Quality Support Group

Failure Modes and Effects Analysis (FMEA)
New 7 Step Approach!

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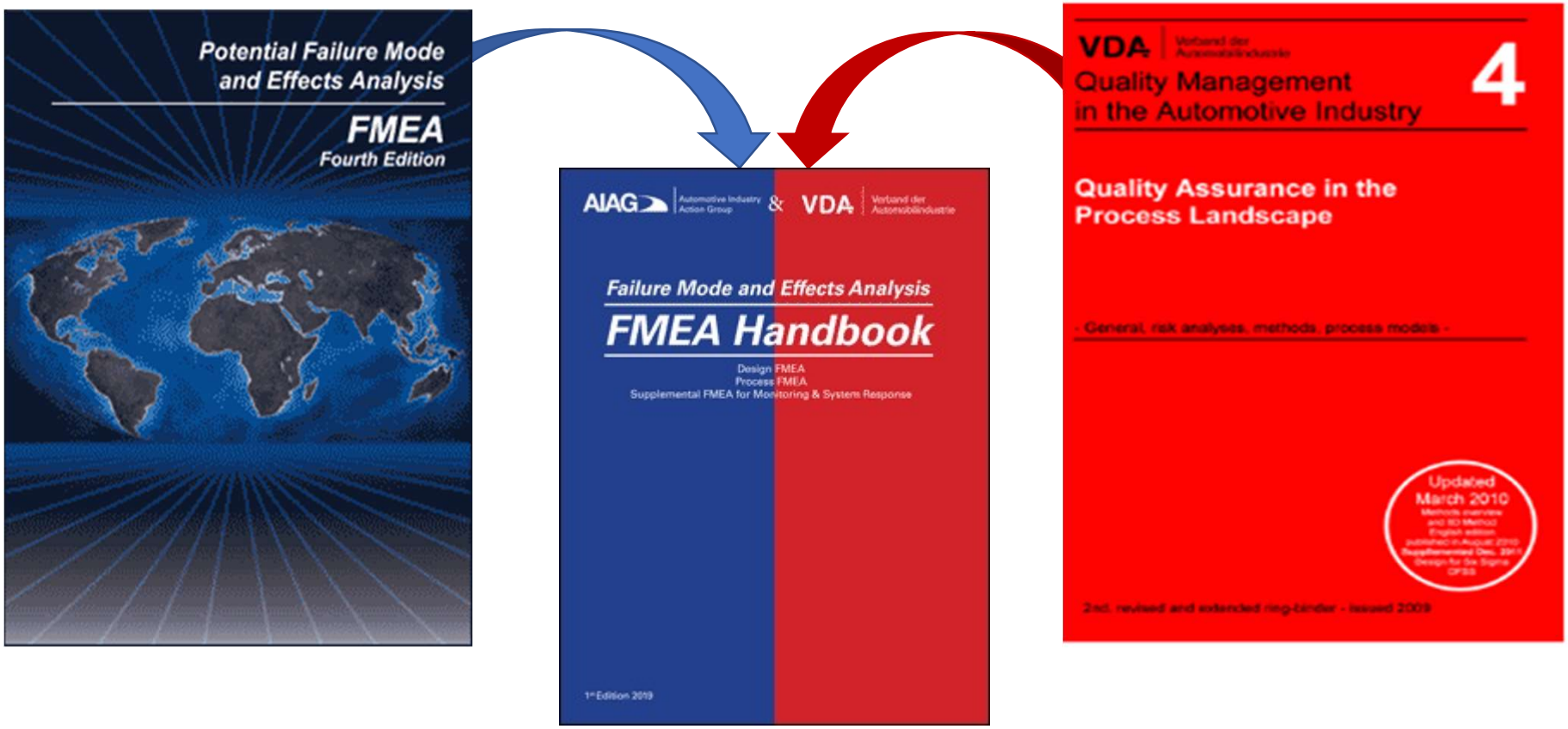
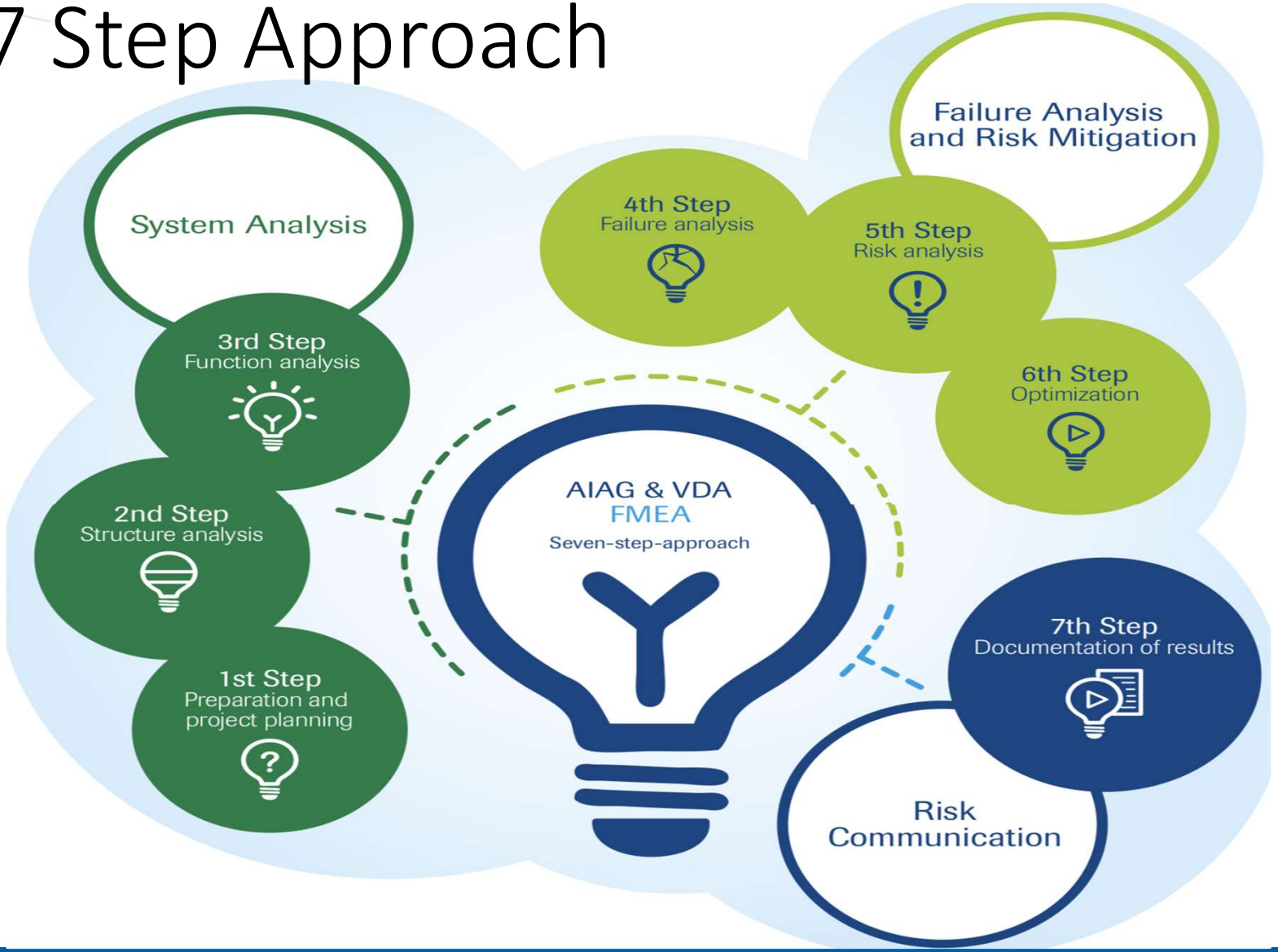
FMEA Alignment of AIAG & VDA



