

A satellite view of Earth is shown on the left side of the slide, featuring the Gulf of Mexico and the surrounding landmasses. A thick red horizontal band spans across the middle of the image, containing the main title.

# SYSTEMS ASSURANCE

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# Defect Cost: Prevention vs. Detection



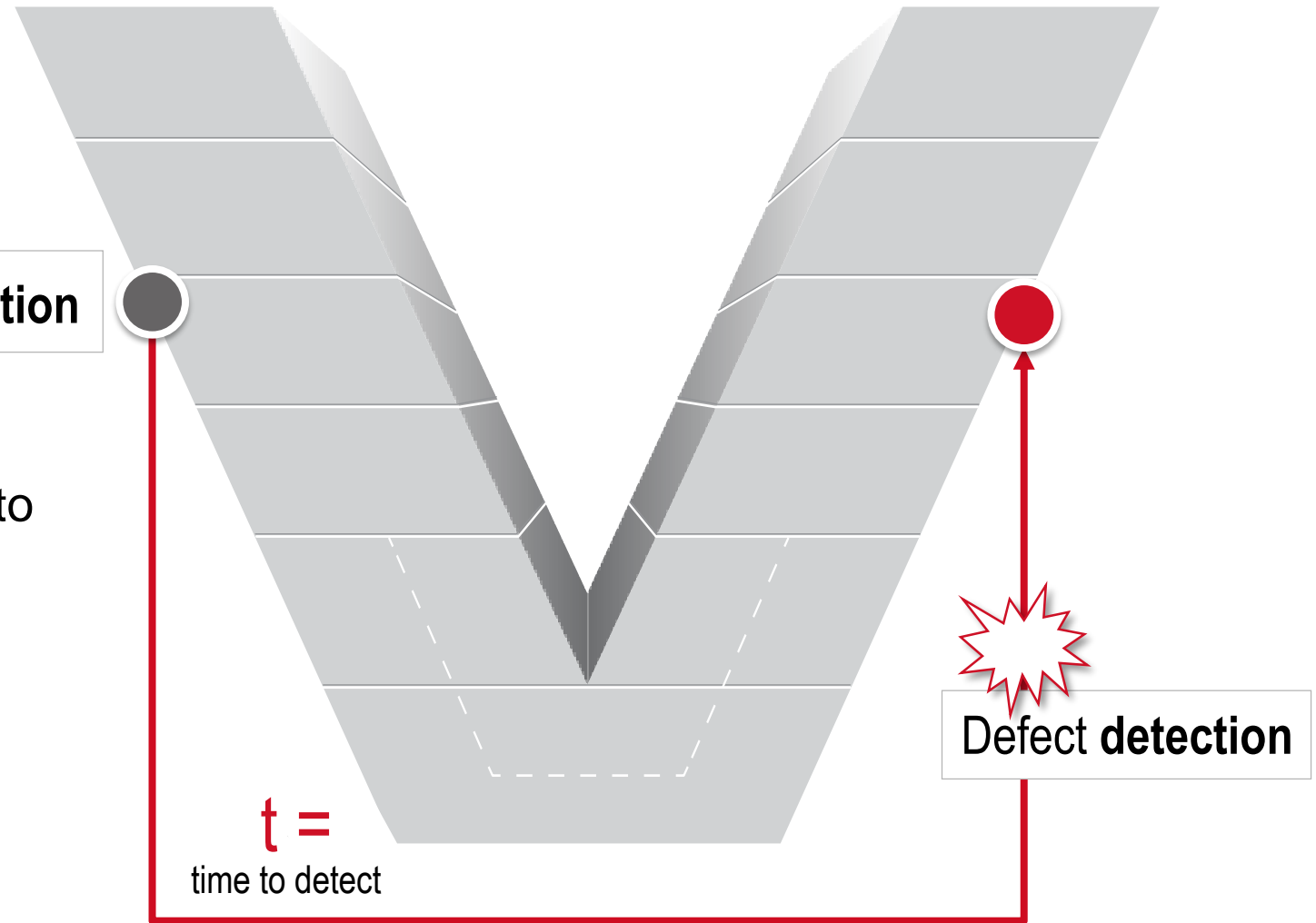
➤ Defect origination

## Postulate 1:

A defect **identified early** costs less to correct than a defect **identified late**.

