What would FMEA 3.0 be?

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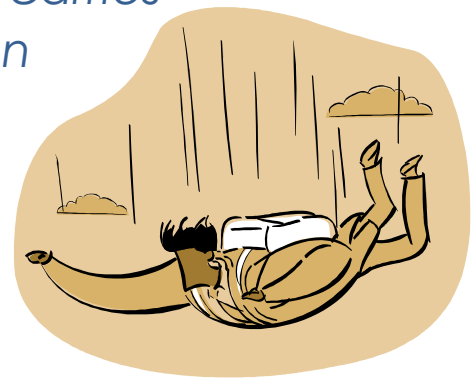
SYMCOSYS
Systems & Processes for Quality & Reliable Products

OPS A La Carte
Reliability Consultants

Every adversity, every failure, every heartache carries with it the seed on an equal or greater benefit

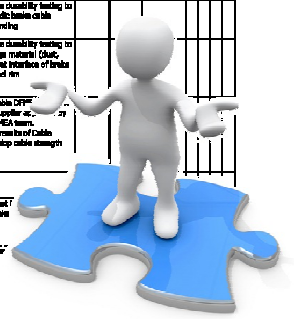
- Napoleon Hill



But it is better to fail early in development where the pain isn't as great

Failure Mode Effects Analysis (FMEA)

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Classification	Potential Cause(s) of Failure	Occ	Current Design Controls (Prevention)	Current Design Controls (Detection)	Det	RPN	Recommended Actions	Responsibility & Target Completion Date	Action Results: Actions Taken & Effective Date	Sev r	Occ r	Det r	RPN r
Provide the correct level of friction between brake pad assembly and wheel rim to safely stop bicycle in the required distance, under all operating conditions.	Insufficient friction delivered by hand brake mechanism between brake pads and wheels during heavy rain conditions.	Bicycle wheel does not slow down when the brake lever is pulled potentially resulting in accident.	10		Cable Binds due to inadequate lubrication or poor routing	4	Design review of brake system	Bicycle system durability test # 789	3	80	Modify bicycle durability testing to include particle/water entry checks for binding						
					External foreign material reduces friction	2			3	60	Modify bicycle durability testing to include foreign material (dust, leaves, etc.) at interface of brake pad and wheel rim						
					Cable breaks	6	Cable material selection based on ANSI #ABC.	Bicycle system durability test # 789	4	240	1. Require cable DFMEA from cable supplier as part of AB-Brands FMEA team. 2. Based on results of Cable DFMEA, develop cable strength test						
					Brake Lever breaks	1	Design review of brake system	Bicycle system durability test # 789	1	10							
					Selected brake pad material does not apply required friction to wheel	2			2	40	Add bench test if adequate brakes						
Brake system is easy	Brake system	Brake system does	10		Brake cable sub-	6		Bicycle system	5	300	1. Develop an						



Types: FMECA, DFMEA, PFMEA,…

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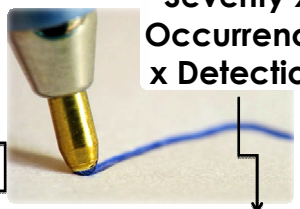
FMEA Example

Function	Failure Mode	Potential Effects	Severity
Ball point delivers ink to paper	Non consistent ink delivery to paper	Intermittent, incomplete lines.	7



Severity x Occurrence x Detection

Potential Causes	Prevention Controls	Occurrence	Detection Control	Detection	Risk Priority Number
Ball diameter variations	Tolerance Specification	1	Process Control XYZ	2	14

One of the more popular tool for risk management

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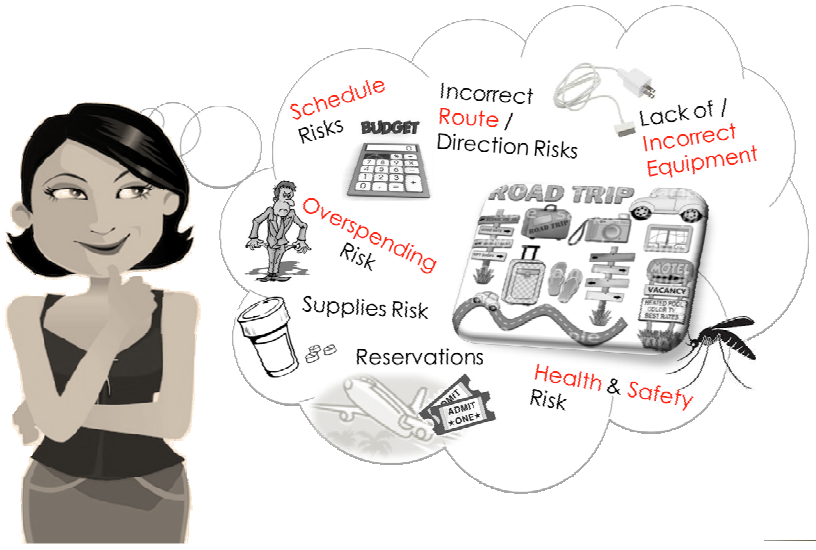
Personal Risk Management