FMEA Alignment of AIAG & VDA

- Automotive suppliers to both North American and German OEMs were required to assess their failure modes and effects differently
  - Differences between the Severity, Occurrence, and Detection rating tables in the AIAG and VDA FMEA Manuals
- Caused confusion and added complexity to product development and process improvement activities
- Alignment was needed in order to create a common set of requirements so suppliers can have a single FMEA business process meeting needs and expectations of any of their automotive customers

7 Step Approach



Seven Step Approach

System Analysis			Failure Analysis and Risk Mitigation			Risk Communication
1st Step Planning & Preparation	2nd Step Structure Analysis	3rd Step Function Analysis	4th Step Failure Analysis	5th Step Risk Analysis	6th Step Optimization	7th Step Results Documentation
						
Project identification	Visualization of the analysis scope	Visualization of functions	Establishment of the Failure chain	Assignment of existing and/or planned controls and rating of failures	Identification of the actions necessary to reduce risks	Communication of results and conclusions of the analysis
Project plan: InTent, Timing, Team, Tasks, Tools (5T)	**DFMEA & FMEA-MSR:** Structure tree or equivalent: block diagram, boundary diagram, digital model, physical parts **PFMEA:** Structure tree or equivalent: process flow diagram	**DFMEA & FMEA-MSR:** Function tree/net or function analysis form sheet and parameter diagram **PFMEA:** Function tree/net or equivalent process flow diagram	**DFMEA:** Potential Failure Effects, Failure Modes, Failure Causes for each product function. **PFMEA:** Potential Failure Effects, Failure Modes, Failure Causes for each process function **FMEA-MSR:** Potential Failure Cause, Monitoring, System Response, Reduced Failure Effect	**DFMEA & PFMEA:** Assignment of Prevention Controls to the Failure Causes Assignment of Detection Controls to the Failure Causes and/or Failure Modes **FMEA-MSR:** Assignment of a Rationale for Frequency Rating Assignment of Monitoring Controls Analysis of Provisions for functional safety and regulatory compliance	Assignment of responsibilities and deadlines for action implementation	Establishment of content of the documentation
Analysis boundaries: What is included and excluded from the analysis	**DFMEA:** Identification of design interfaces, interactions, close clearances **PFMEA:** Identification of process steps and sub-steps	Association of requirements or characteristics to functions. Cascade of customer (external and internal) functions with associated requirements	**DFMEA &FMEA-MSR:** Identification of product failure causes using a parameter diagram or failure network **PFMEA:** Identification of process failure causes using a fishbone diagram (4M) or failure network	**DFMEA & PFMEA:** Rating of Severity, Occurrence and Detection for each failure chain Evaluation of Action Priority **FMEA-MSR:** Rating of Severity, Frequency and Monitoring for each failure chain Evaluation of Action Priority	Implementation of actions taken including confirmation of the effectiveness of the implemented actions and assessment of risk after actions taken	Documentation of actions taken including confirmation of the effectiveness of the implemented actions and assessment of risk after actions taken
Identification of baseline FMEA with lessons learned	Collaboration between customer and supplier engineering teams (interface responsibilities)	Collaboration between engineering teams (systems, safety, and components)	Collaboration between customer and supplier (Failure Effects)	Collaboration between customer and supplier (Severity)	Collaboration between the FMEA team, management, customers, and suppliers regarding potential failures	Communication of actions to reduce risks, including within the organization, and with customers and/or supplier as appropriate
Basis for the Structure Analysis step	Basis for the Function Analysis step	Basis for the Failure Analysis step	Basis for the documentation of failures in the FMEA form and the Risk Analysis step	Basis for the product or process Optimization step	Basis for refinement of the product requirements and prevention and detection controls	Record of risk analysis and reduction to acceptable levels.

