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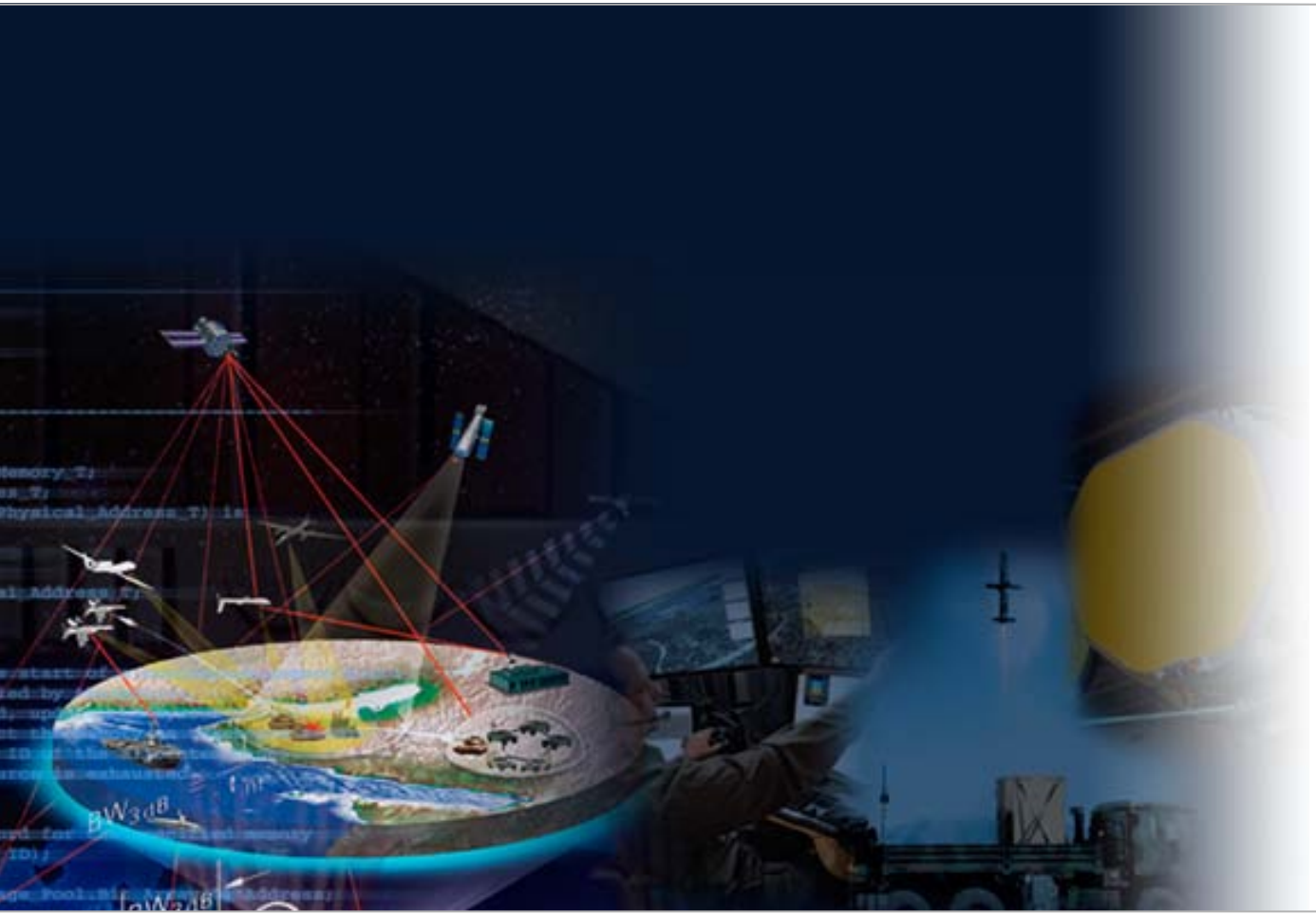
Customer Success Is Our Mission



High Maturity Heresy!

Doing Level 5 Before Level 4 Without Data?

Thomas Lienhard

17 November 2010

Where Do We Get Our High Maturity Knowledge?

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The CMMI
- Upfront material
- Infamous page 80

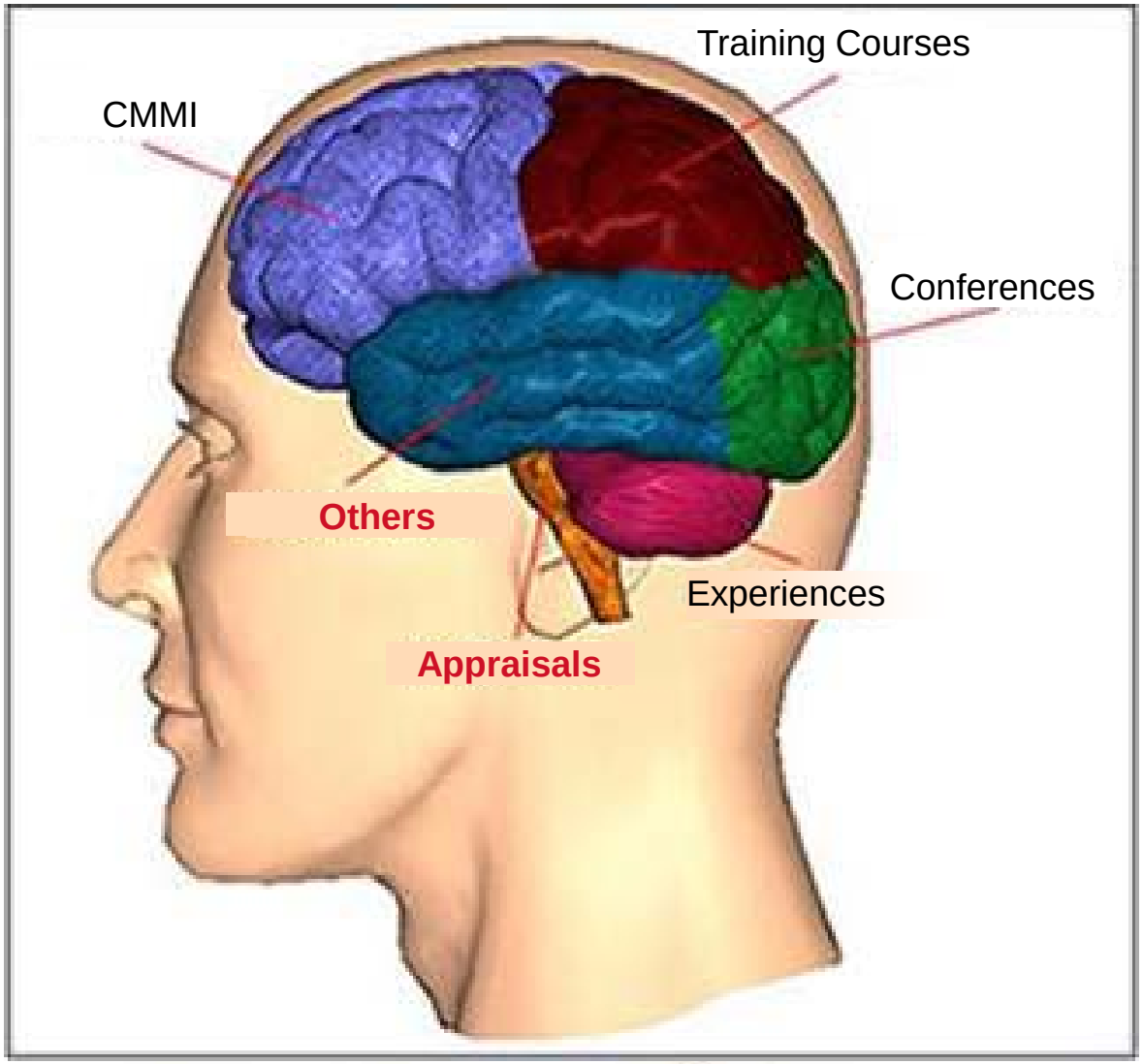
Training Courses
- CMMI Overview
- Understanding CMMI High Maturity Practices
- Six Sigma

