FMEA THROUGH THE PROJECT LIFECYCLE

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UNDERSTAND THE **FMEA** PROCESS

WHO?   -> Reliability, Design, SME, Testing, Quality, Manufacturing, Maintenance, Service

WHAT?   -> Bottom-up (inductive) study of a design / process's failure modes, and their effects

WHEN? -> From absolute beginning of the design process, and continuing through project lifetime

WHY?   -> Improve safety and reliability, Identify and remove single point failures, decrease cost. *Changes throughout the project lifecycle.*

NOTIONAL FMEA

Hardware Item, Process, or Service under study	Failure Modes	Failure Causes	Failure Effects (Integrated)	Severity (Criticality)	Detection Methods	System Response / Action	Controls / Mitigation	(RPN)
Sensor	Erroneous Output (on scale)	Component failures, loss of power, physical stress, etc	Depends on integration - effect from loss of (reliable) information	Depends on scale and vehicle effects	None	None	Tests or inspections, other	*
	Erroneous Output (off scale)				Sense off-scale reading	Disqualify Sensor		
	Individual Pin Failures				Depending on effects	Depending on effects		
	…							
NOTIONAL, DOES NOT REPRESENT REAL HARDWARE OR FAILURE EFFECTS								

Outcomes by Project Phase

Concept -> Influence the design architecture

Preliminary Design -> Influence the design at a functional level

Train engineers on systems, for integration @ later stage

Detail Design -> Influence the design at a detailed level

Create test + inspection plans

Prepare for Troubleshooting & RCA

Produce + Operate -> Generate 'lessons learned' for design

Add data for Troubleshooting & RCA

Outcome ∝ Resources Invested

And we need 100% of the outcome! Often, 1 failure is too many!

- Analyze lower levels of assembly
  get more design influences,
  get more safety improvement,
  price -> more work

- Don't under-analyze!
  FMEA only protects from
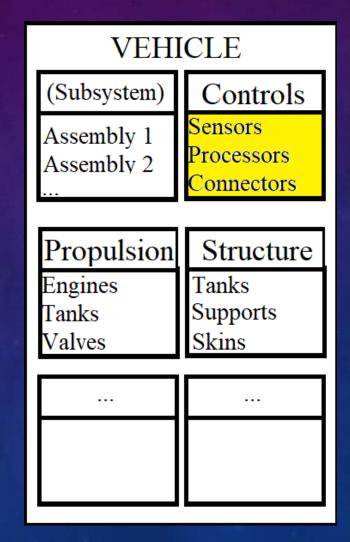 failures when it is comprehensive

LEVEL OF ANALYSIS : VEHICLE EXAMPLE (E.ENG)

System broken out into increasing levels of detail, exploring one of many paths.

The FMEA is a "Bottom-Up" Analysis – where is the bottom?

Need to identify the lowest level to perform analysis, to create useful work.

Rule of Thumb: Seek to 'analyze out ' uncertainty.

Vehicle

Controls System

Sensor

Circuit

Component

Terminal

Summary

Concept, Preliminary-> Analyze available data (system to hardware)

Influences Architecture, Functional Design, and prepares RE's to integrate analysis in later phase

Detail Design -> Analyze from bottom up ("hardware level")

Influences Detailed Design, Test/Inspection Plan and prepares for maintenance & RCA

Produce + Operate -> Further analysis generates lessons learned (variable)

Influences Future Design, R&M Models