Figure 1.6-1 FMEA 7 Step Approach

Step 1: Planning & Preparation

Five T's	Questions to Answer
InTent	• Have all Core Team Members received training on FMEAs? • Have all Core Team Members allocated time to fully participate?
Timing	• What APQP Phase or VDA Maturity Level is the project in? • What is the FMEA Start Date and Target Completion Date?
Team	• Have the team members been assigned with clearly defined roles and responsibilities (Leader, Facilitator, Champion, Core Team Member, Extended Team Member)?
Task	• Is the scope of the study clear? • Has the documentation/reporting methodology been clarified? • Will the FMEA Report be shared with customers? • Will the FMEA results be audited?
Tools	• Will a spreadsheet or specific software program be used to document the results?

Step 2: Structure Analysis

DFMEA

- Identification of design interfaces, interactions, close clearance
- Tools:
  - Structure tree
  - Block diagram
  - Boundary diagram

STRUCTURE ANALYSIS (STEP 2)		
1. Next Higher Level	2. Focus Element	3. Next Lower Level or Characteristic Type
Window Lifter Motor	Commutation System	Brush Card Base Body

Figure 2.2-3 Example of Structure Analysis Form Sheet

PFMEA

- Identification of process steps and sub-steps
- Tools:
  - Structure tree
  - Process flow diagram

STRUCTURE ANALYSIS (STEP 2)		
1. Process Item System, Subsystem, Part Element or Name of Process	2. Process Step Station No. and Name of Focus Element	3. Process Work Element 4M Type
Electrical Motor Assy Line	[OP 30] Sintered Bearing Press-In Process	Operator
Electrical Motor Assy Line	[OP 30] Sintered Bearing Press-In Process	Press Machine

Figure 3.2-5 Example of Structure Analysis Form Sheet

Step 3: Function Analysis

DFMEA

- Association of requirements to functions
- Tools:
  - Function analysis tree
  - Parameter diagram

FUNCTION ANALYSIS (STEP 3)		
1. Next Higher Level Function and Requirement	2. Focus Element Function and Requirement	3. Next Lower Level Function and Requirement or Characteristic
Convert electrical energy into mechanical energy according to parameterization	Commutation system transports the electrical current between coil pairs of the electromagnetic converter	Brush card body transports forces between spring and motor body to hold the brush spring system in x, y, z position (support commutating contact point)

Figure 2.3-5 Example of Function Analysis Form Sheet

PFMEA

- Association of characteristics to functions
- Tools:
  - Function analysis tree
  - Parameter diagram

1. Function of the Process Item Function of System, Subsystem, Part Element or Process	2. Function of the Process Step and Product Characteristic (Quantitative value is optional)	3. Function of the Process Work Element and Process Characteristic
Your Plant: Assembly of shaft into pole housing assembly Ship to Plant: Assembly of motor to vehicle door End User: Window raises and lowers	Press in sintered bearing to achieve axial position in pole housing to max gap per print	Machine presses sintered bearing into the pole housing seat until the defined axial position

Figure 3.3-3 Example of Function Analysis Form Sheet

Step 4: Failure Analysis

DFMEA

- Potential Failure Effects, Failure Modes, Failure Causes for each product function
- Tools:
  - Parameter diagram

FAILURE ANALYSIS (STEP 4)		
1. Failure Effects (FE) to the Next Higher Level Element and/or End User	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Next Lower Element or Characteristic
Torque and rotating velocity of the window lifter motor too low	Angle deviation by commutation system intermittently connects the wrong coils (L1, L3 and L2 instead of L1, L2 and L3)	Brush card body bends in contact area of the carbon brush

Figure 2.4-6 Example of Failure Analysis Form Sheet

PFMEA

- Potential Failure Effects, Failure Modes, Failure Causes for each process function
- Tools:
  - Fishbone diagram (4M)

FAILURE ANALYSIS (STEP 4)		
1. Failure Effects (FE) to the Next Higher Level Element and/or End User	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Work Element
Your Plant: Clearance too small to assemble shaft without potential damage Ship to Plant: Assembly of motor to vehicle door requires additional insertion force with potential damage End User: Comfort closing time too long.	Axial position of sintered bearing is not reached	Machine stops before reaching final position

Figure 3.4-3 Example of Failure Analysis Form Sheet

Step 5: Risk Analysis

DFMEA

- Assignment of Prevention Controls to Risk Causes
- Risk Ratings (Sev, Occ, Det)
- Evaluation of Action Priority

FAILURE ANALYSIS (STEP 4)				DFMEA RISK ANALYSIS (STEP 5)					
1. Failure Effects (FE) to the Next Higher Level Element and/or End User	Severity (S) of FE	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Next Lower Element or Characteristic	Current Prevention Control (PC) of FC	Occurrence (O) of FC	Current Detection Controls (DC) of FC or FM	Detection (D) of FC/FM	DFMEA AP	Filter Code (Optional)
Torque and rotating velocity of the window lifter motor too low	6	Angle deviation by commutation system intermittently connects the wrong coils (L1, L3 and L2 instead of L1, L2 and L3)	Brush card body bends in contact area of the carbon brush	Simulation of dynamic forces on brush card body acc. FEM 6370	2	Sample test: measuring the elastics and plastic deformation effects of brush card body acc. test spec. MRJ82/60	2	L	

Figure 2.5-3 Example of DFMEA Risk Analysis Form Sheet

PFMEA

- Assignment of Prevention Controls to Risk Causes
- Risk Ratings (Sev, Occ, Det)
- Evaluation of Action Priority

FAILURE ANALYSIS (STEP 4)				PFMEA RISK ANALYSIS (STEP 5)						
1. Failure Effects (FE) to the Next Higher Level Element and/or End User	Severity (S) of FE	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Work Element	Current Prevention Control (PC) of FC	Occurrence (O) of FC	Current Detection Controls (DC) of FC or FM	Detection (D) of FC/FM	PFMEA AP	Special Characteristics	Filter Code (Optional)
Your Plant: Clearance too small to assemble shaft without potential damage Ship to Plant: Assembly of motor to vehicle door requires additional insertion force with potential damage End User: Comfort closing time too long	8	Axial position of sintered bearing is not reached	Machine stops before reaching final position	Force adjusted acc. data sheet	5	100% check of motor performance curve acc. spec. MRKJ5039	2	M		