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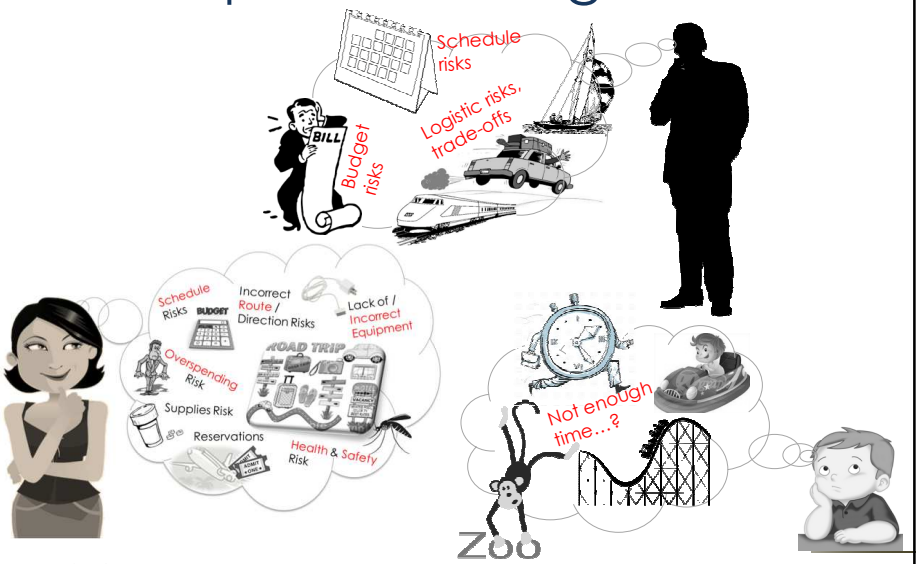
Group Risk Management



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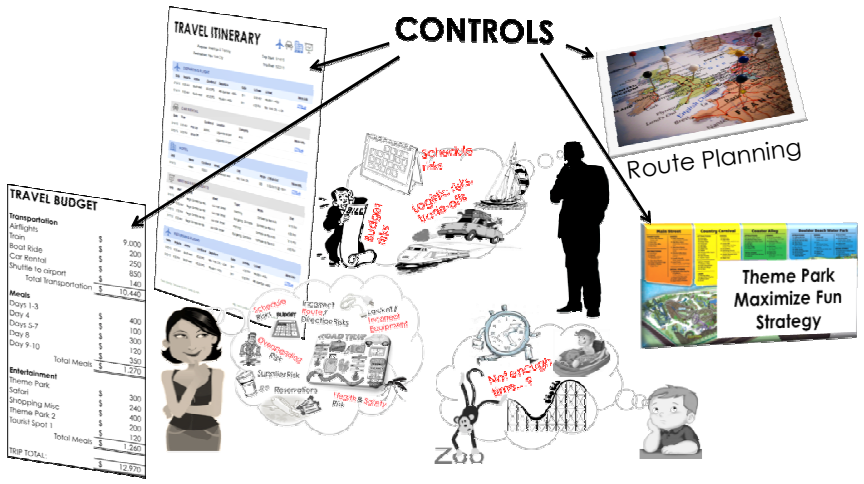
Group Risk Management



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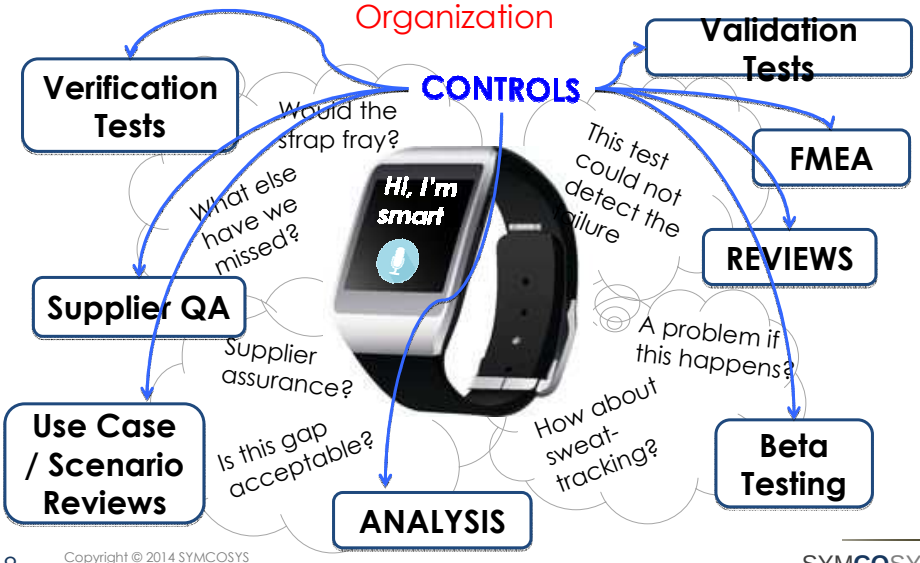
Group Risk Management



