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The Case for Using TSP^{SM} With CMM$^{®}$/CMMI^{SM}

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Report Documentation Page

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Acronyms Used

CMM	Software Capability Maturity Model v.1.1
CMMI	CMMI-SE/SW/IPPD v.1.1
EPG	Engineering Process Group
GP	Generic Practice
KPA	Key Process Area
ML	Maturity Level
PA	Process Area
PSP	Personal Software Process
SP	Specific Practice
SSM	Software Subcontract Management
TP	Training Program
TR	Technical Report
TSP	Team Software Process (and sometimes its co-requisite PSP)

Target Audience

- Your organization uses CMM as a process standard, and will be moving soon (or is already moving) to CMMI.

- Your organization is just starting out in model-based improvement, and has chosen CMMI as the reference model.

- Your organization uses CMM and has no current plans to upgrade to CMMI, but you expect that you will have to do so eventually.

- Your organization uses TSP and is investigating model-based improvement.

Topics

➡ Logic for TSP, CMM, and CMMI

CMMI: An Upgrade for CMM

TSP for CMM Implementation

TSP for CMMI Implementation

Getting Started

The Logical Argument

Major premise: CMMI is a model upgrade from the CMM.

Minor premise: TSP provides an efficient, effective vehicle for implementing CMM-based improvement.

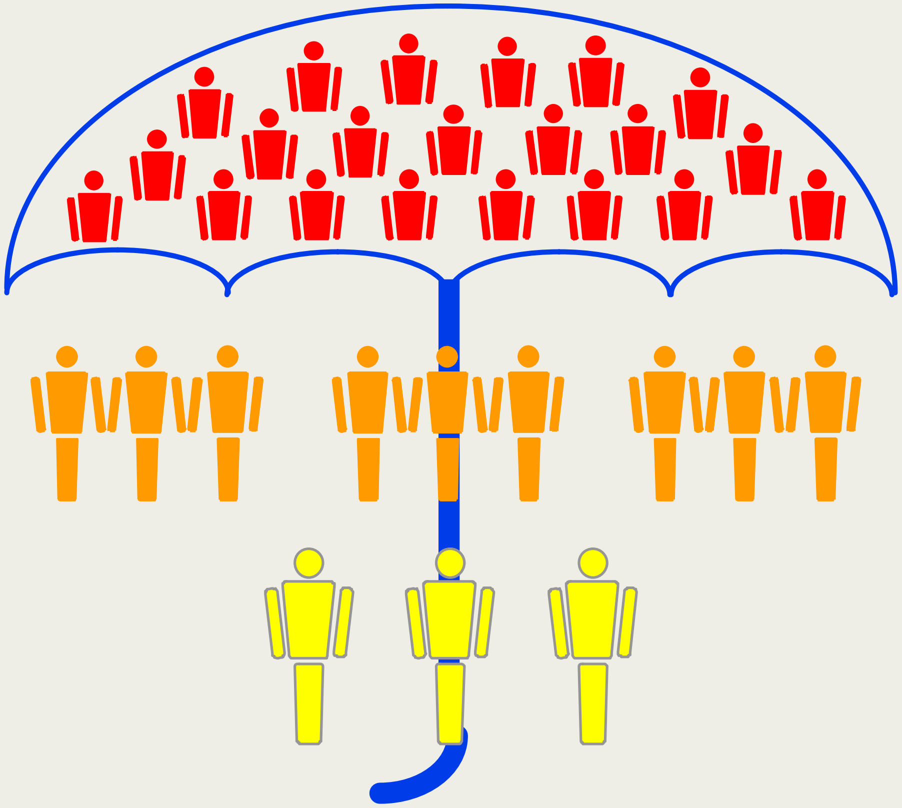
Conclusion: TSP provides an efficient, effective vehicle for implementing CMMI-based improvement.

Vertically Aligned Capabilities

CMM/CMMI - *for organizational capability*

TSP - *for quality products on cost and schedule*

PSP - *for individual skill and discipline*



Topics

Logic for TSP, CMM, and CMMI

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Getting Started

Fundamental Goals of CMM/CMMI

The original CMM goals have not changed with the CMMI.