Conferences

Experiences

Appraisals
- Leads
- Mini Team partners

Others
- Consultants
- "Experts"



Where Do We Get Our High Maturity Knowledge?

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[My] Evolution of High Maturity Understanding

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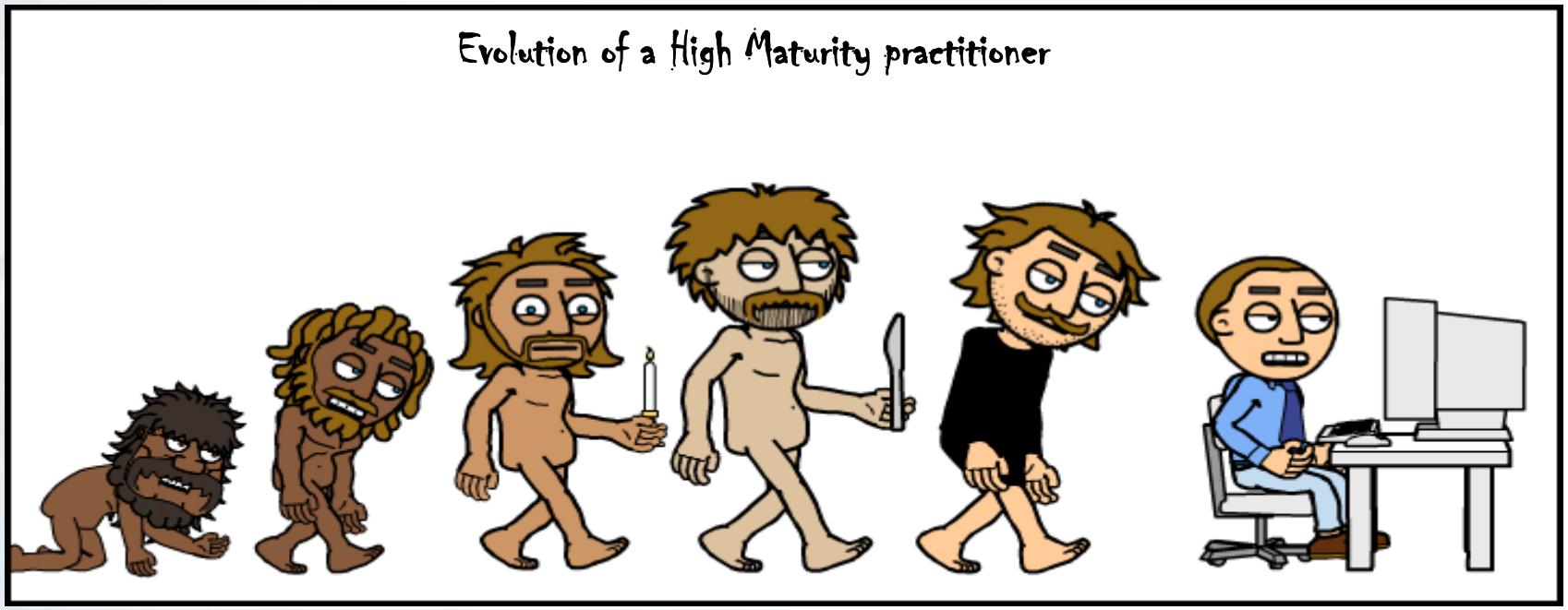

SW CMM	Six Sigma BlackBelt	SW CMMI	CMMI	Understand High Maturity Practices	Understand Business Objectives
peer reviews	analysis of variation	peer review defect density	control charts	?	identify what REALLY matters predict performance

Nirvana at Level 5?

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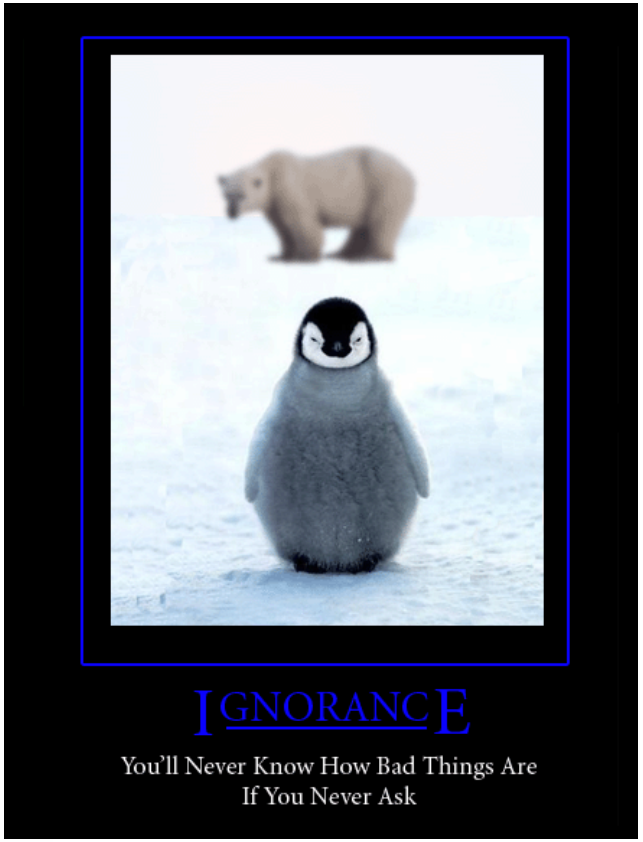
- Achieved SW CMM Level 5 in 2001
- Did not see the “promised” 8:1 ROI
- What went wrong?

