Lessons Learned in Seamless Integration of CMMI, TSP, and PSP
Why All Three Are Needed

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Advanced Information Services Inc.

Winner IEEE Software Process Achievement Award

http://www.sei.cmu.edu/managing/ieee-award/ieee.award.html

SW-CMM®
Level 5
Company

SEIPartner
CMMI · TSP

Topics

- ➢ Issues
  - ◆ Quality and Schedule
  - ◆ Rational Management and Commitment
  - ◆ Insanity and Malpractice
- ➢ Three Improvement Perspectives
  - ◆ Organization - CMM/CMMI
  - ◆ Individual – PSP
  - ◆ Team – TSP
- ➢ Seamless Integration of CMMI, PSP, TSP
  - ◆ The glue – Process Improvement Proposal
  - ◆ AIS Experience
- ➢ Lessons Learned

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Quality Is More Important Than Schedule

"In today's software marketplace, the principal focus is on cost, schedule, and function; quality is lost in the noise. This is unfortunate since poor quality performance is the root cause of most software cost and schedule problems."

Watts Humphrey

Rational Management - Developers

➢ When pressed for early deliveries, the responsible team members say

"I understand your requirements, I will do my utmost to meet it, but until I make a plan, I can not responsibly commit to a date"

Rational Management - Managers

➢ When pressed for early deliveries, the responsible managers say

> "I trust you to create an aggressive and realistic plan, I will review the plan, but I will not commit you to a date that you can not meet"

Rational Management - Principles

➢ Set challenging goals

➢ Get the facts

➢ Use facts and data

➢ Anticipate and address problems

Insanity or Malpractice?

Insanity

Doing the same thing over and over and expecting a different result

Malpractice

An organization which does not have a

top-management-sponsored

continuous improvement initiative in place

Organization Improvement Capability Maturity Model

Level	Focus	Key Process Areas (KPA)
5 Optimizing	Continuous process improvement	Defect prevention Technology change management Process change management
4 Managed	Product and process quality	Quantitative process management Software quality management
3 Defined	Engineering process	Organization process focus Organization process definition Training program Integrated software management Software product engineering Intergroup coordination Peer reviews
2 Repeatable	Project management	Requirements management Software project planning Software project tracking Software quality assurance Software configuration management Software subcontract management

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Comparing SW-CMM to CMMI

SW-CMM key process areas

CMMI Process Areas

Level 5
Optimizing

Defect Prevention → Causal Analysis and Resolution
Technology Change Management → Organizational Innovation and Deployment
Process Change Management

Level 4
Managed

Quantitative Process Management → Organizational Process Performance
Software Quality Management → Quantitative Project Management

Organization Process Focus → Organizational Process Focus
Organization Process Definition → Organizational Process Definition
Training Program → Organizational Training
Integrated Software Management → Integrated Project Management
Risk Management

Software Product Engineering → Requirements Development
Technical Solution
Product Integration

Intergroup Coordination → Verification
Peer Reviews → Validation

Level 3
Defined

Decision Analysis and Resolution

Requirements Mgmt → Requirements Management
Software Project Planning → Project Planning
Software Project Tracking & Oversight → Project Monitoring and Control
Software Subcontractor Management → Supplier Agreement Management
Software Quality Assurance → Product & Process Quality Assurance
Software Configuration Management → Configuration Management

