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Innovation. In all domains.

# How Peer Reviews Actually Work

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## Pilot Results from a Peer Review Performance Model

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Raytheon



# The Problem...

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## **The Slippery Slope of Managing Software (SW) Peer Reviews:**

- We believe Peer Reviews increase SW quality & decrease SW cost**
- Yet... SW Project Managers can't assess their impact on quality/cost**
- So... Peer Reviews are underutilized**

# ... and the Solution

The Peer Review Exploitation Tool\* (PRET) resolved this... by using a Performance Model to forecast:

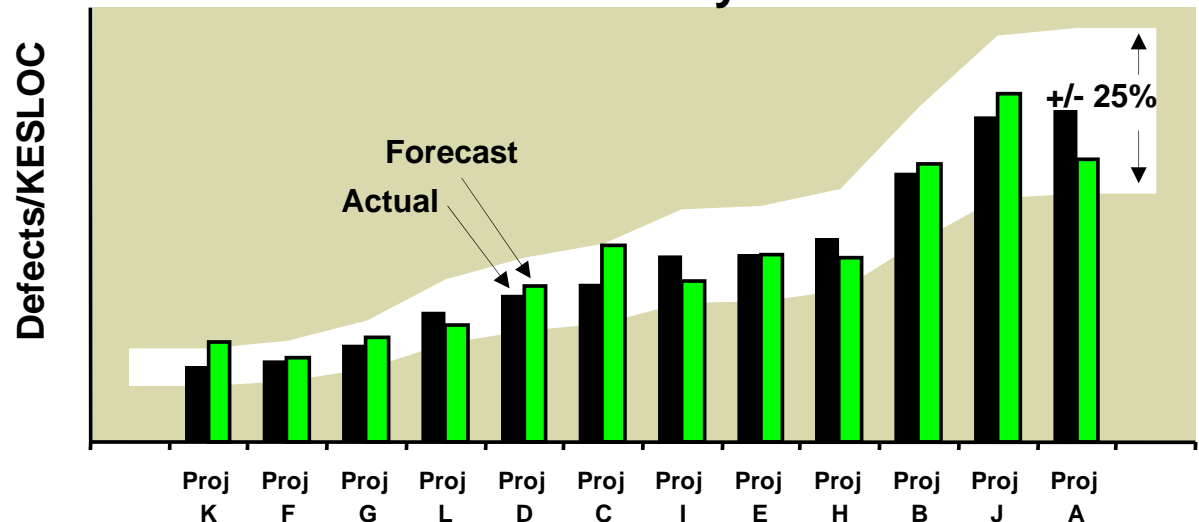
- Defect Density (quality)
- Related cost impacts of performing Peer Reviews

(Empirical)  
Performance Model  
( $R^2 = 0.92$ )

Density: Defects  
per Thousand  
Equivalent Source  
Lines of Code

\* US Patent 7,599,819

SW Product Defect Density Forecast vs. Actual



*Peer Review Exploitation Tool*



# Agenda

- Performance Model Derivation
- Performance Impacts of:
  - Peer Review Investment
  - Process Improvements
- Conclusion



# Performance Model Overview

**Peer Review Defect Removal**

(Explicit)

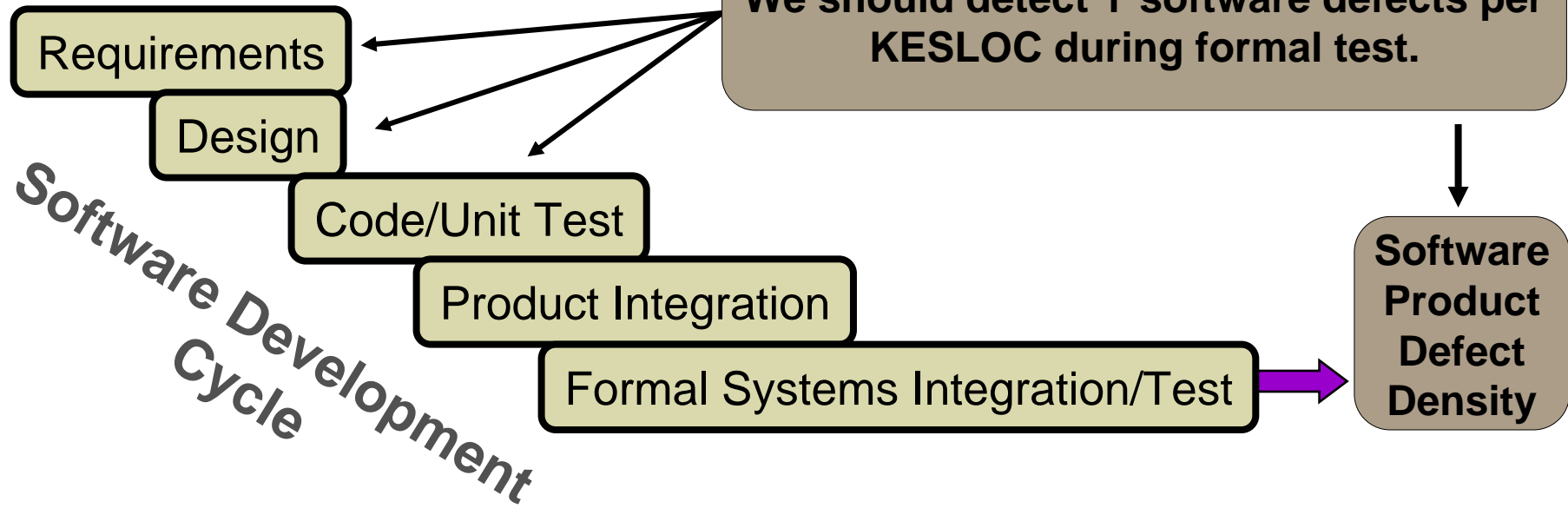
**PEP (Process, Environment, & People)**