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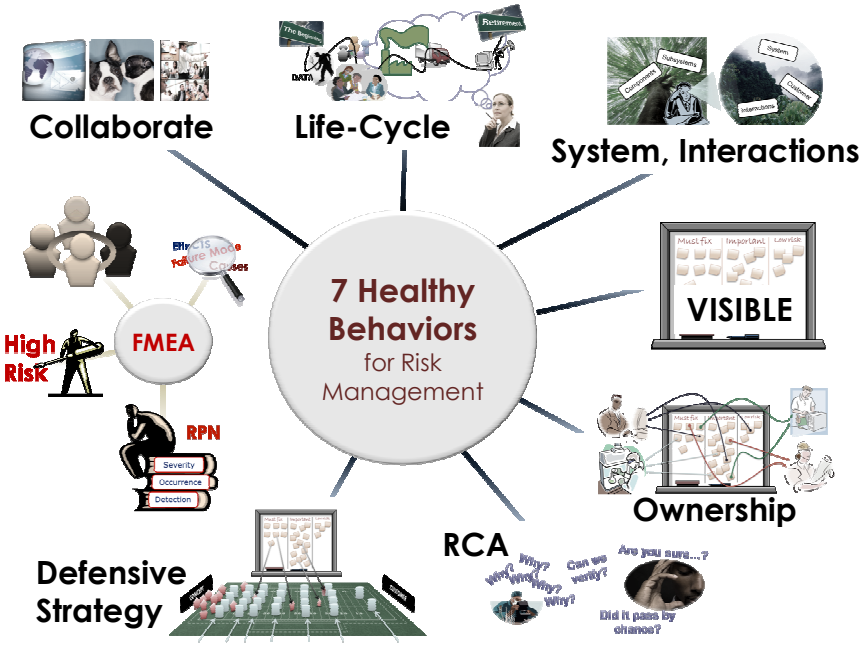
Risk Management Overview

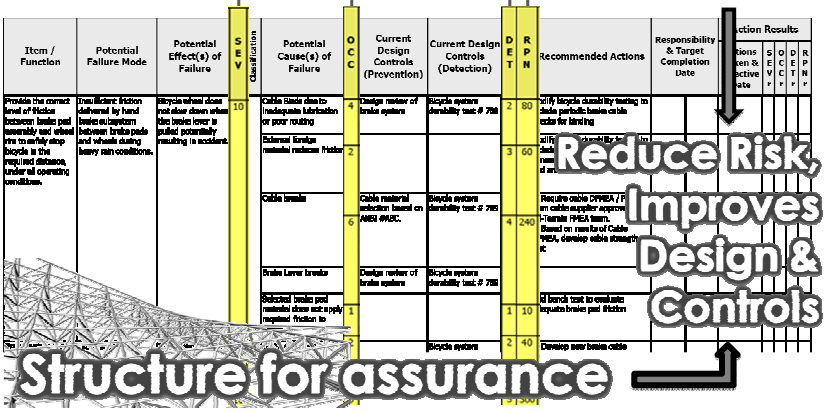
Identify, Assess, Prioritize

Eliminate, Minimize, Control, Transfer



Why FMEA - Overview?

Severity × Occurrence × Detection = **Risk Priority Number**



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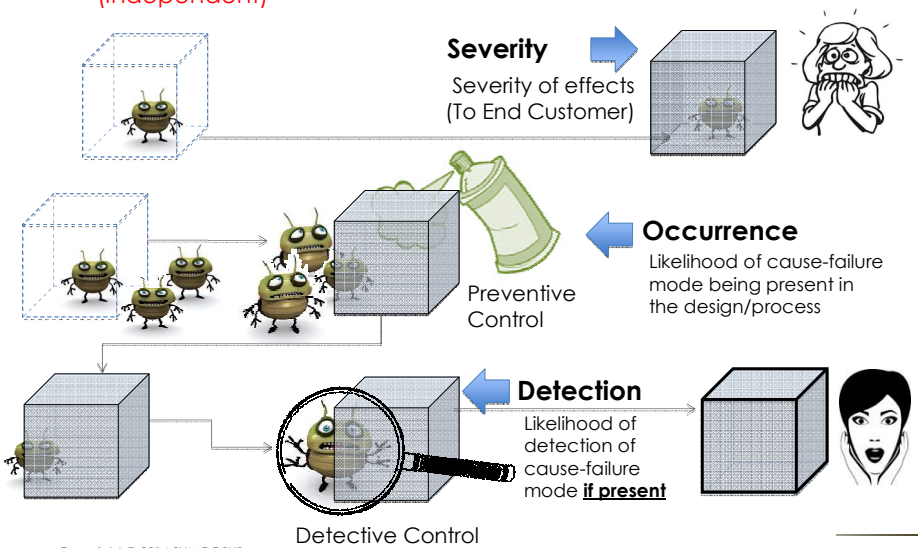
Risk Ratings – How it works