Level 2
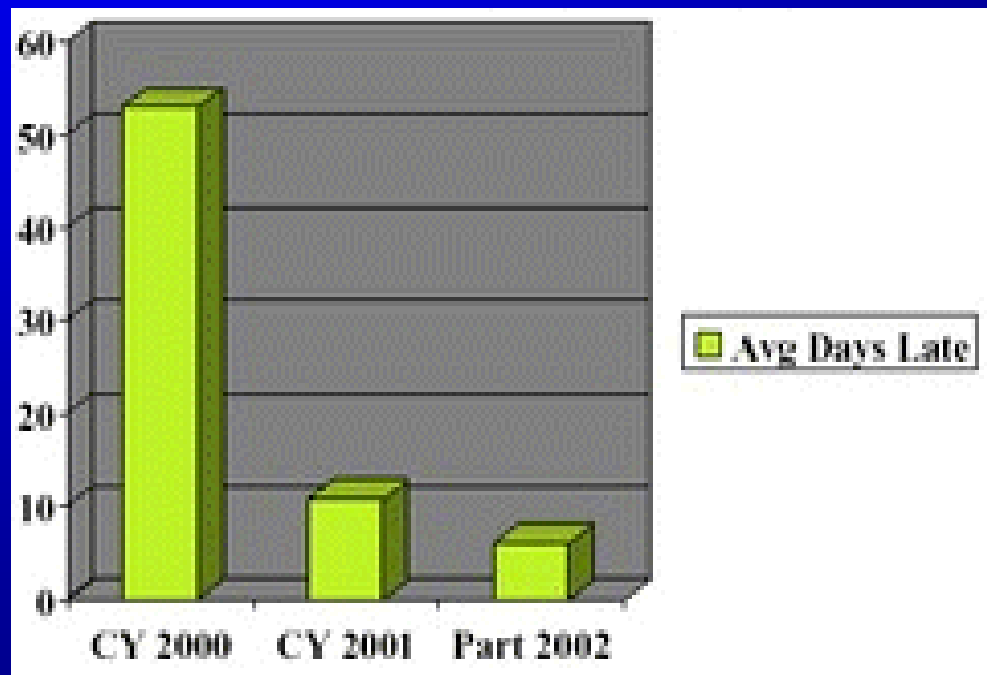*Repeatable*

Measurement and Analysis

Issues Addressed by CMM

➢ Getting management attention

➢ Maintaining long-term improvement focus

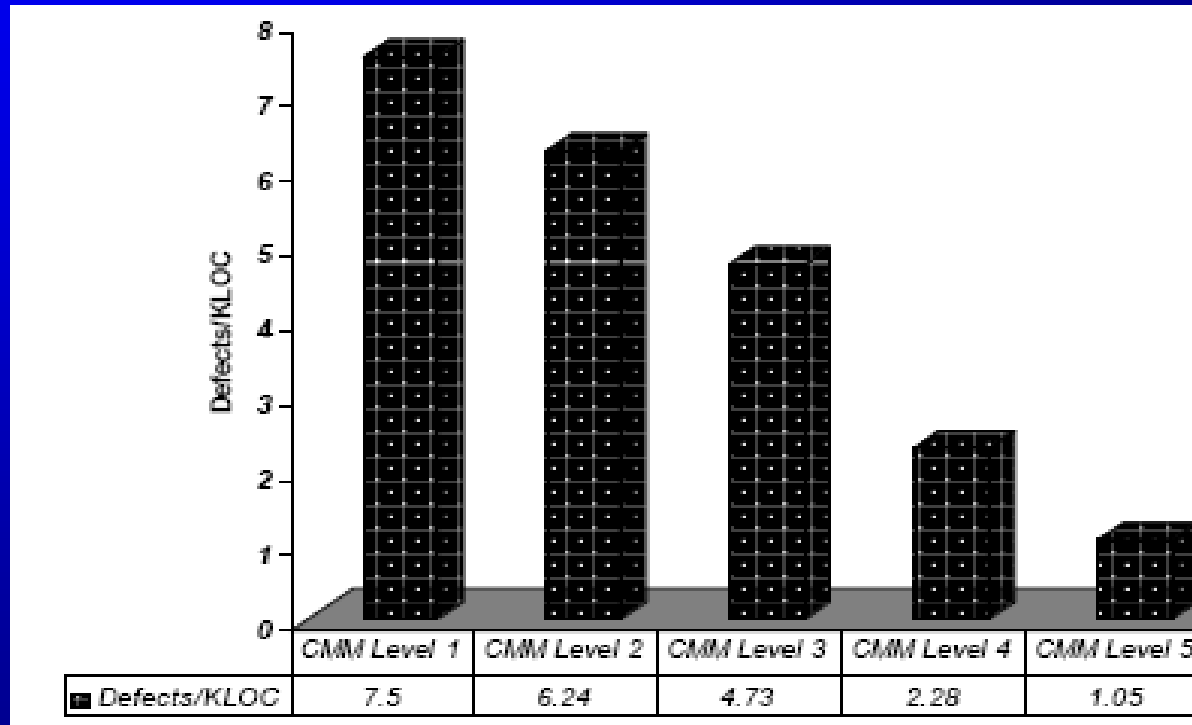➢ Guiding the improvement work

CMM Results – Schedule GM

➢ Average number of days late in meeting milestones declined from over 50 days to fewer than 10 following organization focus on CMMI

General Motors Presentation, SEPG, Boston, MA, 2003

CMM Results – Defects

■ Defects/KLOC	CMM Level 1	CMM Level 2	CMM Level 3	CMM Level 4	CMM Level 5
Defects/KLOC	7.5	6.24	4.73	2.28	1.05

The TSP in Practice, SEI Technical Report, September 2003

CMM Problems

- ➢ No simple model could precisely measure process maturity and complex models are not useful in guiding improvement

- ➢ CMM consciously focused on *what* organization should do, not on *how* they should do it

- ➢ The teamwork practices and personal disciplines required for quality software work are almost entirely issues of *how*, and not just *what*