- Is it about finding an iterative process to collect data so SPC can be applied?
- Is it about hanging a sticker on the wall?
- Is it about appeasing the SEI to avoid an audit?
- Or is it about meeting your primary business objectives?
    - Needed to understand our business and business objectives
    - Needed to understand which processes had the greatest impact on business objectives



When you think you have it right, talk with those responsible for cost and schedule

Understanding What's Critical to Our Business

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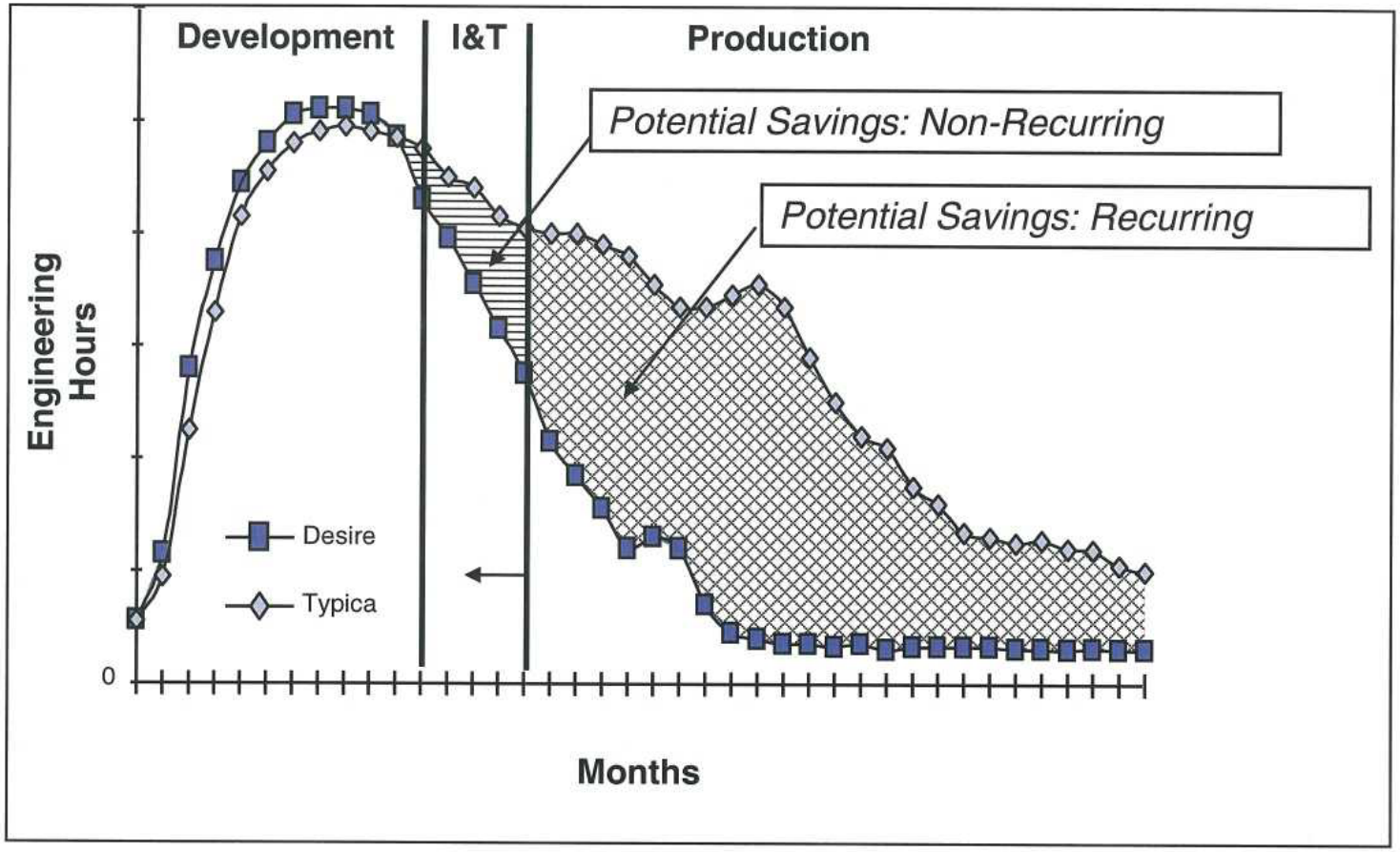

Figure 1. Typical Product Development Cycle

Production is where opportunity abounds

Changing Our Approach

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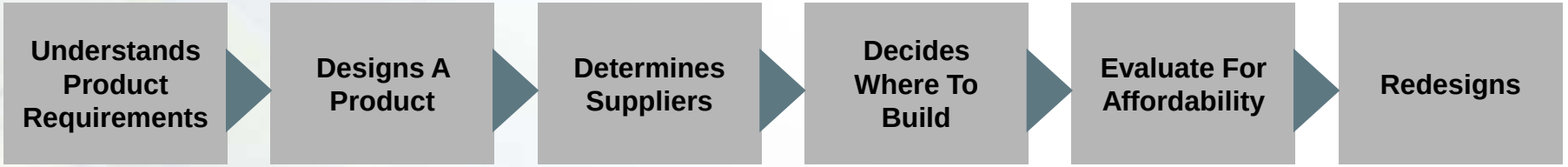
How to move from a Business that…



