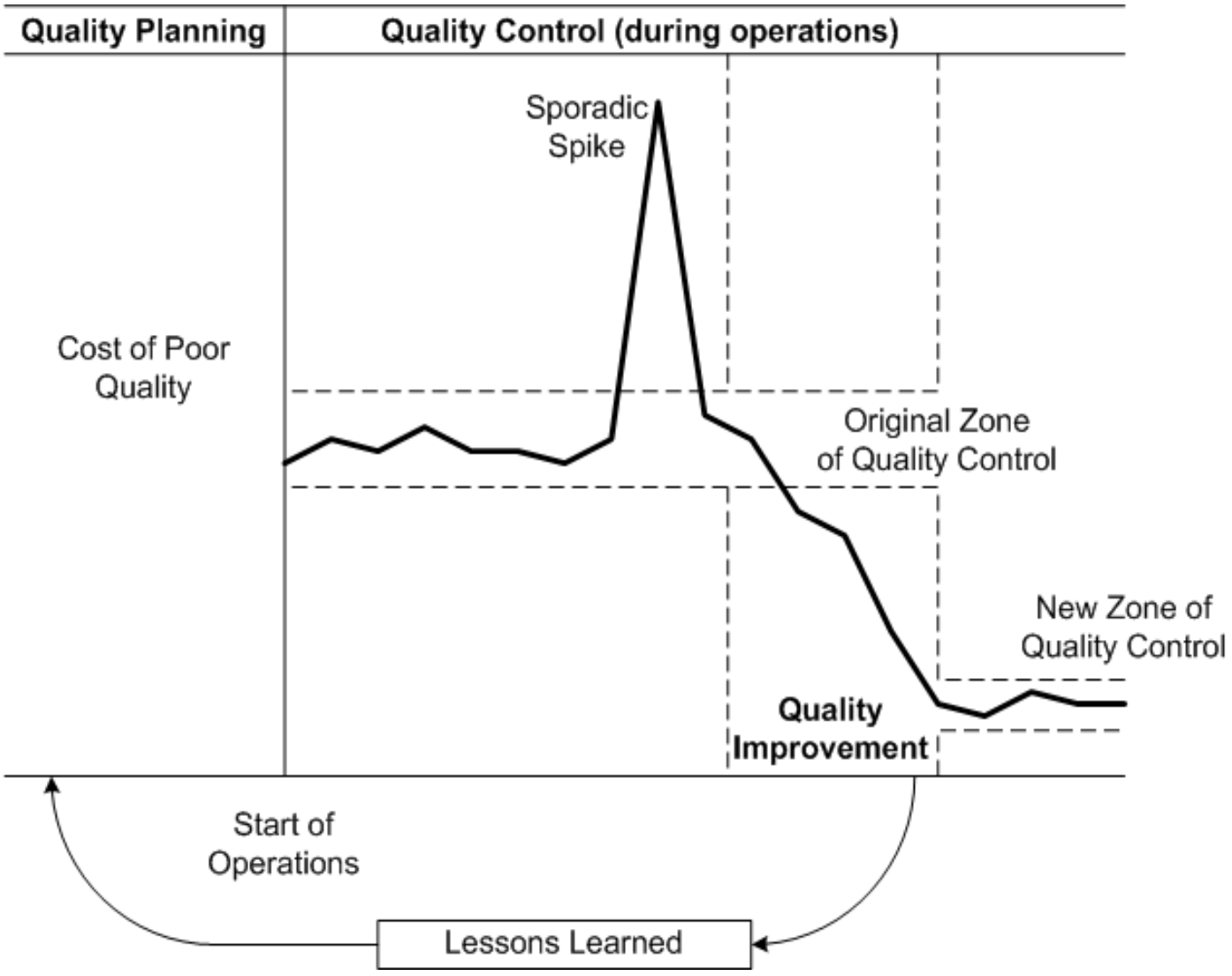
Motivation and Intent

- Quality System documentation provides the means to fix communications:
  - Document Explicit Accountability
  - Procedurally Define Important Communications

ISO 9001 Quality Systems Model



The Juran Trilogy® Diagram



PPAP Documentation Requirements

2.2.1 Design Record	2.2.2 Authorized Engineering Changes	2.2.3 Customer Engineering Approval	2.2.4 Design FMEA	2.2.5 Process Flow Diagrams	2.2.6 Process FMEA
2.2.7 Control Plan	2.2.8 MSA Studies	2.2.9 Dimensional Results	2.2.10 Material and Test Results	2.2.11 Initial Process Studies	2.2.12 Qualified Laboratory Documentation
2.2.13 Appearance Approval Report	2.2.14 Sample Production Parts	2.2.15 Master Sample	2.2.16 Checking Aids	2.2.17 Customer Specified Requirements	2.2.18 Part Submission Warrant

ASQ

Significant Production Run

- For production parts, product for PPAP should be taken from a significant production run.
- This significant production run shall consist of from one hour to eight hours of production, and with the specific production quantity to total a minimum of 300 consecutive parts, unless otherwise specified by the authorized customer representative.

ASQ

Significant Production Run

- This significant production run shall be:
  - conducted at the production site,
  - at specified production rates,
  - using the production tooling,
  - production gaging,
  - production process,
  - production materials,
  - and production operators.
- Parts from each unique production process shall be measured and tested.

Part Submission Status

- Upon approval of the submission, the organization shall assure that future production continues to meet all customer requirements.

- Customer PPAP Status:
  1. Approved
  2. Interim Approval
  3. Rejected

Teams

- Multi-functional teams are essential.
- Ensure expertise from appropriate sources.
- Select team with ability to contribute:
  - Knowledge
  - Information
  - Experience
  - Equity
  - Empowerment
- In addition to the team
  - Call in Experts as Needed

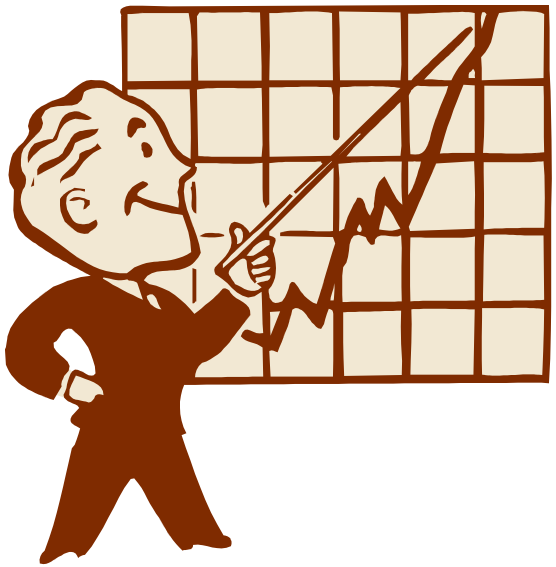
ASQ

Considerations for *Meetings*

- Team Facilitation
- Good Communication
- Agree upon Team Goals
- Clearly Defined Roles
- Establish Ground Rules
- Beneficial Team Behaviors

Common *Team Problems*

- No Common Understanding
- Overbearing Participants
- Reluctant Participants
- Opinions Treated as Facts
- Rush to Accomplishments
- Digression and Tangents
- Hidden Agendas
- Going through the Motions



ASQ

Managing Teams

- Select the Right Members
- Gain a Sense of Common Purpose
- Set Clear Expectations
- Assign Responsibility with Due Dates
- Insist on Tasks Completed on Time