- ➢ Because engineers will not change the way they work without very specific guidance, the CMM does not change engineering behavior
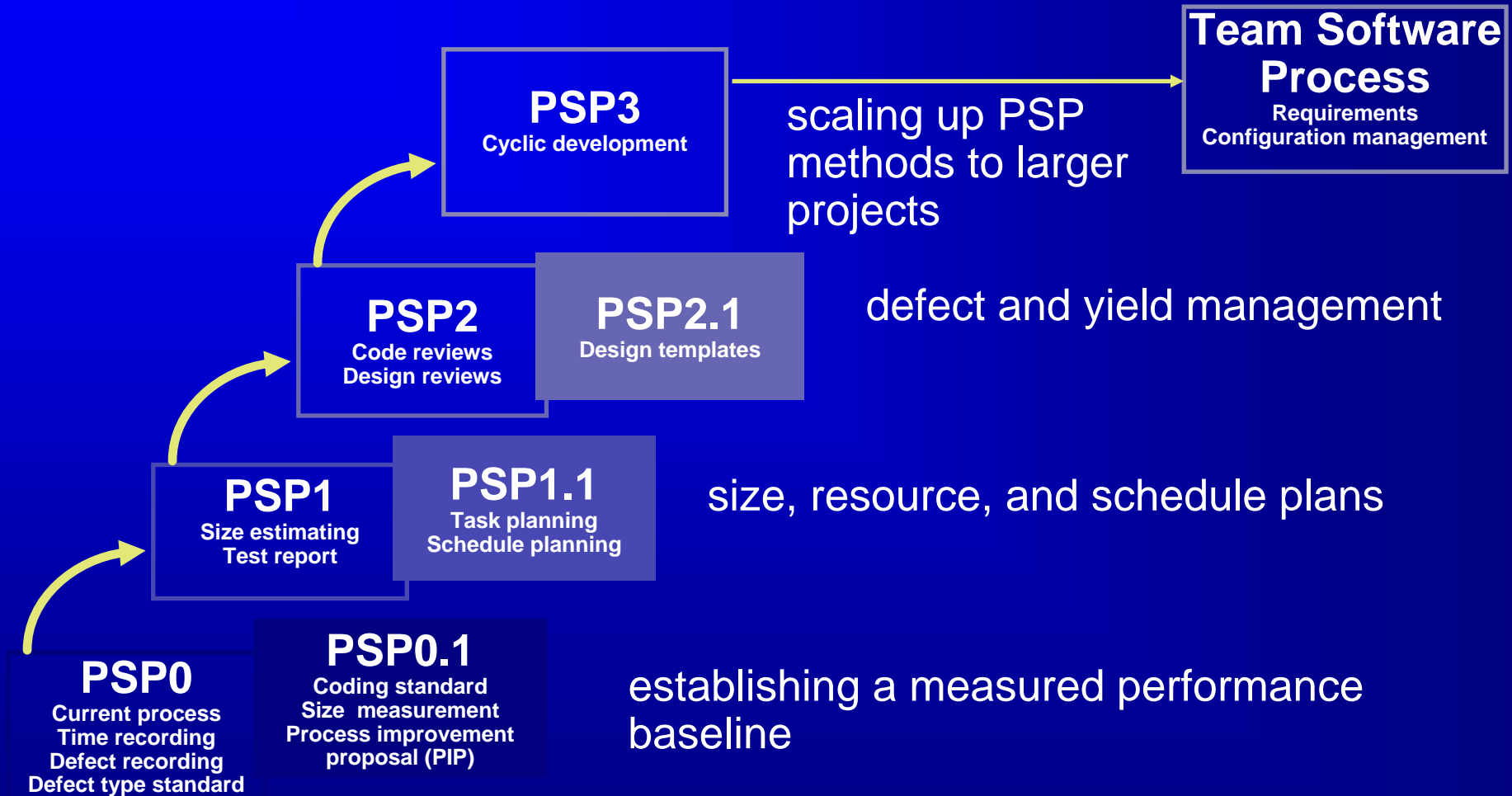
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The Real Need

➢ The need is not for lots of process data but for engineers who gather and use that data

➢ What would happen if software professionals used sound engineering practices?
  - made and followed detailed plans
  - gathered and used historical data
  - measured and managed quality
  - analyzed and improved their processes

➢ The need is for a Level 5 Process at the individual level

Self Improvement
From Project To Project

"You can not stand still, so you should treat every project as a way to build talent rather than merely treating your talent as a way to build projects"

Watts Humphrey

Self Improvement
Personal Software Process - 1

Team Software Process
Requirements
Configuration management

PSP3
Cyclic development

scaling up PSP methods to larger projects

PSP2
Code reviews
Design reviews

PSP2.1
Design templates

defect and yield management

PSP1
Size estimating
Test report

PSP1.1
Task planning
Schedule planning

size, resource, and schedule plans

PSP0
Current process
Time recording
Defect recording
Defect type standard

PSP0.1
Coding standard
Size measurement
Process improvement proposal (PIP)

establishing a measured performance baseline

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Source: Software Engineering Institute

Self Improvement
Personal Software Process -2

➢ At the end of the PSP training, developers know how to:

- ◆ Consistently gather size, time, and defect data
- ◆ Make commitments based on historical data
- ◆ Analyze personal data to answer questions
  - – Where am I spending my time?
  - – What are my common defects?
  - – Where do I inject the defects?
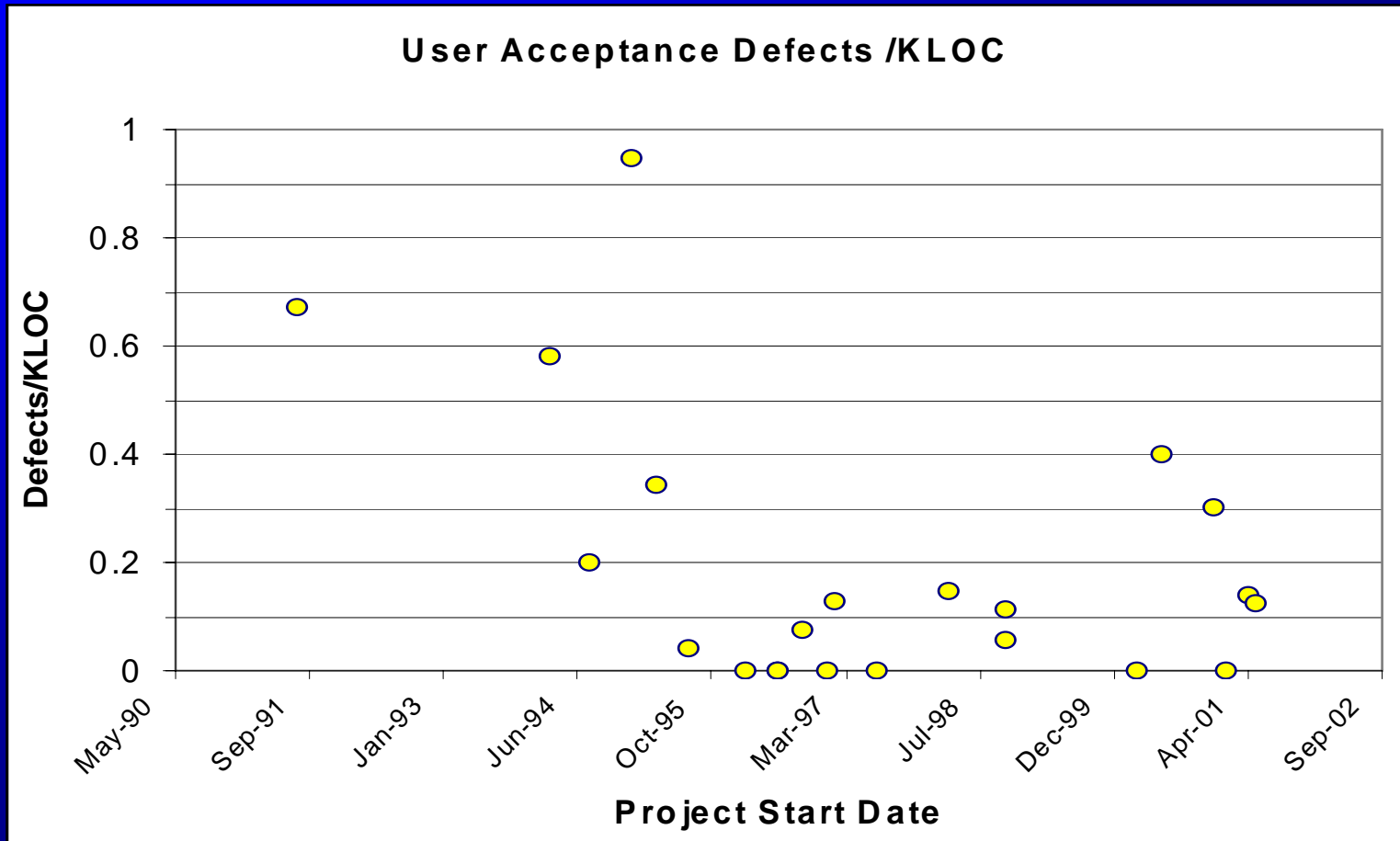 - – What goals do I need to set to improve?

PSP Results – Schedule AIS

Schedule Deviation Individual Value Control Chart - Commercial Systems
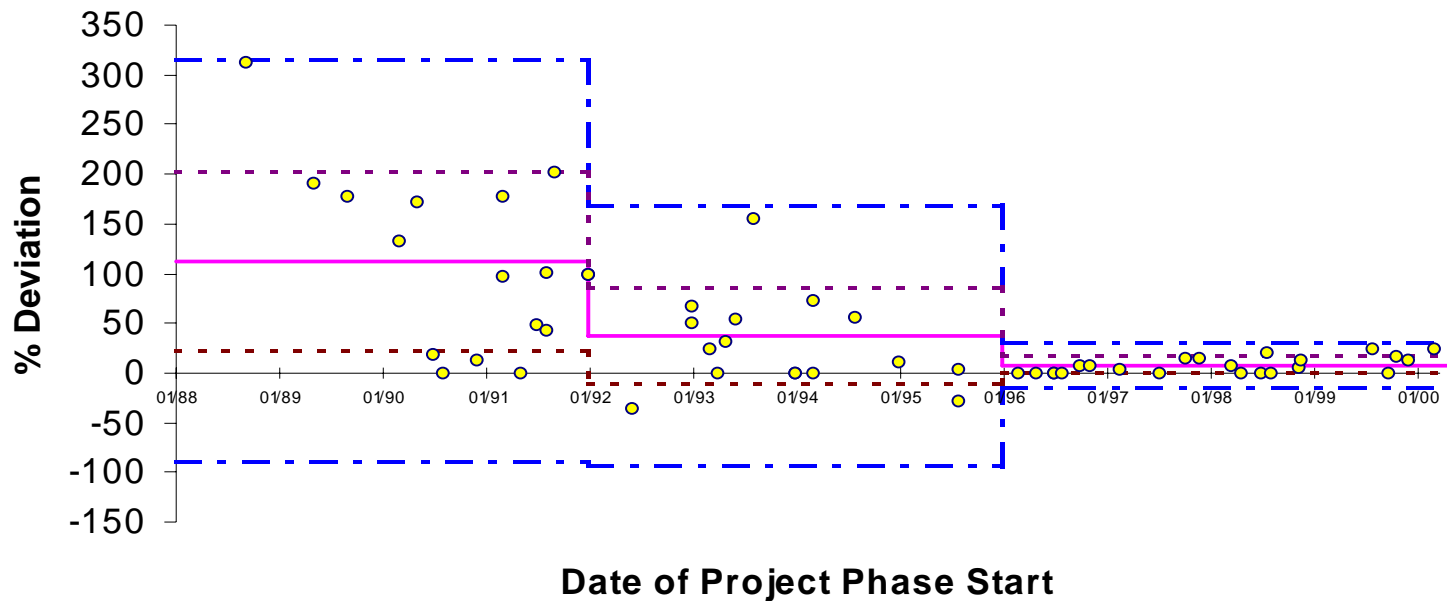
PSP Results – Defects
AIS

