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Lessons Learned in Seamless Integration of CMMI, TSP, and PSP

Why All Three Are Needed

CMMI Technology Conference

November 14, 2007

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

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Topics

- Issues
  - Quality and Schedule
  - Rational Management and Commitment
  - Insanity and Malpractice
- Three Improvement Perspectives
  - Organization - CMM/CMMI
  - Individual ï PSP
  - Team ï TSP
- Lessons Learned

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Is More Important Than Schedule

ñIn todayôs 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.ò

Watts Humphrey

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Rational Management - Developers

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

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

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Rational Management - Managers

- When pressed for early deliveries, the responsible managers say

  ñI 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 meetò

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Rational Management - Principles

- Set challenging goals
- Get the facts
- Use facts and data
- Anticipate and address problems

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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

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ization 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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ring SW-CMM to CMMI

	l 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
Level 3 *Defined*	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
		Decision Analysis and Resolution
Level 2 *Repeatable*	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
		Measurement and Analysis

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Issues Addressed by CMM

- Getting management attention
- Maintaining long-term improvement focus
- Guiding the improvement work

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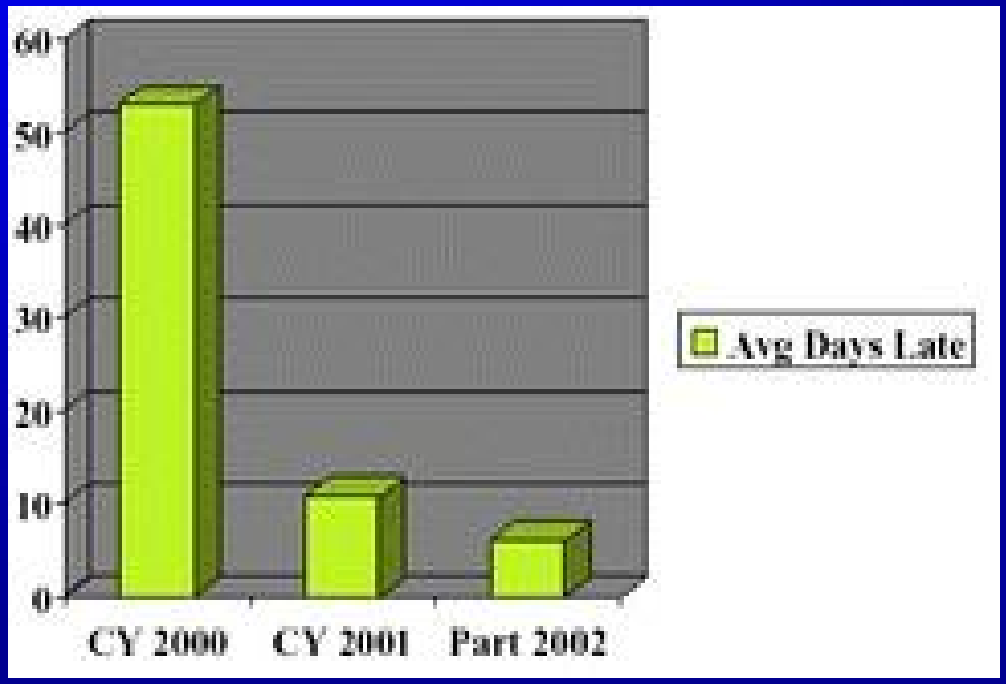
M Results ï Schedule GM