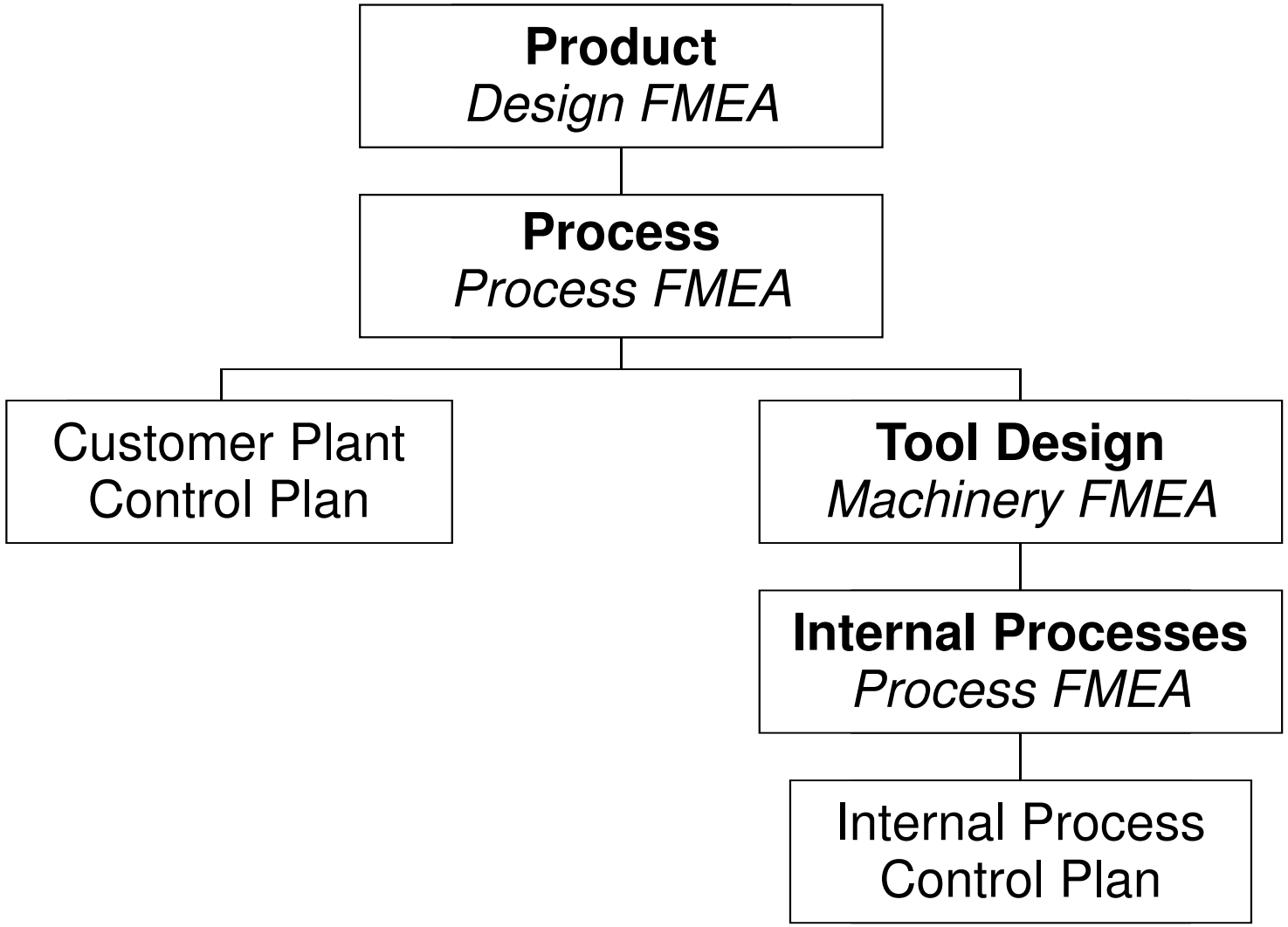
ASQ

Rules for *Brainstorming*

- Everyone Contributes
- Don’t Hold Back Ideas; More Ideas are Better
- No Discussion during the Brainstorm
- No Judgment; No Criticism
- Build on the Ideas of Others
- Write ALL of the Ideas so they are Visible