Figure 3.5-3 Example of PFMEA with Risk Analysis Form Sheet

Step 6: Optimization

DFMEA

- Assignment of responsibilities and due dates
- Implementation of actions

PFMEA

- Assignment of responsibilities and due dates
- Implementation of actions

DFMEA OPTIMIZATION (STEP 6)

DFMEA Preventive Action	DFMEA Detection Action	Responsible Person's Name	Target Completion Date	Status	Action Taken with Pointer to Evidence	Completion Date	Severity (S)	Occurrence (O)	Detection (D)	DFMEA AP
None	Final product test: measuring the current under worst case conditions acc. Test spec. MRJ1140	Test Engineer Mr. Max Mueller	dd.mm. yyyy	planned			6	2	1	L

PFMEA OPTIMIZATION (STEP 6)

Prevention Action	Detection Action	Responsible Person's Name	Target Completion Date	Status	Action Taken with Pointer to Evidence	Completion Date	Severity (S)	Occurrence (O)	Detection (D)	Special Characteristics	PFMEA AP	Remarks
Selected press with position control sensor	Selected press with force monitoring	Process Engineer Mr. Paul Duncan	dd. mm. yyyy	open			8	3	2		L	

Step 7: Results Documentation

- Communicate results and conclusions of the analysis
  - Within organization
  - With customers and/or suppliers (as appropriate)
- Document actions taken including effectiveness

Revised Rating Tables

DFMEA Severity Table

Product General Evaluation Criteria Severity (S)			
Potential Failure Effects rated according to the criteria below.			Blank until filled in by user
S	**Effect**	**Severity criteria**	**Corporate or Product Line Examples**
10	**Very High**	Affects safe operation of the vehicle and/or other vehicles, the health of driver or passenger(s) or road users or pedestrians.	
9		Noncompliance with regulations.	
8	**High**	**Loss** of primary vehicle function necessary for normal driving during expected service life.	
7		**Degradation** of primary vehicle function necessary for normal driving during expected service life.	
6	**Moderate**	**Loss** of secondary vehicle function.	
5		**Degradation** of secondary vehicle function.	
4		Very objectionable appearance, sound, vibration, harshness, or haptics.	
3	**Low**	Moderately objectionable appearance, sound, vibration, harshness, or haptics.	
2		Slightly objectionable appearance, sound, vibration, harshness, or haptics.	
1	**Very low**	No discernible effect.	

Table D1 - DFMEA SEVERITY (S)

DFMEA Occurrence Table

Occurrence Potential (O) for the Product			
Potential Failure Causes rated according to the criteria below. Consider Product Experience and Prevention Controls when determining the best Occurrence estimate (Qualitative rating).			Blank until filled in by user
O	Prediction of Failure Cause Occurring	Occurrence criteria - DFMEA	Corporate or Product Line Examples
10	Extremely high	First application of new technology anywhere without operating experience and/or under uncontrolled operating conditions. No product verification and/or validation experience. Standards do not exist and best practices have not yet been determined. Prevention controls not able to predict field performance or do not exist.	
9	Very high	First use of design with technical innovations or materials within the company. New application or change in duty cycle / operating conditions. No product verification and/or validation experience. Prevention controls not targeted to identify performance to specific requirements.	
8		First use of design with technical innovations or materials on a new application. New application or change in duty cycle / operating conditions. No product verification and/or validation experience. Few existing standards and best practices, not directly applicable for this design. Prevention controls not a reliable indicator of field performance.	
7	High	New design based on similar technology and materials. New application or change in duty cycle / operating conditions. No product verification and/or validation experience. Standards, best practices, and design rules apply to the baseline design, but not the innovations. Prevention controls provide limited indication of performance	
6		Similar to previous designs, using existing technology and materials. Similar application, with changes in duty cycle or operating conditions. Previous testing or field experience. Standards and design rules exist but are insufficient to ensure that the failure cause will not occur. Prevention controls provide some ability to prevent a failure cause.	

DFMEA Occurrence Table (contd.)

Occurrence Potential (O) for the Product			
Potential Failure Causes rated according to the criteria below. Consider Product Experience and Prevention Controls when determining the best Occurrence estimate (Qualitative rating).			**Blank until filled in by user**
O	**Prediction of Failure Cause Occurring**	**Occurrence criteria - DFMEA**	**Corporate or Product Line Examples**
5	Moderate	Detail changes to previous design, using proven technology and materials. Similar application, duty cycle or operating conditions. Previous testing or field experience, or new design with some test experience related to the failure. Design addresses lessons learned from previous designs. Best Practices re-evaluated for this design but have not yet been proven. Prevention controls capable of finding deficiencies in the product related to the failure cause and provide some indication of performance.	
4		Almost identical design with short-term field exposure. Similar application, with minor change in duty cycle or operating conditions. Previous testing or field experience. Predecessor design and changes for new design conform to best practices, standards, and specifications. Prevention controls capable of finding deficiencies in the product related to the failure cause and indicate likely design conformance.	
3	Low	Detail changes to known design (same application, with minor change in duty cycle or operating conditions) and testing or field experience under comparable operating conditions, or new design with successfully completed test procedure. Design expected to conform to Standards and Best Practices, considering Lessons Learned from previous designs. Prevention controls capable of finding deficiencies in the product related to the failure cause and predict conformance of production design.	
2	Very low	Almost identical mature design with long term field exposure. Same application, with comparable duty cycle and operating conditions. Testing or field experience under comparable operating conditions. Design expected to conform to standards and best practices, considering Lessons Learned from previous designs, with significant margin of confidence. Prevention controls capable of finding deficiencies in the product related to the failure cause and indicate confidence in design conformance.	
1	Extremely low	Failure eliminated through prevention control and failure cause is not possible by design	
Product Experience: History of product usage within the company (Novelty of design, application or use case). Results of already completed detection controls provide experience with the design.			
Prevention Controls: Use of Best Practices for product design, Design Rules, Company Standards, Lessons Learned, Industry Standards, Material Specifications, Government Regulations and effectiveness of prevention oriented analytical tools including Computer Aided Engineering, Math Modeling, Simulation Studies, Tolerance Stacks and Design Safety Margins			
Note: O 10, 9, 8, 7 can drop based on product validation activities.			