- 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

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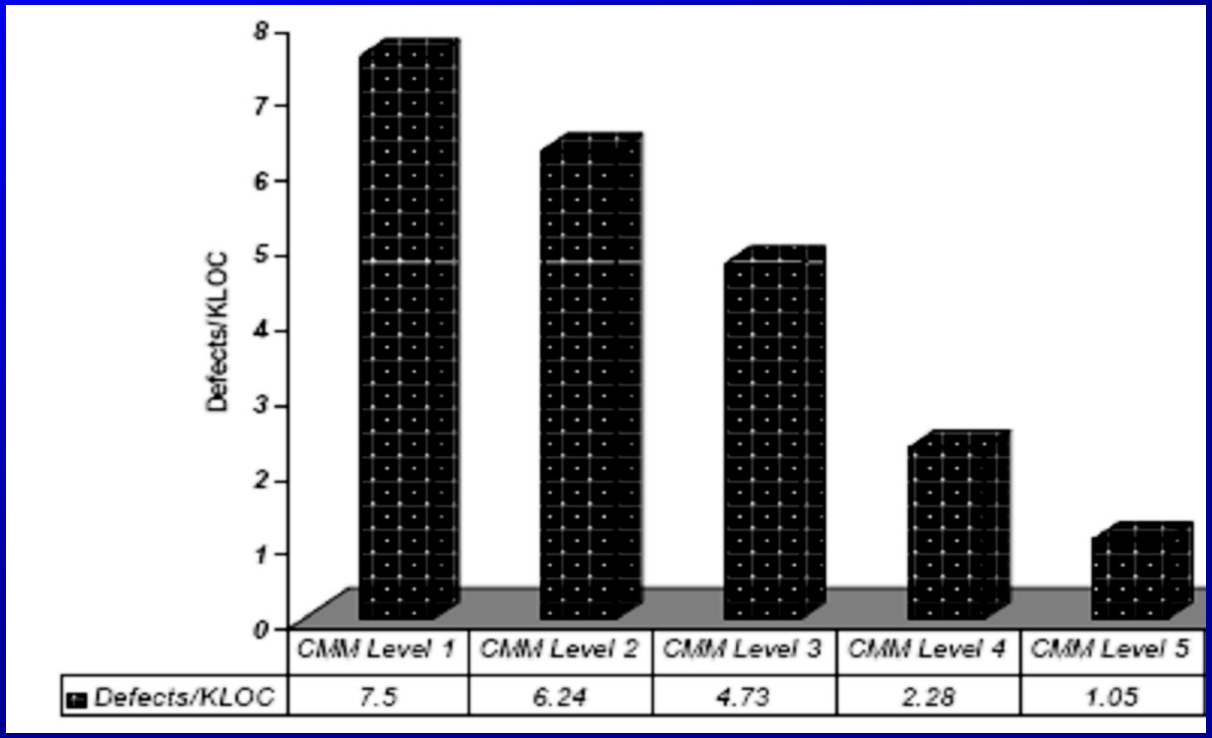
CMM Results ï Defects



The TSP in Practice, SEI Technical Report, September 2003

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Time to Advance from ML1 to ML5

Source: Software Engineering Institute

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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

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elf Improvement From Project To Project

ñYou 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 projectsò

Watts Humphrey

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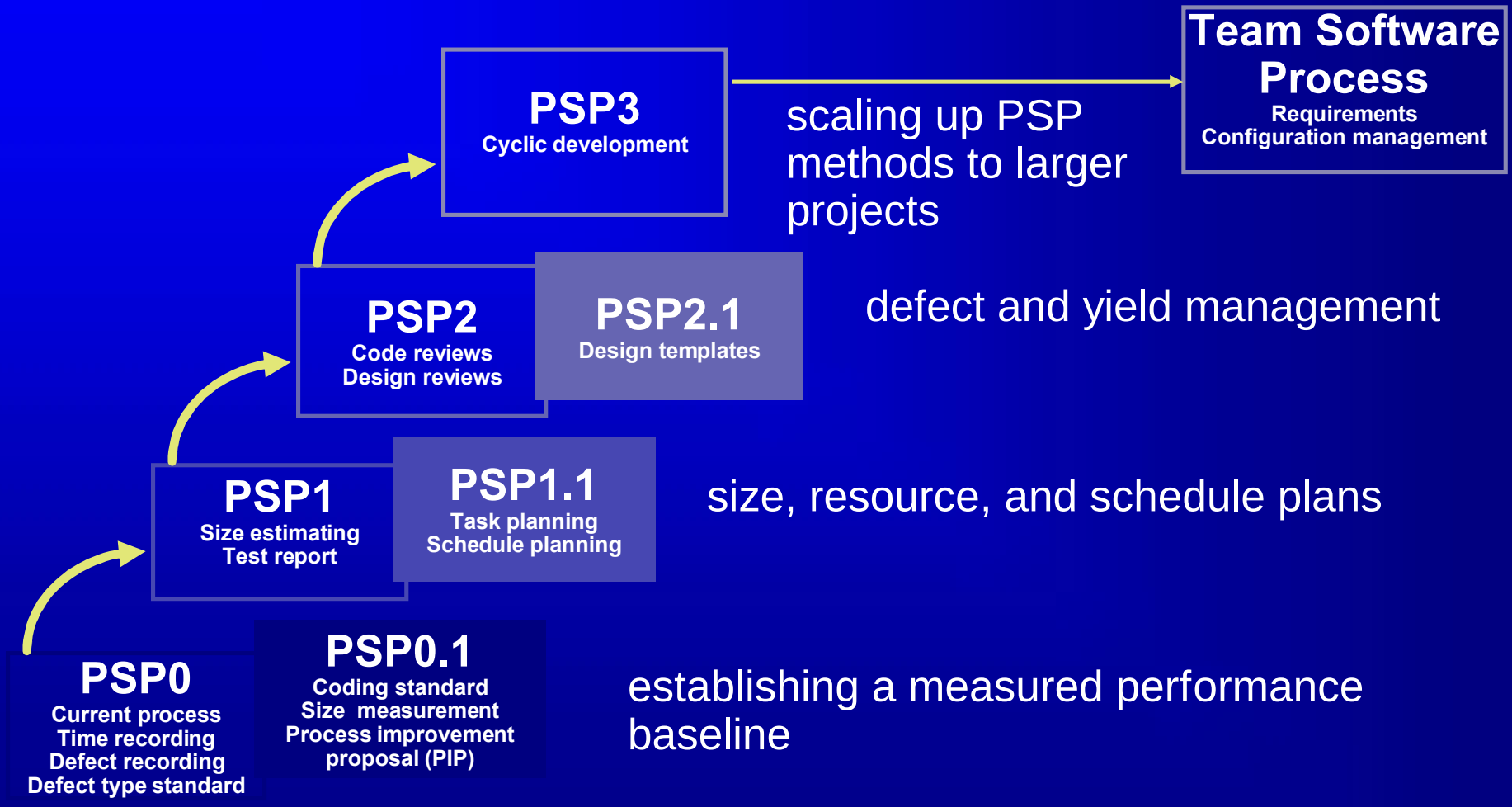
elf Improvement
Personal Software Process - 1