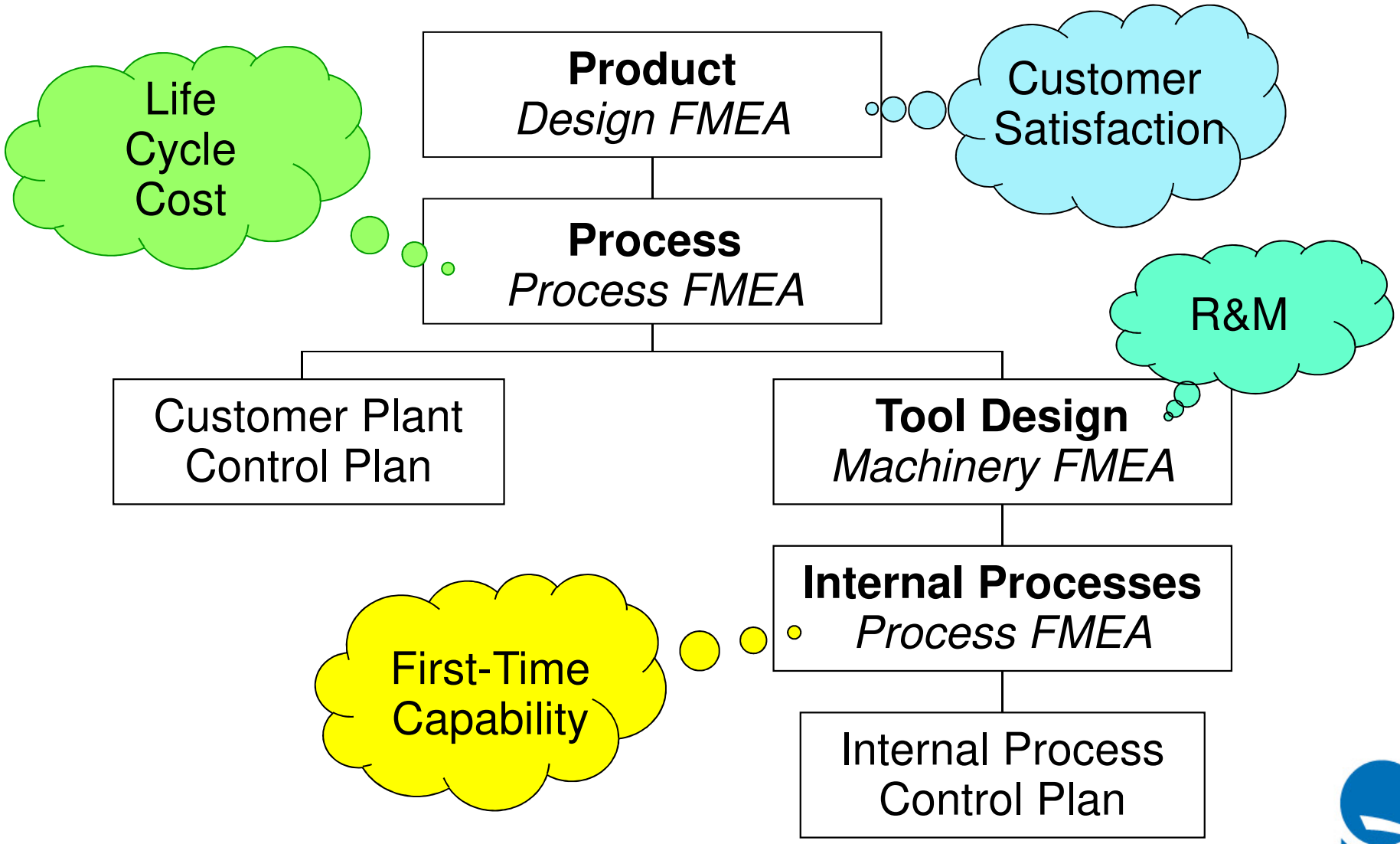
ASQ

A Rational Structure for Quality Planning ™

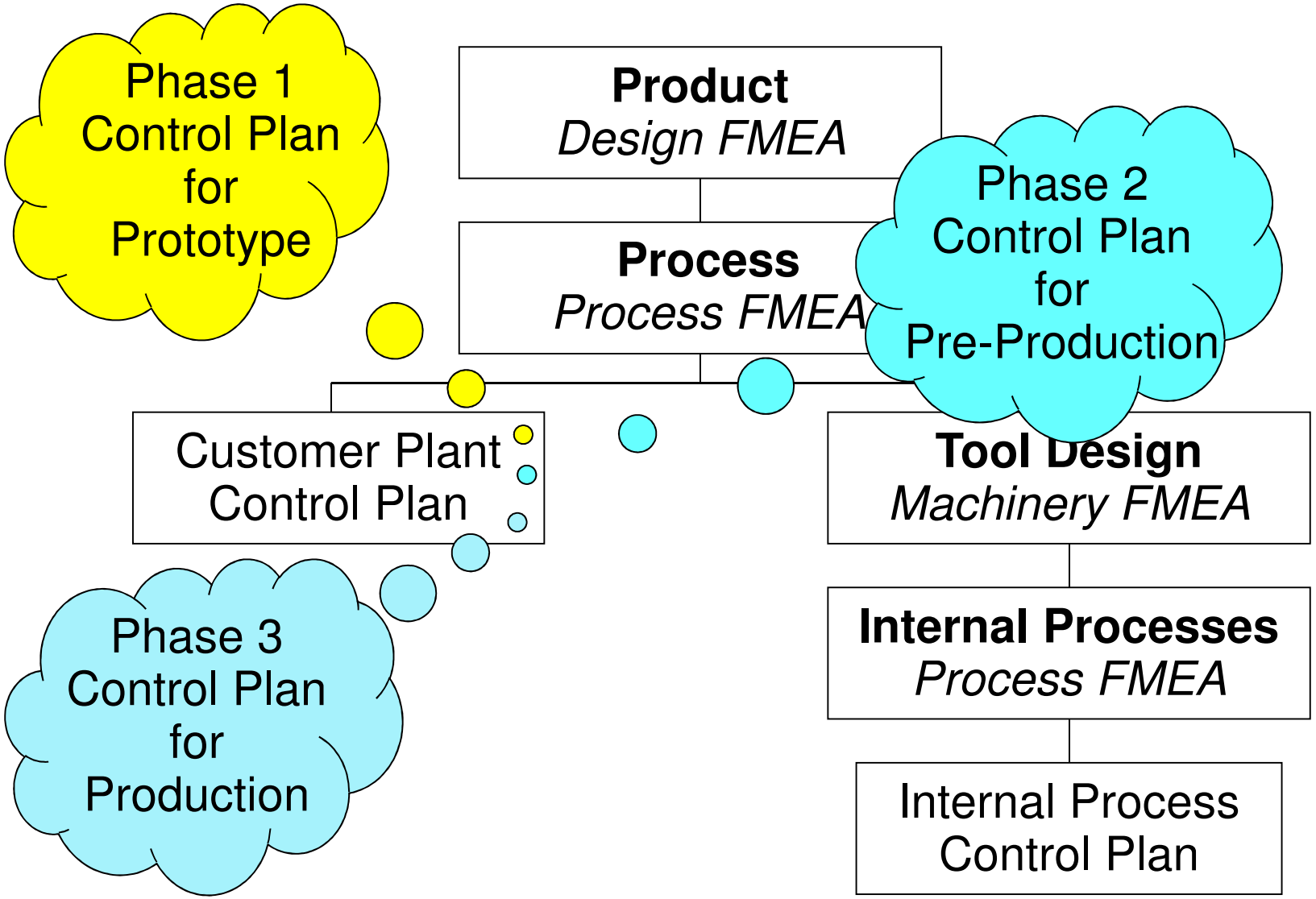


ASQ

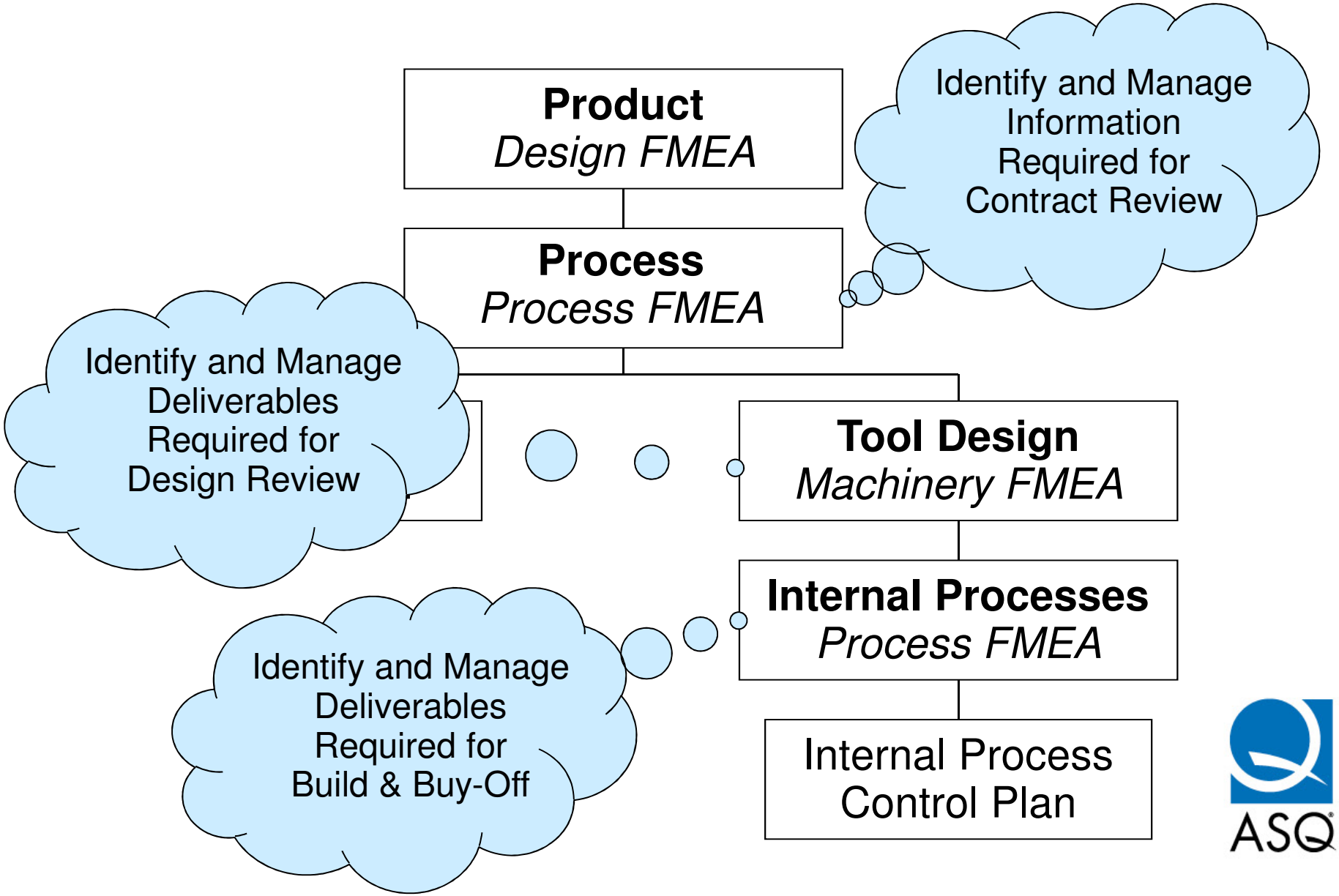
Motivation for Specific FMEAs



Three Phases of Control Plan



Rational Structure and Project Specific Control Plans



Fundamentals of Quality Planning

ASQ®
The Global Voice of Quality™

PPAP Documentation Requirements

2.2.1 Design Record	2.2.2 Authorized Engineering Changes	2.2.3 Customer Engineering Approval	2.2.4 Design FMEA	2.2.5 Process Flow Diagrams	2.2.6 Process FMEA
2.2.7 Control Plan	2.2.8 MSA Studies	2.2.9 Dimensional Results	2.2.10 Material and Test Results	2.2.11 Initial Process Studies	2.2.12 Qualified Laboratory Documentation
2.2.13 Appearance Approval Report	2.2.14 Sample Production Parts	2.2.15 Master Sample	2.2.16 Checking Aids	2.2.17 Customer Specified Requirements	2.2.18 Part Submission Warrant

ASQ

Significant Production Run

- For production parts, product for PPAP should be taken from a significant production run.
- This significant production run shall consist of from one hour to eight hours of production, and with the specific production quantity to total a minimum of 300 consecutive parts, unless otherwise specified by the authorized customer representative.

ASQ

Significant Production Run

- This significant production run shall be:
  - conducted at the production site,
  - at specified production rates,
  - using the production tooling,
  - production gaging,
  - production process,
  - production materials,
  - and production operators.
- Parts from each unique production process shall be measured and tested.

Part Submission Status

- Upon approval of the submission, the organization shall assure that future production continues to meet all customer requirements.

- Customer PPAP Status:
  1. Approved
  2. Interim Approval
  3. Rejected

Fundamentals of Quality Planning

Advanced Product Quality Planning

- Organize the Team
- Define the Scope
- Team to Team Communication
- Training Requirements
- Customer and Organization Involvement
- Simultaneous Engineering
- Control Plans
- Concern Resolution
- Product Quality Timing Plan
- Plans Relative to the Timing Chart

ASQ

Containment Considerations

- Cost of Defects
- Risk of Defects
- Bracketing Strategies
- Protecting On-Time Delivery
- Cost of Stopping Production
- Cost of Recall Campaigns
- Benefits of Traceability

ASQ

Practical Issues of Quality Planning

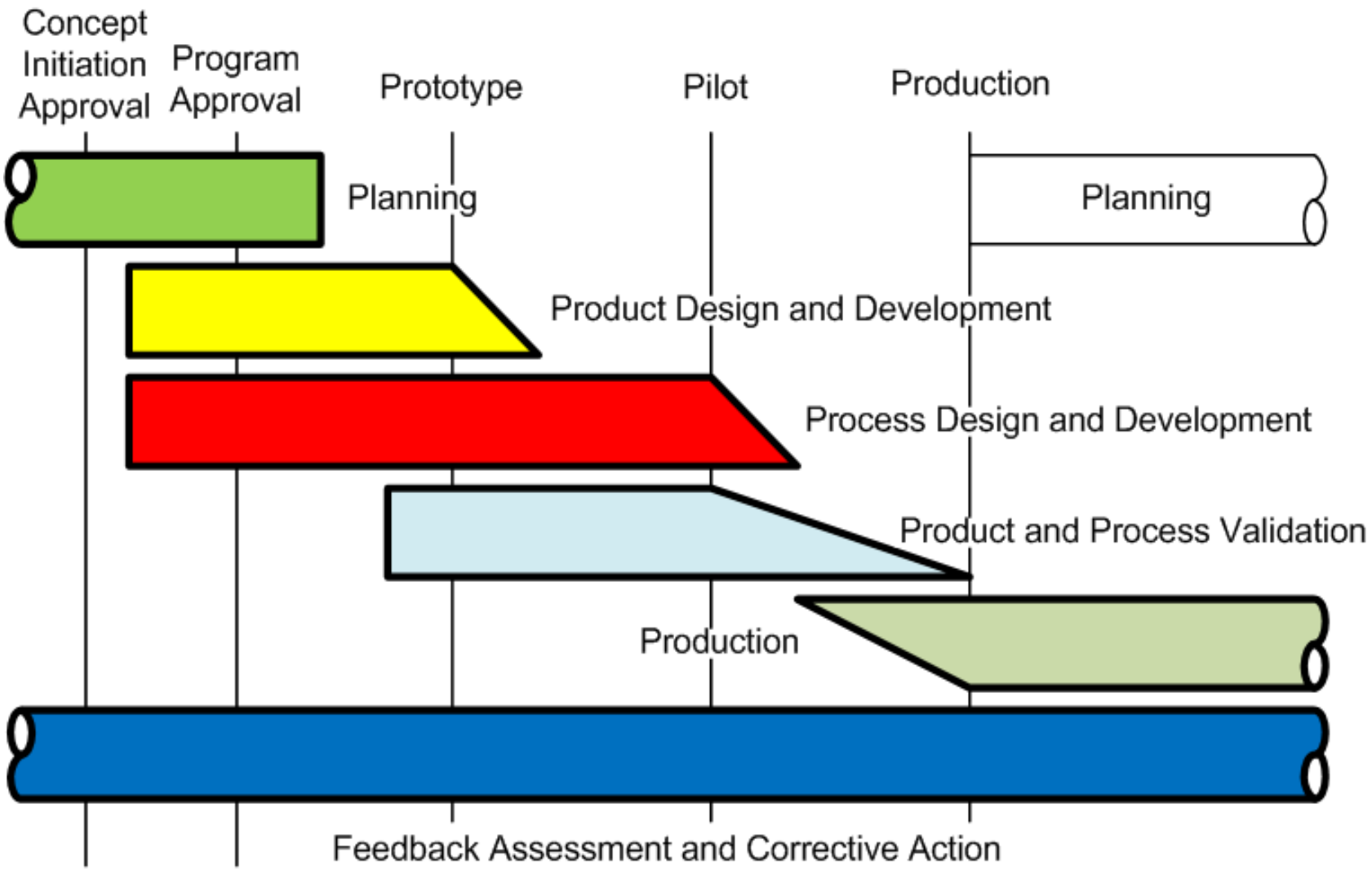
- What is the cost of inspection?
- What is the risk of not inspecting?
- How often should we inspect?
- How many parts should we inspect?
- When this 100% inspection make sense?
- How should the need for destructive tests impact our decisions?

