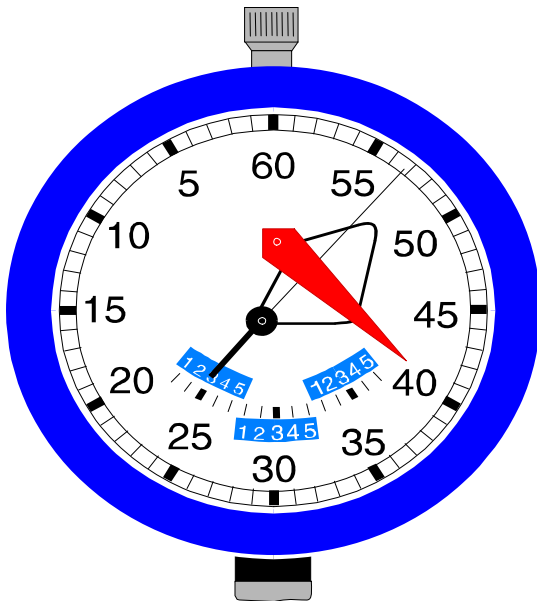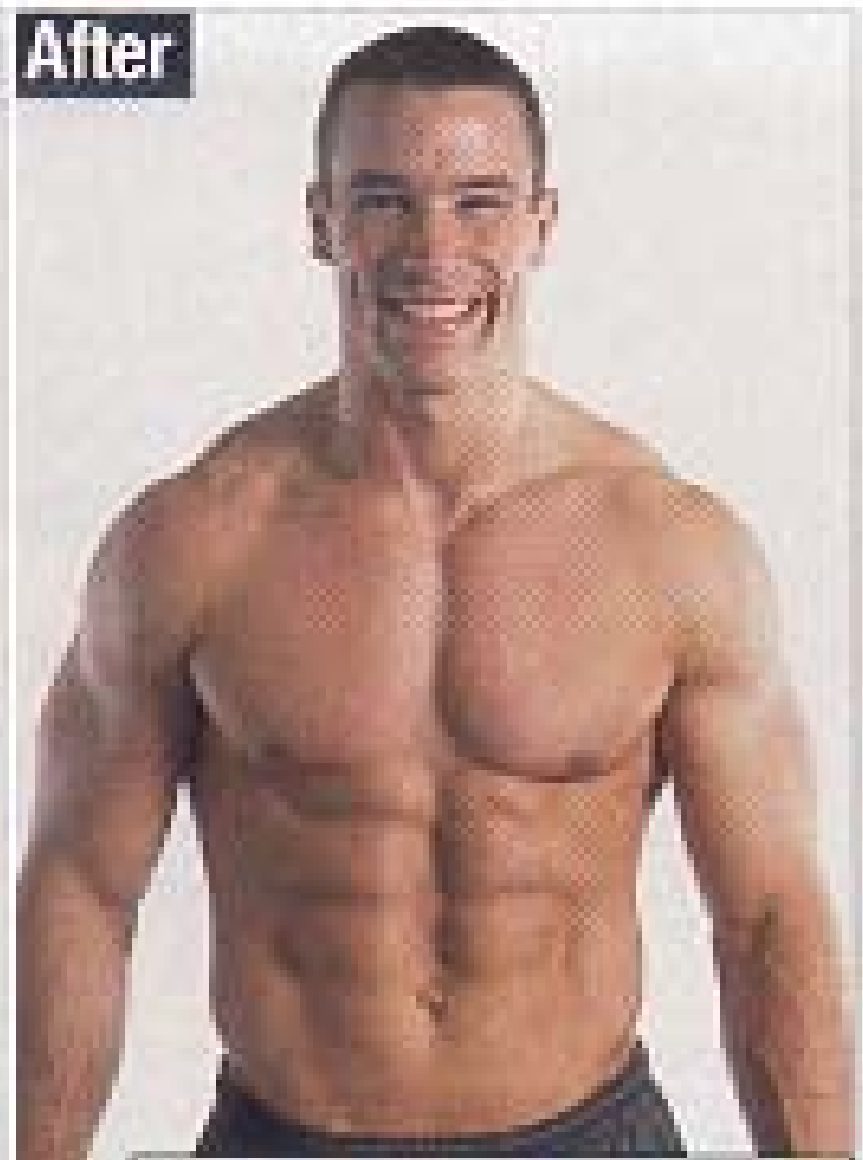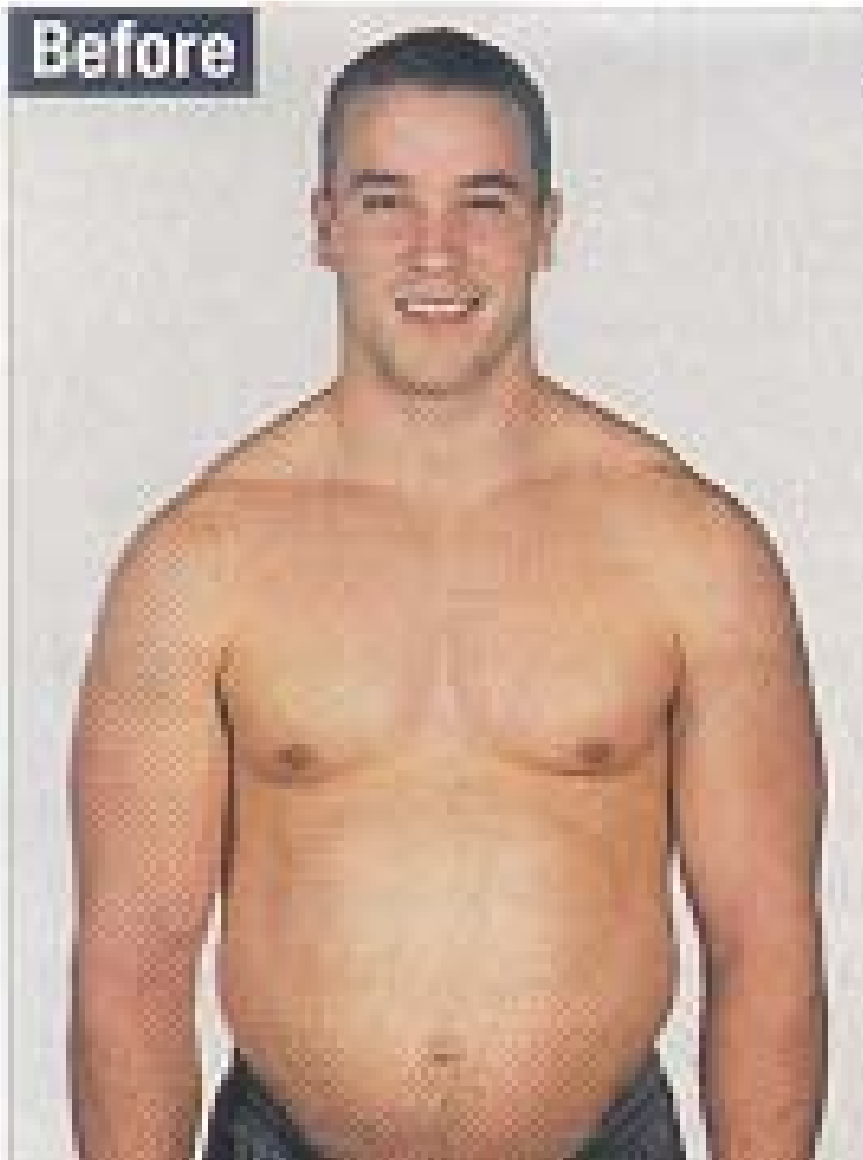# Agile Productivity Metrics:

"XP and Productivity Measures – What the Numbers Say"

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Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

❑ Individuals and interactions over processes and tools working software over comprehensive documentation

❑ Customer collaboration over contract negotiation responding to change over following a plan

❑ That is, while there is value in the items on the right, we value the items on the left more.