## Postulate 2:

A defect **prevented** costs less than a defect **corrected**.



# A Measure of Quality = Cost of Quality

*The cost of not creating a quality product or service.*

– AMERICAN SOCIETY OF QUALITY



## $\Sigma$ Total Cost of Quality =

**Prevention cost:** investment to prevent poor quality,

**Appraisal cost:** cost to assure product and service conformance,

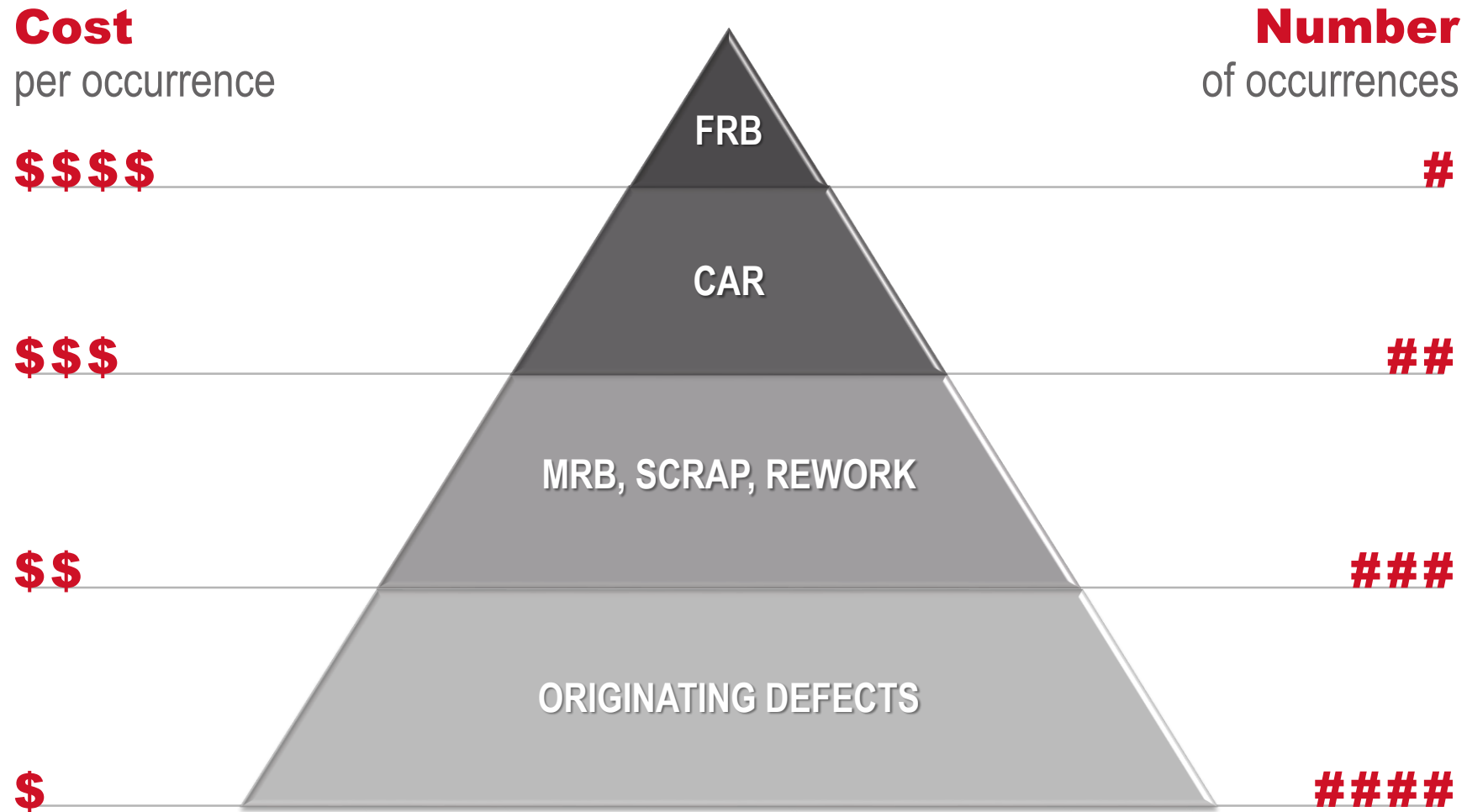
### **Failure cost = Cost of Poor Quality (CoPQ)**