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Source: Software Engineering Institute

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elf 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
    - ï Where am I spending my time?
    - ï What are my common defects?
    - ï Where do I inject the defects?
    - ï What goals do I need to set to improve?

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Results ï Schedule

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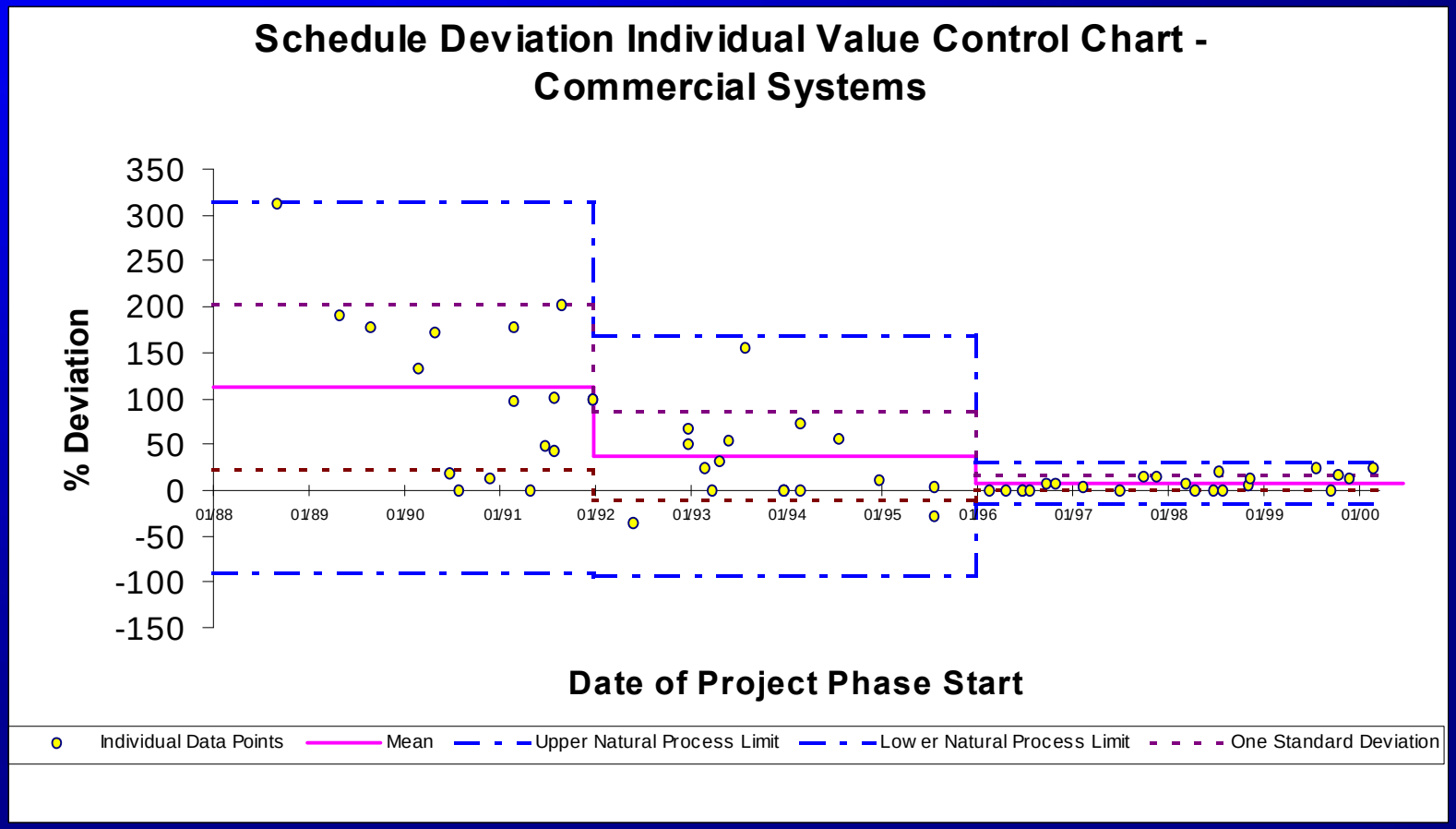