© 2001 Kent Beck, Mike Beedle, Arie van Bennekum, Alistair Cockburn, Ward Cunningham, James Grenning, Jim Highsmith, Andrew Hunt, Ron Jeffries, Jon Kern, Brian Marick, Robert C. Martin, Steve Mellor, Ken Schwaber, Jeff Sutherland, Dave Thomas, Martin Fowler

"Frothy eloquence neither convinces nor satisfies me. I am from Missouri. You have got to show me."

- Missouri Congressman Willard Duncan Vandiver, 1899

"Without metrics, you're just another person with a different opinion."

QSM Corporate Profile

❑ Founded by Larry Putnam, international expert in software estimation.

❑ QSM Software Lifecycle Management Tools (SLIM Suite) used worldwide by Fortune 500 Clients, Federal, and State Agencies to measure, estimate, and control software development

❑ Offices in Washington DC, New England, London, Paris, Amsterdam, and Tokyo.

❑ QSM research findings and the methodology within SLIM are published in 5+ books, over 100+ published papers.

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SEARCH [   ] GO
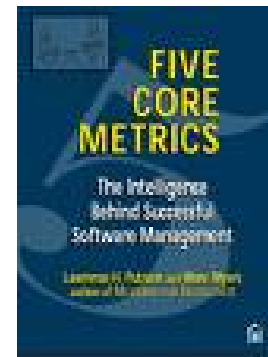
SLIM-Estimate

SLIM-Control

SLIM-Metrics

Estimate Express

Download Demo

SLIM Suite Demos

We have better tools for predicting the future...

Precision software tools backed by industry leading consulting

Find out how QSMA can help your organization control costs and create better software >>

INDUSTRY CONNECTION

Optimal Friction

NEW!
Michael's Blog exploring the world of dynamic software development.

Join the conversation >>

Other Musings from Michael >>

TOOL NEWS

Featured Customer

MISYS (m)
MISYS HEALTHCARE SYSTEMS

Read the *Computerworld* article...
"Haste Makes Waste" in software development

SD Times Special Feature...
SLIM shows the Best and Worst in Class Software Projects!

TRAINING ALERT

Training Overview
Learn About Training, Dates and Times

Sep 27 - 29...Sign Up Here...
SLIM Training Alert...Become SLIM enabled in 2006!

RESOURCES

Click Here to Learn More!
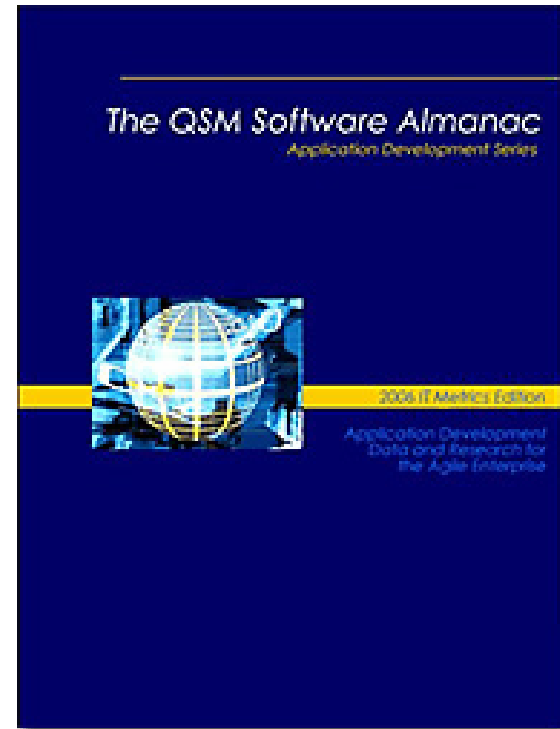The NEW *QSM 2006 Software Almanac IT Metrics Edition*

Cutter Consortium on Agile Metrics
Download the Webinar...

Cutter Report Abstract *"The Agile IT Executive and Outsourcing"*

Industry Data from the QSM SLIM-Metrics Database

- ❑ Spans 20+ years

- ❑ Large, worldwide heterogeneous database contains over 7,300+ projects

- ❑ Represents over 685+ million SLOC, 7+ million function points, over 600 languages, from 500+ organizations in 18 countries

- ❑ Adding 200 – 400 projects/year

The QSM Software Almanac
Application Development Series

2006 IT Metrics Edition

Application Development
Data and Research for
the Agile Enterprise

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Partial List of Clients
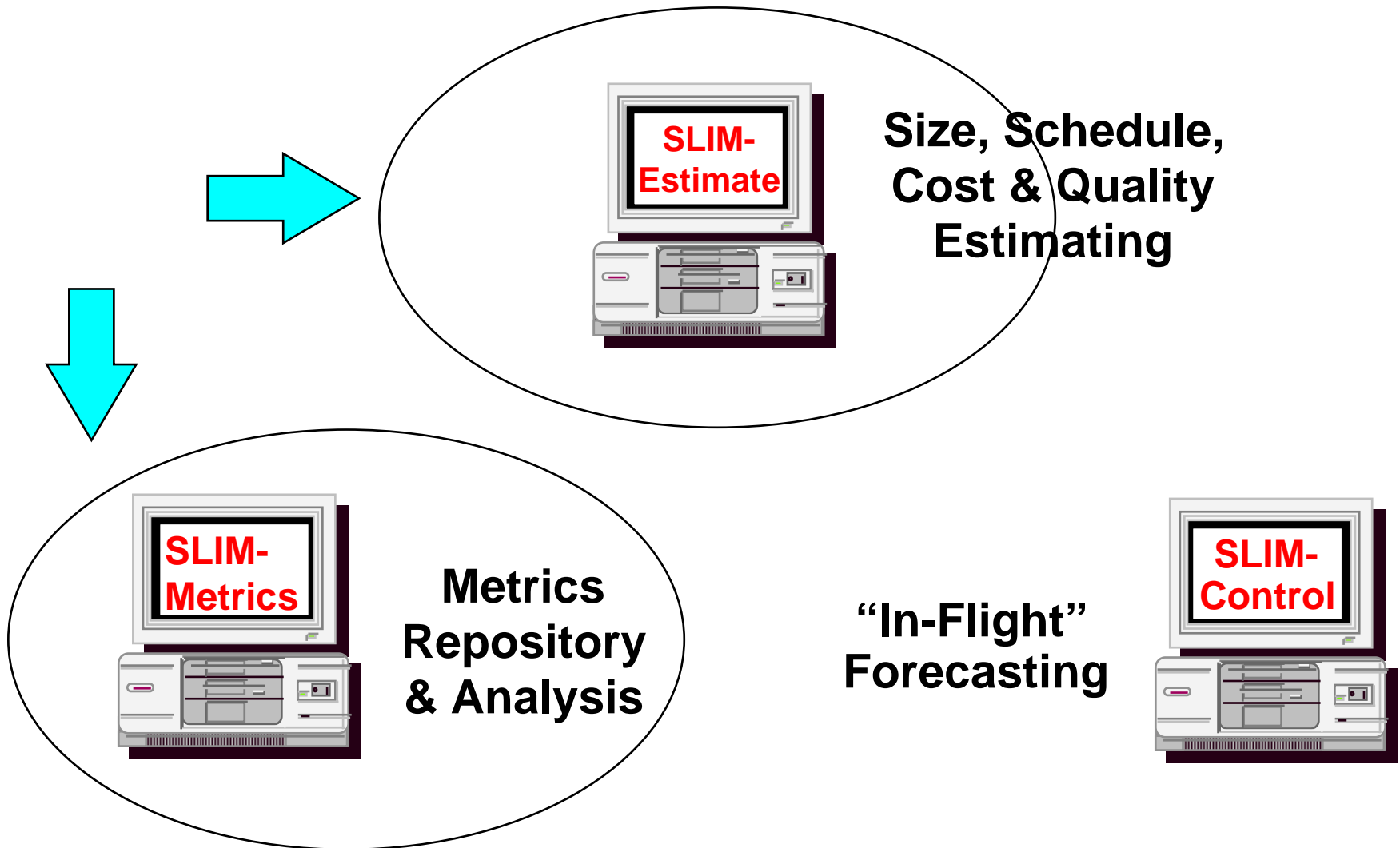
- British Telecom
- SAP
- Microsoft
- Intel
- BellSouth
- Keane
- Motorola
- Verizon Wireless
- Computer Sciences Corp