Table D2 - DFMEA Occurrence (O)

DFMEA Detection Table

Detection Potential (D) for the Validation of the Product Design				
Detection Controls rated according to Detection Method Maturity and Opportunity for Detection.				Blank until filled in by user
D	**Ability to Detect**	**Detection Method Maturity**	**Opportunity for Detection**	**Corporate or Product Line Examples**
10	**Very low**	Test procedure yet to be developed.	Test method not defined	
9		Test method not designed specifically to detect failure mode or cause.	Pass-Fail, Test-to-Fail, Degradation Testing	
8	**Low**	New test method; not proven.	Pass-Fail, Test-to-Fail, Degradation Testing	
7		Proven test method for verification of functionality or validation of performance, quality, reliability and durability; planned timing is later in the product development cycle such that test failures may result in production delays for re-design and/or re-tooling.	Pass-Fail Testing	
6	**Moderate**		Test-to-Failure	
5			Degradation Testing	
4	**High**	Proven test method for verification of functionality or validation of performance, quality, reliability and durability; planned timing is sufficient to modify production tools before release for production.	Pass-Fail Testing	
3			Test-to-Failure	
2			Degradation Testing	
1	**Very high**	Prior testing confirmed that failure mode or cause cannot occur, or detection methods proven to always detect the failure mode or failure cause.		

Table D3 - DFMEA DETECTION (D)

PFMEA Severity Table

Process General Evaluation Criteria Severity (S)					
Potential Failure Effects rated according to the criteria below.					Blank ur filled in by user
S	**Effect**	**Impact to Your Plant**	**Impact to Ship-to Plant (when known)**	**Impact to End User (when known)**	**Corporate or Product Line Examples**
10	**High**	Failure may result in an acute health and/or safety risk for the manufacturing or assembly worker	Failure may result in an acute health and/or safety risk for the manufacturing or assembly worker	Affects safe operation of the vehicle and/or other vehicles, the health of driver or passenger(s) or road users or pedestrians.	
9		Failure may result in in-plant regulatory noncompliance	Failure may result in in-plant regulatory noncompliance	Noncompliance with regulations.	
8	**Moderately high**	100% of production run affected may have to be scrapped. Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the manufacturing or assembly worker	Line shutdown greater than full production shift; stop shipment possible; field repair or replacement required (Assembly to End User) other than for regulatory noncompliance. Failure may result in in-plant regulatory noncompliance or may have a chronic health and/or safety risk for the manufacturing or assembly worker.	**Loss** of primary vehicle function necessary for normal driving during expected service life.	
7		Product may have to be sorted and a portion (less than 100%) scrapped; deviation from primary process; decreased line speed or added manpower	Line shutdown from 1 hour up to full production shift; stop shipment possible; field repair or replacement required (Assembly to End User) other than for regulatory noncompliance	**Degradation** of primary vehicle function necessary for normal driving during expected service life.	

PFMEA Severity Table (contd.)

Process General Evaluation Criteria Severity (S)					
Potential Failure Effects rated according to the criteria below.					Blank until filled in by user
S	**Effect**	**Impact to Your Plant**	**Impact to Ship-to Plant (when known)**	**Impact to End User (when known)**	**Corporate or Product Line Examples**
6	**Moderately low**	100% of production run may have to be reworked off line and accepted	Line shutdown up to one hour	**Loss** of secondary vehicle function.	
5		A portion of the production run may have to be reworked off line and accepted	Less than 100% of product affected; strong possibility for additional defective product; sort required; no line shutdown	**Degradation** of secondary vehicle function.	
4		100% of production run may have to be reworked in station before it is processed	Defective product triggers significant reaction plan; additional defective products not likely; sort not required	Very objectionable appearance, sound, vibration, harshness, or haptics.	
3	**Low**	A portion of the production run may have to be reworked in-station before it is processed	Defective product triggers minor reaction plan; additional defective products not likely; sort not required	Moderately objectionable appearance, sound, vibration, harshness, or haptics.	
2		Slight inconvenience to process, operation, or operator	Defective product triggers no reaction plan; additional defective products not likely; sort not required; requires feedback to supplier	Slightly objectionable appearance, sound, vibration, harshness, or haptics.	
1	**Very low**	No discernible effect	No discernible effect or no effect	No discernible effect.	

Table P1 - PFMEA SEVERITY (S)

PFMEA Occurrence Table

Occurrence Potential (O) for the Process				
Potential Failure Causes rated according to the criteria below. Consider Prevention Controls when determining the best Occurrence estimate. Occurrence is a predictive qualitative rating made at the time of evaluation and may not reflect the actual occurrence. The occurrence rating number is a relative rating within the scope of the FMEA (process being evaluated). For Prevention Controls with multiple Occurrence Ratings, use the rating that best reflects the robustness of the control.				Blank until filled in by user
O	**Prediction of Failure Cause Occurring**	**Type of Control**	**Prevention Controls**	**Corporate or Product Line Examples**
10	**Extremely high**	None	No prevention controls.	
9	**Very high**	Behavioral	Prevention controls will have little effect in preventing failure cause.	
8				
7	**High**	Behavioral or Technical	Prevention controls somewhat effective in preventing failure cause.	
6				
5	**Moderate**		Prevention controls are effective in preventing failure cause.	
4				
3	**Low**	Best Practices: Behavioral or Technical	Prevention controls are highly effective in preventing failure cause.	
2	**Very low**			
1	**Extremely low**	Technical	Prevention controls are extremely effective in preventing failure cause from occurring due to design (e.g. part geometry) or process (e.g. fixture or tooling design). Intent of prevention controls - Failure Mode cannot be physically produced due to the Failure Cause.	