To a Business that

High Maturity Timeline

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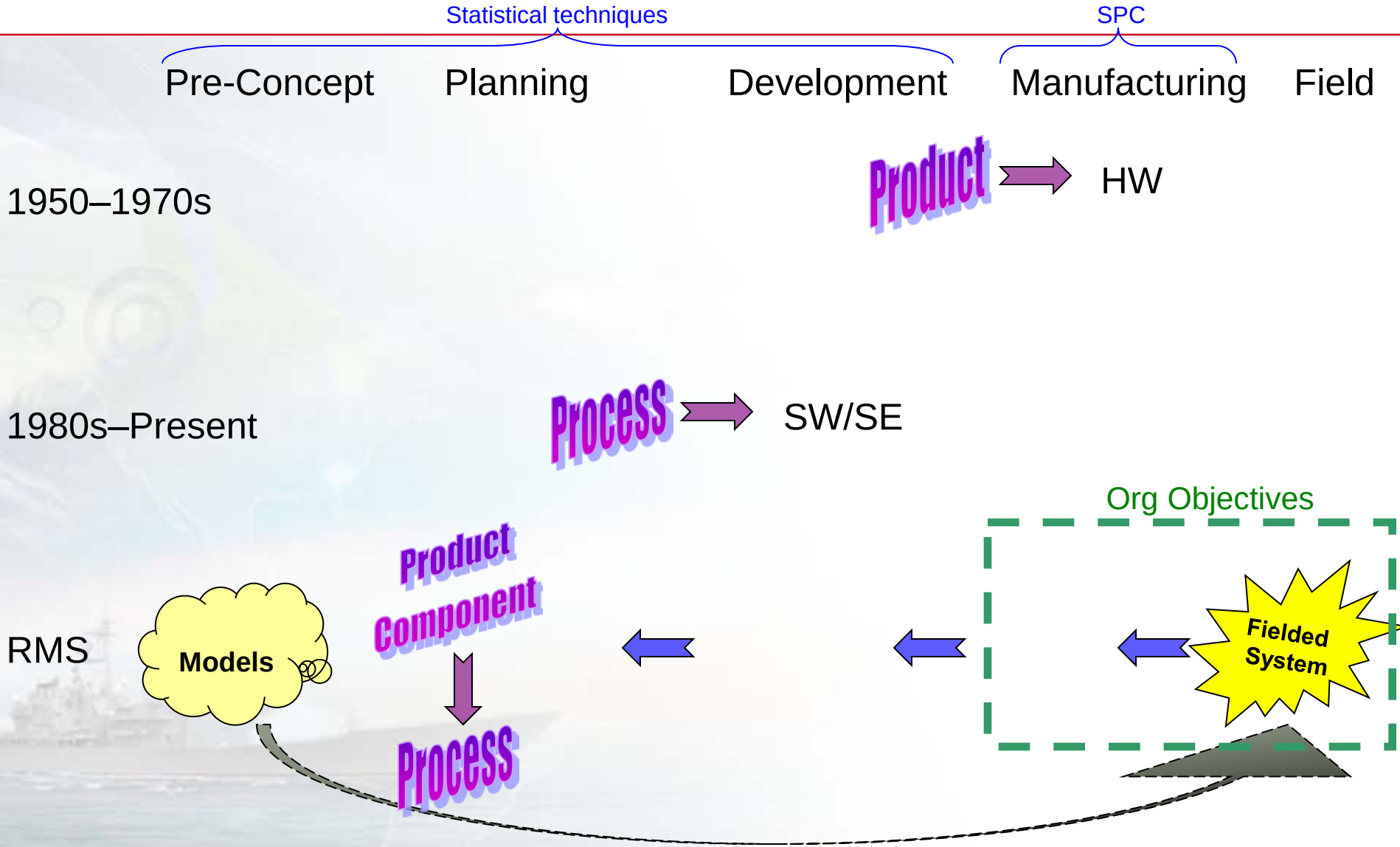

Balance performance with producibility and affordability

High Maturity Timeline

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Statistical techniques — SPC

Pre-Concept | Planning | Development | Manufacturing | Field

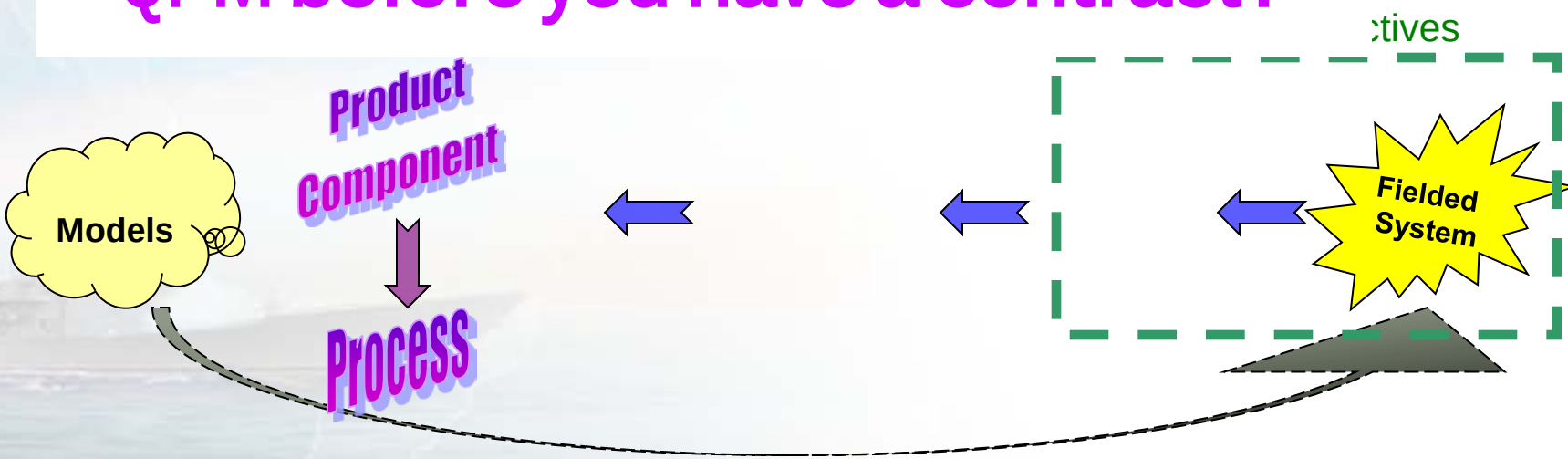
1950–1970s

Product → HW

1980s–Pr

Would you ever implement QPM before you have a contract?