- Thomson Medstat
- IBM Global
- Misys Healthcare
- JPMorganChase
- Boeing
- Bank of New York
- Discover Card
- Siemens Medical
- The Vanguard Group

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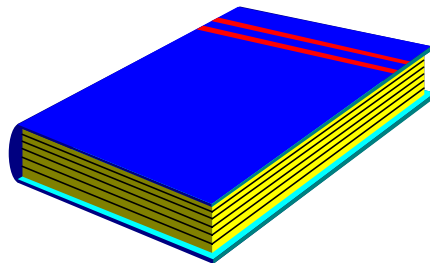QSM ASSOCIATES

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Models Used for this Analysis

SLIM-Estimate

Size, Schedule, Cost & Quality Estimating

SLIM-Metrics

Metrics Repository & Analysis

"In-Flight" Forecasting

SLIM-Control

Agile Measurement Approach

1 - COLLECT AND VALIDATE PROJECT DATA

2 - ANALYZE PROJECTS USING QSM REFERENCE DATABASE

4 - DOCUMENT RESULTS
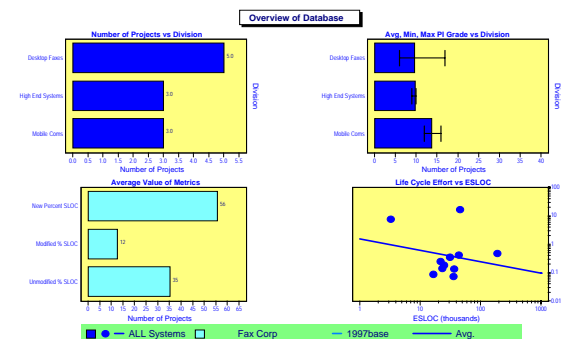
3 - DETERMINE PROCESS METRICS & PROJECT POSITIONING

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Agile/XP Client #1

- ❑ **Team size**
  - ❑ 24 Developers
  - ❑ 7 Testers
  - ❑ 3 Customers
  - ❑ 3 Project Leaders

- ❑ **Code Base**
  - ❑ 1,000,000 lines of code
  - ❑ 7,000 automated unit test
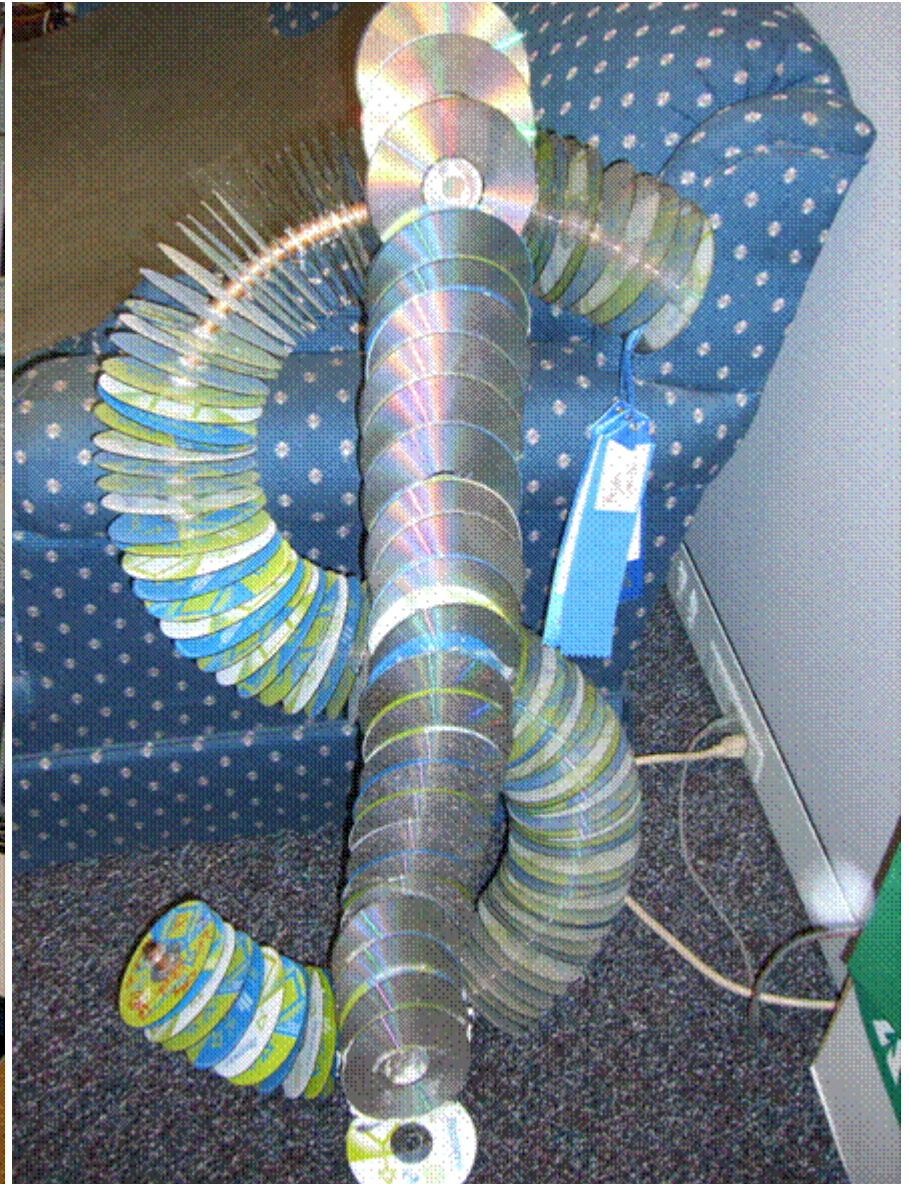 - ❑ 10,000 automated acceptance test

People Management

❑ XP Says "XP works in small to medium sized teams"

❑ How we evolved or extended this rule

   ❑ Subteams

   ❑ 1 large room is mandatory

❑ Trade-offs

   ❑ Communication between subteams

   ❑ 1 room noise level (distractions)