Prevention Control Effectiveness: Consider if prevention controls are technical (rely on machines, tool life, tool material, etc.), or use best practices (fixtures, tool design, calibration procedures, error-proofing verification, preventive maintenance, work instructions, statistical process control charting, process monitoring, product design, etc.) or behavioral (rely on certified or non-certified operators, skilled trades, team leaders, etc.) when determining how effective the prevention controls will be.

Table P2 - PFMEA OCCURRENCE (O)

PFMEA Detection Table

Detection Potential (D) for the Validation of the Process Design				
Detection Controls rated according to the Detection Method Maturity and Opportunity for Detection.				Blank until filled in by user
D	**Ability to Detect**	**Detection Method Maturity**	**Opportunity for Detection**	Corporate or Product Line Examples
10	Very low	No testing or inspection method has been established or is known.	The failure mode will not or cannot be detected.	
9		It is unlikely that the testing or inspection method will detect the failure mode.	The failure mode is not easily detected through random or sporadic audits.	
8	Low	Test or inspection method **has not been** proven to be effective and reliable (e.g. plant has little or no experience with method, gauge R&R results marginal on comparable process or this application, etc.).	Human inspection (visual, tactile, audible), or use of manual gauging (attribute or variable) that should detect the failure mode or failure cause.	
7			Machine-based detection (automated or semi-automated with notification by light, buzzer, etc.), or use of inspection equipment such as a coordinate measuring machine that should detect failure mode or failure cause.	

PFMEA Detection Table (contd.)

Detection Potential (D) for the Validation of the Process Design				
Detection Controls rated according to the Detection Method Maturity and Opportunity for Detection.				Blank until filled in by user
D	**Ability to Detect**	**Detection Method Maturity**	**Opportunity for Detection**	Corporate or Product Line Examples
6	Moderate	Test or inspection method **has been** proven to be effective and reliable (e.g. plant has experience with method; gauge R&R results are acceptable on comparable process or this application, etc.).	Human inspection (visual, tactile, audible), or use of manual gauging (attribute or variable) that will detect the failure mode or failure cause (including product sample checks).	
5			Machine-based detection (semi-automated with notification by light, buzzer, etc.), or use of inspection equipment such as a coordinate measuring machine that will detect failure mode or failure cause (including product sample checks).	
4	High	System has been proven to be effective and reliable (e.g. plant has experience with method on identical process or this application), gauge R&R results are acceptable, etc.	Machine-based automated detection method that will detect the failure mode **downstream**, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility.	
3			Machine-based automated detection method that will detect the failure mode **in-station**, prevent further processing or system will identify the product as discrepant and allow it to automatically move forward in the process until the designated reject unload area. Discrepant product will be controlled by a robust system that will prevent outflow of the product from the facility.	
2		Detection method has been proven to be effective and reliable (e.g. plant has experience with method, error-proofing verifications, etc.).	Machine-based detection method that will detect the cause and prevent the failure mode (discrepant part) from being produced.	
1	Very high	Failure mode cannot be physically produced as-designed or processed, or detection methods proven to **always** detect the failure mode or failure cause.		

Table P3 - PFMEA DETECTION (D)

Action Priority

- **High (H):**
  - Required to identify appropriate action to improve Prevention and/or Detection Controls; OR justify and document why current controls are adequate
- **Priority Medium (M):**
  - Should identify appropriate actions to improve prevention and/or detection controls; OR, at the discretion of management, justify and document why current controls are adequate
- **Priority Low (L):**
  - Could identify actions to improve prevention or detection controls

FMEA Action Priority Table

Action Priority (AP) for DFMEA and PFMEA							
Action Priority is based on combinations of Severity, Occurrence, and Detection ratings in order to prioritize actions for risk reduction.							Blank until filled in by user
Effect	**S**	**Prediction of Failure Cause Occurring**	**O**	**Ability to Detect**	**D**	**ACTION PRIORITY (AP)**	**Comments**
Product or Plant Effect Very high	9-10	Very high	8-10	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	H	
				Very high	1	H	
		High	6-7	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	H	
				Very high	1	H	
		Moderate	4-5	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	H	
				Very high	1	M	
		Low	2-3	Low - Very low	7-10	H	
				Moderate	5-6	M	
				High	2-4	L	
				Very high	1	L	
		Very low	1	Very high - Very low	1-10	L	
Product or Plant Effect High	7-8	Very high	8-10	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	H	
				Very high	1	H	
		High	6-7	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	H	
				Very high	1	M	
		Moderate	4-5	Low - Very low	7-10	H	
				Moderate	5-6	M	
				High	2-4	M	
				Very high	1	M	
		Low	2-3	Low - Very low	7-10	M	
				Moderate	5-6	M	
				High	2-4	L	
				Very high	1	L	
		Very low	1	Very high - Very low	1-10	L	

FMEA Action Priority Table (contd)