ASQ

AIAG Model for Quality Planning

ASQ®
The Global Voice of Quality™

AIAG Model for Quality Planning



Plan and Define Program

Input Documents

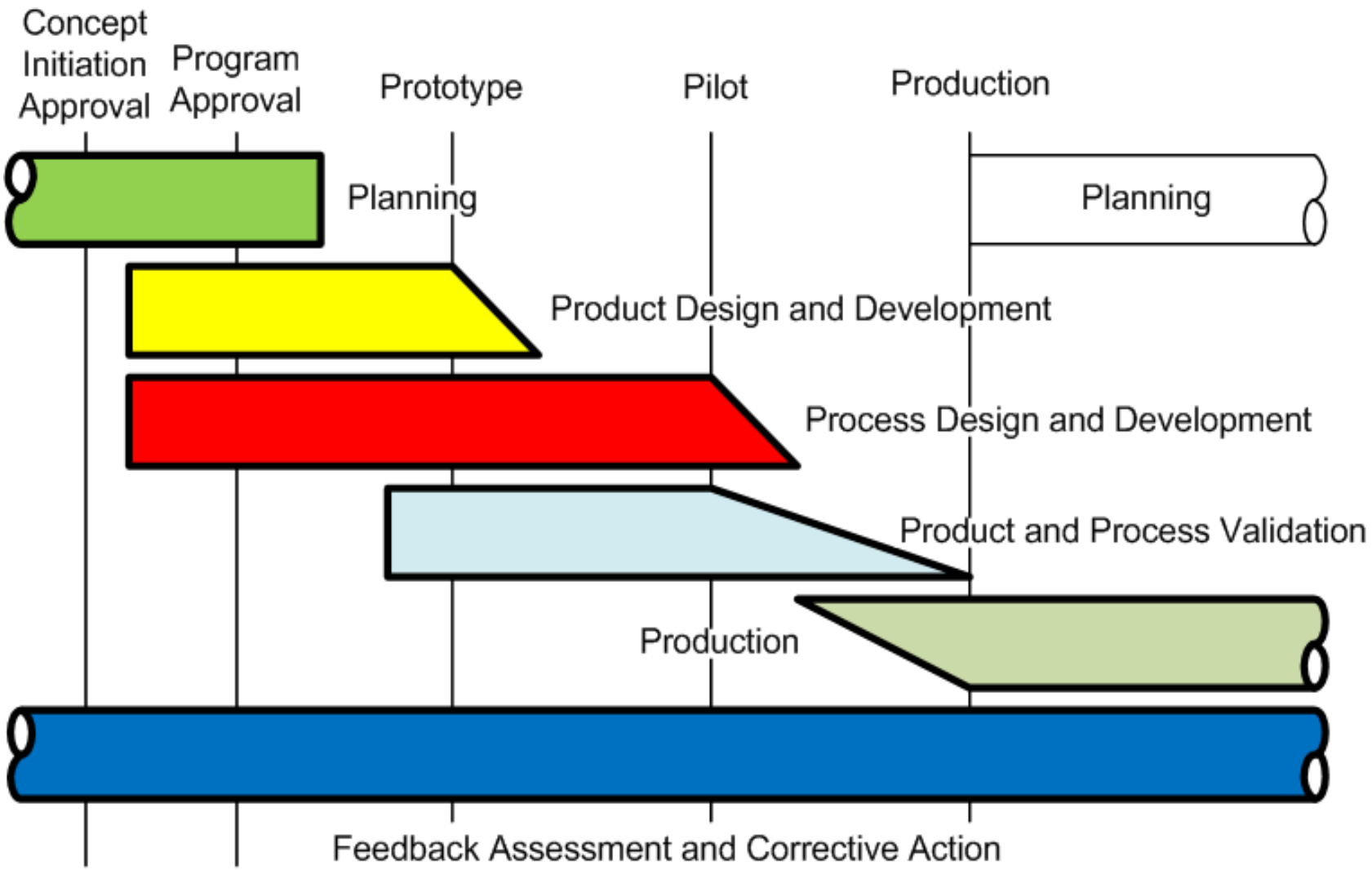
- Voice of the Customer
- Business Plan
- Marketing Strategy
- Product & Process Benchmarking
- Product & Process Assumptions
- Product Reliability Studies
- Customer Inputs

Output Documents

- Design Goals
- Reliability and Quality Goals
- Preliminary Bill of Material
- Preliminary Process Flow Chart
- Preliminary Special Characteristics
- Product Assurance Plan
- Management Support

ASQ

AIAG Model for Quality Planning



Product Design and Development

Inputs

- Design Goals
- Reliability and Quality Goals
- Preliminary Bill of Material
- Preliminary Process Flow Chart
- Preliminary Special Characteristics
- Product Assurance Plan
- Management Support

Design Outputs

- Design FMEA
- Design for Mfg & Assy
- Design Verification
- Design Reviews
- Prototype Build – Control Plan
- Engineering Drawings
- Engineering Specifications
- Material Specifications
- Drawing & Specification Changes

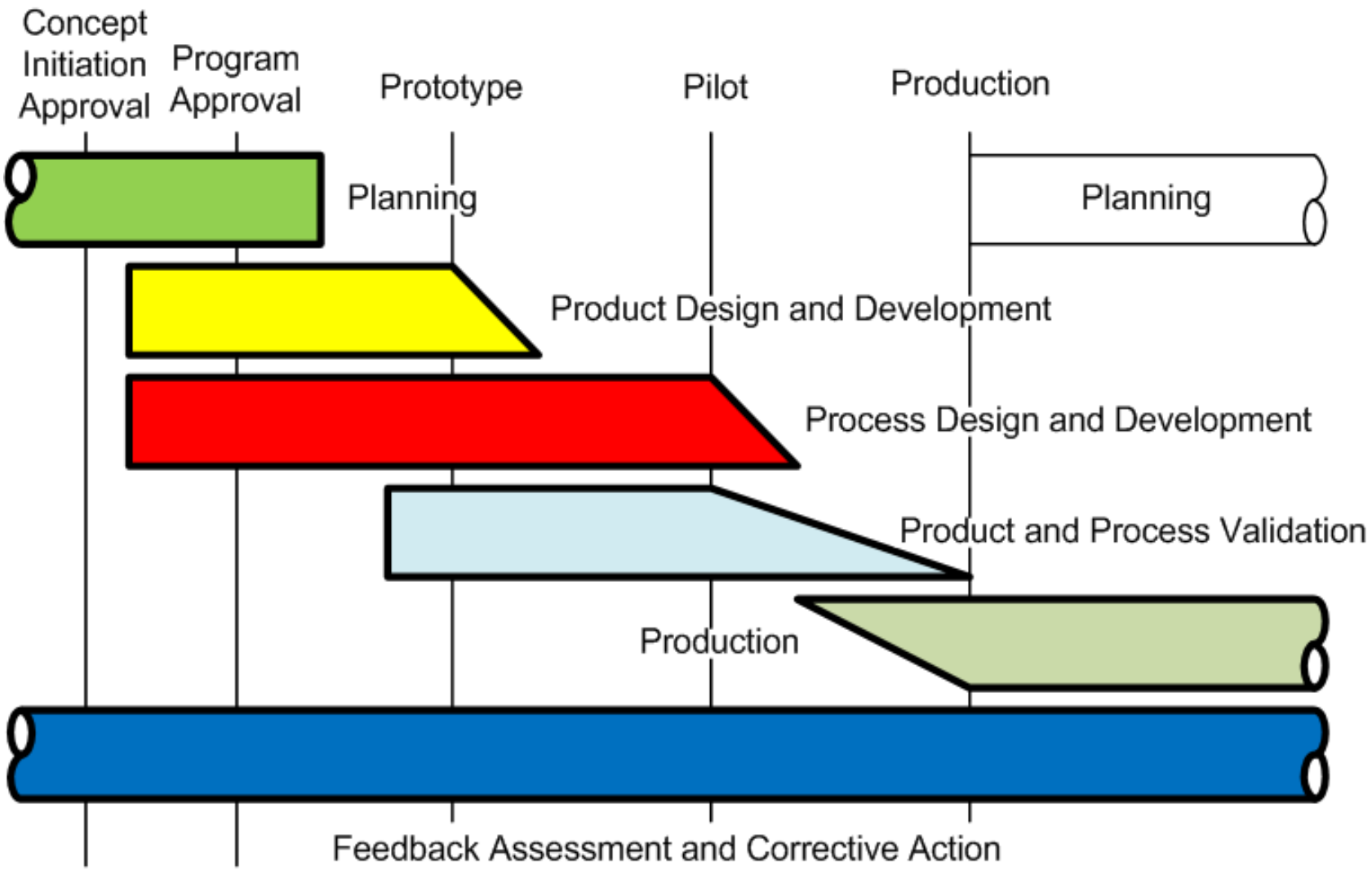
ASQ

Product Design and Development

- APQP Outputs
  - New Equipment, Tooling and Facilities Requirements
  - Special Product and Process Characteristics
  - Gages / Testing Equipment Requirements
  - Team Feasibility Commitment
  - Management Support