   ❑ Lack of personal space
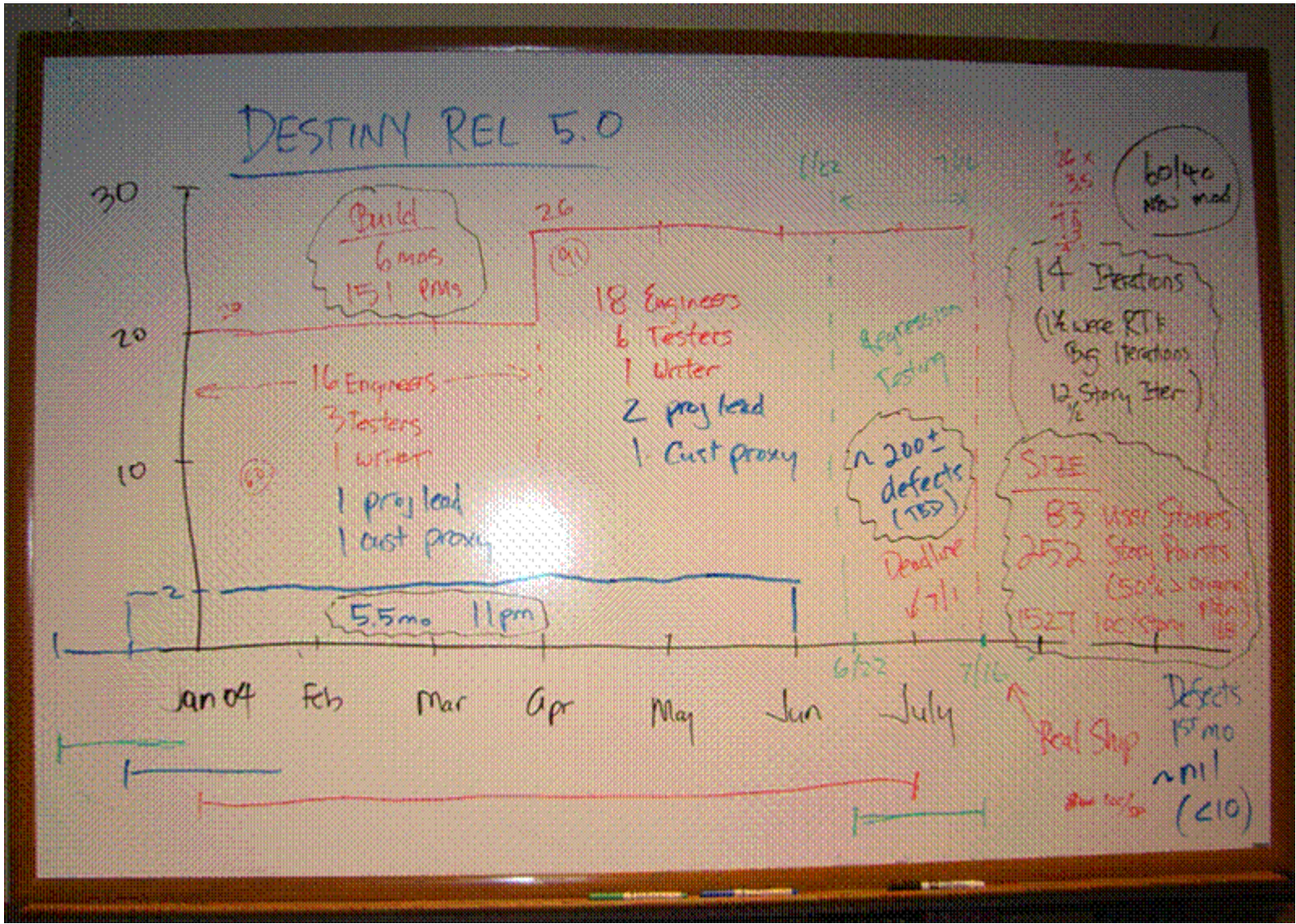
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Input to SLIM

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SLIM Replica – Destiny 5.0

Staffing & Probability Analysis

Avg Staff (people)
<Destiny Release 5.0>

STORY
BUILD

Milestones
0 - CSR
1 - SRR
2 - HLDR
3 - LLDR
4 - CUT
5 - IC
6 - STC
7 - UAT
8 - FCR
9 - 99R
10 - 99.9R
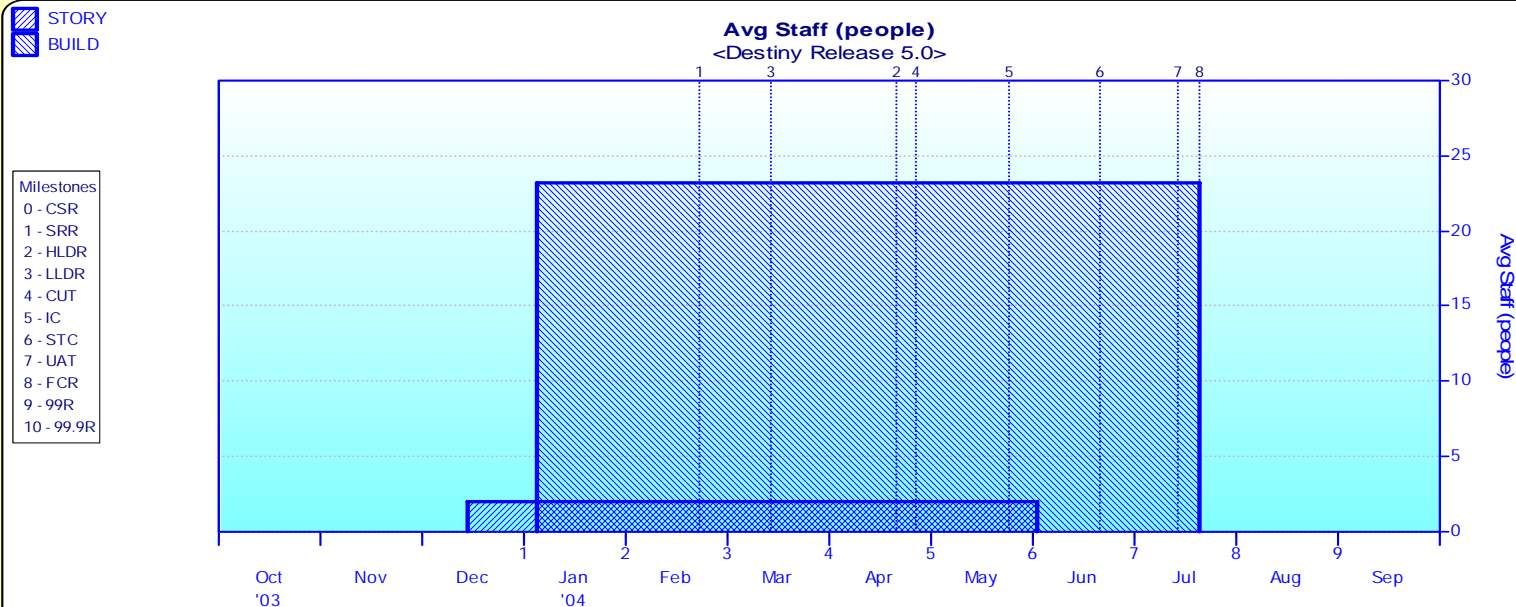
SOLUTION PANEL - <Destiny Release 5.0>			
	BUILD	Life Cycle	
Duration	6.5	7.2	Months
Effort	151	162	PM
Cost	1283.5	1377.2	$ (K)
Peak Staff	23.2	23.2	people
MTTD	0.675	0.675	Days
Start Date	1/5/2004	12/15/2003	
PI=23.1	**MBI=5.6**	**Eff SLOC=218,531**	

CONTROL PANEL - <Destiny Release 5.0>

23.1	23.2	219
18.5 27.7	18.5 27.8	175 262
PI	Peak Staff	Eff SLOC (K)

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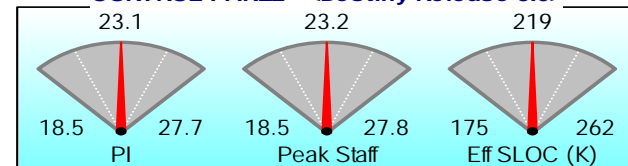
Trendline Assessment –Build Phase Staffing