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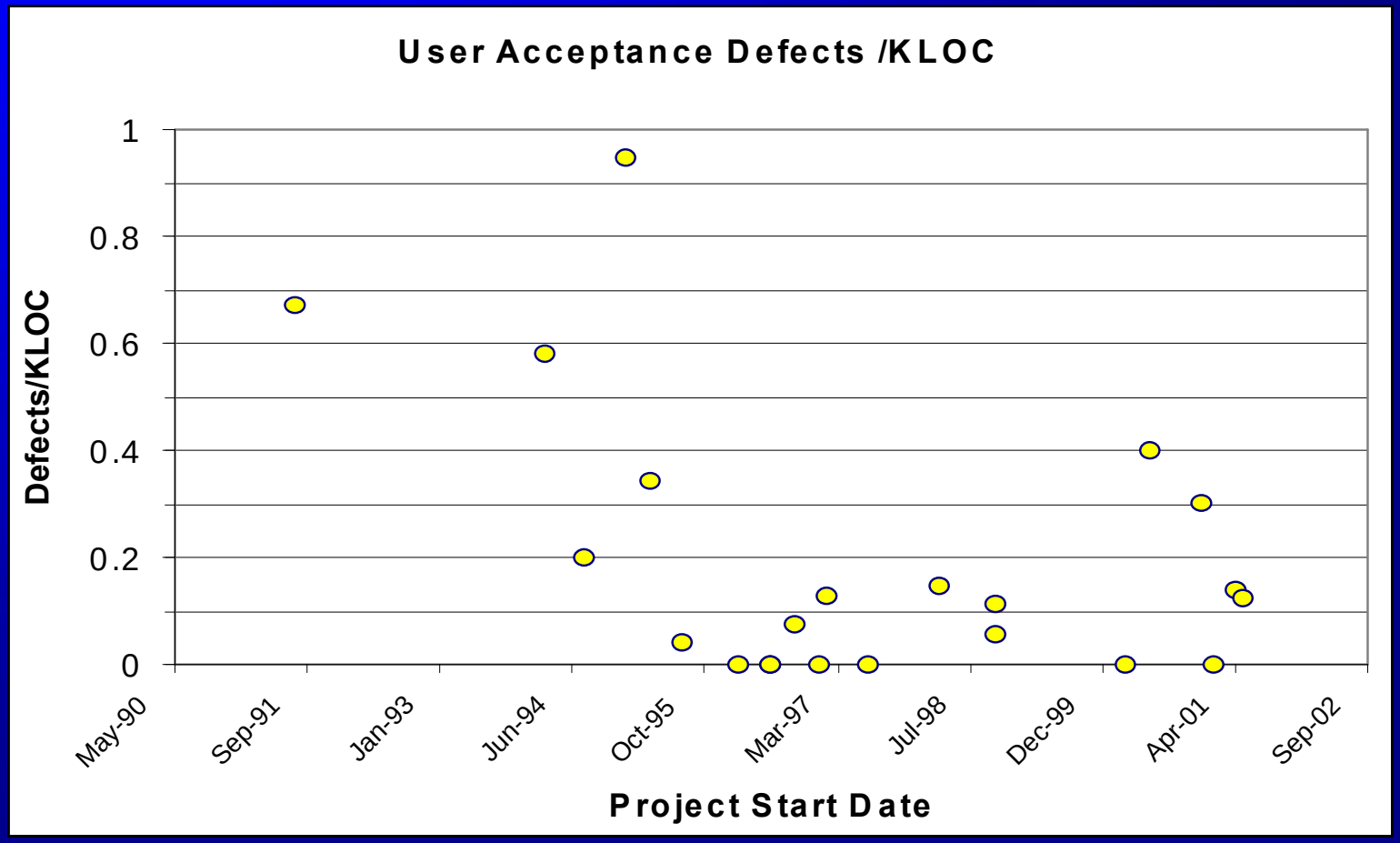
P Results ï Defects AIS