User Acceptance Defects /KLOC

PSP Problems

➤ To do quality work, engineers need a detailed plan and a defined process

➤ Without the process, they cannot make detailed plans, take consistent measurements, or track their work against the plan

➤ However, when engineers have a project to deliver, they are rarely willing to take the time to define a complex process, even when they know how

The Real Need

➢ Need a mechanism to guide teams through defining their processes and making complete, precise, and detailed plans

➢ Need a vehicle to help organizations capitalize on the potential benefits of disciplined teamwork

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Team Improvement
Jelled Teams

"The speed with which organizations form and deploy teams is the single most important factor in determining their competitive success"

"Jelled teams are the most powerful tool ever devised for doing challenging work"
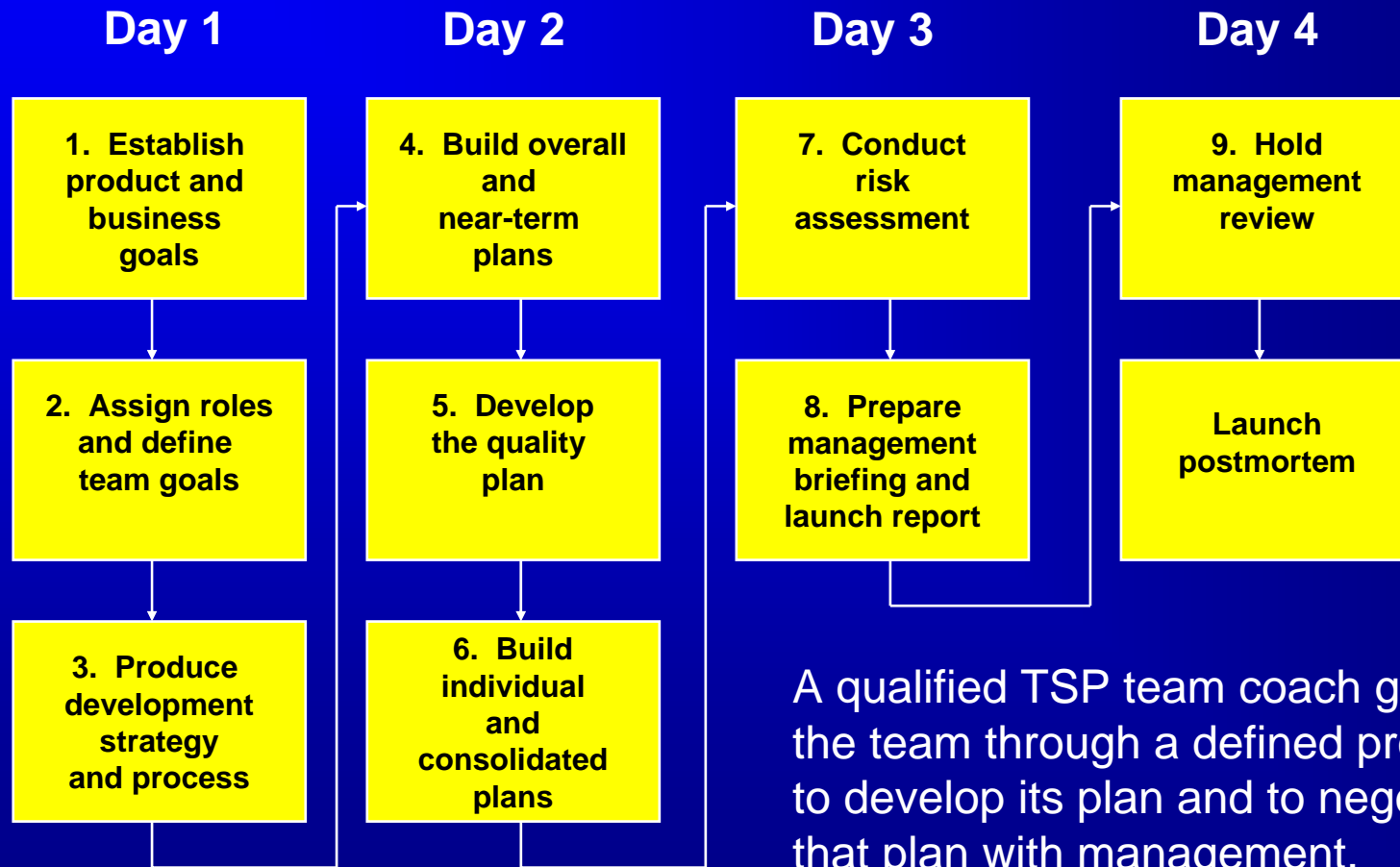
➢

Watts Humphrey

Team Improvement Self-directed Teams

➤ Characteristics of self-directed teams

  – Sense of membership and belonging

  – Commitment to a common team goal

  – Ownership of the process and plan

  – The skill to make a plan, the conviction to defend it, and the discipline to follow it

  – Dedication to excellence

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Building Self-directed Teams
The TSP Launch Process

Day 1

1. Establish product and business goals

2. Assign roles and define team goals

3. Produce development strategy and process

Day 2

4. Build overall and near-term plans

5. Develop the quality plan

6. Build individual and consolidated plans

Day 3

7. Conduct risk assessment

8. Prepare management briefing and launch report

Day 4

9. Hold management review

Launch postmortem

A qualified TSP team coach guides the team through a defined process to develop its plan and to negotiate that plan with management.

