FMEA

Failure Mode (and) Effects Analysis

What is an FMEA?

- A procedure that examines each item in a system, considers how that item can fail and then determines how that failure will affect (or cascade through) the system

Why would anyone perform a FMEA?

- Improves design by discovering unanticipated failures
- Highlights the impact of the failures
- Potentially helpful during legal actions
- Provides a method to characterize product safety

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
Front Door L.H.

___ System 1 - Automobile
___ Subsystem 2 - Body Closures
X Component 3 - Front Door L.H.
Design Responsibility Body Engineering
Model Year(s)/Program(s) 199X/Lion 4dr/Wagon
Key Date 3/3/2003
Core Team T. Fender - Car Product Dev., C. Childers - Manufacturing, J. Ford - Assy Ops (Dalton, Fraser, Henley Assembly Plants)

FMEA Number 1234
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Prepared By A. Tate - X6412 - Body Engr
FMEA Date (Orig.) 2/28/2003 (Rev) 3/3/2003

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/Mechanism(s) of Failure	Occur	Current Design Controls	Detec	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Action Results: Actions Taken	Sev	Occ	Det	RPN
3 - Front Door L.H.																
- Ingress to and egress from vehicle. - Occupant protection from weather, noise, and side impact. - Support anchorage for door hardware including mirror, hinges, latch and window regulator. - Provide proper surface for appearance items - paint and soft trim.	Corroded interior lower door panels	Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware.	7		Upper edge of protective wax application specified for inner door panels is too low.	6	Vehicle general durability test veh. T-118 T-109 T-301	7	294	Add laboratory accelerated corrosion testing.	A. Tate Body Engrg - 2/25/2003	Based on test results (Test No. 1481) upper edge spec raised 125 mm.	7	2	2	28
					Insufficient wax thickness specified.	4	Vehicle general durability testing - as above. - Detection	7	196	Add laboratory accelerated corrosion testing.	A. Tate Body Engrg - 3/28/2003	Test results (Test No. 1481) show specified thickness is adequate.	7	2	2	28
										Conduct Design of Experiments (DOE) on wax thickness.	A. Tate Body Engrg - 3/28/2003	DOE shows 25% variation in specified thickness is acceptable.				
					Inappropriate wax formulation specified.	2	Physical and Chem Lab test - Report No. 1265. - Detection	2	28				7	2	2	28
					Entrapped air prevents wax from entering corner/edge access.	5	Design aid investigation with nonfunctioning spray head. - Detection	8	280	Add team evaluation using production spray equipment and specified wax.	Body Engrg & Assy Ops - 3/28/2003	Based on test, addition vent holes will be provided in affected areas.	7	1	3	21
					Wax application plugs door drain holes.	3	Laboratory test using "worst case" wax application and hole size. - Detection	1	21				7	3	1	21
					Insufficient room between panels for spray head access.	4	Drawing evaluation of spray head access. - Detection	4	112	Add team evaluation using design aid buck and spray head.	Body Engrg & Assy Ops - 3/28/2003	Evaluation showed adequate access.	7	1	1	7

10 steps to creating a FMEA

1. **List the key process steps in the first column**.
2. **List the potential failure mode for each process step**.
    - In other words, figure out how this process step or input could go wrong.
3. **List the effects of this failure mode**.
    - If the failure mode occurs what does this mean to us and our customer… in short what is the effect?
4. **Rate how severe this effect is** with 1 being not severe at all and 10 being extremely severe.
5. **Identify the causes of the failure mode/effect** and rank it as you did the effects in the occurrence column.
    - This time, as the name implies, we are scoring how likely this cause will occur.
6. **Identify the controls in place to detect the issue** and rank its effectiveness in the detection column.
7. **Multiply the severity, occurrence, and detection numbers** and store this value in the RPN (risk priority number) column. This is the key number that will be used to identify where the team should focus first.
    - If, for example, we had a severity of 10 (very severe), occurrence of 10 (happens all the time), and detection of 10 (cannot detect it) our RPN is 1000. This means all hands on deck… we have a serious issue!
8. **Sort by RPN number and identify most critical issues**.
9. **Assign specific actions with responsible persons**.
10. **Once actions have been completed, re-score the occurrence and detection**.
    - Generally the severity score will not change unless the customer decides this is not an important issue.

Severity/Risk Guidelines

Effect	Rank	Criteria
None	1	No effect
Very Slight	2	Negligible effect on Performance. Some users may notice.
Slight	3	Slight effect on performance. Non vital faults will be noticed by many users
Minor	4	Minor effect on performance. User is slightly dissatisfied.
Moderate	5	Reduced performance with gradual performance degradation. User dissatisfied.
Severe	6	Degraded performance, but safe and usable. User dissatisfied.
High Severity	7	Very poor performance. Very dissatisfied user.
Very High Severity	8	Inoperable but safe.
Extreme Severity	9	Probable failure with hazardous effects. Compliance with regulation is unlikely.
Maximum Severity	10	Unpredictable failure with hazardous effects almost certain. Non-compliant with regulations.

Occurrence Ranking

Occurrence	Rank	Criteria
Extremely Unlikely	1	Failure will occur 0-10% of the time
Remote Likelihood	2	Failure will occur 10-20%+ of the time
Very Low Likelihood	3	Failure will occur 20-30%+ of the time
Low Likelihood	4	Failure will occur 30-40%+ of the time
Moderately Low Likelihood	5	Failure will occur 40-50%+ of the time
Medium Likelihood	6	Failure will occur 50-60%+ of the time
Moderately High Likelihood	7	Failure will occur 60-70%+ of the time
Very High Severity	8	Failure will occur 70-80%+ of the time
Extreme Severity	9	Failure will occur 80-90%+ of the time
Maximum Severity	10	Failure will occur 90%+ of the time

Detection Ranking

Detection	Rank	Criteria
Extremely Likely	1	Can be corrected prior to prototype/ Controls will almost certainly detect
Very High Likelihood	2	Can be corrected prior to design release/ Very High probability of detection
High Likelihood	3	Likely to be corrected/High probability of detection
Moderately High Likelihood	4	Design controls are moderately effective
Medium Likelihood	5	Design controls have an even chance of working
Moderately Low Likelihood	6	Design controls may miss the problem
Low Likelihood	7	Design controls are likely to miss the problem
Very Low Likelihood	8	Design controls have a poor chance of detection
Remote Likelihood	9	Unproven, unreliable design/ poor chance for detection
Extremely Unlikely	10	No design technique available/ Controls will not detect

IN-CLASS FMEA CREATION ASSIGNMENT:

AIRPLANE DEMO

<u>REQUIRED PROCESS:</u>

AIRPLANE MUST FLY A PRE-DETERMINED DISTANCE IN A STRAIGHT LINE.

WHAT MIGHT GO WRONG??