Effect	S	Prediction of Failure Cause Occurring	O	Ability to Detect	D	ACTION PRIORITY (AP)	Comments
Product or Plant Effect Moderate	4-6	Very high	8-10	Low - Very low	7-10	H	
				Moderate	5-6	H	
				High	2-4	M	
				Very high	1	M	
		High	6-7	Low - Very low	7-10	M	
				Moderate	5-6	M	
				High	2-4	M	
				Very high	1	L	
		Moderate	4-5	Low - Very low	7-10	M	
				Moderate	5-6	L	
				High	2-4	L	
				Very high	1	L	
		Low	2-3	Low - Very low	7-10	L	
				Moderate	5-6	L	
				High	2-4	L	
				Very high	1	L	
		Very low	1	Very high - Very low	1-10	L	
Product or Plant Effect Low	2-3	Very high	8-10	Low - Very low	7-10	M	
				Moderate	5-6	M	
				High	2-4	L	
				Very high	1	L	
		High	6-7	Low - Very low	7-10	L	
				Moderate	5-6	L	
				High	2-4	L	
				Very high	1	L	
		Moderate	4-5	Low - Very low	7-10	L	
				Moderate	5-6	L	
				High	2-4	L	
				Very high	1	L	
		Low	2-3	Low - Very low	7-10	L	
				Moderate	5-6	L	
				High	2-4	L	
				Very high	1	L	
		Very low	1	Very high - Very low	1-10	L	
No discernible Effect	1	Very low - Very high	1-10	Very high - Very low	1-10	L	

Table AP – ACTION PRIORITY FOR DFMEA and PFMEA

Key Changes

DFMEA Structure Analysis

AIAG 4th Ed FMEA

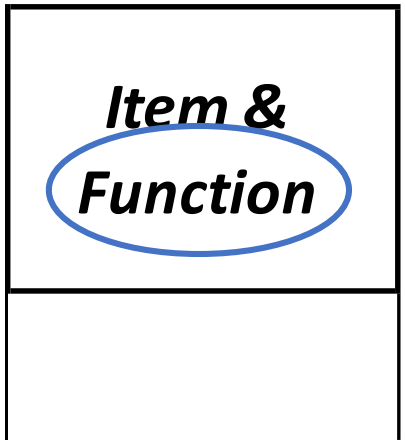
Item & Function

New AIAG-VDA 1st Ed FMEA

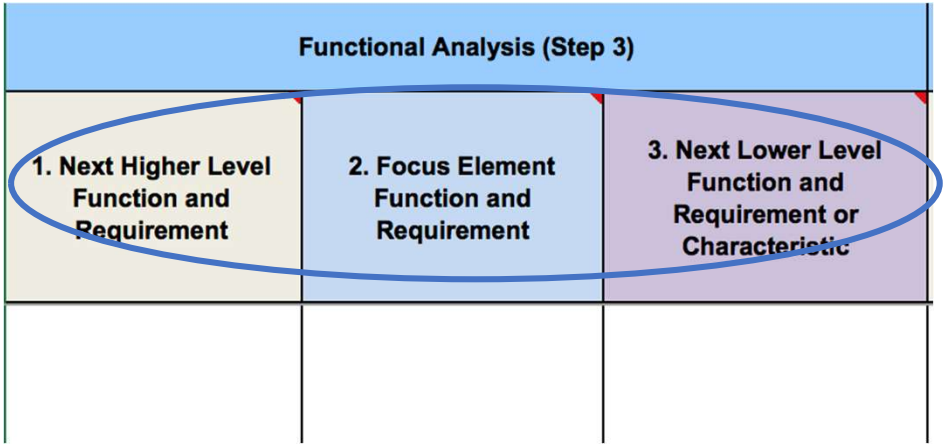
	Continuous Improvement	Structure Analysis (Step 2)		
Issue Number	Hstory/Change Authorization (Optional)	1. Next Higher Level	2. Focus Element	3. Next Lower Level or Characteristic Type