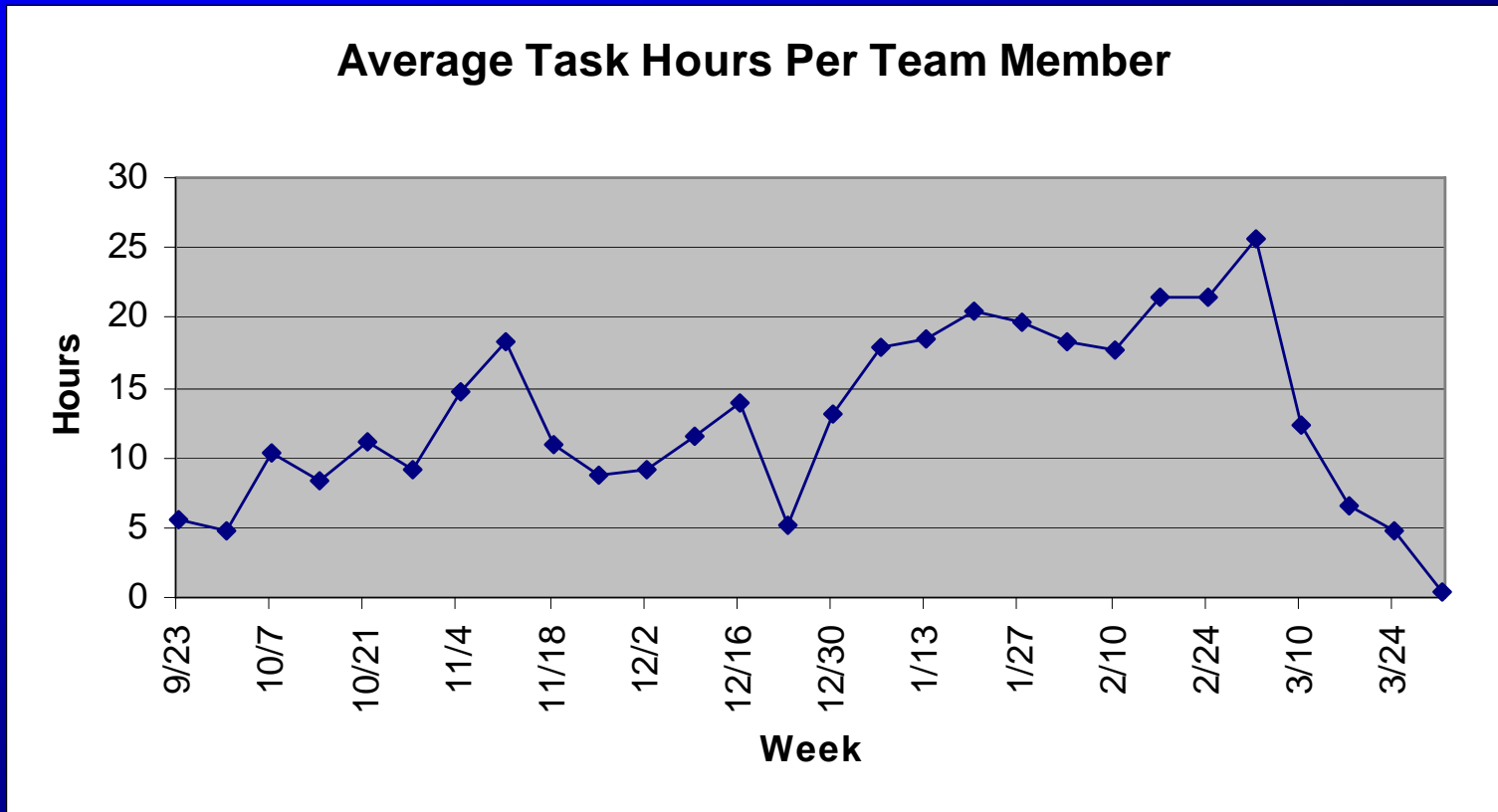## ais

Self-directed Teams
Project Tracking Issues - 1

➢ With PSP training, developers know how to plan, schedule, and track their work

➢ TSP teams use these PSP-learned methods to make detailed plans
- Tasks are no more than 10 task hours each
- Task time is recorded daily
- EV is measured weekly