- Internal (pre-delivery): scrap, rework, material review, downtime, failure
- External (post-delivery): recall, warranty, failure

## ■ CoPQ program benefits:

- Identifies contributors to poor-quality performance
- Identifies deficiencies driving poor quality
- Identifies root cause of poor-quality performance
- Prioritizes improvement efforts

# Cost of Defects

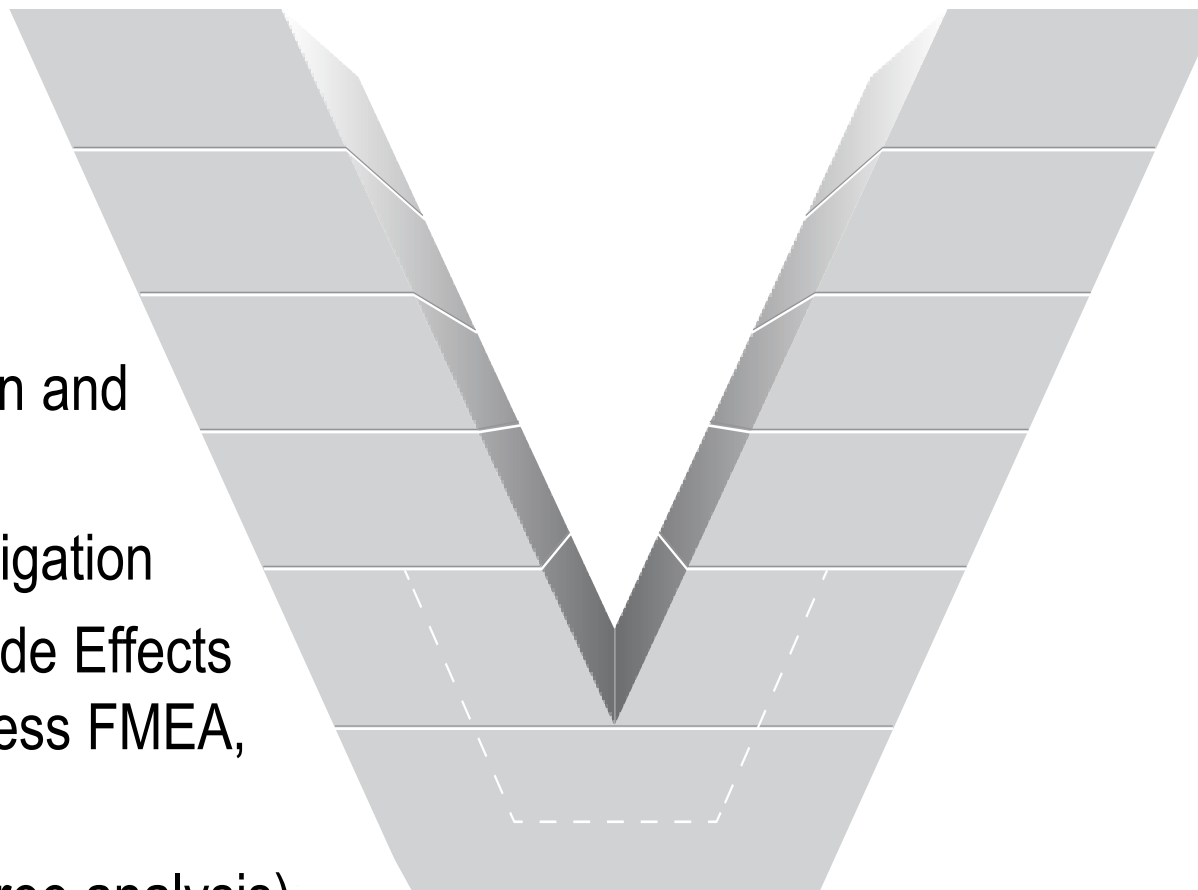


Attack CoPQ by **preventing** originating defects

# Systems Assurance: Processes/Capabilities

## > Early Life Cycle

- Requirements analysis and verification
- Design assurance
- Independent verification and validation
- Risk assessment & mitigation
- Reliability – Failure Mode Effects Analysis (FMEA), process FMEA, quantitative
- Systems Safety (fault tree analysis)