ASQ

AIAG Model for Quality Planning



Process Design and Development

Input Documents

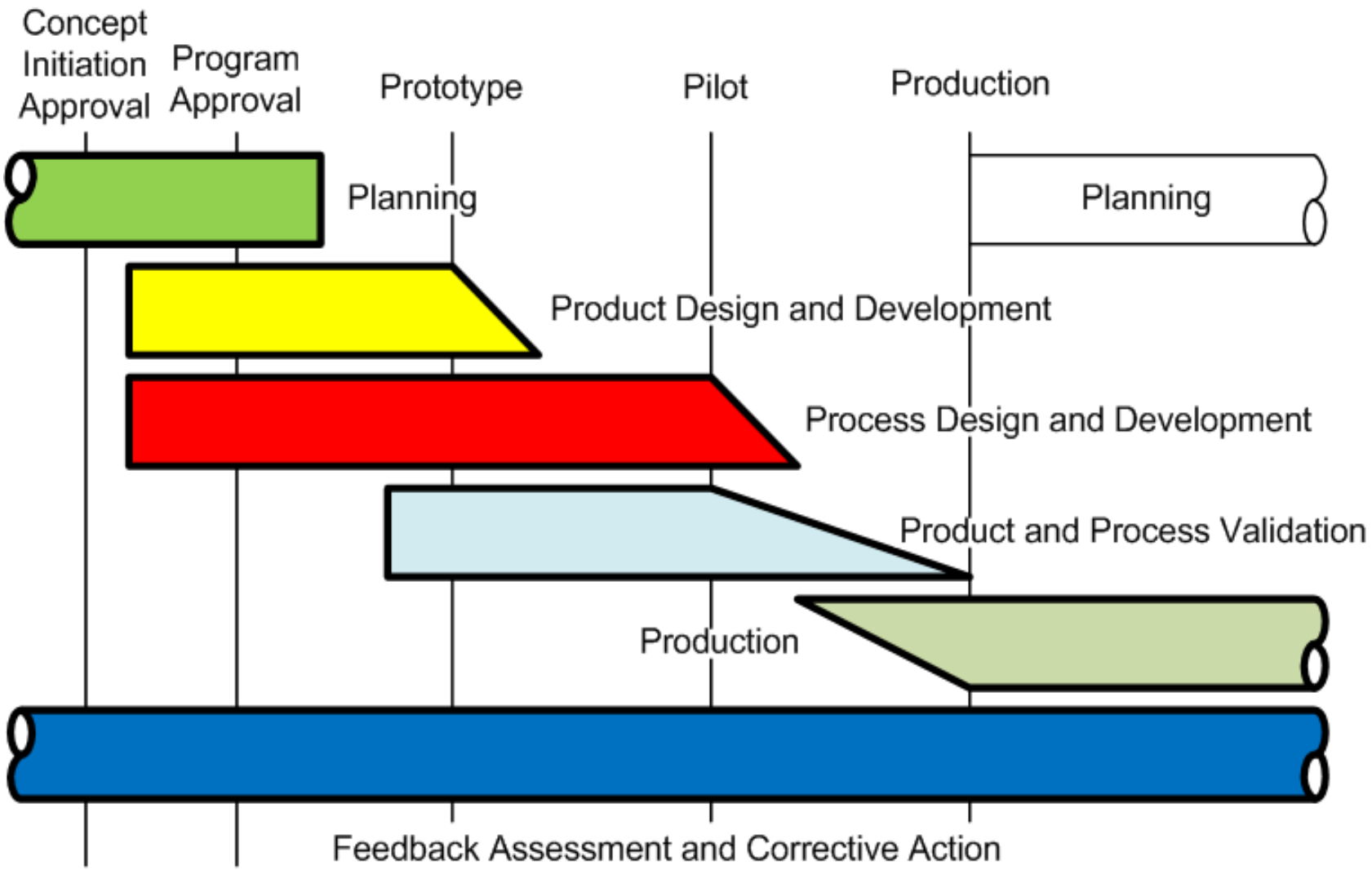
- Design FMEA
- Design for Mfg & Assy
- Design Verification
- Design Reviews
- Prototype Build – Control Plan
- Engineering Drawings
- Engineering Specifications
- Material Specifications
- Drawing & Specification Changes

Output Documents

- Packaging standards & Specs
- Product and Process Quality System Review
- Process Flow Chart
- Floor Plan Layout
- Characteristic Matrix
- Process FMEA
- Pre-Launch Control Plan
- Process Instructions
- Measurement System Plan
- Preliminary Process Capability Study Plan
- Management Support

ASQ

AIAG Model for Quality Planning



Product and Process Validation

Input Documents

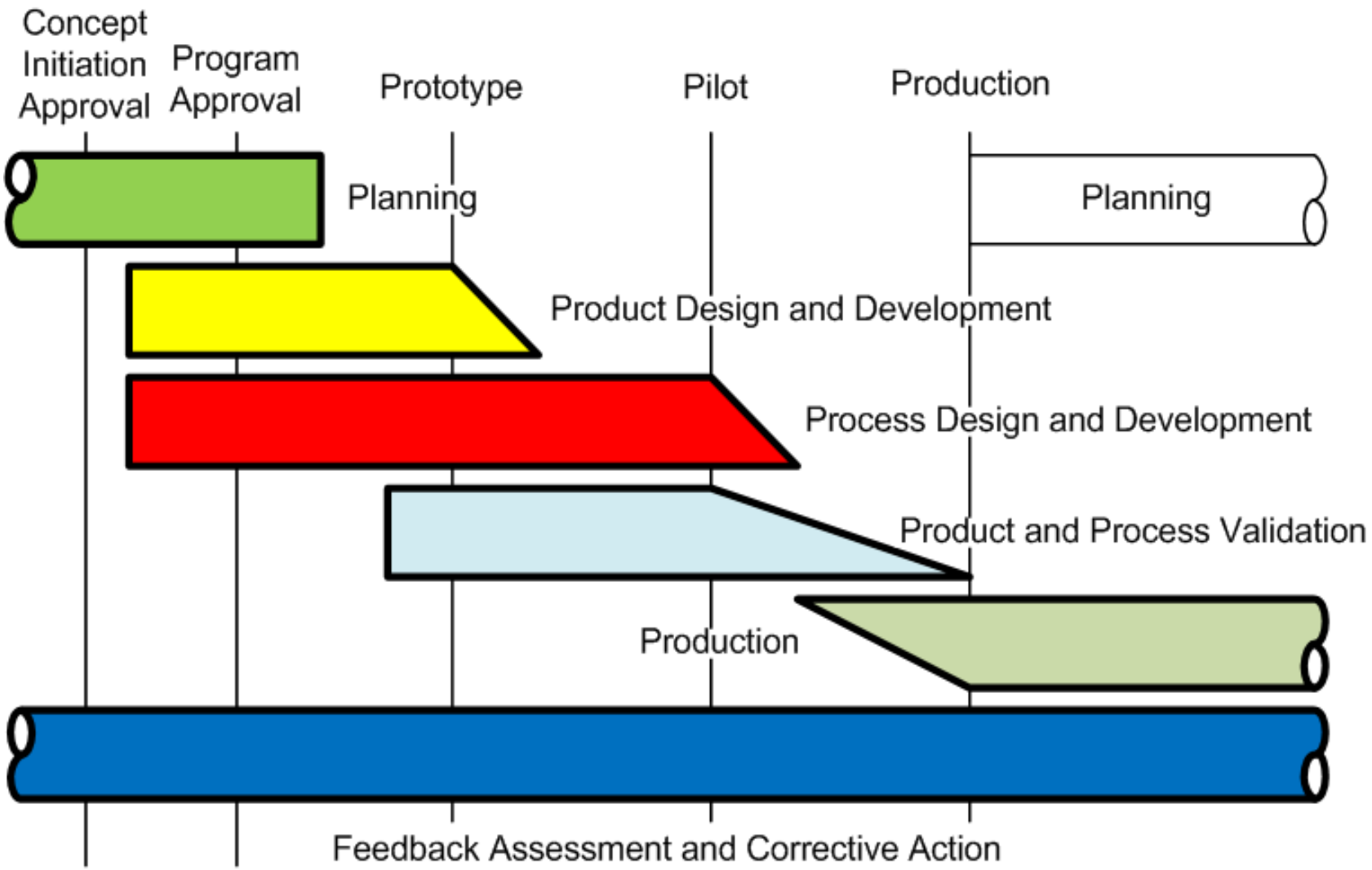
- Packaging standards & Specs
- Product and Process Quality System Review
- Process Flow Chart
- Floor Plan Layout
- Characteristic Matrix
- Process FMEA
- Pre-Launch Control Plan
- Process Instructions
- Measurement System Plan
- Preliminary Process Capability Study Plan
- Management Support