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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

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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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am Improvement
Jelled Teams

ñThe speed with which organizations form and deploy teams is the single most important factor in determining their competitive successò

ñJelled teams are the most powerful tool ever devised for doing challenging workò

Watts Humphrey

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eam Improvement
Self-directed Teams

- Characteristics of self-directed teams
  - ï Sense of membership and belonging
  - ï Commitment to a common team goal
  - ï Ownership of the process and plan
  - ï The skill to make a plan, the conviction to defend it, and the discipline to follow it
  - ï Dedication to excellence

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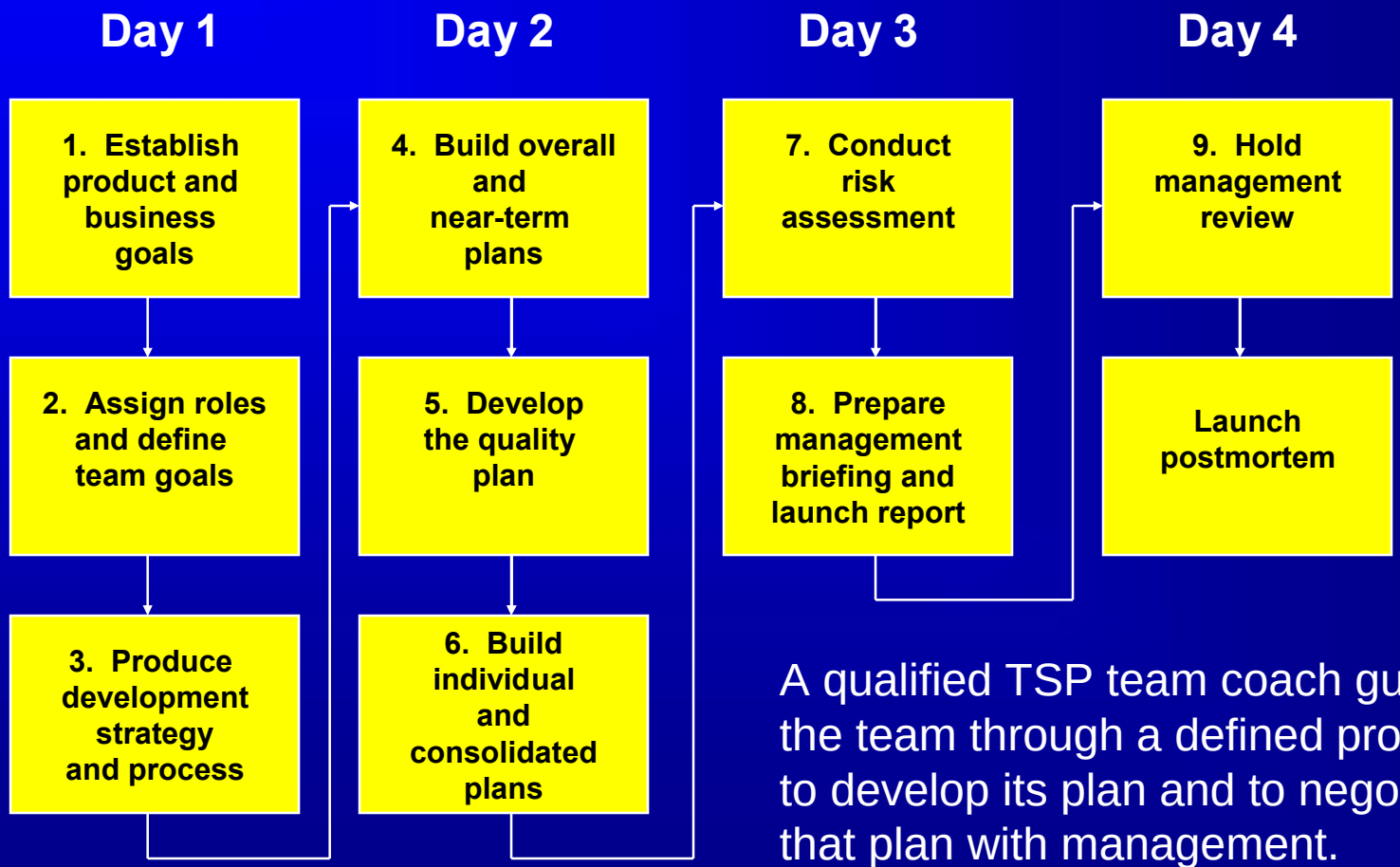
ng Self-directed Teams
The TSP Launch Process