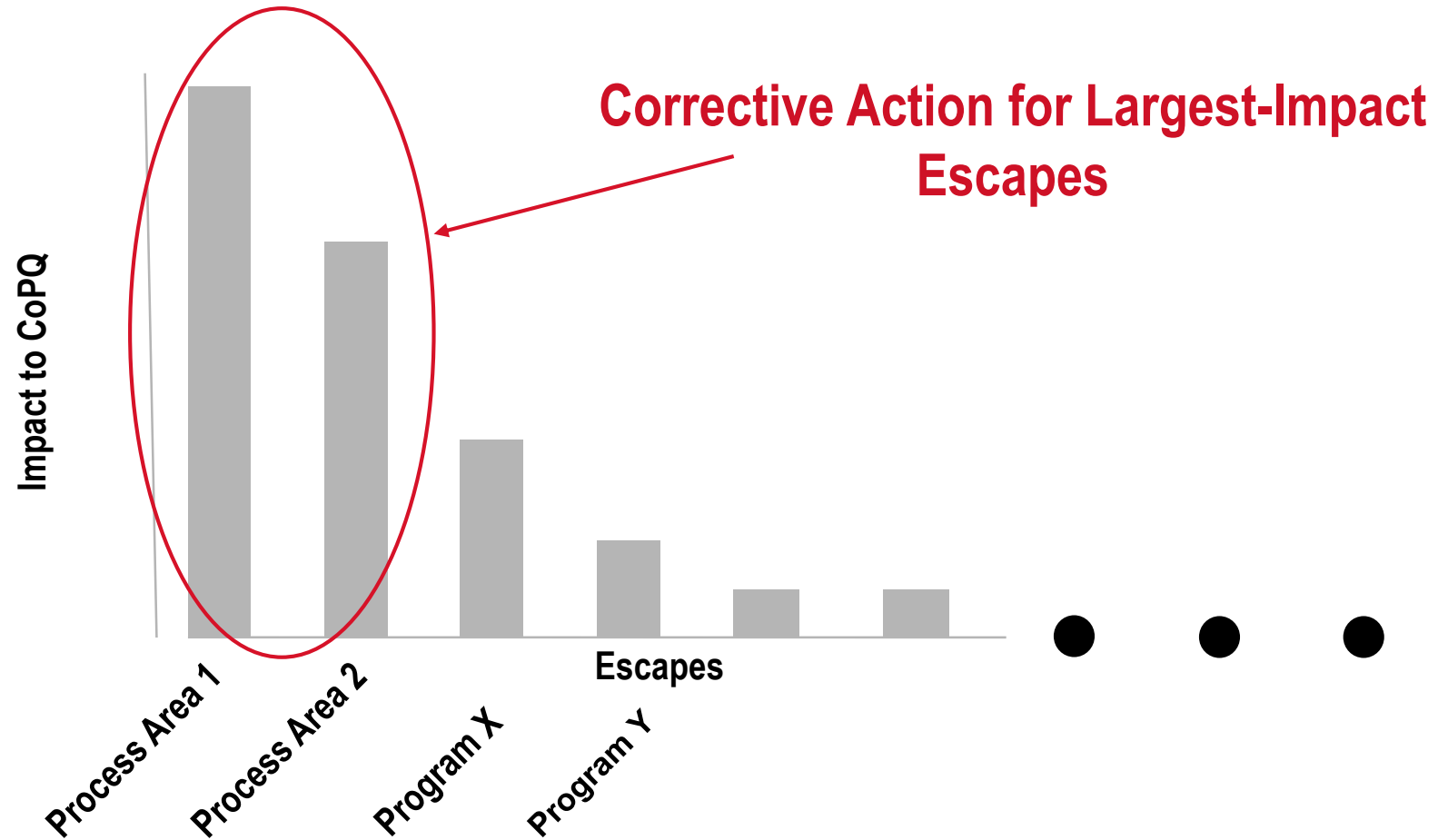


## > Late Life Cycle

- Test and verification
- Verification of risk mitigation
- Reliability (mitigation)
- Systems safety (controls)