Main Build Peak Staff vs. Size
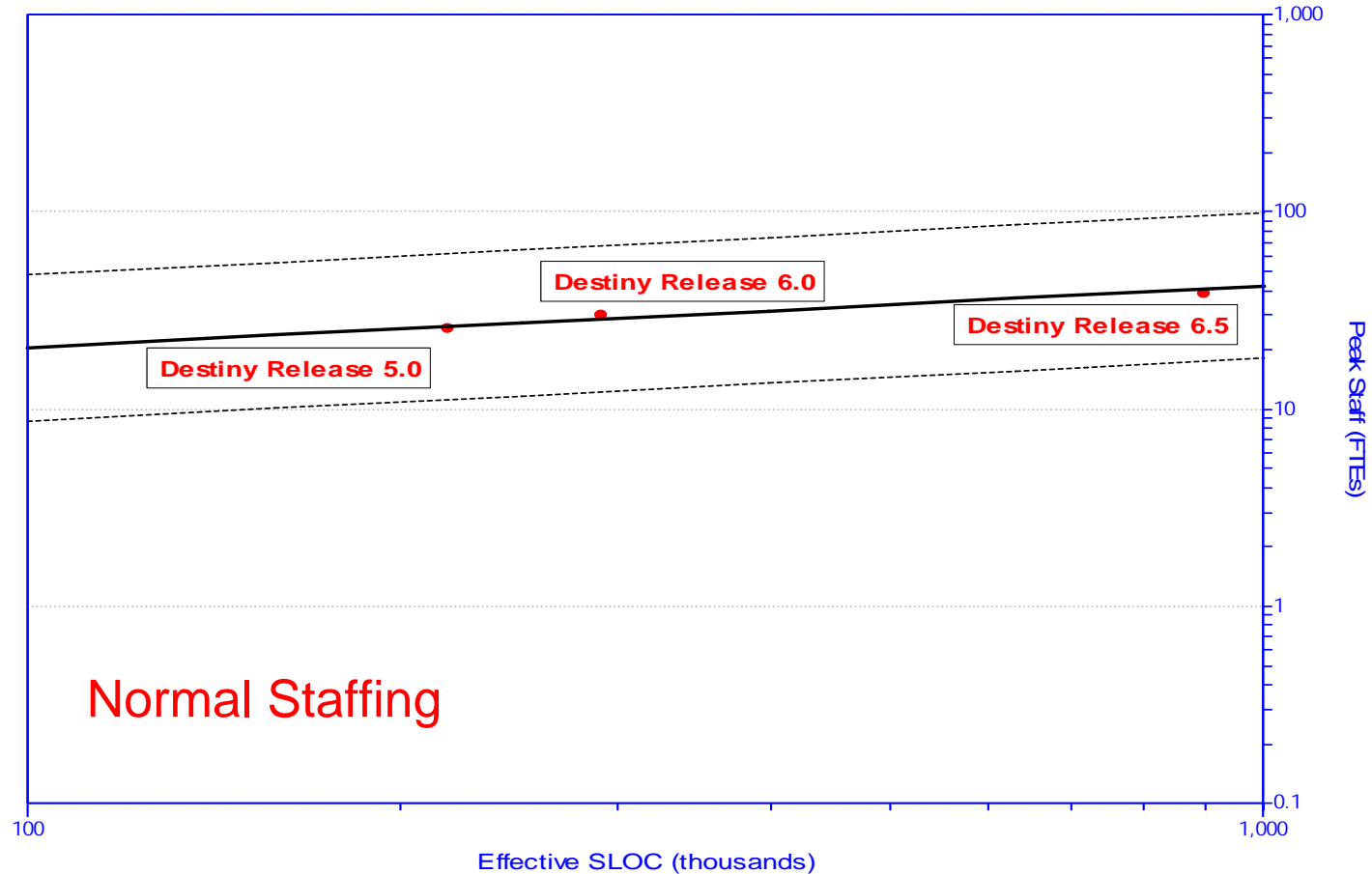
Destiny Release 6.0

Destiny Release 6.5

Destiny Release 5.0

Normal Staffing

Peak Staff (FTEs)

Effective SLOC (thousands)

● Business Systems	■ Avionic Systems	● Command & Control	■ Microcode Systems	● Process Control	—— QSM 2005 Business
—— Avg. Line Style	----- 1 Sigma Line Style				

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Trendline Assessment – Build Phase Schedule
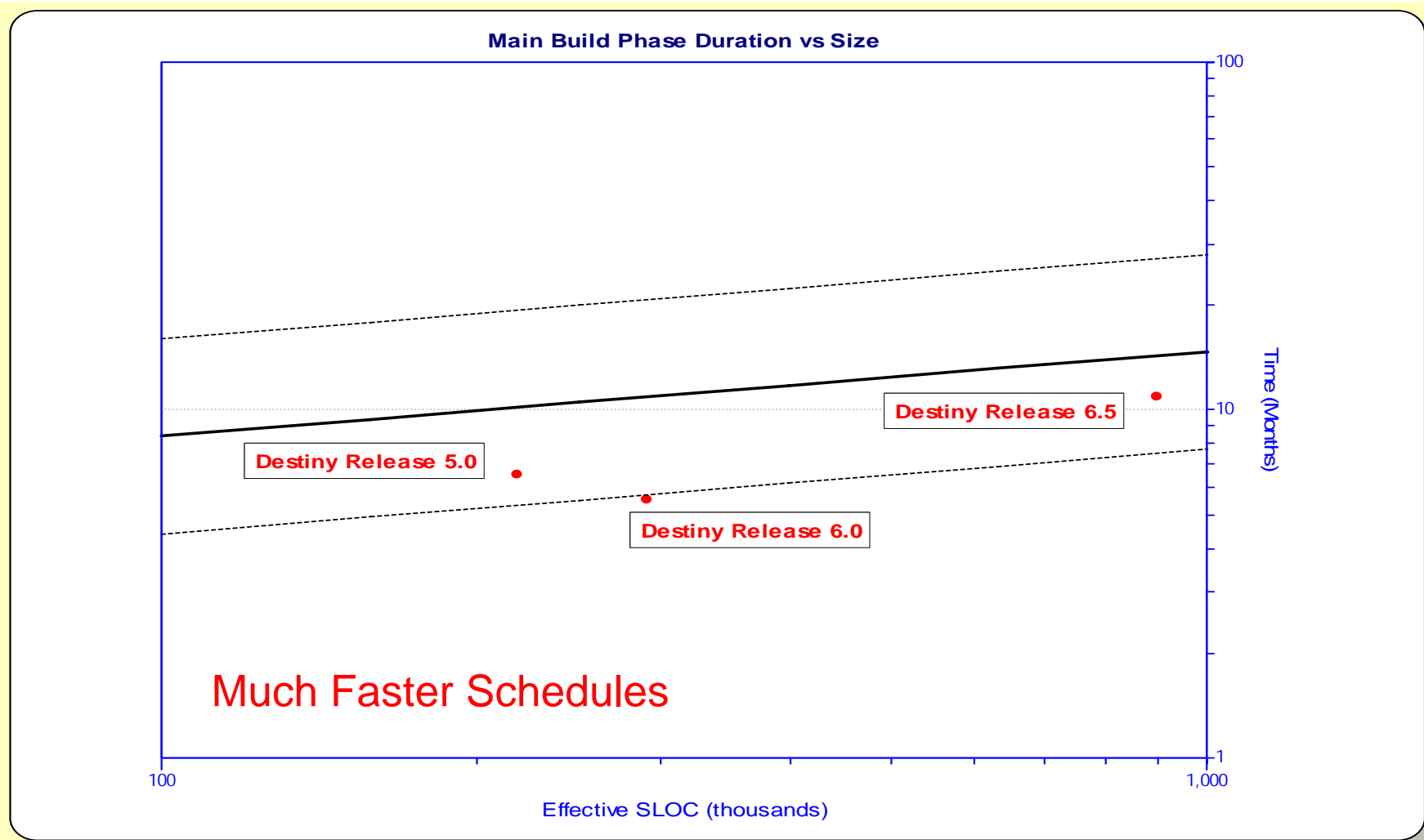
Main Build Phase Duration vs Size

Destiny Release 6.5

Destiny Release 5.0

Destiny Release 6.0

Much Faster Schedules

Time (Months)

100

10

1

Effective SLOC (thousands)

100   1,000

●	Business Systems	■	Avionic Systems	●	Command & Control	■	Microcode Systems	●	Process Control	──	QSM 2005 Business
──	Avg. Line Style	- - - -	1 Sigma Line Style								

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Trendline Assessment – Defects/Quality

Defects During Test

Errors (SysInt-Del)

Destiny Release 6.5

Destiny Release 6.0

Destiny Release 5.0

Far Fewer Defects: >50% Below Industry

Effective SLOC (thousands)