➢ You can tell project status to within 10 task hours

➢ TSP teams regularly report their status
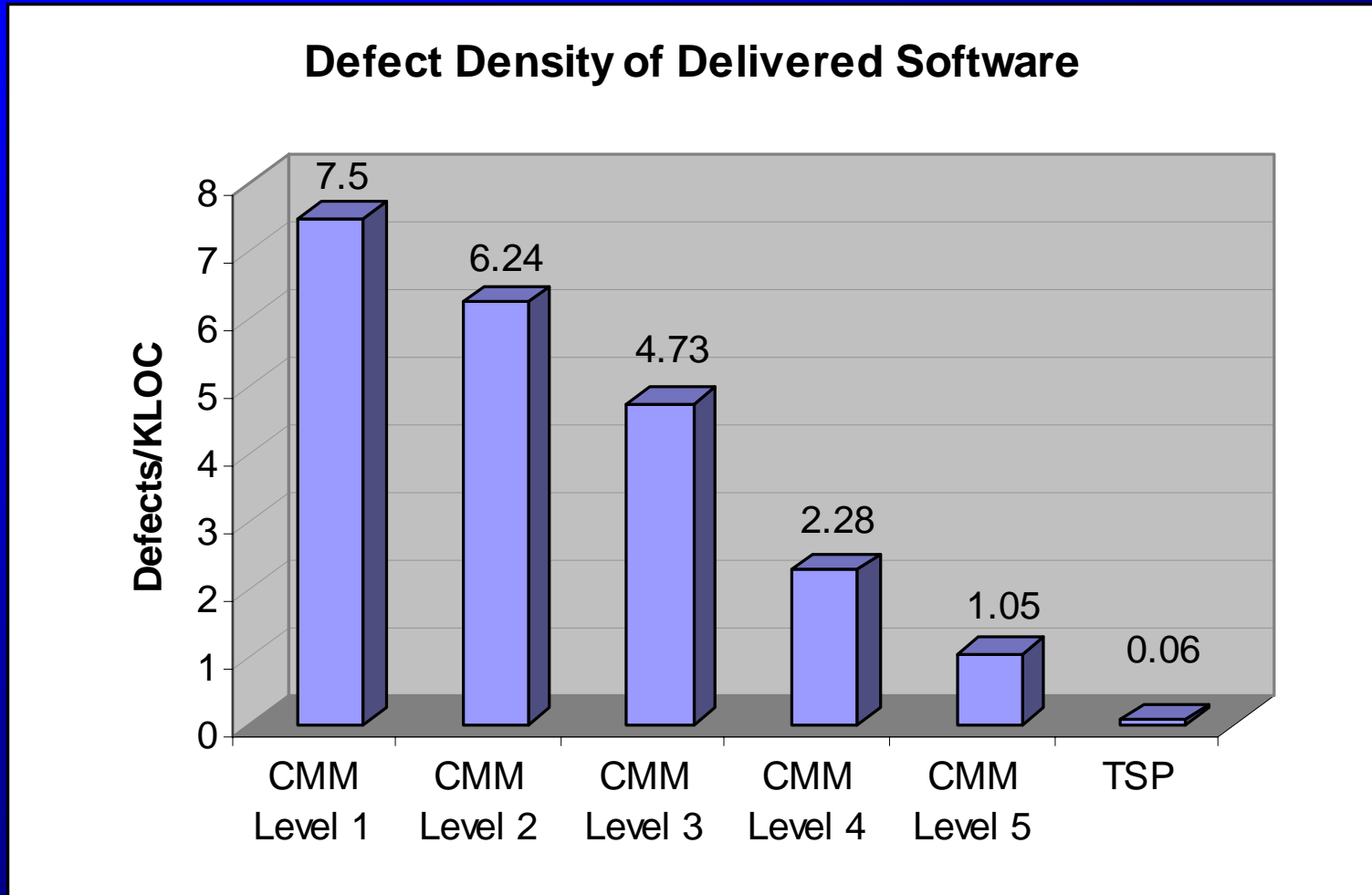
Self-directed Teams Project Tracking Issues - 2

➢ Project schedules slip a day at a time

➢ If you cannot precisely measure project status, you will not know where projects stand

➢ Without such knowledge, you cannot address schedule problems in time to fix them

➢ With the TSP, you can

– closely monitor team performance

– address problems in time

– consistently meet schedules

TSP Results – Task Hours

Source: Allied Signal

TSP Results - Defects

Defect Density of Delivered Software

Defects/KLOC

Category	Value
CMM Level 1	7.5
CMM Level 2	6.24
CMM Level 3	4.73
CMM Level 4	2.28
CMM Level 5	1.05
TSP	0.06

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Transforming the Culture

Level 3 — Organization develops standard processes — *Common culture*

Level 5 — Proactive improvements — *Agile culture*

Level 2 — Project mgrs. establish discipline & stability — *Commitment culture*

Level 4 — Development process managed statistically — *Precision culture*

Level 1 — Ad Hoc processes, inconsistent results — *Hero-driven culture*

Level 5 — Opportunistic improvements — *Empowered culture*

Organization / Project / Individual

Discipline → Trust

Borland

Source: "From MCC to CMM", Dr. Bill Curtis, DC SPIN, April 2006

Process Improvement Principles

➢ It takes time, skill, and money to improve the software process

➢ To improve the software process, someone must work on it

➢ Unplanned process improvement is wishful thinking

➢ Automation of a poorly defined process will produce poorly defined results

➢ **Improvements should be made in small steps**

➢ Train, train, train!

Source: *Managing the Software Process,* Watts Humphrey

Empowered Culture
Process Improvement Proposals (PIPS)

PROCESS IMPROVEMENT PROPOSAL (PIP)

PIP# :
Written By:
Date :   Author(s) :   Project :

Process Name :   Key Process Area :