Prevents defects vs. late identification and correction

# CoPQ Pareto Chart

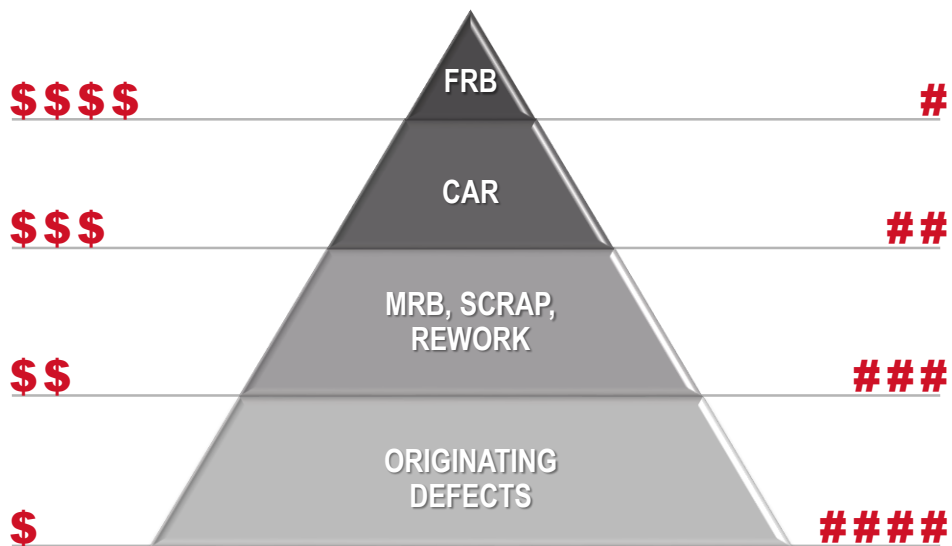


Prioritizes potential CoPQ initiatives

# Example: Printed Wiring Board

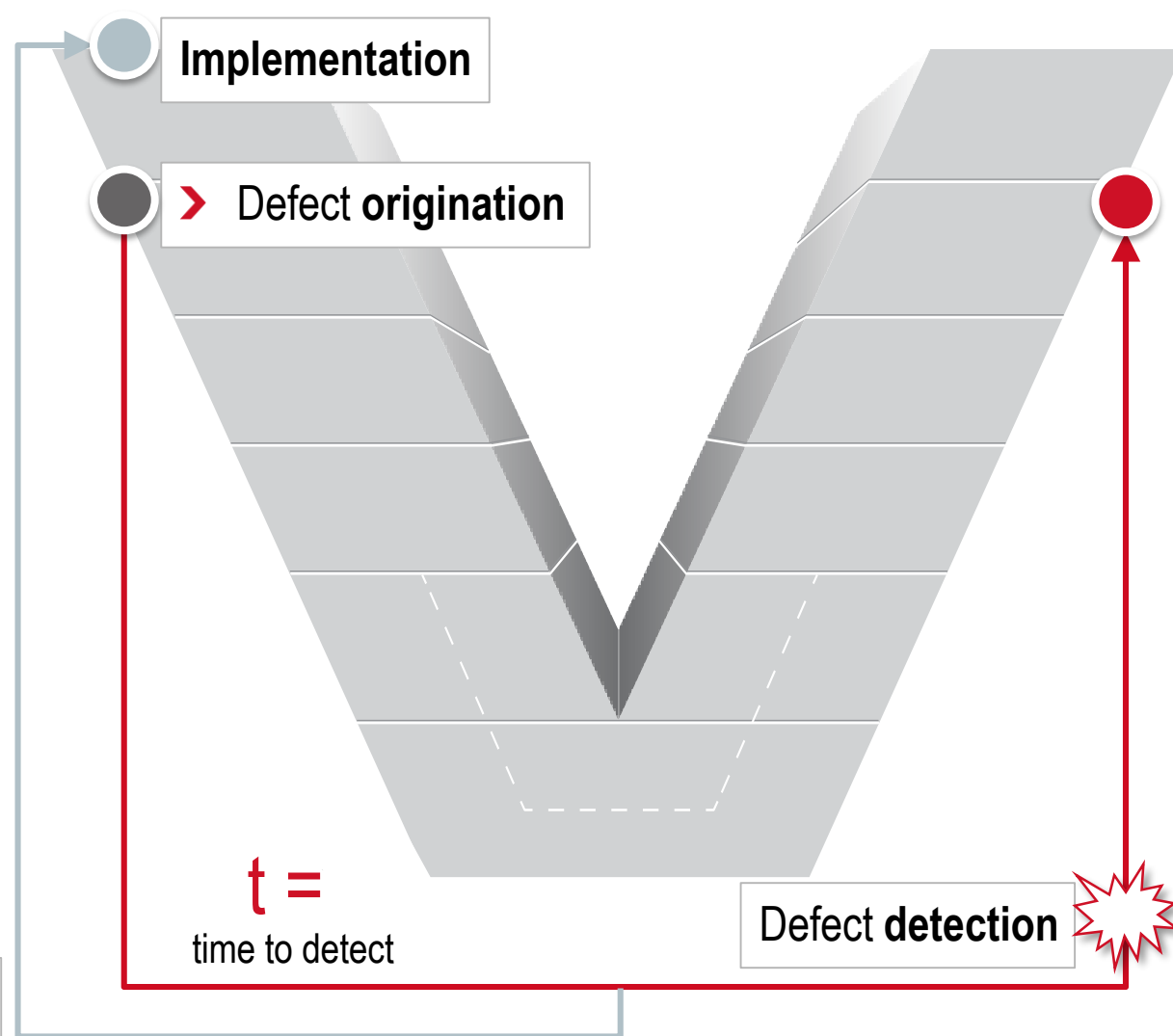
TYPE OF ISSUE = FRB

Quantity	#
CoPQ	\$\$\$\$
Time to Detect	ttt
Mission Assurance Risk	High

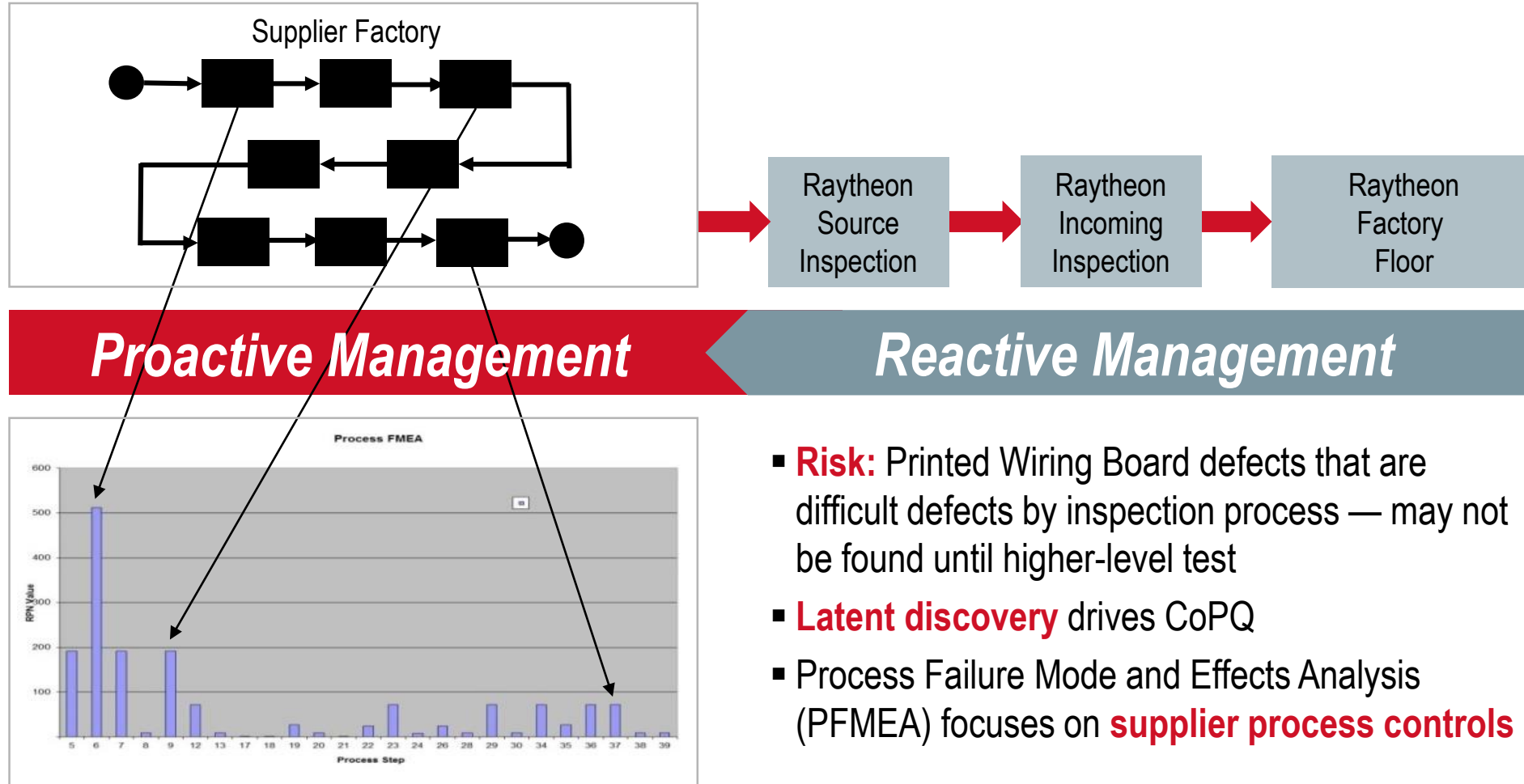


RCCA\*

\*Root Cause Corrective Action



# CoPQ Project: Printed Wiring Board Escapes



*Proactive Management*

*Reactive Management*