Output Documents

- Significant Production Run
- Measurement Systems Evaluation
- Preliminary Process Capability Study
- Production Part Approval
- Production Validation Testing
- Packaging Evaluation
- Production Control Plan
- Quality Planning Sign-Off
- Management Support

ASQ

AIAG Model for Quality Planning



Production and Feedback

Input Documents

- Significant Production Run
- Measurement Systems Evaluation
- Preliminary Process Capability Study
- Production Part Approval
- Production Validation Testing
- Packaging Evaluation
- Production Control Plan
- Quality Planning Sign-Off
- Management Support

Output Documents

- Reduced Variation
- Improved Customer Satisfaction
- Improved Delivery and Service
- Effective Use of Lessons Learned and Best Practices

ASQ

Practical Issues of Quality Planning

- What is the cost of inspection?
- What is the risk of not inspecting?
- How often should we inspect?
- How many parts should we inspect?
- When does 100% inspection make sense?
- How should the need for destructive tests impact our decisions?

Strategy for Actionable Data

- No Inspection without Recording
- No Recording without Analysis
- No Analysis without Action

W. Edwards Deming, PhD

ASQ

Control Plans

ASQ®
The Global Voice of Quality™

Juran's Example of a Control Plan

Part Name Casting			Drawing Rev. B	Issued By RBD
Intended for Structural Support		Part No. 300 82 95	Date Issued 1-14-2008	Rev. Date 2-21-2008
Item Number	Characteristic	Inspection Method		Sample Size
1.1	Corner Cut Undamaged	Visual Inspection		5 per Day

ASQ

AIAG Control Plan Format

☐ Prototype ☐ Pre-Launch ☐ Production

Control Plan

Page _____ of _____.

Control Plan Number:		Key Contact – Phone – Email:	Date (original)	Date (latest revision)
Part Number – Change Level:		Core Team:	Customer Engineering Approval with Date:	
Part Name – Description:		Organization or Plant Approval: Date:	Customer Quality Approval with Date:	
Organization or Plant:	Organization Code:	Other Approvals and Dates:	Other Approvals and Dates:	

Part/ Process Number	Process Name/ Operation Description	Machine, Device, Jigs, Tools for Manufacturing	CHARACTERISTICS			Special Char. Class.	METHODS					Reaction Plan
			No.	Product	Process		Product/Process Specification or Tolerance	Evaluation or Measurement Technique	Sample		Control Method	
									Size	Frequency		

ASQ

AIAG Identified Dominant Processes

Equipment: set up dominant process.

Equipment: machine dominant process.

Equipment: fixture/pallet dominant process.

Equipment: tooling dominant process.

ASQ

AIAG Identified Dominant Processes

People: operator dominant process.

Material: material dominant process.

Methods: preventive maintenance dominant.

Environment: climate dominant process.

ASQ

Reaction Plans

- One of the most significant contributions of a control plan is the reference to explicit reaction strategies when things don't go as planned.

- The intent of reaction plans are to prevent production of nonconforming product.

Three Specific Questions

- Are reactions planned and documented?
- Are appropriate assignments made to manufacturing, engineering, or other activities in reaction plans?
- Will suspect and nonconforming product be quarantined until appropriate action has been taken?

ASQ

Reaction Plans

- Reaction plans may provide different specific solutions for situations of instability and lack of process capability.
- Instability exists when special cause variation is present.
- Incapability exists when a stable process exceeds the specification or tolerance limits

ASQ

The Appendices

ASQ®
The Global Voice of Quality™

List of Appendices

Appendix A – Product Quality Planning Checklists

- Design FMEA
- Design Information
- New Equipment, Tooling, and Test Equipment
- Product/Process Quality
- Floor Plan
- Process Flow Chart
- Process FMEA
- Control Plan

AIAG Control Plan Questions

- Was the control plan methodology referenced in section 6 used in preparing the control plan?
- Have all known customer concerns been identified to facilitate the selection of special product and process characteristics?
- Are all special product and process characteristics included in the control plan?

AIAG Control Plan Questions

- Were in SFMEA, DFMEA, and PFMEA used to prepare the control plan?
- Are material specifications requiring inspection identified?
- Does the control plan address incoming product through processing and assembly, including packaging?

ASQ

AIAG Control Plan Questions

- Are engineering performance testing requirements identified?
- Are gages and test equipment available as required by the control plan?
- If required, as the customer approved the control plan?
- Are gage methods compatible between supplier and customer?

List of Appendices

Appendix B – Analytical Techniques

- Assembly Build Variation Analysis
- Benchmarking
- Cause and Effects Diagram
- Characteristics Matrix
- Critical Path Methods
- Design of Experiments
- Design for Manufacturability and Assembly
- Design Verification Plan and Report
- Mistake Proofing and Error Proofing
- Process Flow Chart
- Quality Function Deployment