RMS



Balance performance with producibility and affordability

High Maturity Timeline

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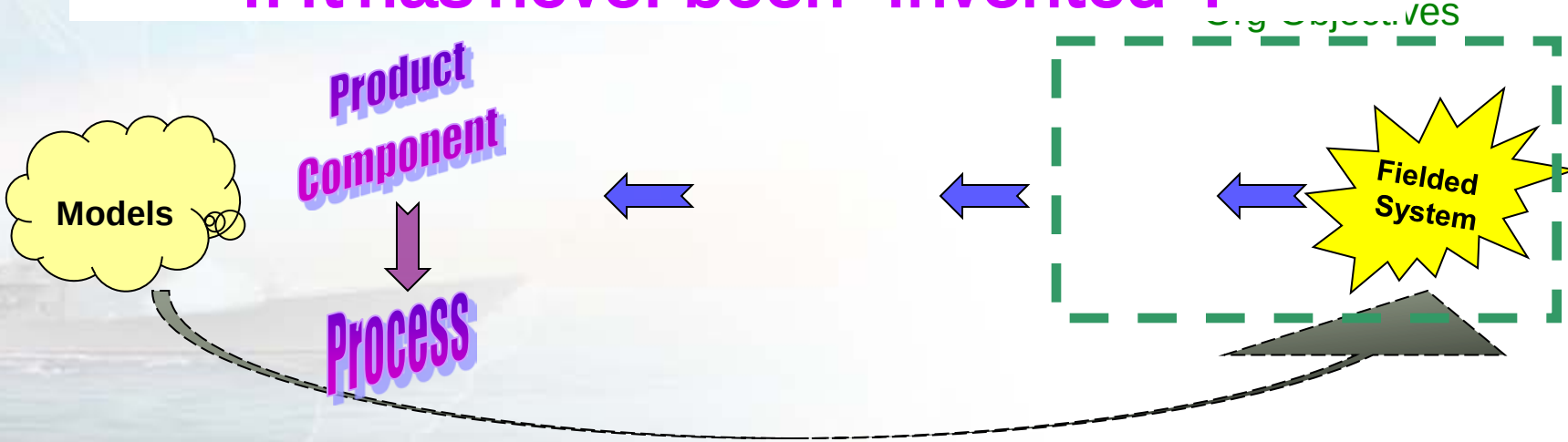
Statistical techniques — SPC

	Pre-Concept	Planning	Development	Manufacturing	Field
1950–1970s			Product → HW		
1980s–Pres					
RMS					

How can you be confident something can be built, if it has never been "invented"?



Balance performance with producibility and affordability

Brain Shift

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SW SE HW

SW SE HW

SW SE HW

SWSEHW

SyDe

SystDeve

System Development

Remember, What is Critical to the Business

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- Production over Development
  - Production is where cost and time are either minimized or super-inflated
  - The organization is willing to invest more in development in order to streamline production
- Production
  - Software
    - Hit control C
    - Rarely impacts development decisions
  - Hardware
    - Extremely complex
    - Very much impacts development decisions
- Primary focus is HW/SE/SW (System Development)
- The life cycle includes:

  - pre-concept
  - development
  - manufacturing
  - fielding

A single Standard Missile-3, produced by Raytheon, is launched from the USS Lake Erie on Feb. 20. The missile hit its target in space, destroying a potentially hazardous rogue satellite.

U.S. Navy photo via ap

Leveraging our capabilities to be innovative, fast, and effective

Profound Shift in Focus

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	Development
SW	

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	Development
SW	
SE	

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	Development
SW	
SE	
HW	

Profound Shift in Focus

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	Development
SW	1st
SE	2nd
HW	2nd

Profound Shift in Focus

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Pre-Concept		Development	Production	Field/Maint
	SWSEHW			

Profound Shift in Focus

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Pre-Concept		Development	Production	Field/Maint
1st	SWSEHW	2nd	1st	1st

High Maturity “Epiphany”

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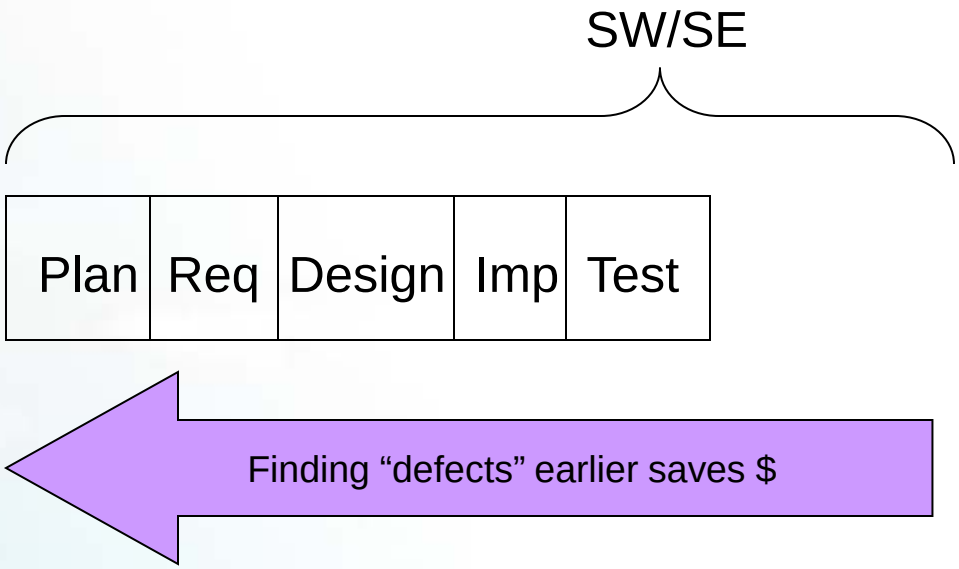

High Maturity “Epiphany”