- **Risk:** Printed Wiring Board defects that are difficult defects by inspection process — may not be found until higher-level test
- **Latent discovery** drives CoPQ
- Process Failure Mode and Effects Analysis (PFMEA) focuses on **supplier process controls**

Moving left to improve process controls when defect detection is difficult and risk is high




# Mission Assurance

## DEVELOP MISSION ASSURANCE TALENT

ADVANCED


	HARDWARE Q	SOFTWARE Q	SUPPLIER Q	AUDITOR	SYSTEM ASSURANCE	MA LEAD
BASIC						

**MA CERTIFICATION PROGRAM**



**MATCH SKILLS TO PROGRAM COMPLEXITY**

## DEPLOY IN THE BUSINESSES

	MISSION ASSURANCE LEAD	SYSTEM ASSURANCE	QUALITY (HW, SW AND AUDIT)	SUPPLIER QUALITY	
PRODUCT LINE 1					
PRODUCT LINE 2					
PRODUCT LINE 3					

## SCALE MISSION ASSURANCE TO PROGRAM COMPLEXITY

← COMPLEX ————— SIMPLE →

KEY MA PROCESSES				
Integration, Verification and Validation				
Reliability Engineering Safety Program				
Alerts and Information Bulletins				
Raytheon Lessons Learned System				
Quality Management System				
Corrective/Preventive Action				
Raytheon Six Sigma				
IPDS Framework and Tailoring				