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

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elf-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

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lf-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
  - ï closely monitor team performance
  - ï address problems in time
  - ï consistently meet schedules

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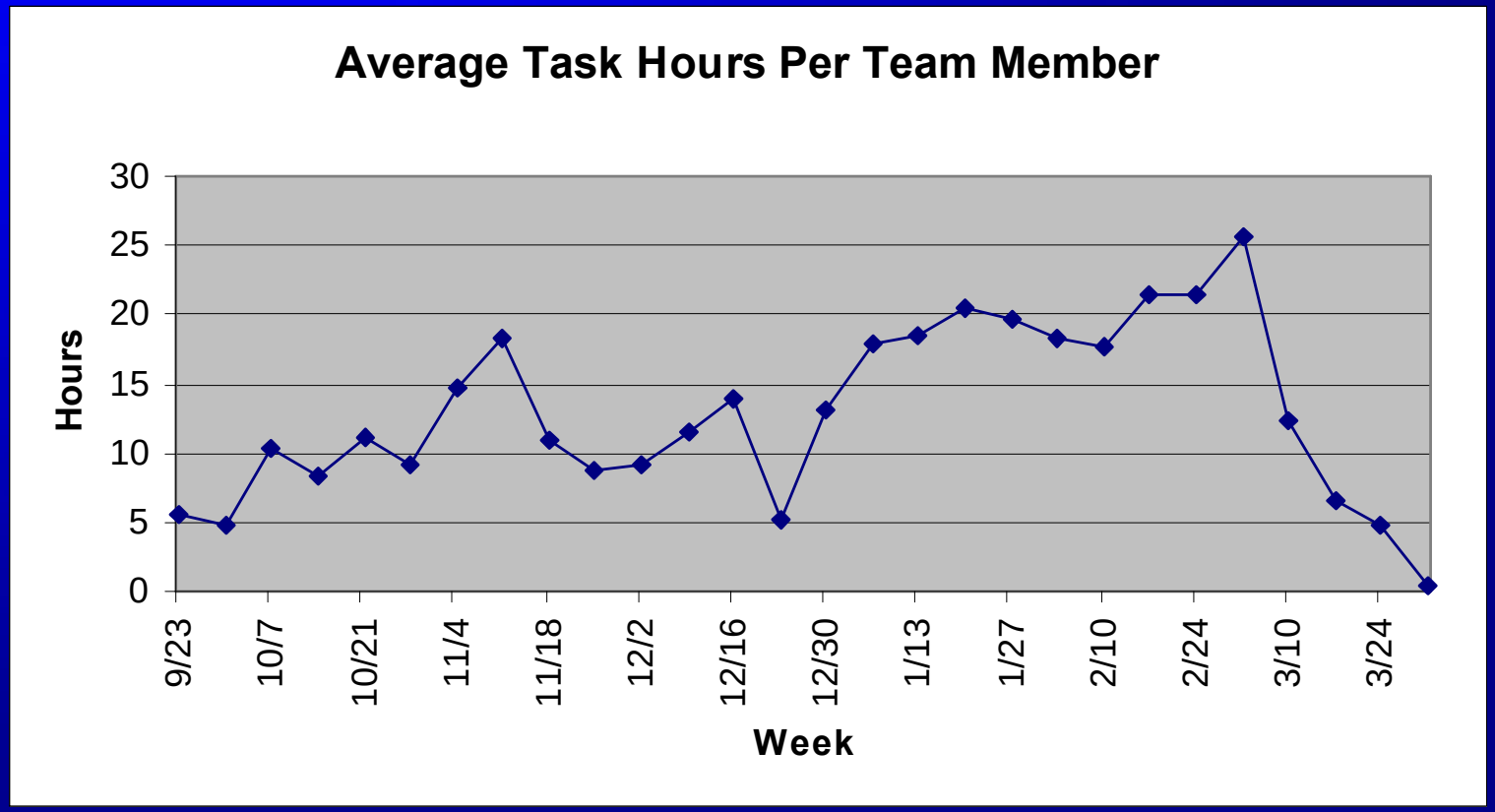
TSP Results ï Task Hours