(Independent)



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Risk Ratings – DFMEA Example

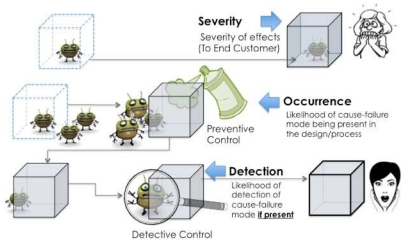
SEVERITY	
10	Hazard, non-compliance
9	
8	Primary Function Affected
7	
6	Secondary Function Affected
5	
4	Fit, Finish, Squeak / Rattle
3	
2	
1	No effect

OCCURRENCE	
10	Very High
9	1 in 3
8	High
7	
6	Moderate
5	
4	
3	Low
2	1 in 1 Million
1	Fully Prevented

(Poor) DETECTION	
10	Cannot Detect
9	
8	
7	
6	
5	Moderate
4	
3	
2	1 in 1 Million
1	Will Detect

Risk Ratings – How it helps

It breaks down the risk to its elements – better chance to identify risk reduction strategies.



And it helps prioritize risks

Examples of Risk Reduction Strategies

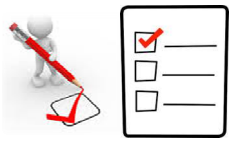
SEVERITY	• Eliminate failure mode • Redundancy • Compensating provisions
Occurrence	• Eliminate failure mode • Thorough reviews • Analysis / Calculations • Redundancy
(Poor) Detection	• Design for testability • Improve test/analysis • Increase sample size • Apply higher stresses/environments

FMEA can be of value… BUT

For many organizations, the following are the things that make FMEAs feel **forced**, **unnatural** and perceived as a "**checklist**" activity:

Meetings are tedious

FMEA Output: Action items



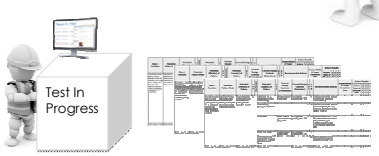
Completing tasks ⊄ risk reduction

FMEA can be of value… BUT

For many organizations, the following are the things that make FMEAs feel **forced**, **unnatural** and perceived as a "**checklist**" activity:

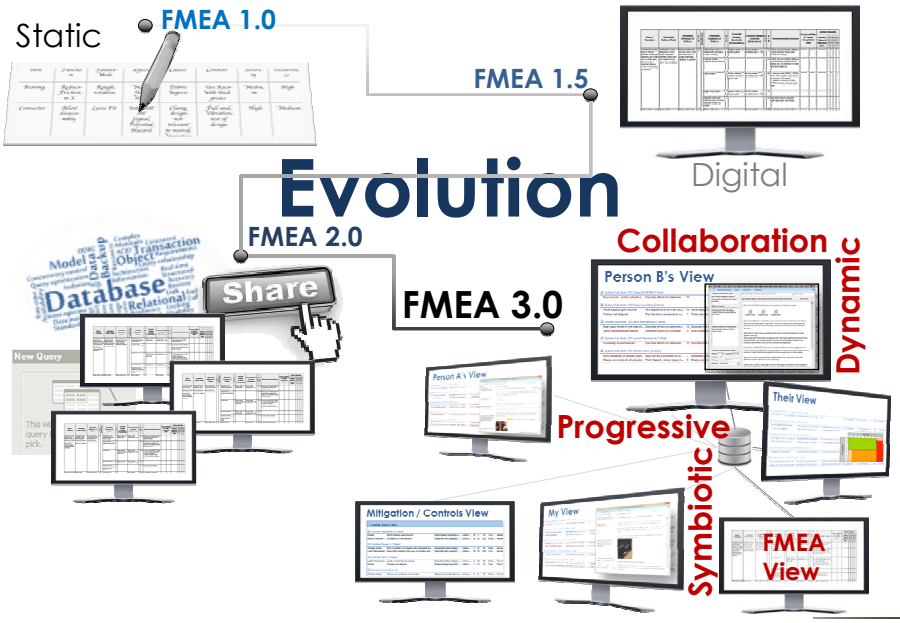
Playing Catch Up.

Limited scrutiny of CONTROLS



What we've covered

- Brief intro into FMEA
- Risk Management
- Why FMEA and Risk Ratings
- FMEA Challenges
- *…The future of FMEA*



Collaborative Risk Assessment & Management

Progressive FMEA

Each failure has many 'owners'

With different perspectives

Engineer: The problem is this… and the fix is…

Test owner: Why didn't my test detect this?