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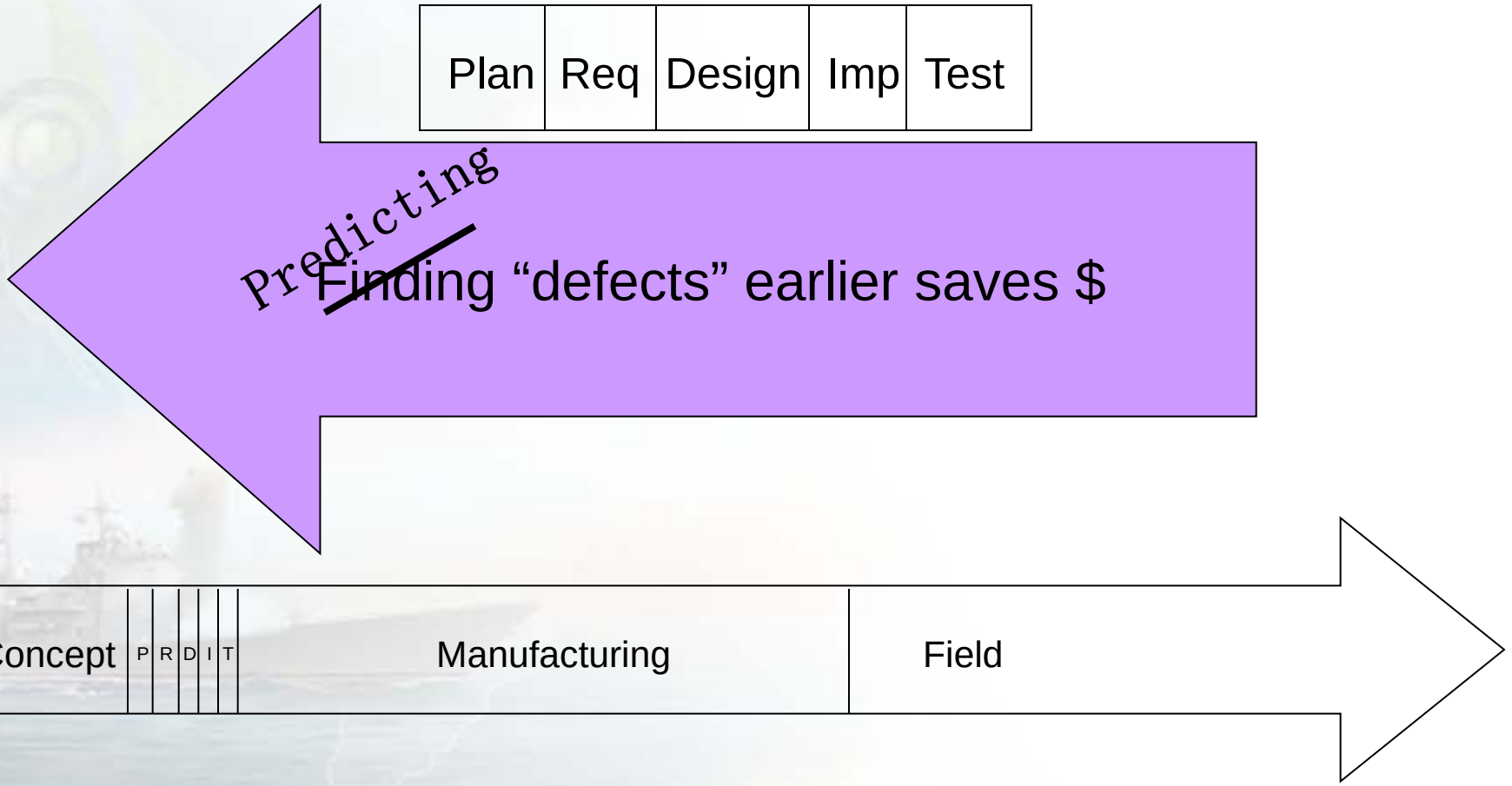

Modeling Throughout the Lifecycle

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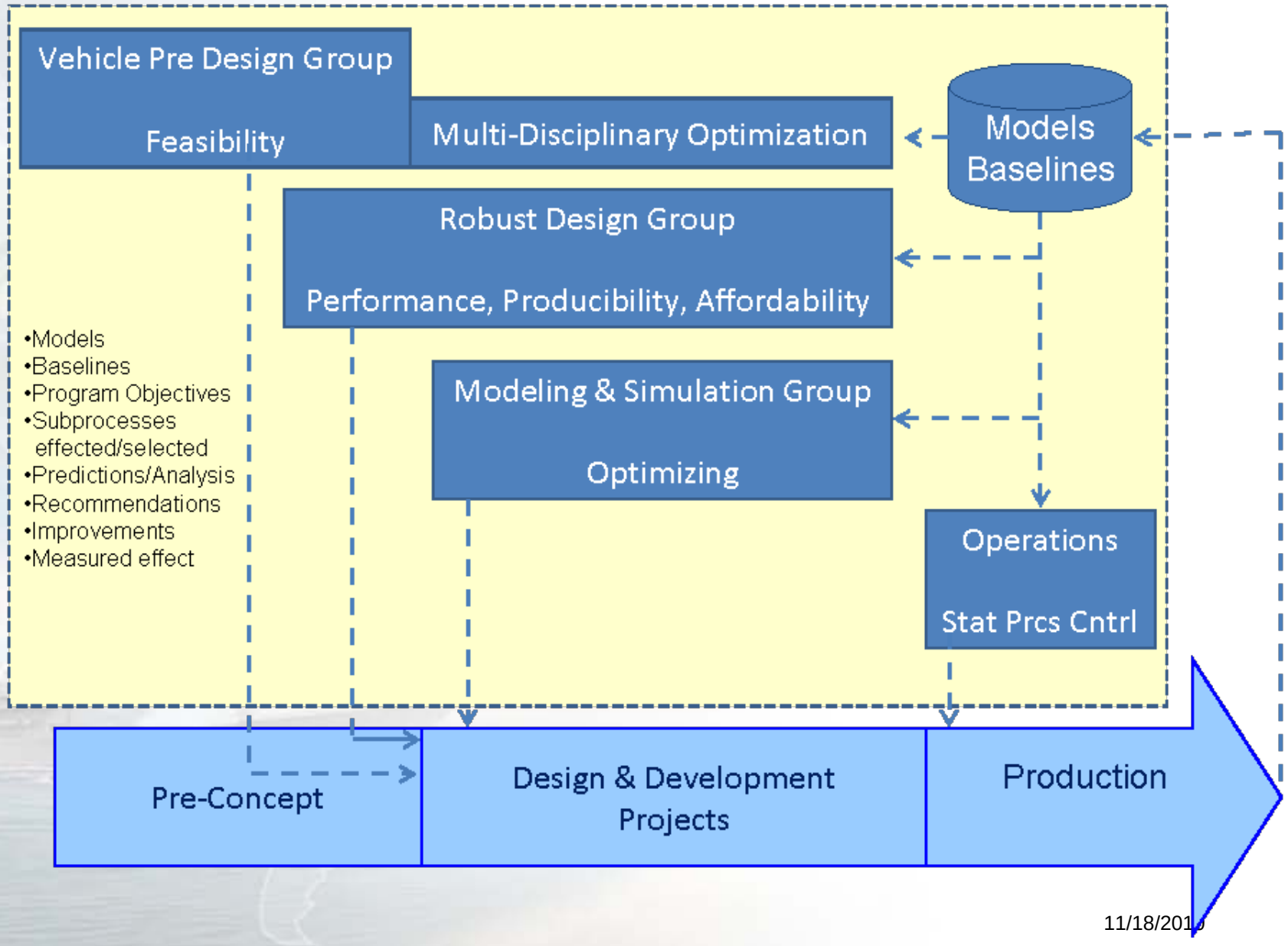