Source: Allied Signal

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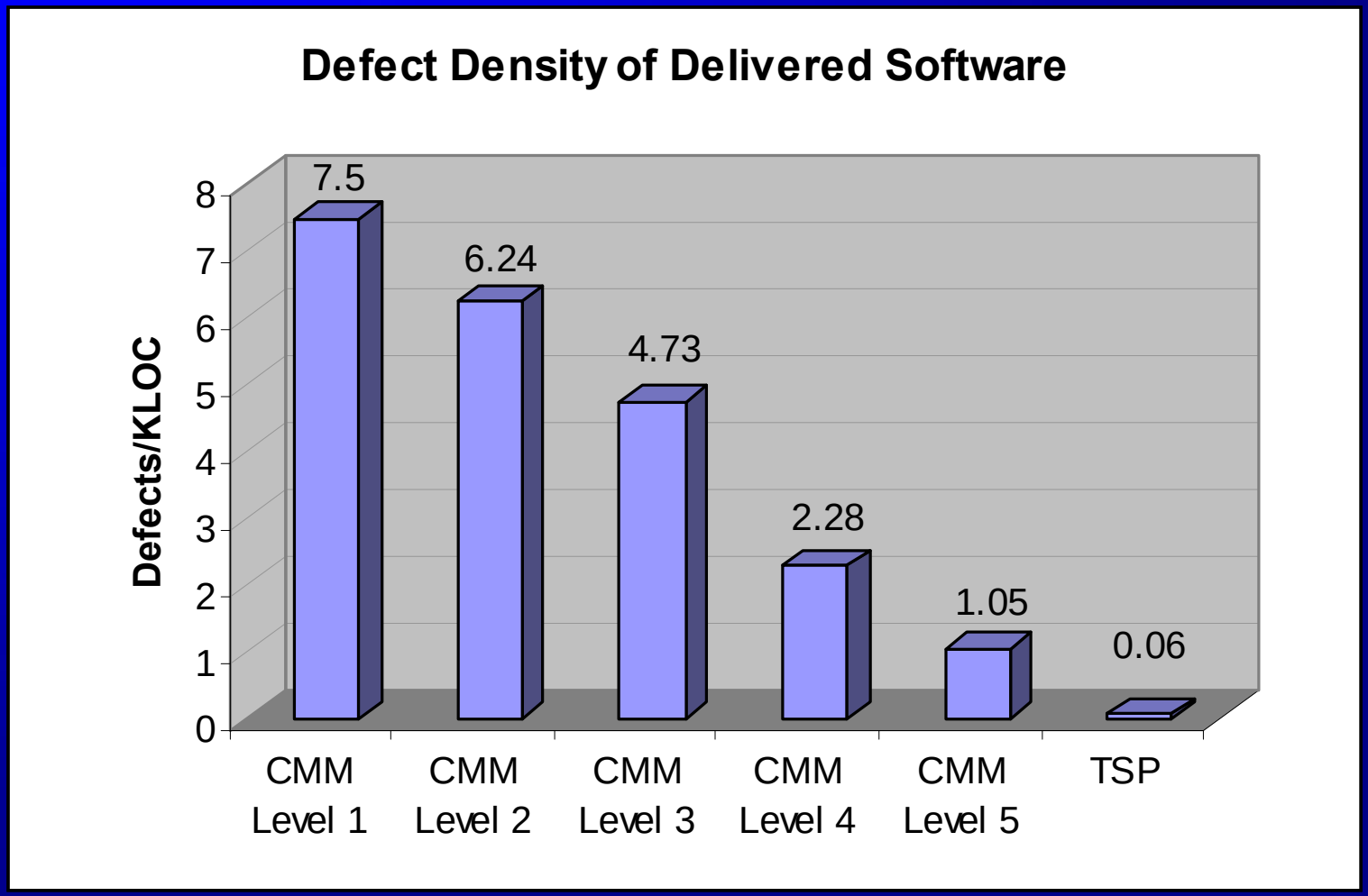
TSP Results - Defects



Ref: SEI Technical Report 2003-014

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TSP Results - NAVAIR

Table 1: P-3C Process Improvement Results

	Before Process Improvement	Early Stages of Process Improvement	Process Improvement and the PSP/TSP	Percentage Change
Source Lines of Code (SLOC)	27,880	32,780	36,690	n/a
Productivity (SLOC/hr)	2.7	2.7	4.9	+ 81%
Development de-fects	n/a	n/a	105	n/a
Test defects	128	69	12[1]	-91%
Defects per KSLOC	4.6	2.1	1[2]	-78%
Plan Release Date	none[2]	12/4/2001	1/26/2004	
Actual Release Date		5/29/2001	2/5/2004	

Source: SEI Technical Report Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI

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NAVAIR Timeline to Advance to ML4

March 2000	began CMM-based improvement effort
October 2000	began PSP/TSP introduction
January 2001	launched first TSP team
May 2001	reached Maturity Level 2
June 2002	launched second TSP team
September 2002	reached Maturity Level 4 (SW-CMM)