Manufacturing QA: Production controls that will Prevent?

FMEA Facilitator: Root cause? Severity? Likelihood? Detection?

Manager: Will this affect our project?

Progressive FMEA Example

Function	Failure Mode	Potential Effects	Severity	Potential Causes	Prevention Controls	Occurrence	Detection Control	Detection	Risk Priority Number
Ball point delivers ink to paper	Non consistent ink delivery to paper	Intermittent, incomplete lines.	7	Ball diameter variations	Tolerance Specification	1	Process Control XYZ	2	14
			7	Debris ingress affecting ink flow	Special' Tip design and tight tolerances	2	Debris ingress test	6	84
			7	Insufficient pressure applied by user	Usage force study	4	Ink delivery Design of Experiments	4	112

Test guy: *"I don't think the current debris test verifies this risk adequately. I suggest…"*

Progressive FMEA Example

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+ Step Stress

Engineer: *"Test guy and I decided to make some modifications… by step stressing…"*

Progressive FMEA Example

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+ Step Stress

Facilitator: "*See attached email, we agree detection has improved … but occurrence…*"

Progressive FMEA Example

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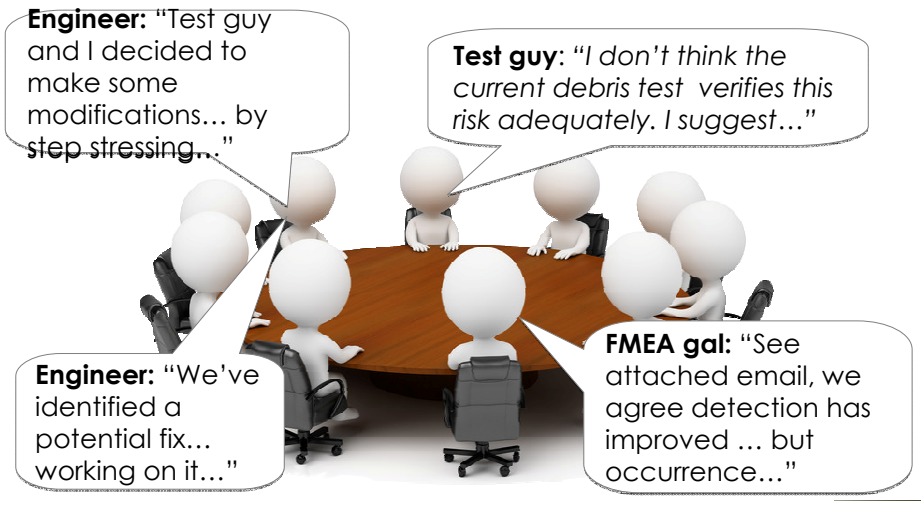
+ Step Stress

Engineer: "*We've identified a potential fix… working on it…*"

This kind of conversation rarely occurs in one FMEA meeting



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It is more like this…

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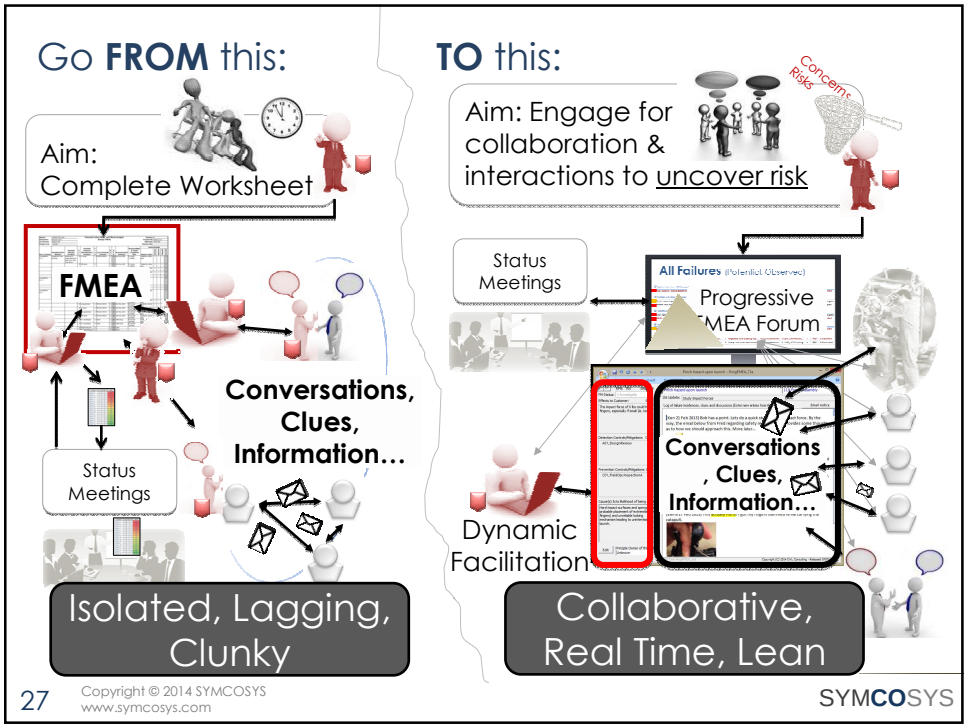