Breaking the Paradigm – Level 5 Before 4 Without "Data"

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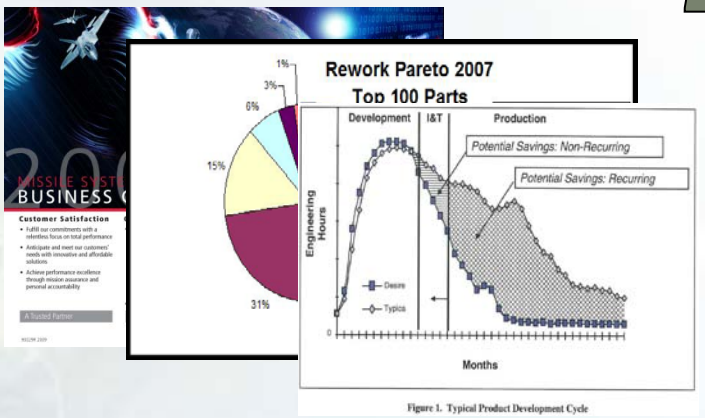
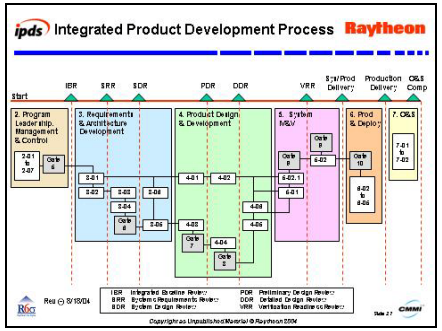
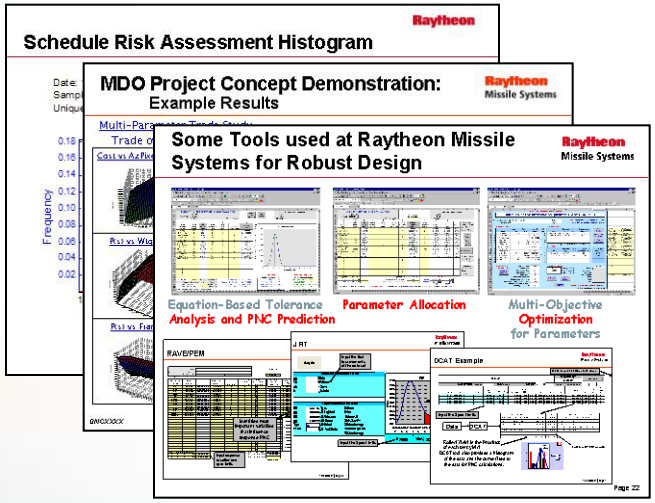
Start with business goals and drivers



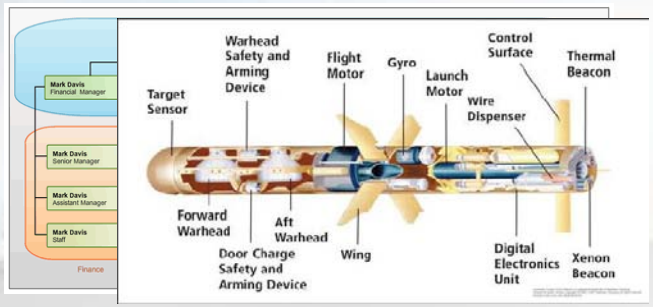
Establish objectives for entire lifecycle (pre-concept through delivery)



Predict success prior to design



Take a product centric, multi-discipline approach



Results Driven - Product Centric – Full Life Cycle – Multifunctional Approach

EXAMPLE

Business Objective – Increase Margin Profit

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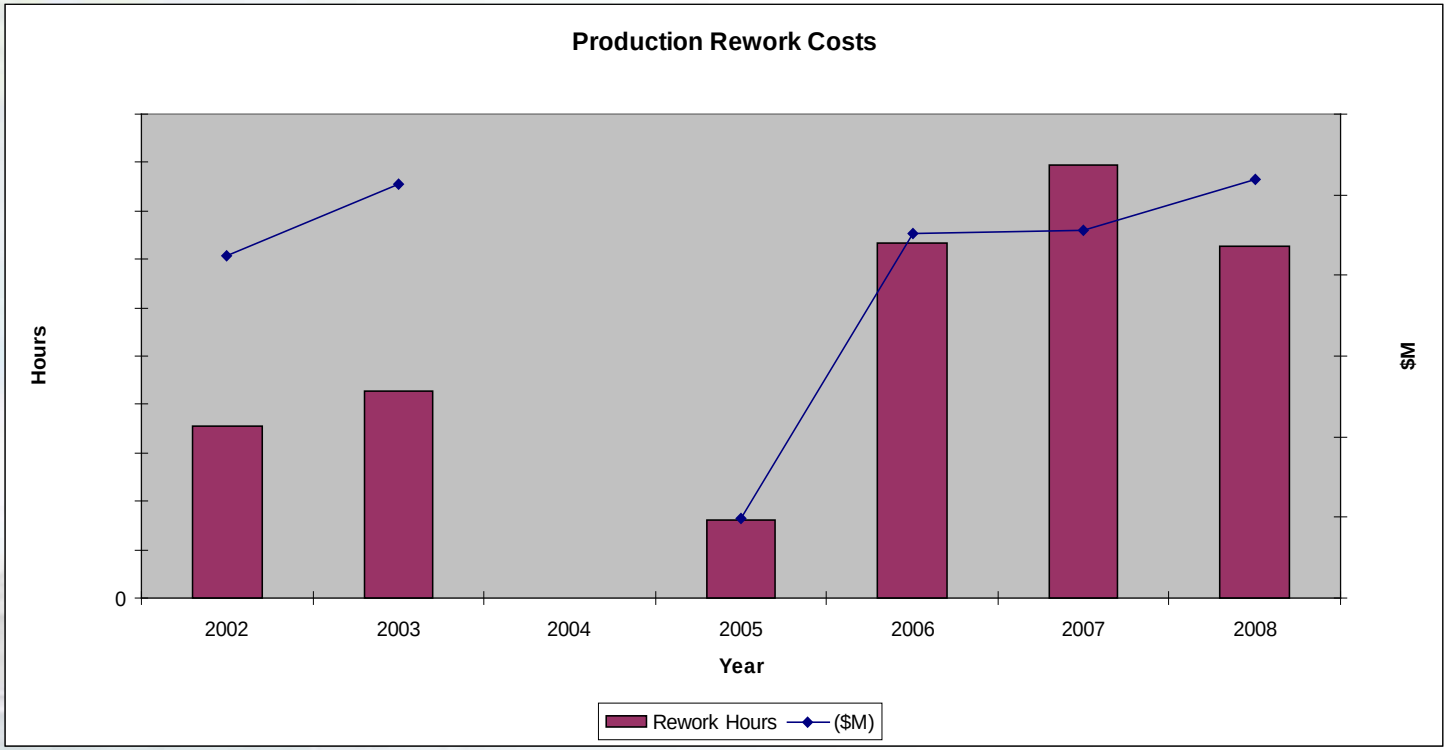
- **Cost of Poor Quality is Too High**
  - Cost and schedule need to be reduced
  - Rework, scrap and support costs need to be reduced