(Implicit)



Forecast

If we conduct X Peer Reviews...  
We should detect Y software defects per  
KESLOC during formal test.

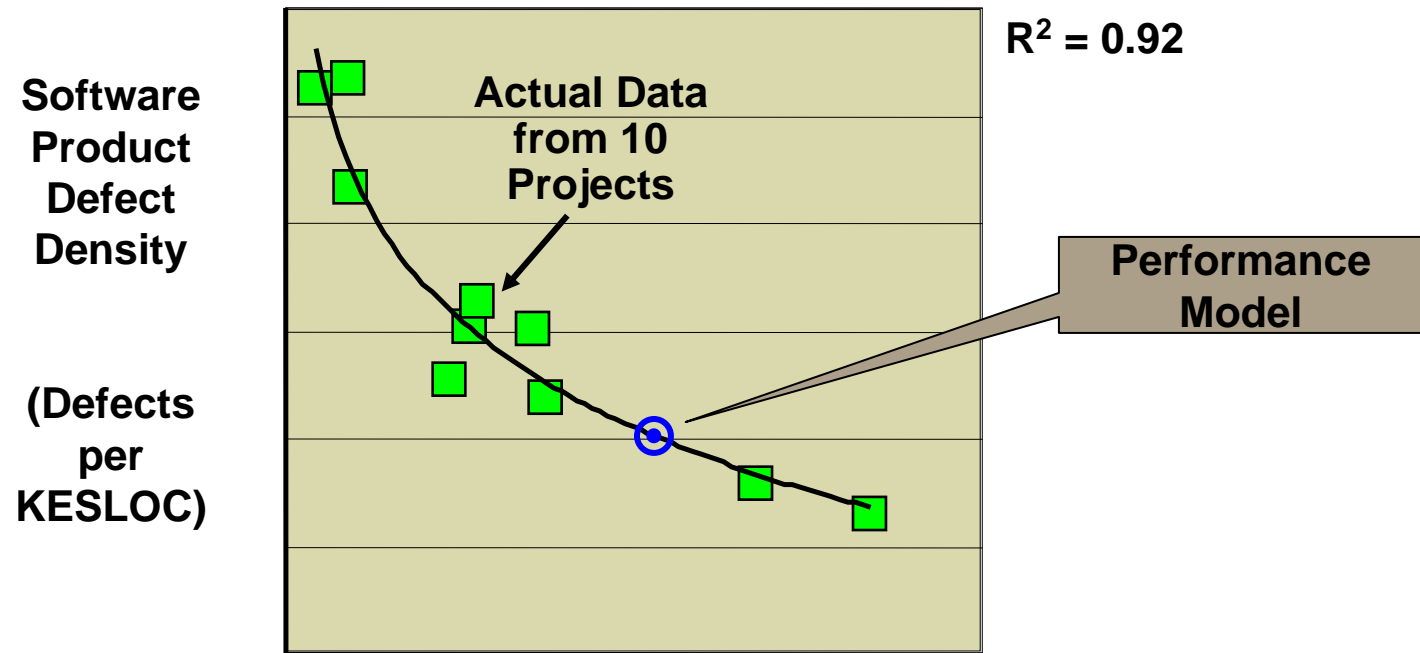


**Prediction is based on both explicit and implicit defect reduction**



# Performance Model Equations

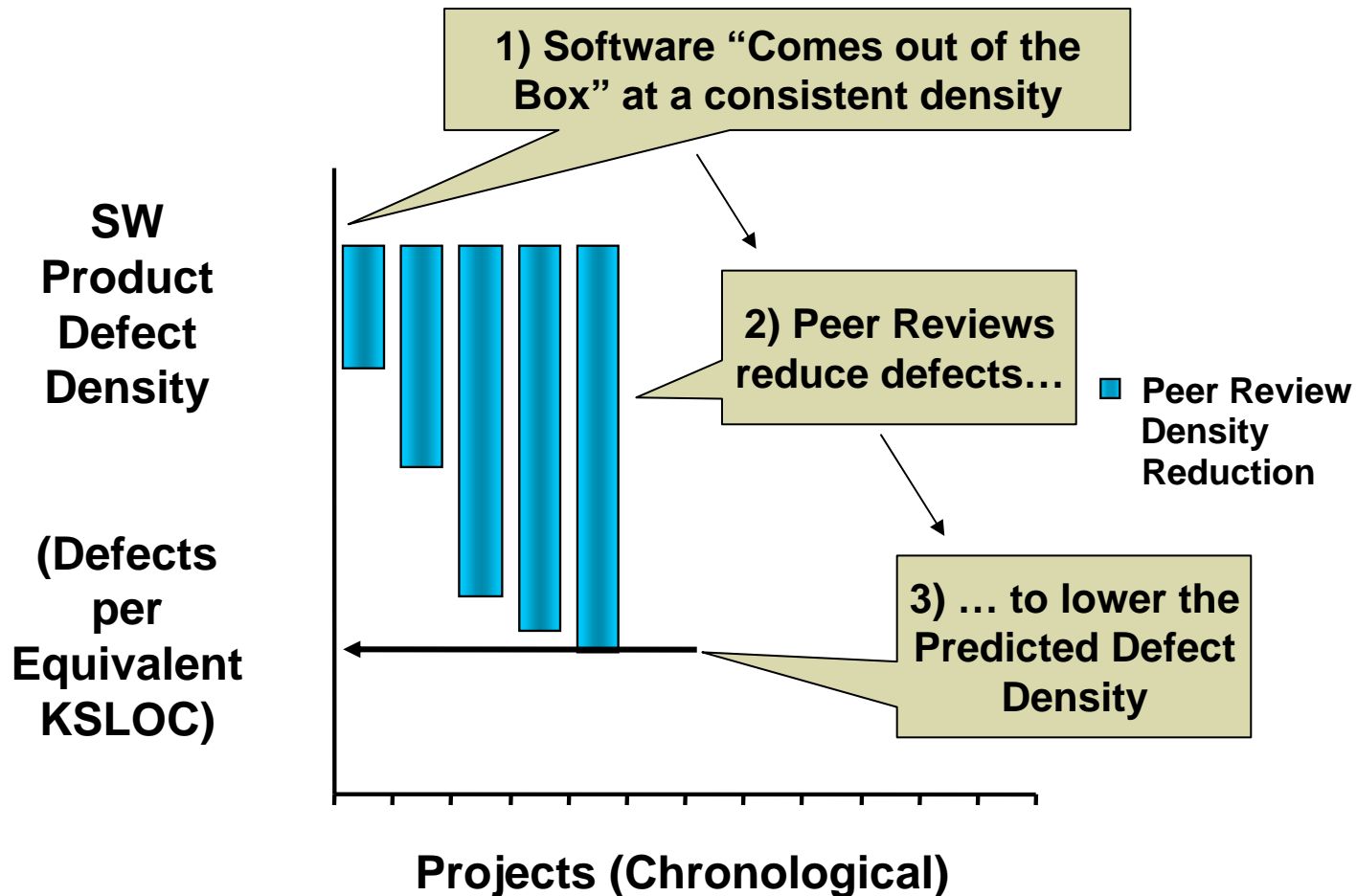
## Defect Density vs. Predictive “Score”



“Score” is calculated from Peer Review Defect Removal and PEP (Process, Environment, & People)