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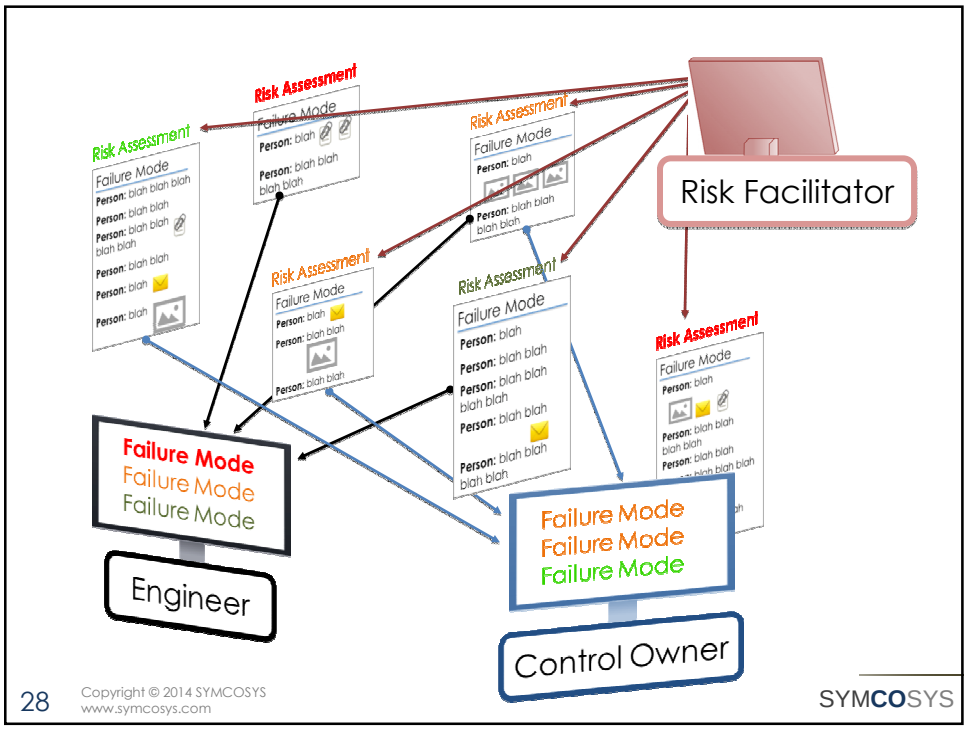