Source: SEI Technical Report Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI

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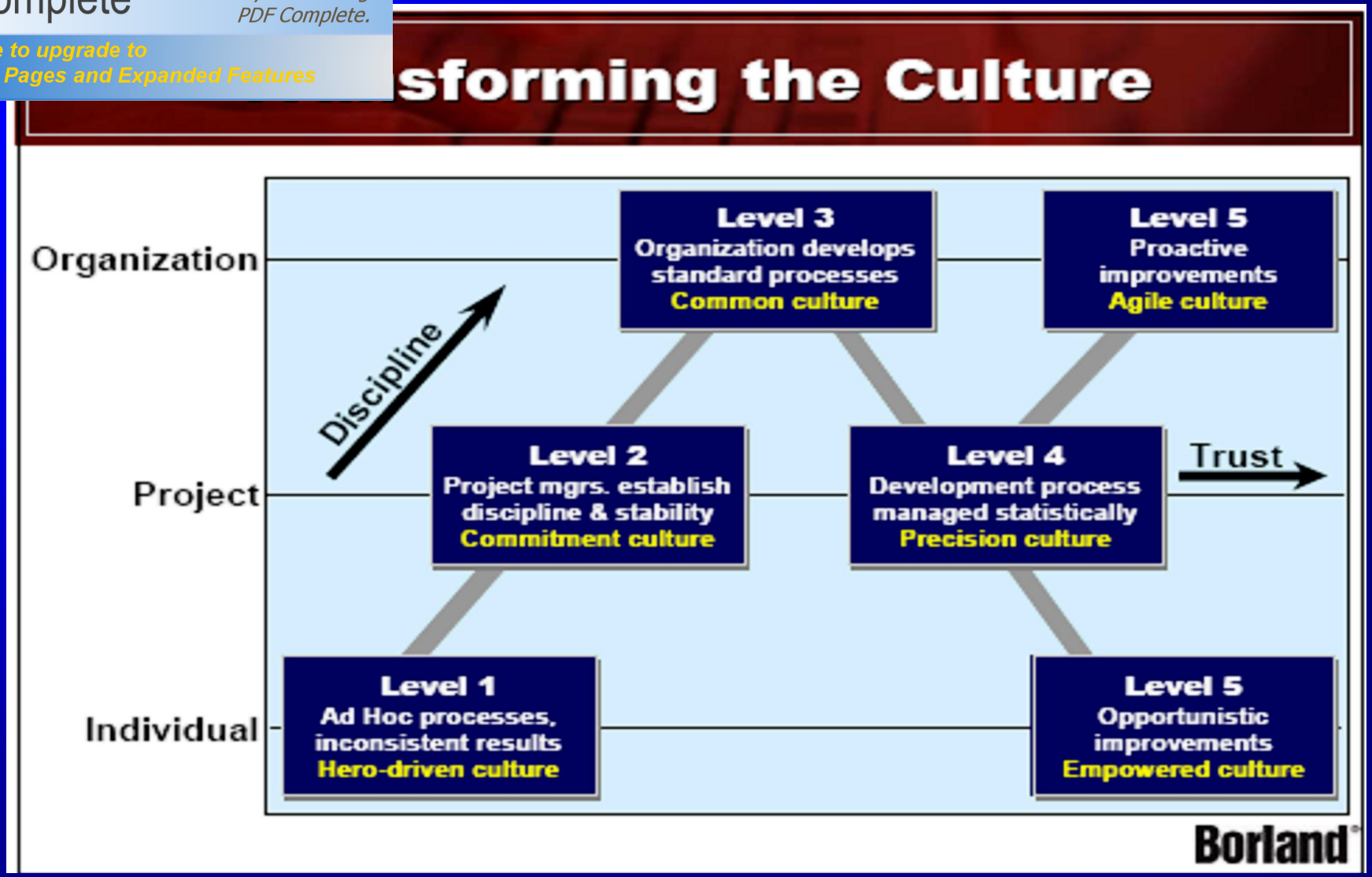
sforming the Culture



Source: ñFrom MCC to CMMò, Dr. Bill Curtis, DC SPIN, April 2006

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mpowered 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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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

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ssons 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 ñhow toò 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 projectôs 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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stems Engineering Conference October 22-25

- Study of 3700 findings from assessments ï More than half negative
- High capability and maturity do not guarantee program success
- Programs fail because ñwe donôt start them right, we donôt manage them rightò
- Developers often at lower maturity level than organization

CMM, TSP, PSP ï Why we need all three

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