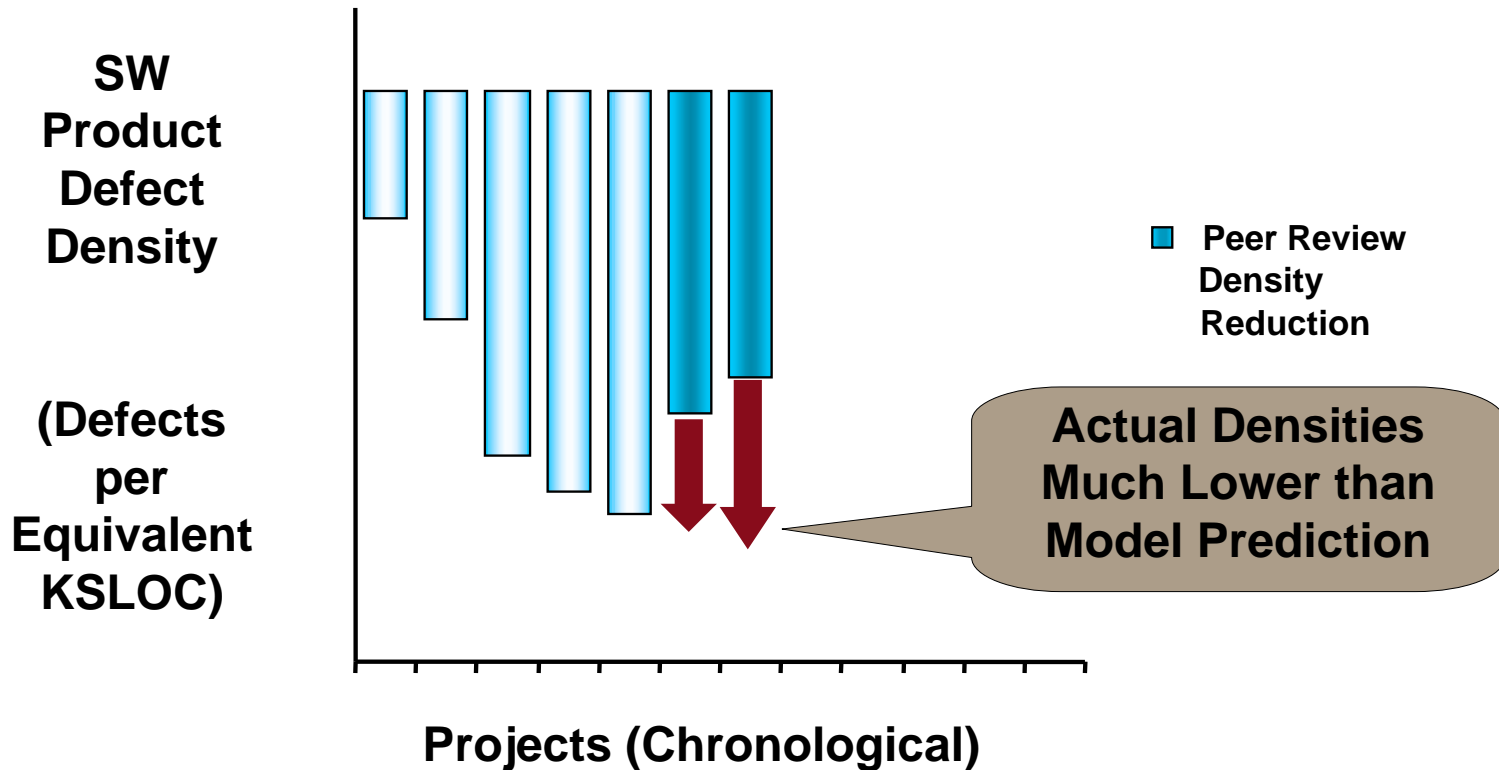
**Defect Density is reduced as more defects are removed and PEP is more favorable**