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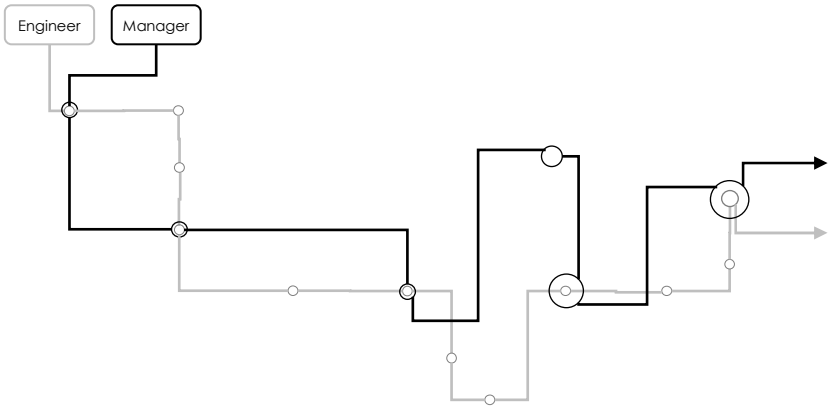
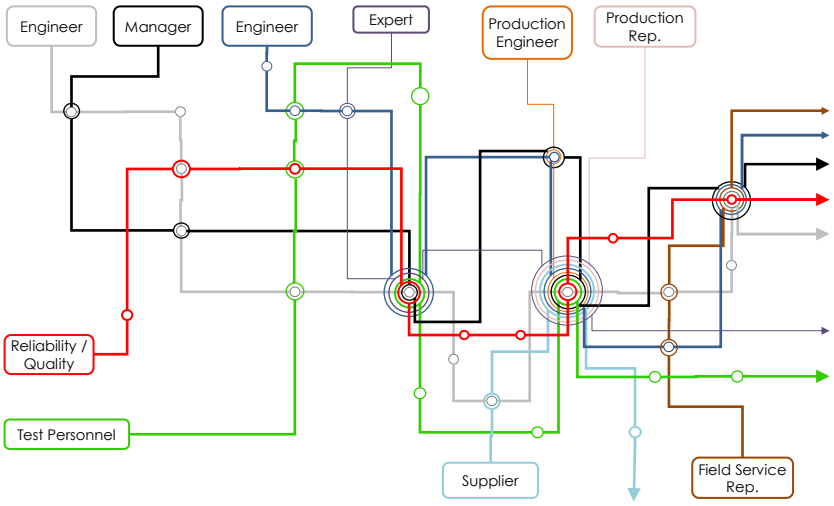
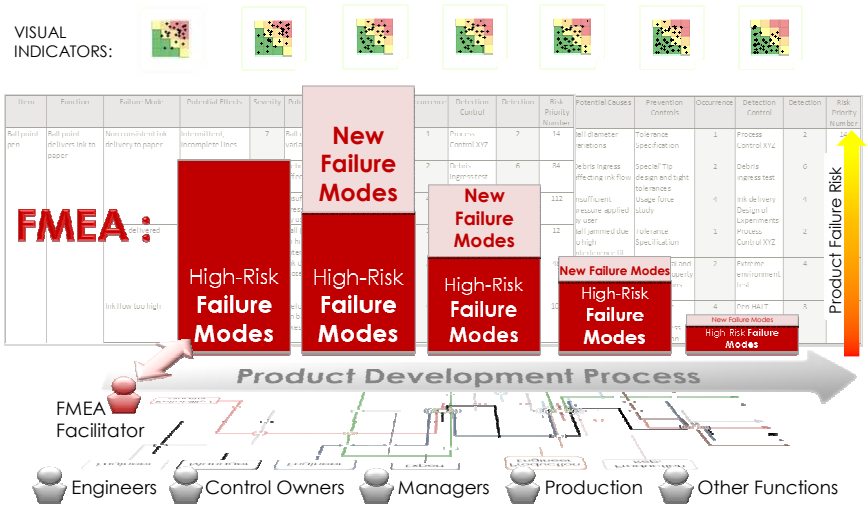
Risk Management Interactions



Risk Management Interactions



Aim: Good Capture & Management of Risk



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Progressive FMEA's AIM:

Is NOT to complete FMEAs to reduce risk,

but ***...to foster interaction and collaboration to reduce risk, guided by FMEA fundamentals.***

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Risk ratings changes for each Failure Mode "as it happens".

Guilty until proven/justified approach, doesn't use RPN_i & RPN_r

Progressive FMEA

Is the progressive risk analysis and management of each failure mode,

as it evolves through the risk discovery and reduction process;

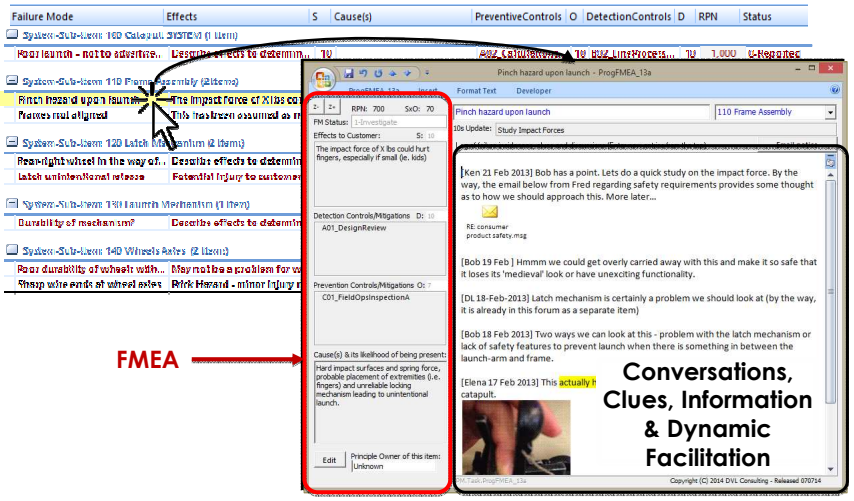
based on collaborative development of captured and organized information,

from cross functional team members

led by constantly visible risk metrics and dynamic facilitation.

Progressive FMEA

Can be implemented using **MS Outlook™, MS SharePoint™** or your own system.