Improvement Description :
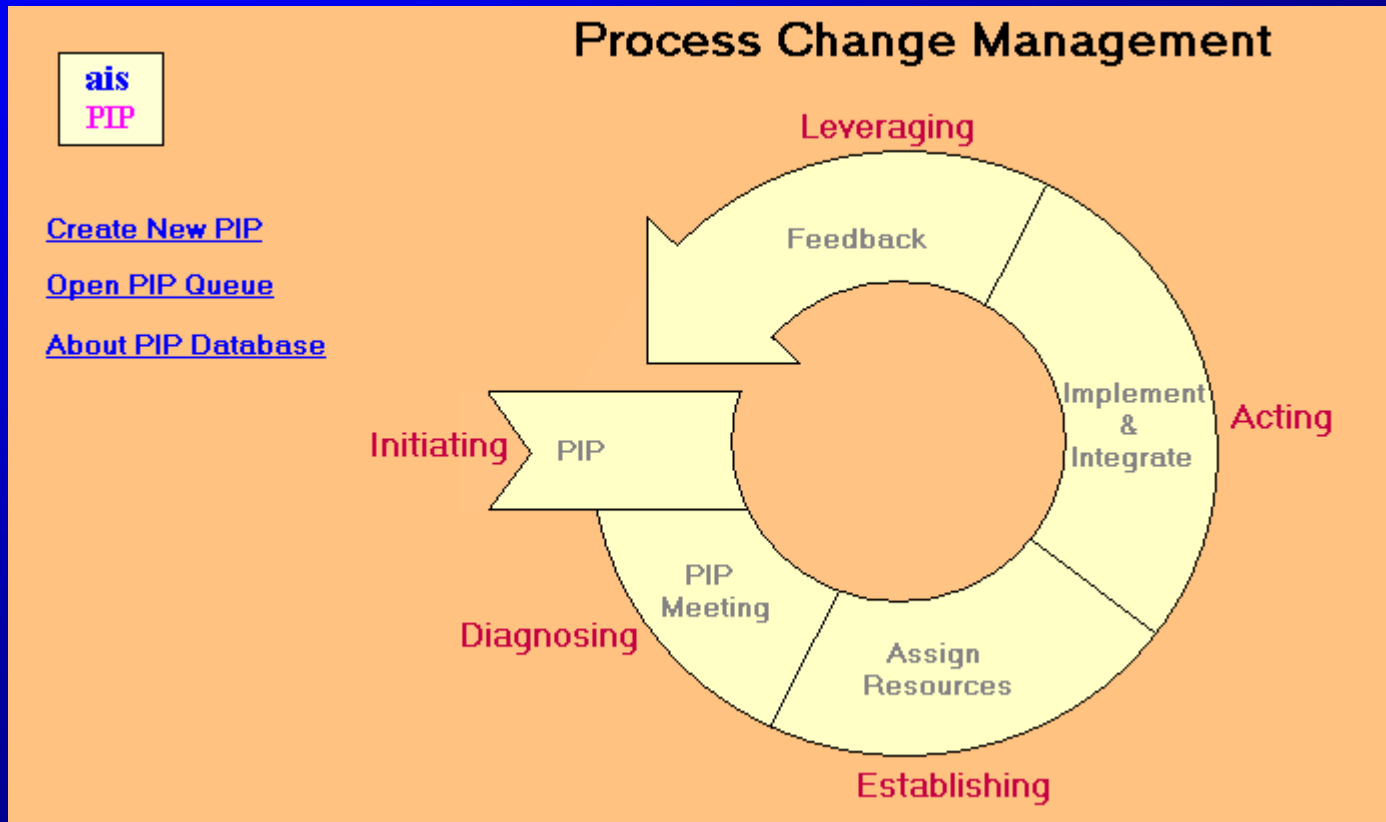
Improvement Benefits (Check One) :

○ Document Improvement   ○ Reduced Cycle Time
○ Improved Quality   ○ Reduced Risk

Benefits Description (Quantify Where Possible) :
(Attach files if needed)

Attach the PIP Pilot Report here (if applicable):

[Submit]

▼ SEPG Evaluation

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The AIS PIP Process

AIS PIPs Summary

Jan 22, 1992 – To date

No. of PIPs submitted   1502

No. of PIPs implemented: 972

No. of PIPs by improvement category:

- Improved quality   232
- Reduced cycle time   86
- Reduced risk   63
- Improved documentation   161
- Not categorized   410

Sample PIPs – Organization Process

➢ Incorporate the TSP into the AIS CPIW as suggested by the attached work products (ProjectCommitmentProcess.zip) which reflect the current practice

➢ Change Launch meeting 9A so that review is held, not only by management, but also peer Project Managers. Accordingly, these same individuals may need to be present in meeting 1B

Sample PIPs – Team Process

➢ For UI component enhancements, change process to do Design Inspection, Test Case Inspections and Code Inspections <u>after</u> Compile

➢ For components where performance requirement is critical, execute two rounds of unit test

  – Unit test of performance test cases <u>before</u> code inspection

  – Unit test of features <u>after</u> code inspection

Sample PIPs – Personal Process

➢ Reduce phase distribution % for Design Review for UI Components

➢ Update Personal Review Checklist

➢ Batch process E Mail three times a day

➢ Move end of day post mortem to start of day to process and analyze previous day's data

Lessons Learned - 1

➢ While models are useful to indicate where improvements are needed, only committed people can make the improvements

➢ A supportive management environment that rewards disciplined behavior is absolutely essential

➢ Timely feedback on the status and disposition of the PIPs is important to sustain the PIP mechanism and feeling of empowerment

➢ Do not need to wait till level 5 to start implementing process change management

Lessons Learned - 2

➤ While CMM is necessary as an organizational capability improvement model, it is not sufficient to change engineering behavior; the PSP provides the detailed "how to" for improvement at the individual level

➤ The TSP provides the management framework for continuously improving self directed teams. The PIP mechanism is key for team ownership of the project's process and commitment to improve

➤ CMM, TSP, and PSP all three are needed for an integrated approach to model based improvement at the organization, team, and individual levels without the risk of sub-optimization

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- ◆ CMMI$^{®}$
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