# Early Calibration



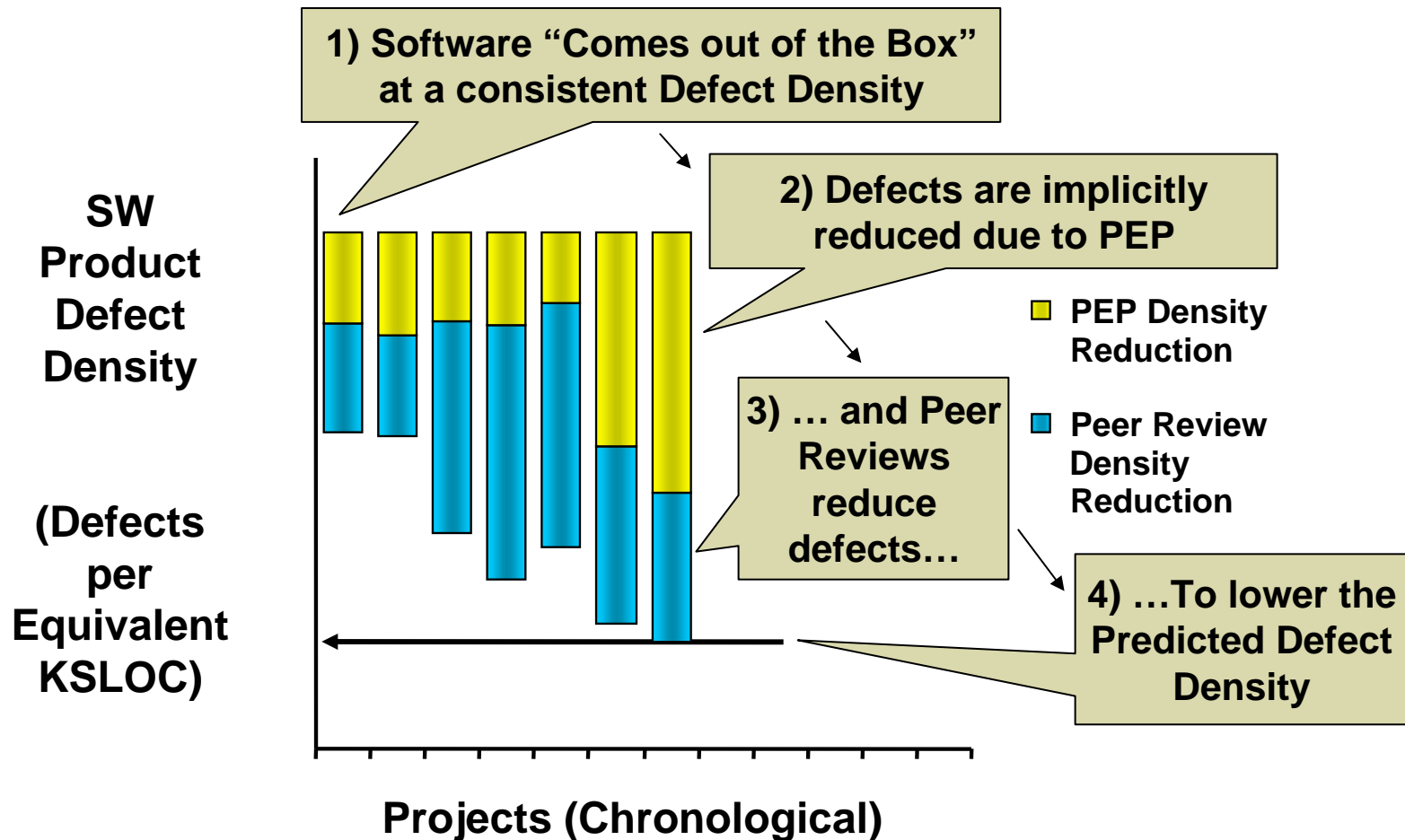
The initial model was based on the impact of Peer Reviews alone