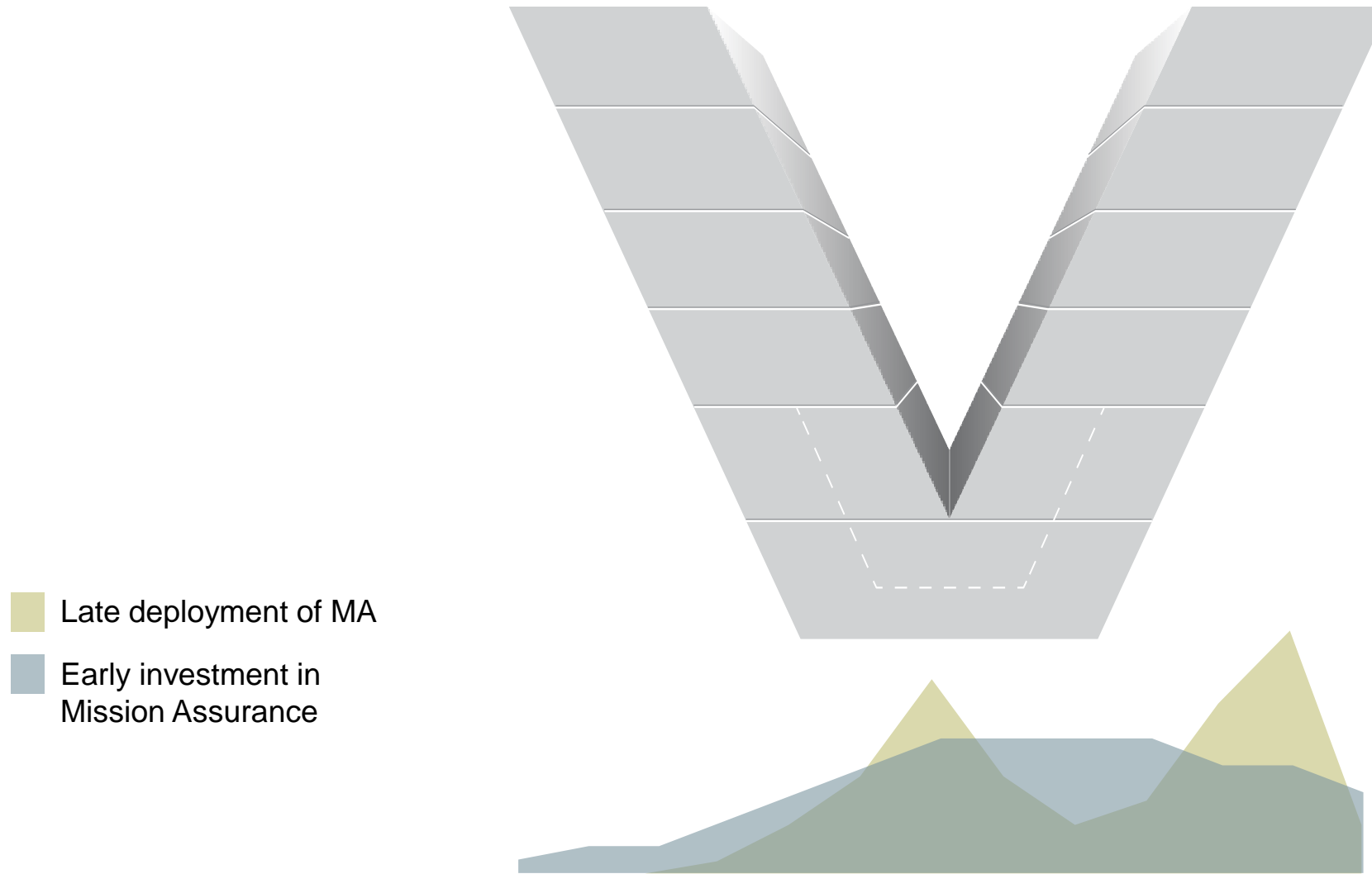
**ENABLING THE RIGHT SOLUTION**

**DESIGN AND BUILD IT RIGHT**

**SUPPORT THE FULL-PRODUCT LIFE CYCLE**

Improving performance across all programs

# Representative Staffing Profile



Equal staffing cost leads to reduced quality costs

# Summary

- Quality needs to “move left” in the life cycle in order to prevent defects versus inspecting in quality
- Utilizing CoPQ allows us to drive improvements which positively impact the business
- Systems assurance involves:
  - Moving from inspection to prevention
  - Shifting emphasis from corrective to preventive measures
  - Utilizing data to identify improvement opportunities