10,000
1,000
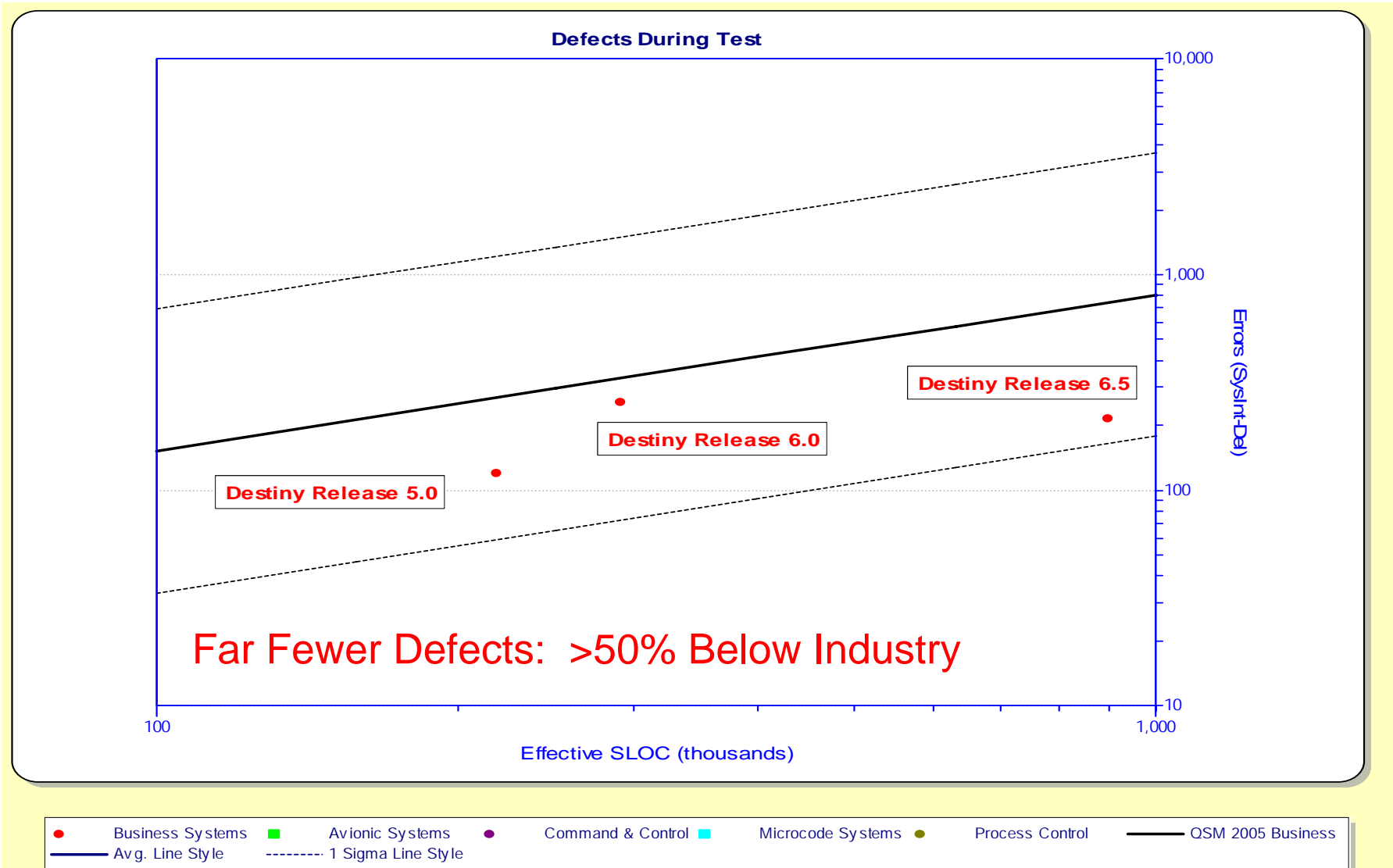100
10

100   1,000

● Business Systems ■ Avionic Systems ● Command & Control ■ Microcode Systems ● Process Control —— QSM 2005 Business
—— Avg. Line Style   --------- 1 Sigma Line Style

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Customers

❑ **XP Says "The customer is always available"**

  ❑ All phases of an XP project require communication with the customer

  ❑ The customer will also be needed to help with functional testing.

❑ **How this rule was evolved or extended**

  ❑ Customers are external end-users

  ❑ Customer Proxy role

    ❑ Customer Advocate

❑ **Trade-offs**

  ❑ Customer advocate allows someone to "always be available"

  ❑ Potential for different interpretation of need
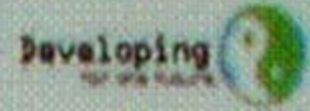
Company A vs. Industry Average

	Industry Average	Current Performance	Improvement
Project Cost	$3.5 Million	$2.4 Million	-$1.1M
Schedule	12.3 months	8.7 months	-3.6 mos
Cumulative Defects	2,702	1372	<50%
Staffing	33	33	n/a

* Using average project size of 150,000 lines of new and modified code

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Industrial XP Environment – Agile Client #2

Software Vision

Developing

- People buy our product <u>because of</u> the software!

  – Our software products help our customers do their work better than our competitors

  – The software component of our product suite will become a significant positive differentiator in the marketplace

  – The quality of our software products will give us a competitive advantage in the marketplace

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Industrial XP Environment

Industrial XP Environment

Photo courtesy of Joshua Kerievsky

Traditional Release – Whiteboard Sketch

Input to SLIM

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Digitized Replica Using SLIM™

Staffing & Probability Analysis

R&D
C&T

Milestones
0 - CSR
1 - SRR
2 - HLDR
3 - LLDR
4 - CUT
5 - IC
6 - STC
7 - UAT
8 - FCR
9 - 99R
10 - 99.9R

Avg Staff (people)
<Single Goal - MBI 1.1946>

Avg Staff (people)

| | | Jul Aug Sep | Oct Nov Dec | Jan Feb Mar | Apr May Jun | Jul Aug Sep | Oct Nov Dec | Jan Feb Mar | Apr May Jun | Jul Aug Sep |
| '01 | | | | '02 | | | | '03 | |
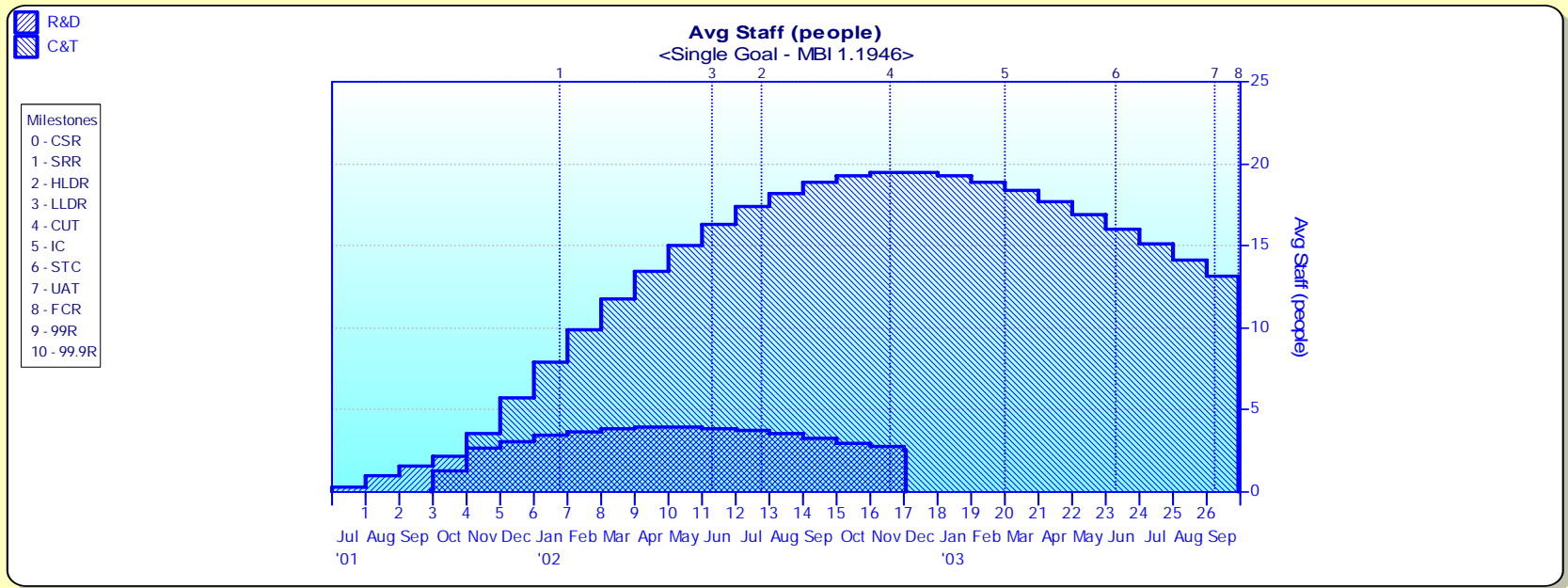
SOLUTION PANEL   <Single Goal - MBI 1.1946>