# Calibration Issues



The next 2 projects “broke” the model, revealing the need for a new factor

# Revised Calibration

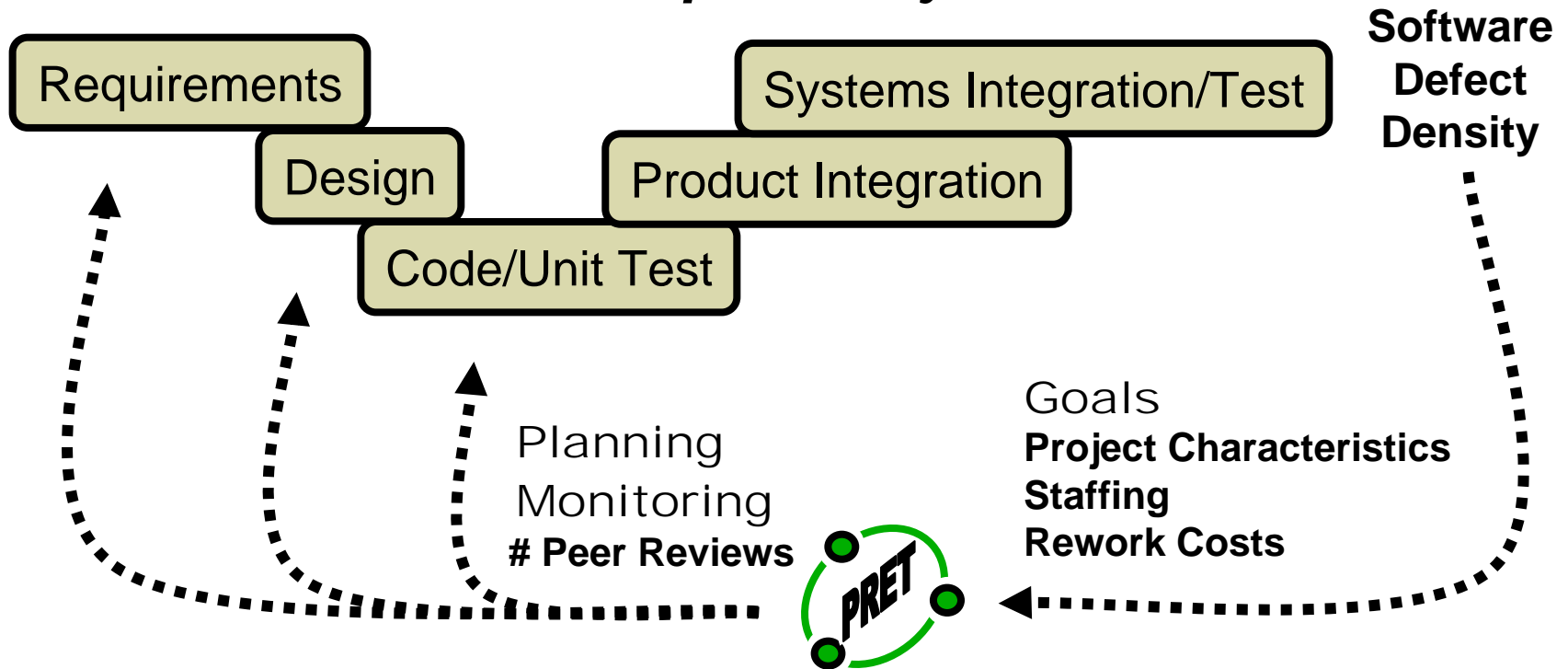


The model was revised to include PEP (characterization for Process, Environment and People)