- quality products
- on committed schedules
- for the lowest possible costs

CMMI recognizes that these goals apply to the entire engineering life cycle, not just the software development life cycle.

PSP and TSP were designed to support CMM/CMMI goals at the individual and project team levels, respectively.

Generic Goals and Practices

A major feature of the CMMI is the introduction of uniform generic goals and practices across all process areas.

This represents a significant improvement upon the Institutionalization Features of the CMM.

- consistency across the PAs
- explicit application of other PA disciplines (planning, tracking, measurement, process definition, configuration management, quality assurance)
- explicit improvement path for any particular process

PSP-trained engineers on TSP teams already perform many if not most of the CMMI generic practices.

Measurement and Analysis

Why does the average organization going from level 3 to level 4 take 28 months* to get there?

The addition of the Measurement and Analysis PA at level 2 corrects a common flaw in CMM-based improvement, namely, the deferral of measurement issues until higher maturity goals come into sight.

With CMMI, information needs and measurement objectives become fundamental to improvement efforts ***as originally intended***.

Measurement and analysis activities are fundamental to the PSP and the TSP.

*** Process Maturity Profile of the Software Community, August 2002 (www.sei.cmu.edu/sema/pdf/2002aug.pdf)**

Two Representations

The process categories of the CMMI continuous representation provide a better handle on

- understanding the model and its interrelationships
- solving implementation issues in an efficient way

The staged representation will likely continue to be crucial in

- obtaining management sponsorship and support
- establishing improvement priorities
- setting and communicating goals across an organization

Internal and External Forces

CMMI exists in part because of a need to make sense of the plethora of maturity models developed during the 1990s.

U.S. Department of Defense input and funding has driven the development of the integrated models and associated assets.

CMM sunset begins in December 2003, ends in December 2005.

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Getting Started

CMM-TSP Gap Analysis

The TSP initiative team at the SEI published results in a June 2002 Technical Report* (TR-008) of an analysis of TSP practices relative to SW-CMM v.1.1.

TR-008 assumed that

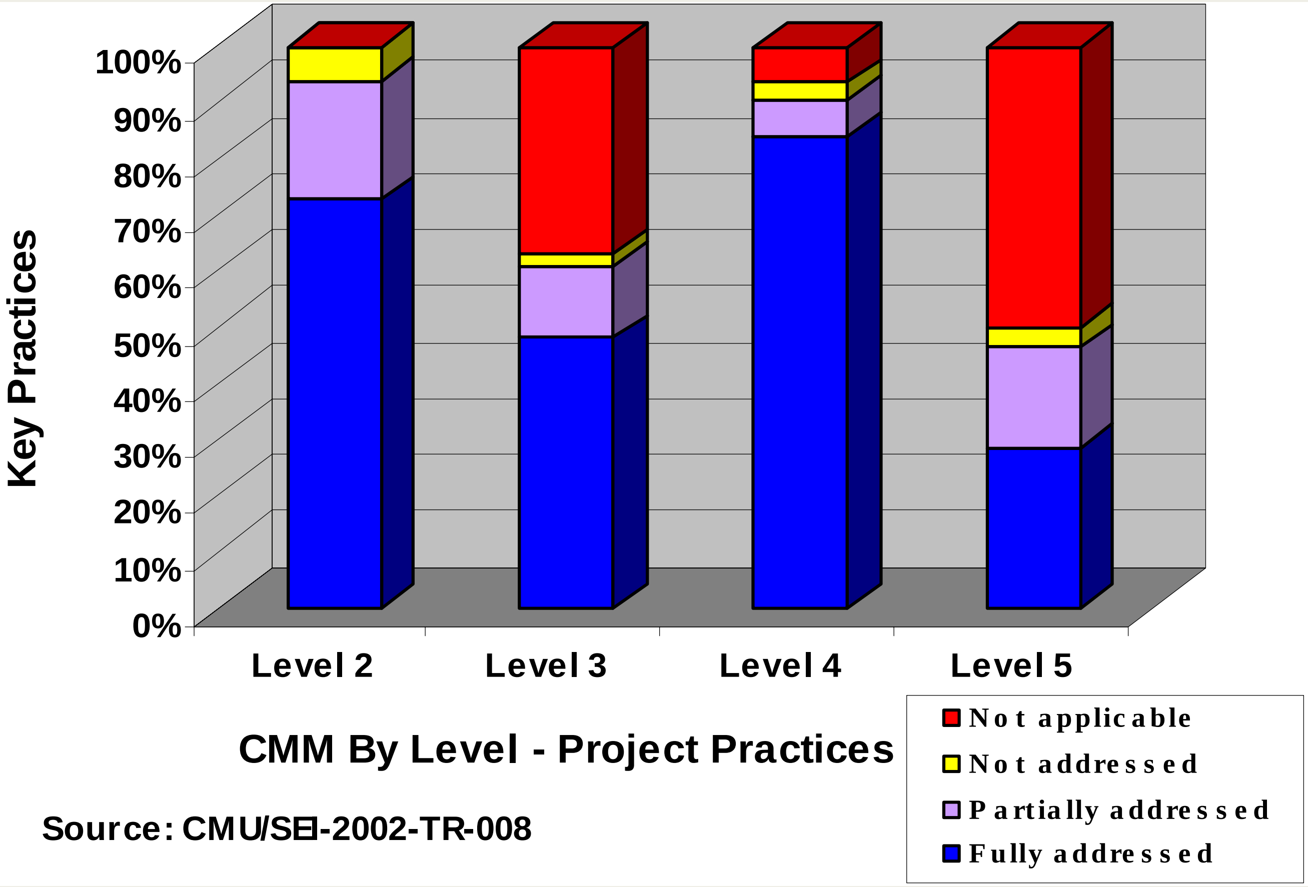
- an organization uses the SEI-recommended TSP introduction strategy
- all development teams in an organization were using TSP