Improving production yields greatly reduces costs, schedule, rework, and scrap

Case Study

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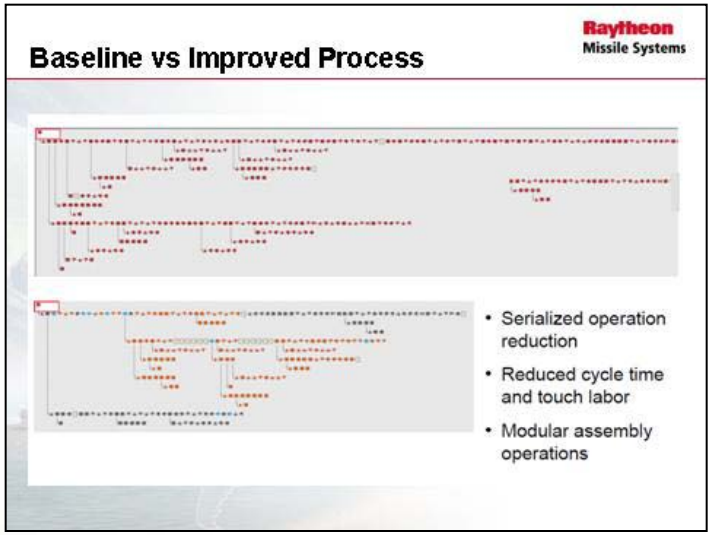
- Multiple projects using a common seeker have an Average Unit Production Cost (AUPC) objective
- Sensitivity analysis showed which subprocess was the significant cost driver
- EOSPA predictive cost model was created to characterize the process performance based on organizational historical baseline data
- Prediction showed the current process was incapable of achieving the AUPC objective
- Causal analysis was done
- Process was characterized:
  - Process steps
  - Touch points/hours
  - Parts
  - Effort
- Improvements were identified and implemented
  - Eliminated non-value added process steps
  - Reduced number of touch points and touch hours
  - Reduced cycle time and touch labor
  - Eliminated parts
  - Substituted processes with new processes which had reduced touch points/hours



Predictive Analysis

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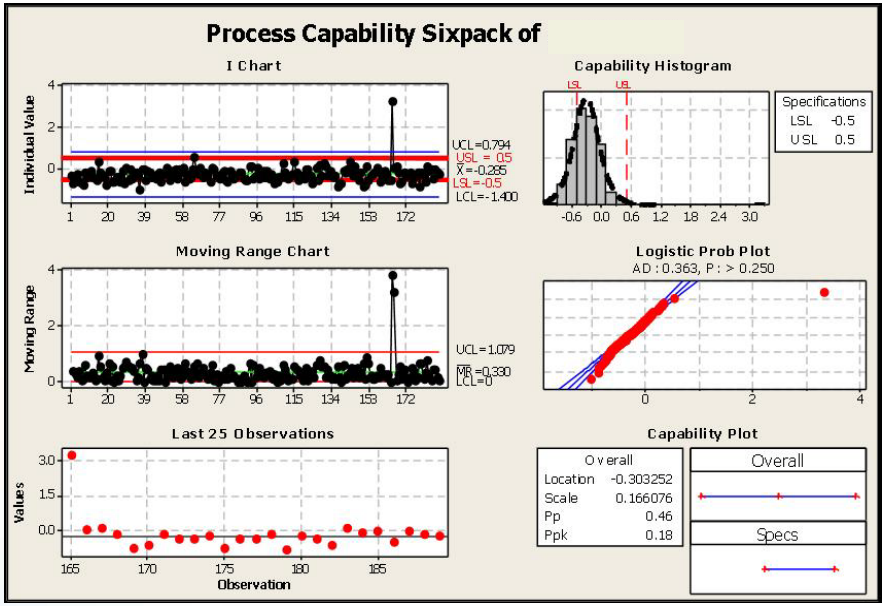
- Probability of Noncompliance (PNC): Probability of exceeding either lower or upper specification limits
- Distribution fitted PNC = 30%
- Predicted estimated cost of scrap: $XXM Annually

- Predictive Analysis Revealed:
  - Out of Control conditions will occur
  - Out of Spec conditions will occur
  - Mean was too close to lower limit –
    - need to center the distribution
  - Variance was too large –
    - identify / reduce sources of variation



Low yields predicted as a result of poor process capability
180 out of 600 units would be scrapped

Results

- Resulted in 59% fewer process steps
- 45% fewer parts
- 44% less time
- 78% improved throughput
- Predicted yields increased to over 90%
- Predicted rework reduced by over 50%
- Predicted scrap reduced by over 40%
- Initial inspection costs reduced by over 50%
- Warranty costs expected to be reduced by over 25%

Tech support? My predictive analysis is giving the wrong answer again – can you please fix it?

Discipline, compliance, predicted performance and continuous improvement

Summary

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- To meet business objectives, engineering must be more predictable
  - Need to characterize process and product performance prior to implementation
  - Need to establish and track design metrics that relate to business objectives (production yield and cost)
  - MUST balance affordability and producibility as well as technical performance

Design for cost and producibility has become part of our DNA

Questions

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