	C&T	Life Cycle	
Duration	24.0	27.0	Months
Effort	347	397	PM
Cost	5893	6741	$ (K)
Peak Staff	19.5	19.5	people
MTTD	0.3	0.3	Days
Start Date	9/29/2001	7/1/2001	
PI=17.0	**MBI=1.2**	**Eff SLOC=376022**	

CONTROL PANEL   <Single Goal - MBI 1.1946>

17.0	19.5	376
13.6 20.4	15.6 23.4	301 451
PI	Peak Staff	Eff SLOC (K)

Project: Condor

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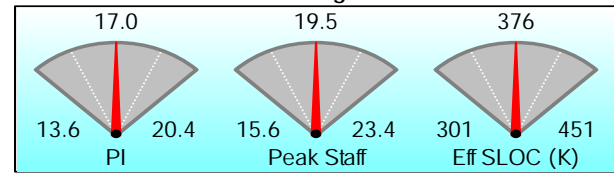
XP Releases – Whiteboard Sketch

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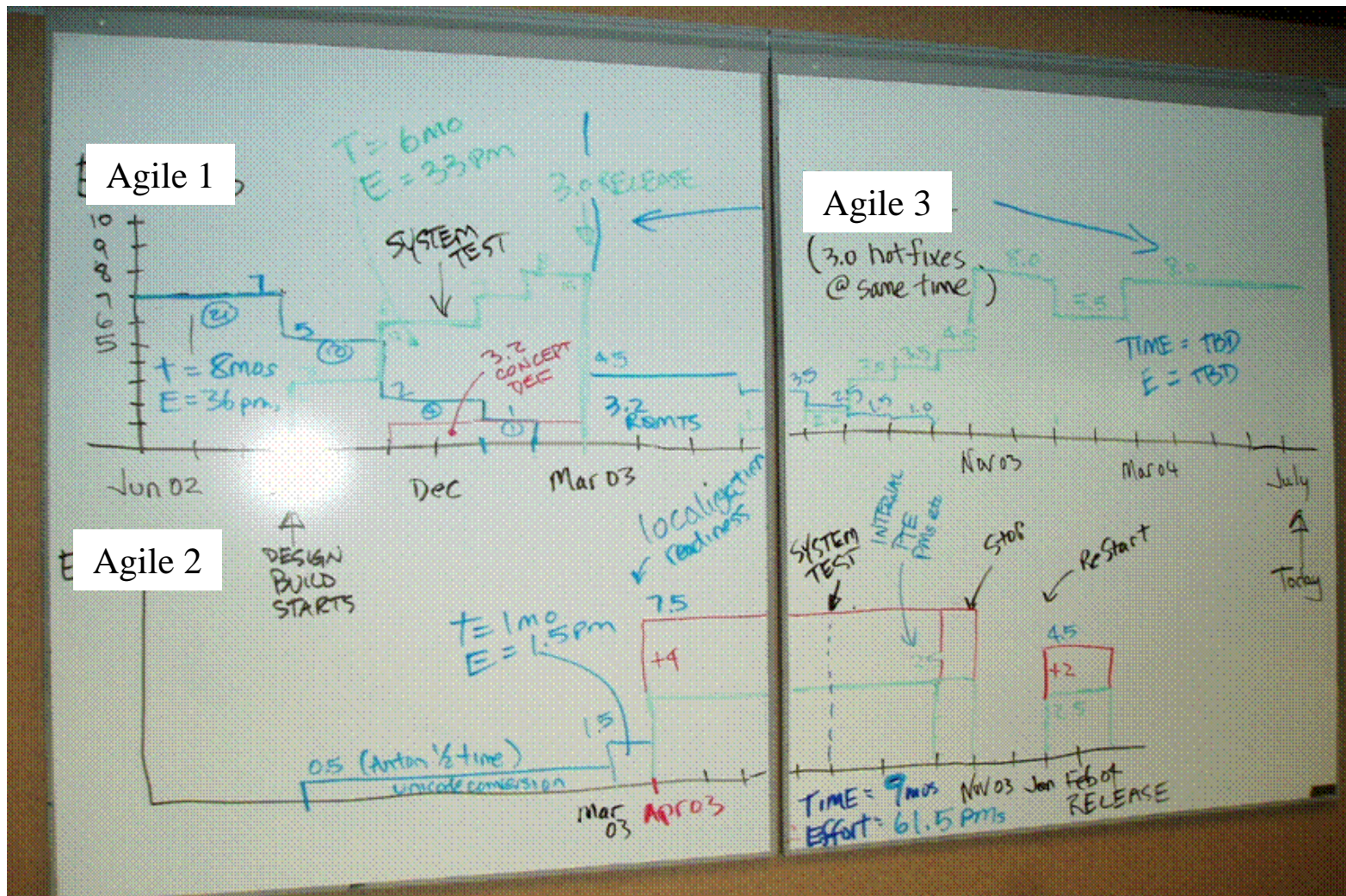
Digitized Replica Using SLIM^{tm}

Staffing & Probability Analysis

R&D
C&T

Avg Staff (people)
<XP Rel. 3.0>

Milestones
0 - CSR
1 - SRR
2 - HLDR
3 - LLDR
4 - CUT
5 - IC
6 - STC
7 - UAT
8 - FCR
9 - 99R
10 - 99.9R

Avg Staff (people)

Apr '02 May Jun Jul Aug Sep Oct Nov Dec Jan '03 Feb Mar
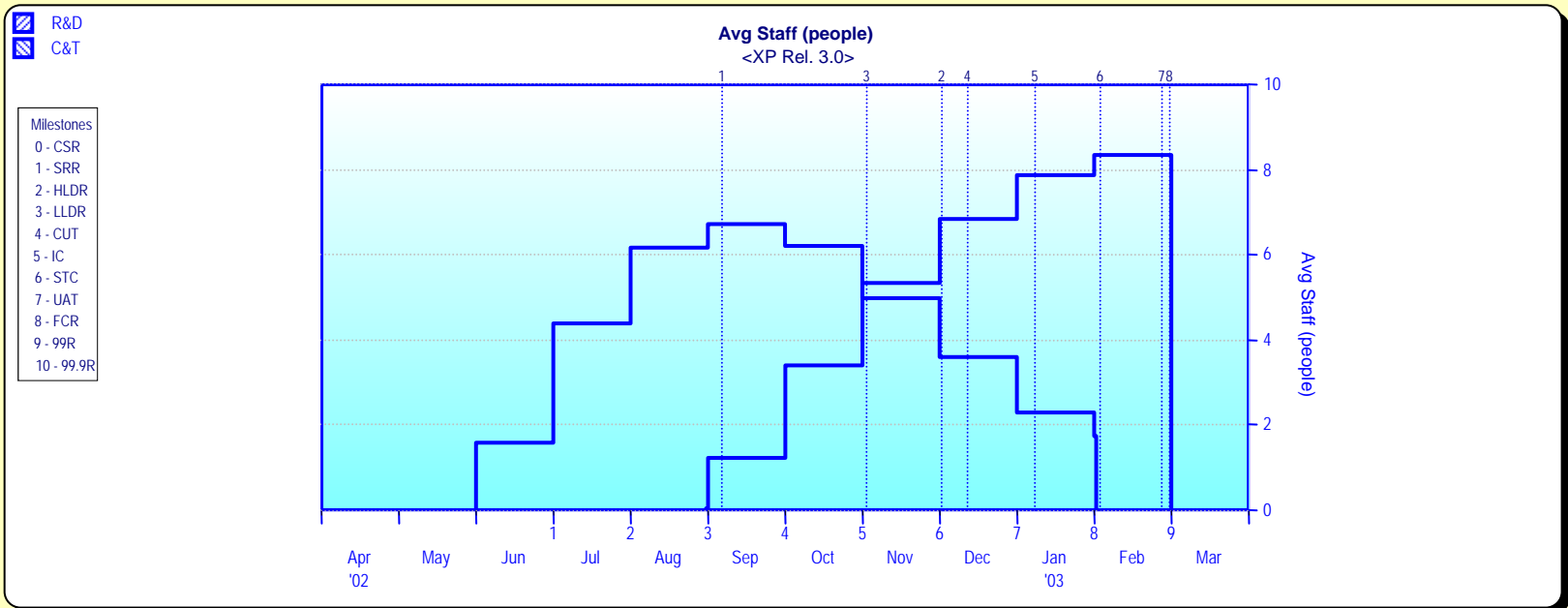
SOLUTION PANEL <XP Rel. 3.0>