Early TR-008 drafts were used by the EPG at two government organizations to help guide their work.

TR-008 will soon be reissued with remarks by Watts Humphrey on using the TSP as part of a CMM-based improvement effort.

*** CMU/SEI-2002-TR-008, Relating the TSP to the CMM for Software, Noopur Davis and Jim McHale, June 2002.**

CMM-TSP Gap Analysis Results



CMM By Level - Project Practices

Source: CMU/SEI-2002-TR-008

Naval Oceanographic Office

1993 SEI conducted Software Risk Evaluation; risk areas mapped to CMM level 2 KPAs (strength in SCM); “traditional” CMM-based improvement with help from SEI and STSC

- Began PSP/TSP introduction by faculty from Embry-Riddle Aeronautical University
- PSP training for developers started

1999 PSP instructors authorized; TSP pilot launched

99-02 CMM Snapshot Assessments and a Process Desk Audit showed progression from ML1 to ML2 to ML3

5/01 “Standdown” to rewrite OSSP to integrate TSP

2001 Began using early draft of TR-008 to help guide improvement efforts

9/02 CBA-IPI: CMM level 3!

NAVAIR AV-8B

March 2000	Began current CMM-based improvement effort
Oct. 2000	Began PSP/TSP introduction sequence
Jan. 2001	First TSP team launched
May 2001	CBA-IPI: CMM level 2; 3 KPAs satisfied at level 3; level 4/5 observations on TSP
June 2001	Received draft of CMM-TSP gap analysis (levels 2 and 3 only, minus SSM and TP) to help guide improvement efforts
Feb. 2002	Received late-model gap analysis (including TP at level 3 and levels 4 and 5)
June 2002	Launched second TSP team
Sep. 2002	CBA-IPI: CMM level 4 (16 months from L2!)

See Crosstalk, Sep. 2002, “AV-8B’s Experiences Using the TSP to Accelerate SW-CMM Adoption,” Dr. Bill Hefley, Jeff Schwalb, and Lisa Pracchia.

TSP Results: CMM/CMMI Goals

Category	Without TSP	With TSP
Average schedule deviation - range	27% to 112%	-8% to 5%
Average effort deviation - range	17% to 85%	-8% to -4%
Acceptance test product quality (defects/KLOC)	.1* to .7	.02 to .1
System test savings (cost to system test 1000 LOC)	1 to 5 days	.1 to 1 days
Number of post-release defects per KLOC	.2 to 1+	0 to .1

* This data (.1 defects/KLOC in acceptance test) is from a CMM level 5 organization.