DFMEA Function Analysis

AIAG 4th Ed FMEA

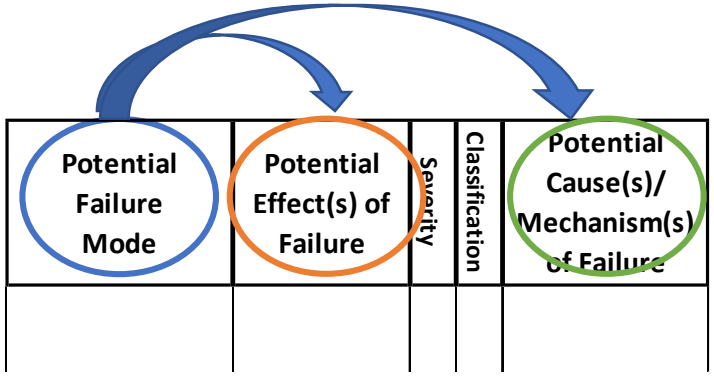


New AIAG-VDA 1st Ed FMEA

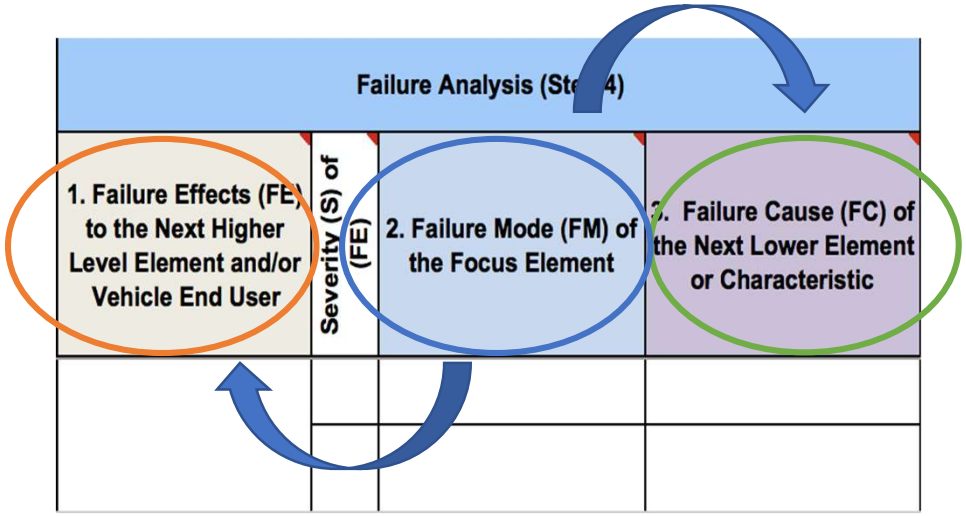


DFMEA Failure Analysis

AIAG 4th Ed FMEA

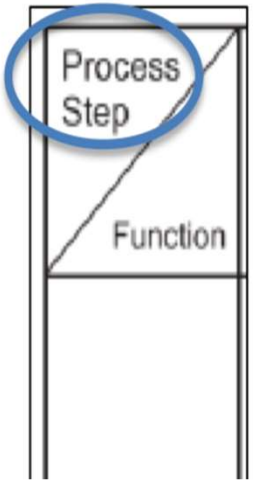


New AIAG-VDA 1st Ed FMEA



PFMEA Structure Analysis

Current AIAG 4th Ed FMEA

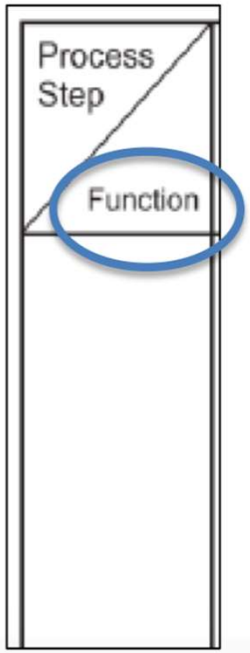


New AIAG-VDA FMEA

STRUCTURE ANALYSIS		
1. Process Item System, Subsystem, Part Element or Name of Process	2. Process Step Station No. and Name of Focus Element	3. Process Work Element [Man, Machine, Indirect Material, Environment, etc.]

PFMEA Function Analysis

Current AIAG 4th Ed FMEA

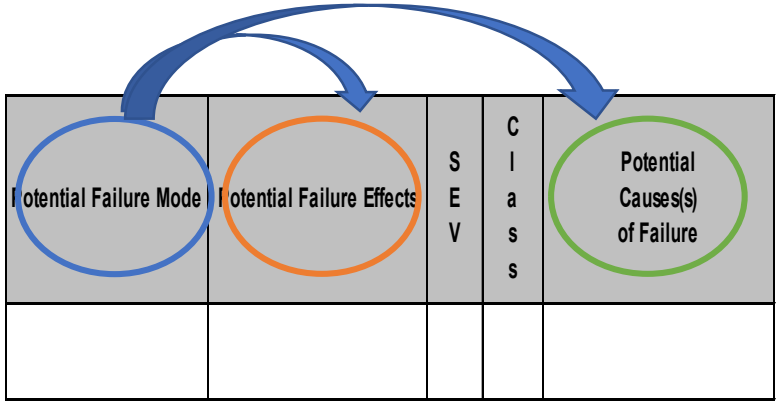


New AIAG-VDA FMEA

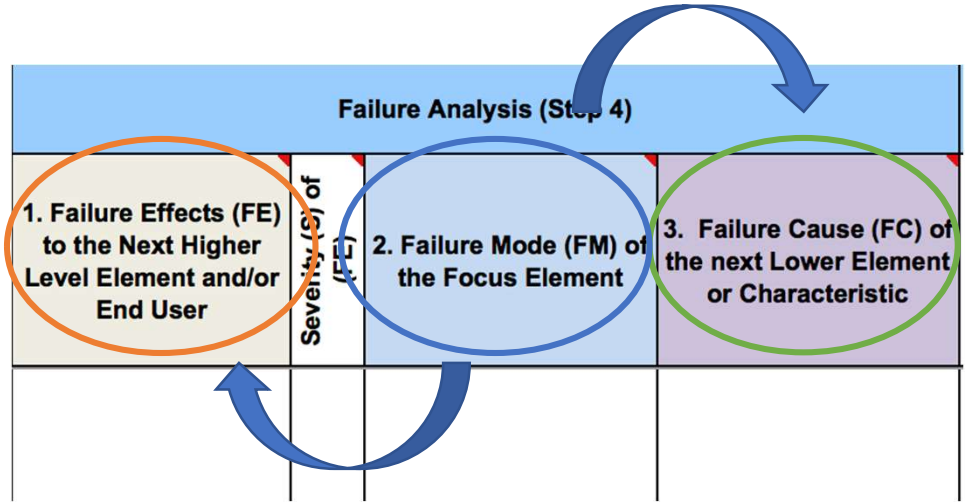
FUNCTION ANALYSIS		
1. Product and/or Process Function that the Process Item Creates (Product, In Plant, Ship to Plant, End user when known)	2. Function or Outcome of the Process Step and Characteristic Description (Quantitative value is optional)	3. Function or Task of the Work Element and Characteristic

PFMEA Failure Analysis

AIAG 4th Ed FMEA



New AIAG-VDA 1st Ed FMEA



Optimization

Current AIAG 4th Ed FMEA

Recommended Action	Responsibility & Target Completion Date	Action Results: Actions Taken & Effective Date	Severity	Occurance	Detection	RPN

New AIAG-VDA FMEA

6. OPTIMIZATION										
Prevention Action	Detection Action	Responsible Person's Name	Target Completion Date	Status: Open, Completed, Discarded	Action Taken with Pointer to Evidence	Completion Date	Severity (S)	Occurrence (O)	Detection (D)	AP

Transition Strategy (Automotive Suppliers)

- Existing FMEAs developed per the AIAG 4th Edition can remain
- Plan the transition
  - From current FMEA processes and methods to the new AIAG VDA FMEA process and tools
  - Use existing FMEAs for a starting point
  - Consider: Minor or major change, New rating scales, Analytical methods and format
- New projects
  - Consider:
    - Company leadership mandates, Customer Specific Requirements Transition date and milestones

Questions?