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Progressive FMEA Forum Live DEMONSTRATION

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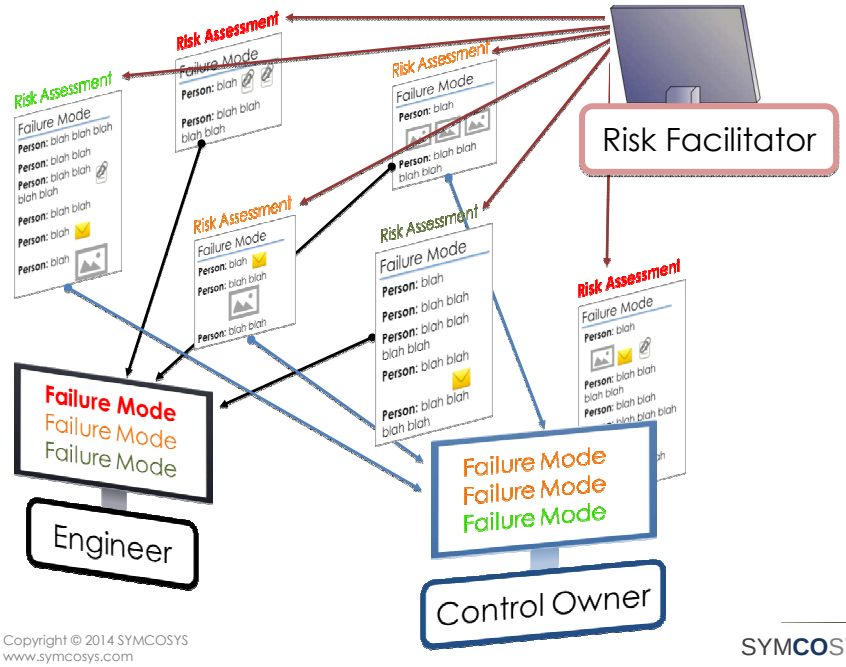


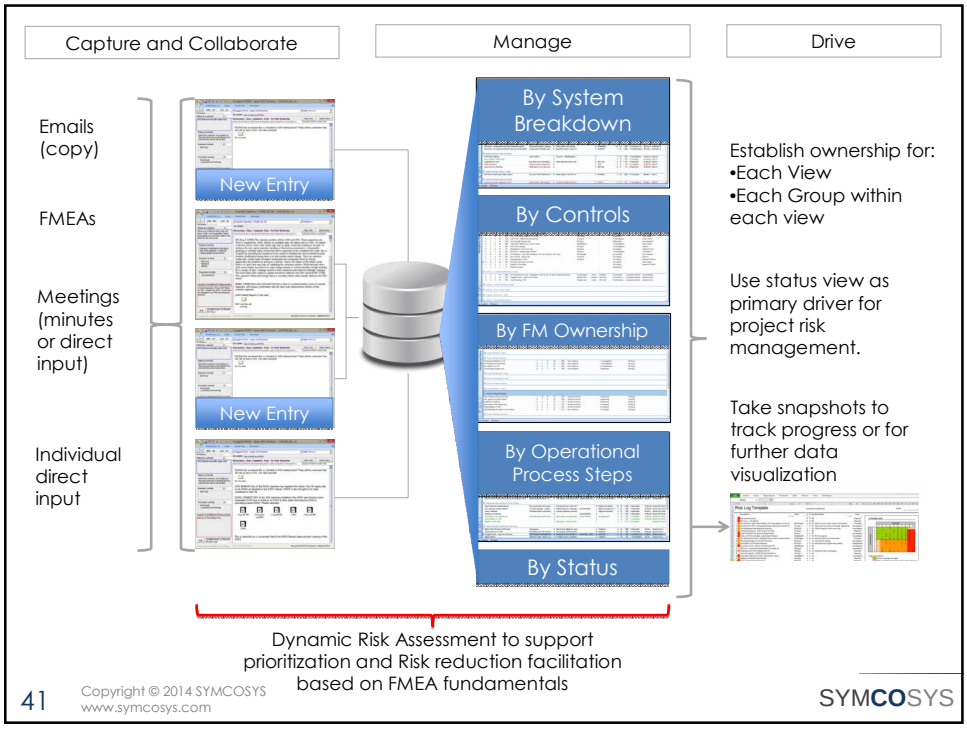
Benefits

Of the Progressive FMEA process

- **Prevent cost of poor quality** – Through improved interactions and collaboration to reduce risk based on FMEA fundamentals.
- **Increased information capital** – More than just an FMEA sheet – Very rich in information. Highly Re-usable.
- **Higher ROI on time spent** – Lean practice of FMEA

Thank You

Any Questions?



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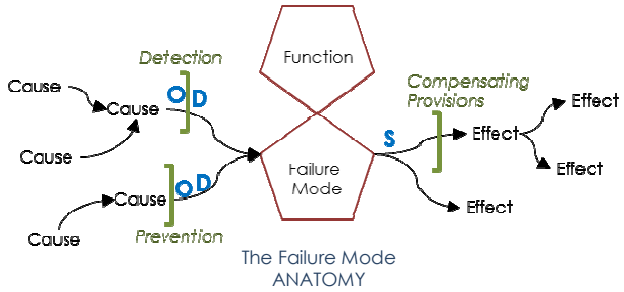
Anatomy of a Failure Mode



The Failure Mode ANATOMY

Cause → Cause → Cause → Cause → Cause → Cause

(Anti-Function) (Effect) (Effect)

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