	C&T	Life Cycle	
Duration	6.0	9.0	Months
Effort	33	69	PM
Cost	561	1173	$ (K)
Peak Staff	8.4	8.4	people
MTTD	1.8	1.8	Days
Start Date	8/31/2002	6/1/2002	

PI=20.7   MBI=3.8   Eff SLOC=67023

CONTROL PANEL <XP Rel. 3.0>

20.7	8.4	67
16.5 24.8	6.7 10.1	54 80
PI	Peak Staff	Eff SLOC (K)

Project

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Schedule Comparison

C&T Duration (Months) vs Effective SLOC

Fast Schedules on Traditional Projects

Even Faster on Agile Projects

Traditional 1

Traditional 2

Agile 2

Agile 1

Agile 3

C&T Duration (Months)

Effective SLOC (thousands)

| ■ All Systems | ● Special Project | —— QSM 2002 | —— Avg. Line Style | ---- 1 Sigma Line Style |

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Defect Comparison

Errors SIT-FOC vs Effective SLOC

High Defects on Traditional Projects
Low Defects on Agile Projects

Traditional 1

Traditional 2

Agile 1

Agile 2

Agile 3

Errors SIT-FOC

Effective SLOC (thousands)

■ All Systems   ● Special Project   —— QSM 2002   —— Avg. Line Style   -------- 1 Sigma Line Style

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Example PI Calculation

Condor
PI = $\dfrac{\text{SIZE}}{\text{TIME} \quad * \quad \text{EFFORT}}$ = 17

Size = 376,022 SLOC

Effort = 347 Person-
   Months

Time = 24 Months

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Productivity Index (PI)
(industry values by application type)

Productivity Index (PI) w/ ±1 Standard Deviation

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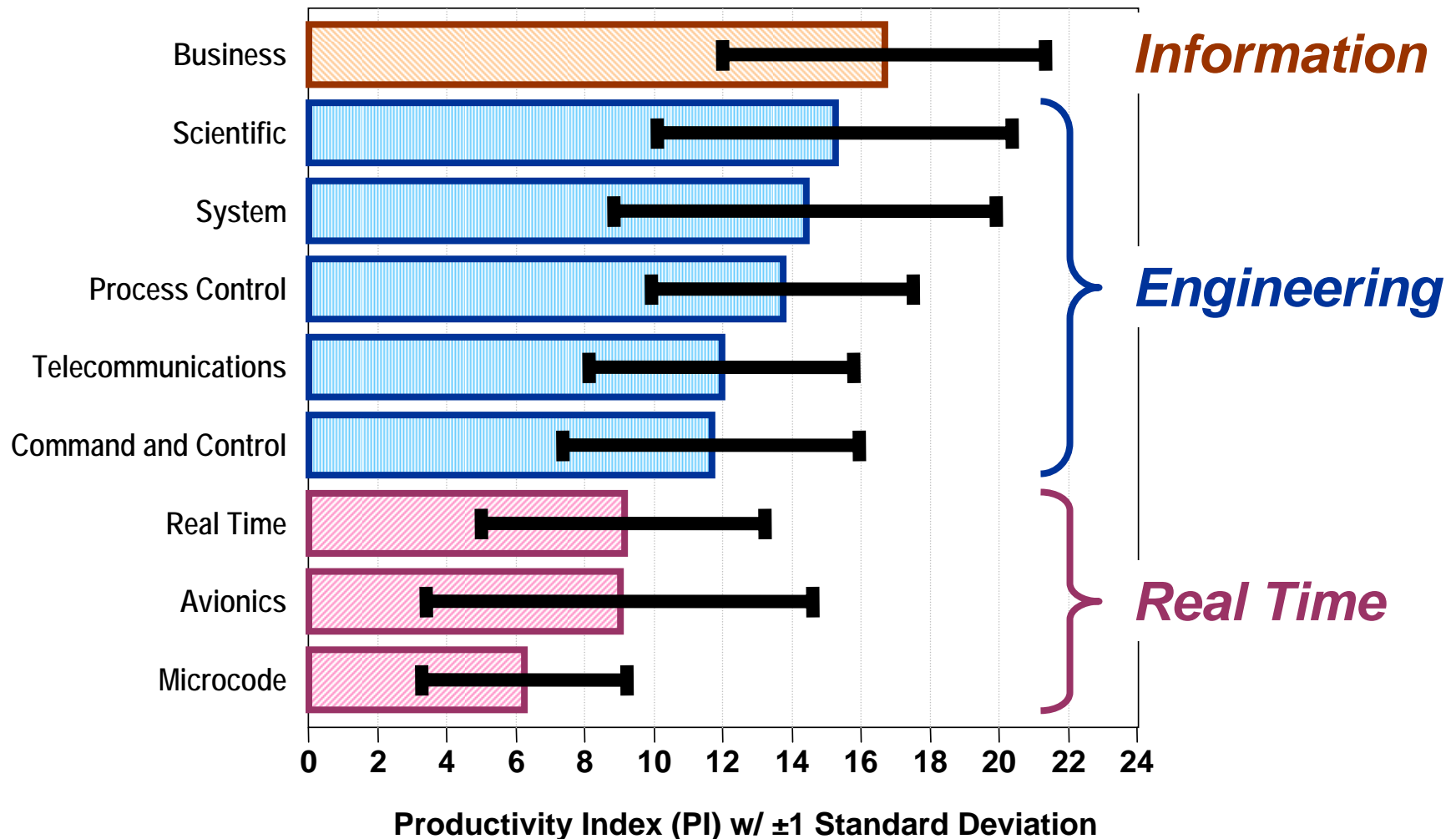
Before vs. After Summary

	Previous Performance	Current Performance	Percent Improvement
Project Cost	$2.8 Million	$1.1 Million	61%
Schedule	18 months	13.5 months	24%
Cumulative Defects	2,270	381	83%
Staffing	18	11	39%

* Using average project size of 150,000 lines of new and modified code

Industry Average vs. Offshore

	Industry Average	Offshore Average	Difference
Project Cost	$3.5 Million	$3.2 Million	-$0.2M
Schedule	12.3 months	9.6 months	-2.7 mos
Cumulative Defects	2,702	7,565	280%
Staffing	33	50	+17

* Using average project size of 150,000 lines of new and modified code

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Metrics Tools Used for this Analysis

SLIM-Estimate

Size, Schedule, Cost & Quality Estimating

SLIM-Metrics

Metrics Repository & Analysis

Statistical Process Control & Adaptive Forecasting

SLIM-Control
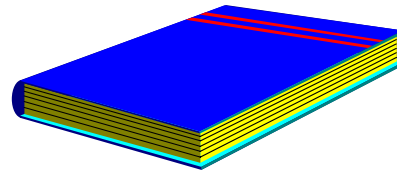
Recommended Web Resources

❖ Blogosphere:

www.optimalfriction.com

❖ QSM Associates Web Library/Resource Center:

www.qsma.com

Recommended Reading

- ❖ "Reassessing XP," by Tom DeMarco/Cutter Business Technology Council, Business Technology Trends Advisory, Volume 6, No. 8. © Cutter Information Corp.

- ❖ Mah, Michael, *"The Making of the Agile IT Executive" Business IT Strategies Advisory Executive Report Vol 6 Number 10.* © 2004 Cutter Information Corp.

- ❖ Putnam, Lawrence H., and Myers, Ware, *"Five Core Metrics, The Intelligence Behind Successful Software Management"* © 2003 Dorset House Publishers.

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