# Peer Review Performance Management

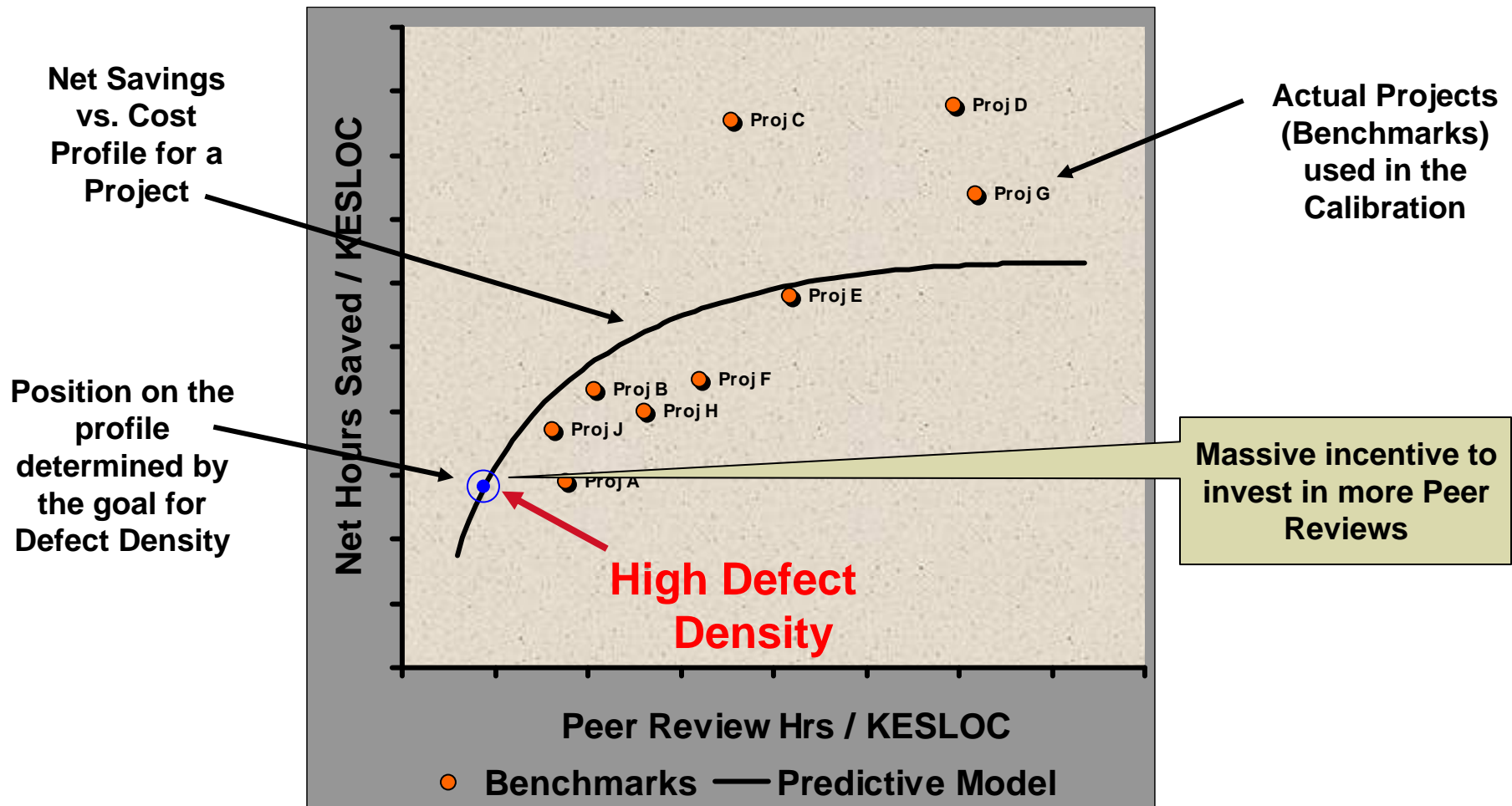
## Software Development Cycle



**SW Projects use PRET during proposals and monthly to budget, plan, and monitor Peer Reviews**



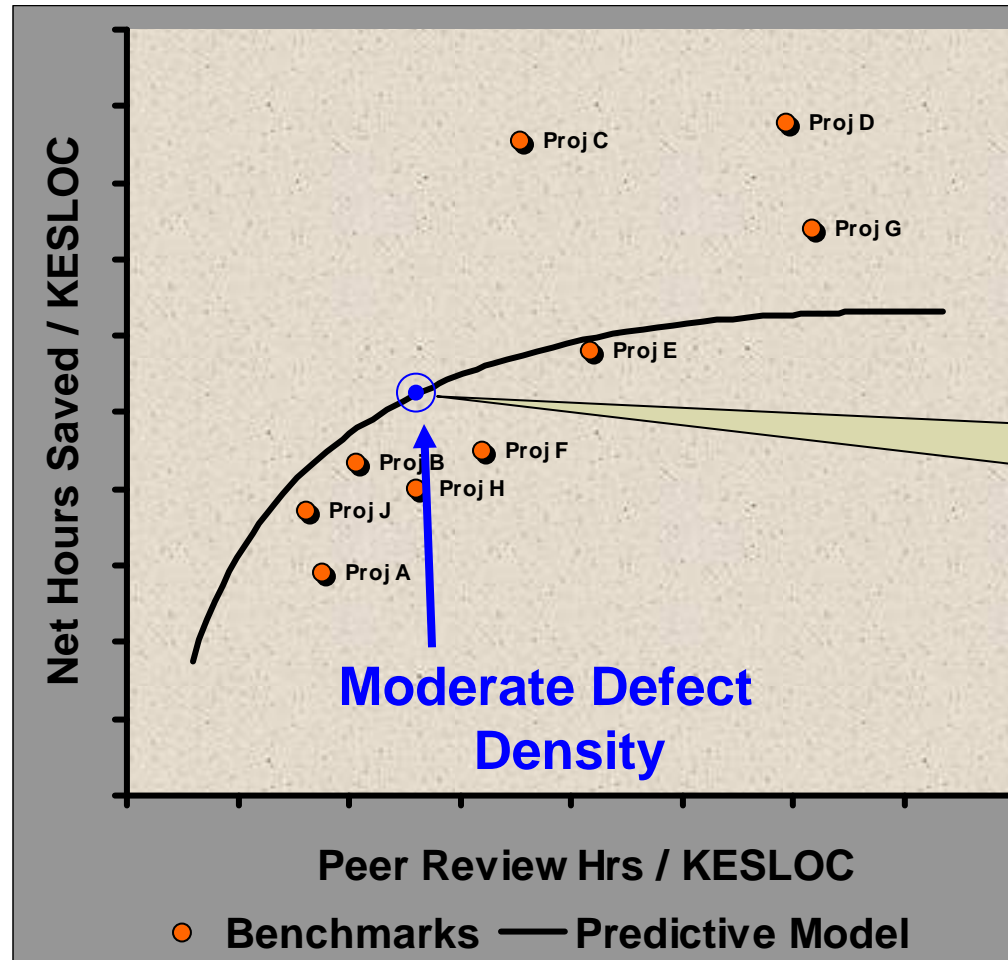
# Small Investment in Peer Reviews



**A small investment isn't enough to prevent high defect densities but does offer a very high Return on Investment**



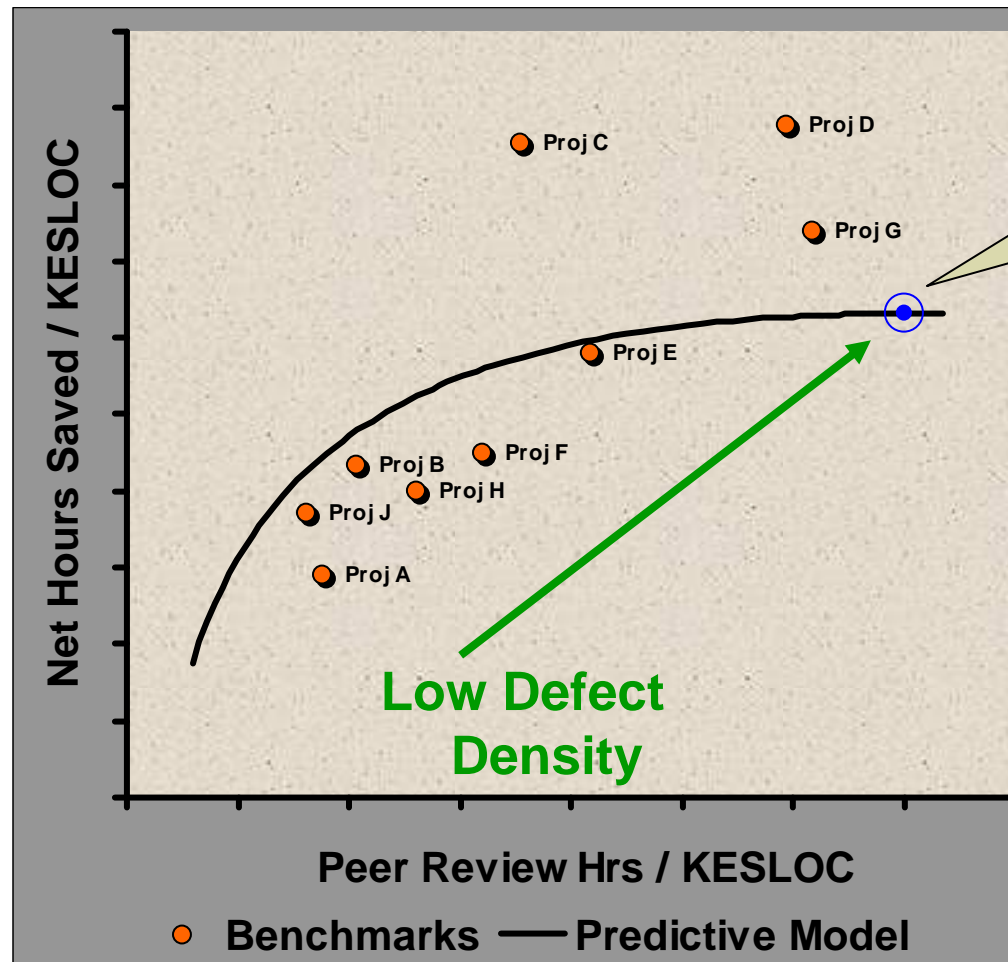