List of Appendices

Appendix C – Reference Material

Appendix D – Team Feasibility Commitment

Appendix E – APQP Summary and Approvals

Appendix F – Glossary

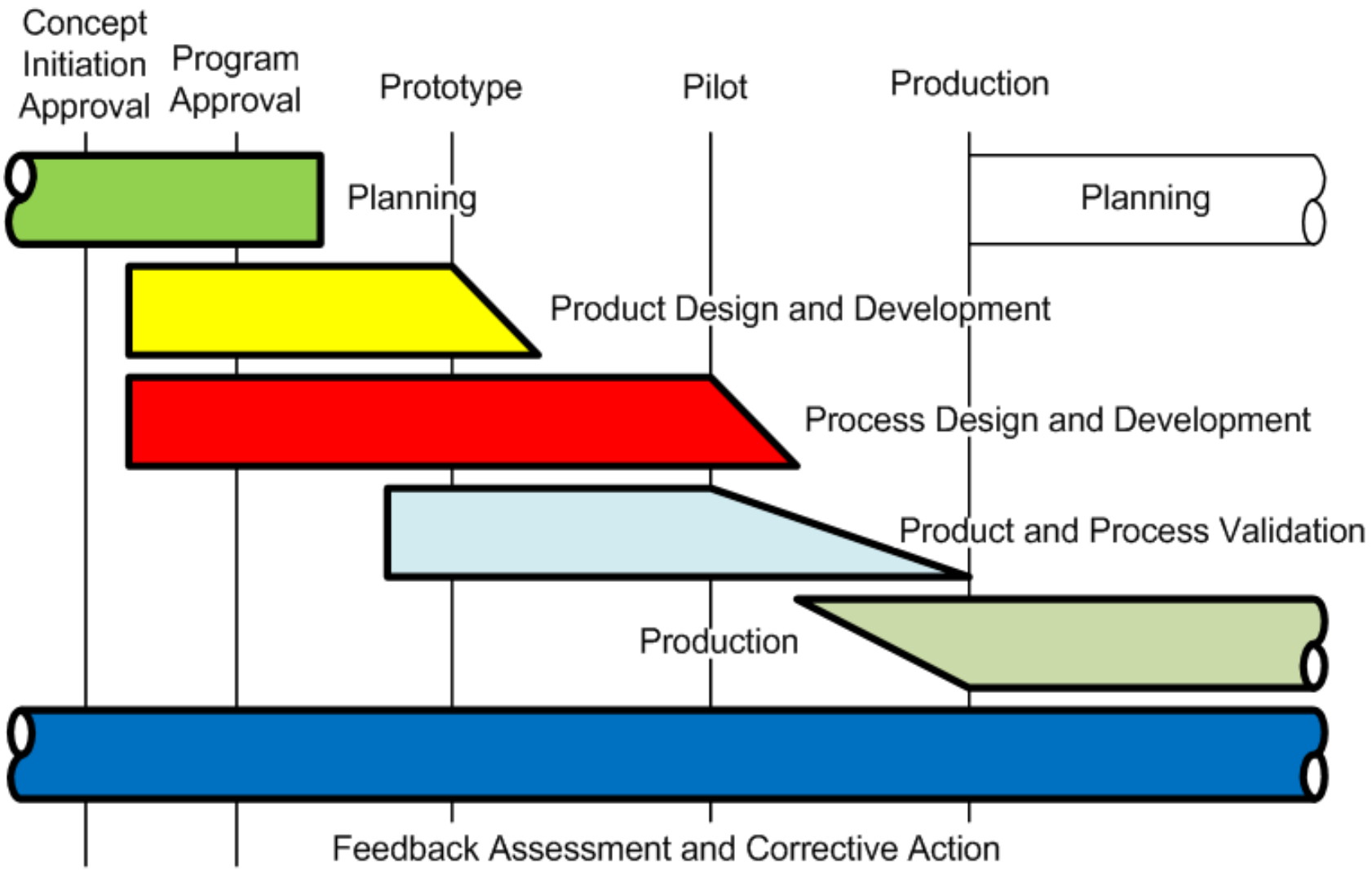
Appendix G – Index

ASQ

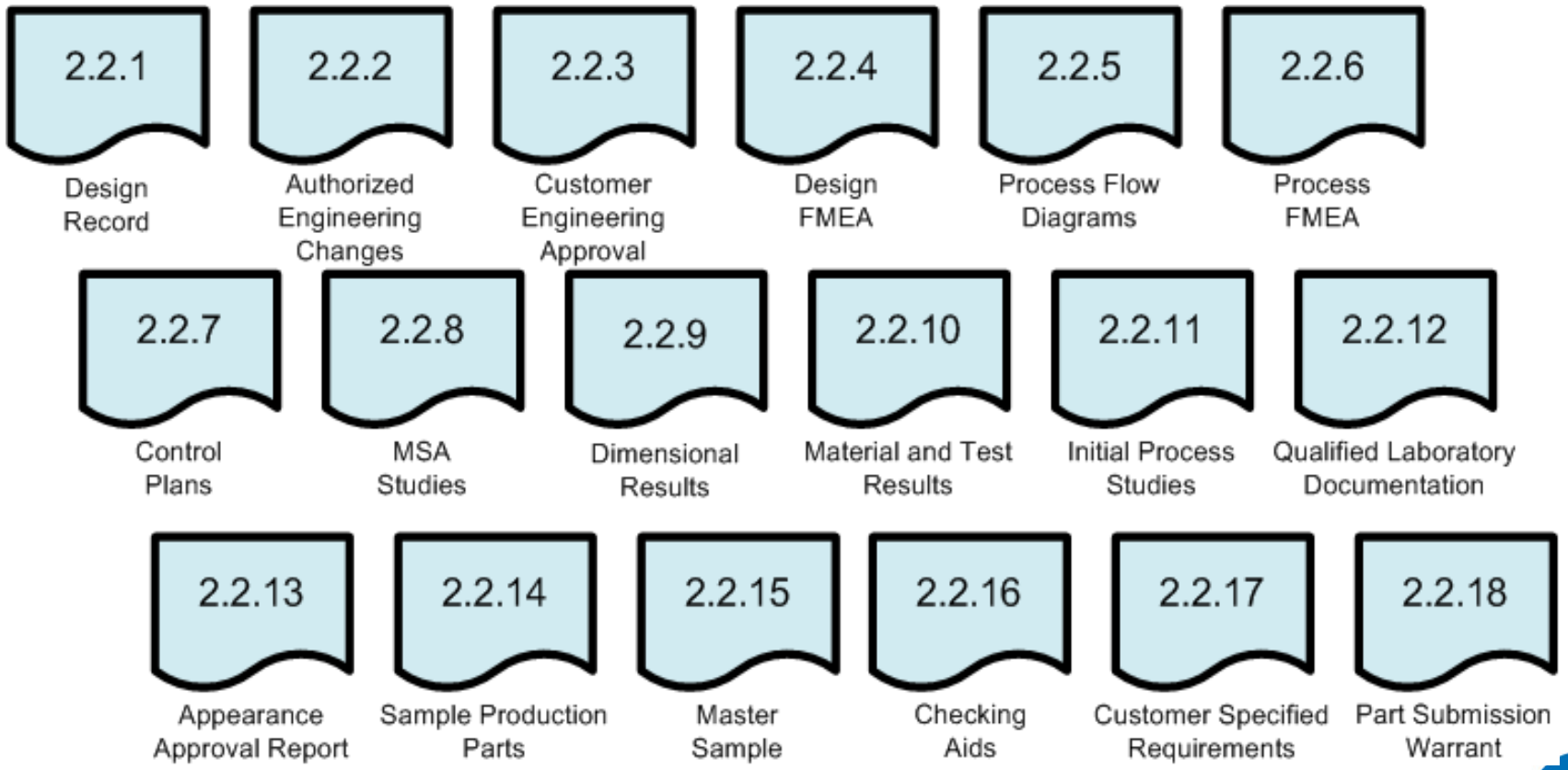
Summary and Closure

ASQ®
The Global Voice of Quality™

APQP Model for Quality Planning



18 Components of PPAP



Agenda

1. Working within a Quality System
2. Fundamentals of Quality Planning
3. AIAG Model for Quality Planning
4. Control Plans
5. Summary and Closure

ASQ

Course Goals

1. To provide a fundamental understanding of the language that guides APQP efforts.

2. To use APQP strategies to determine where to assess special characteristics.

3. To use APQP as a means to achieve robust capable processes for special characteristics.

ASQ

ASQ Automotive Division
The Global Voice of Quality™

Questions and Answers

Please type your questions in the panel box

ASQ
The Global Voice of Quality™

ASQ Automotive Division
The Global Voice of Quality™

Thank You For Attending

Please visit our website www.asq-auto.org for future webinar dates and topics.