# Moderate Investment in Peer Reviews



As investment increases, Return on Investment decreases but is still significant. Density decreases as the investment grows.



# Large Investment in Peer Reviews



At some point, a diminishing return may be reached. Product quality requirements may nevertheless force investment above this level.



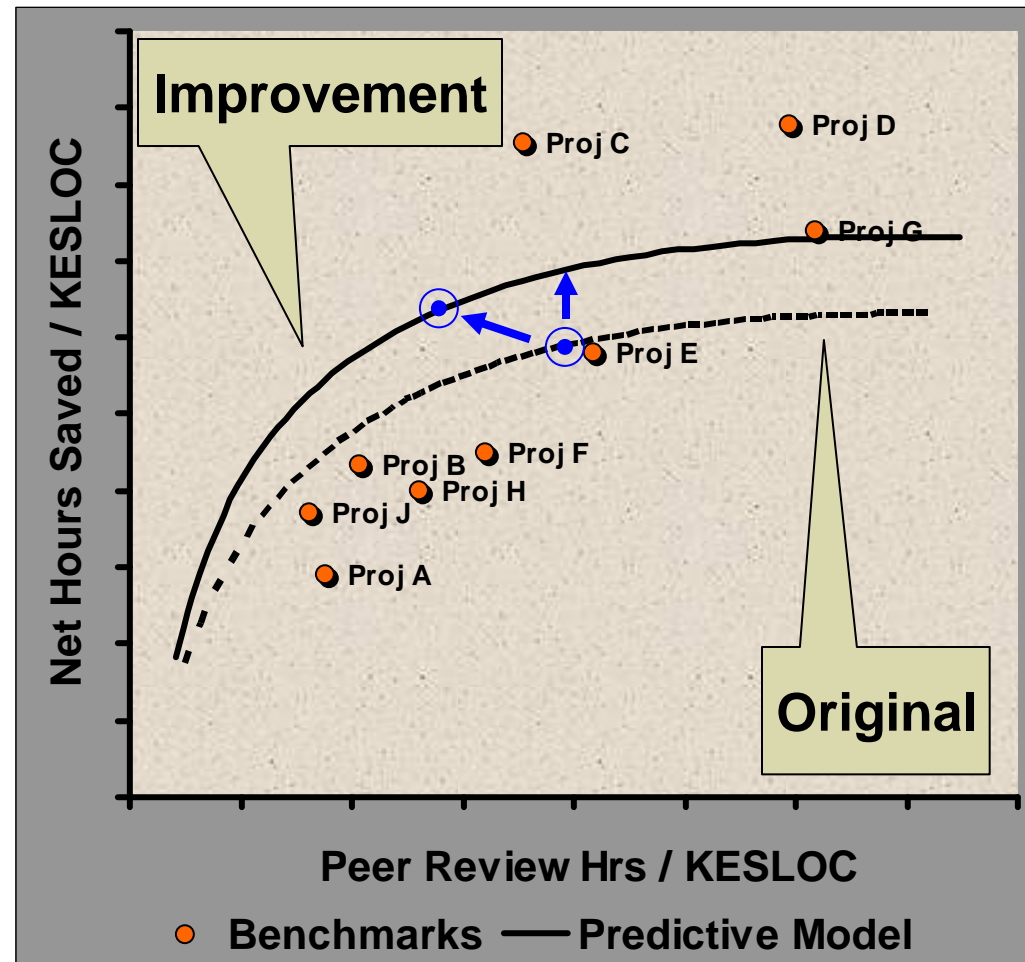
# Efficiency Improvement Example

Fewer average Peer Review hours per defect:

- Increases savings

- Offers an option:

Decrease Investment ←  
or  
Reduce Defect Density ↑



Similar shifts in the profile occur for other Improvements such as effort (simply more Peer Reviews), earlier Peer Reviews, and improved PEP

## Peer Reviews:

- can be measured to quantify performance
- perform as advertised
- have a predictable impact on cost & quality
- offer predictable improvement options

# Acronyms

- KESLOC Thousand Equivalent Source Lines of Code
- PEP Characterization of Process, Environment and People
- PRET Peer Review Exploitation Tool
- SW Software