Source: CMU/SEI-2000-TR-015, The Team Software Process (TSP): An Overview and Preliminary Results of Using Disciplined Practices, Donald R. McAndrews, November 2000. Organizations were CMM levels 1, 2, 3, and 5.

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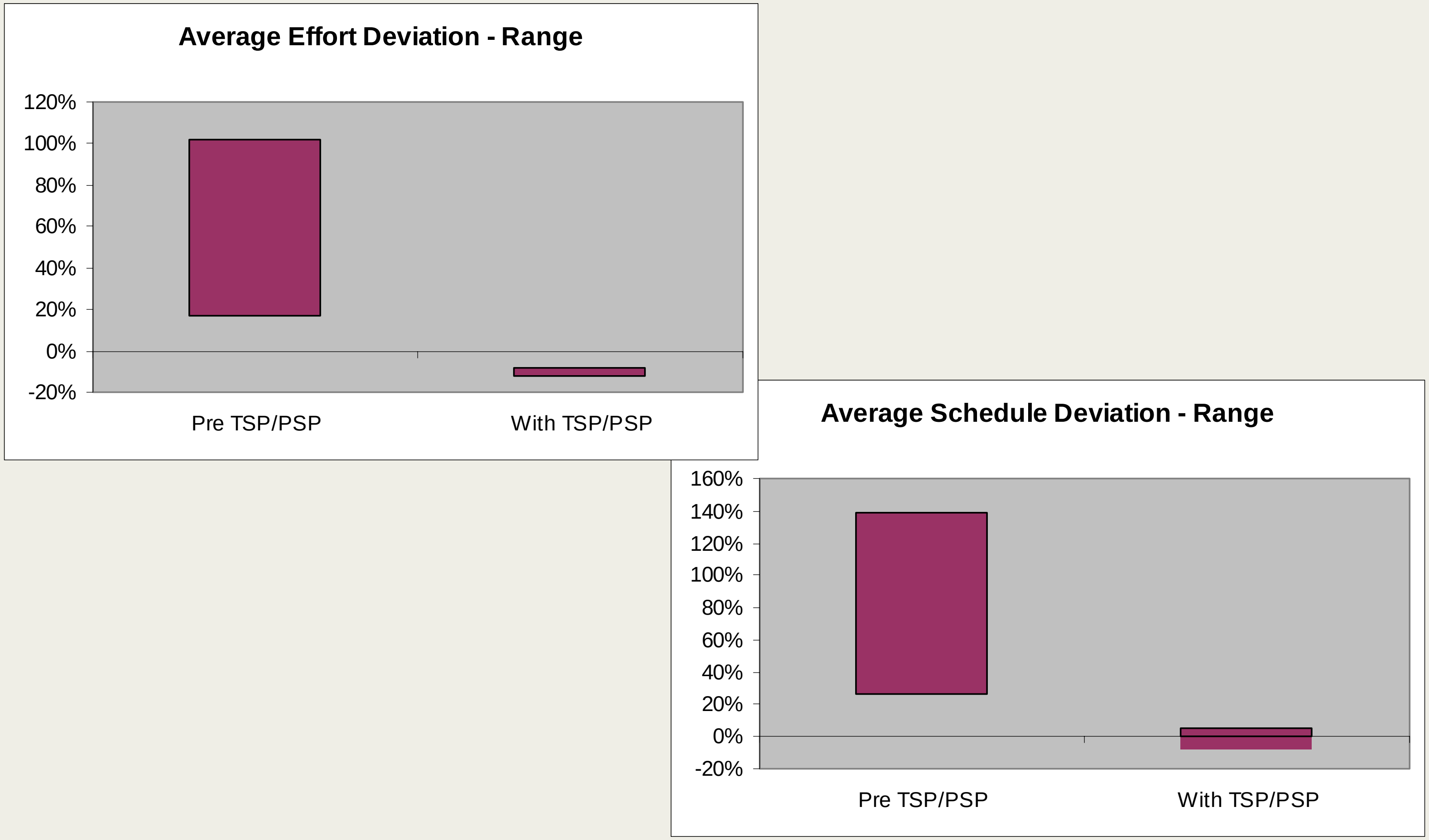
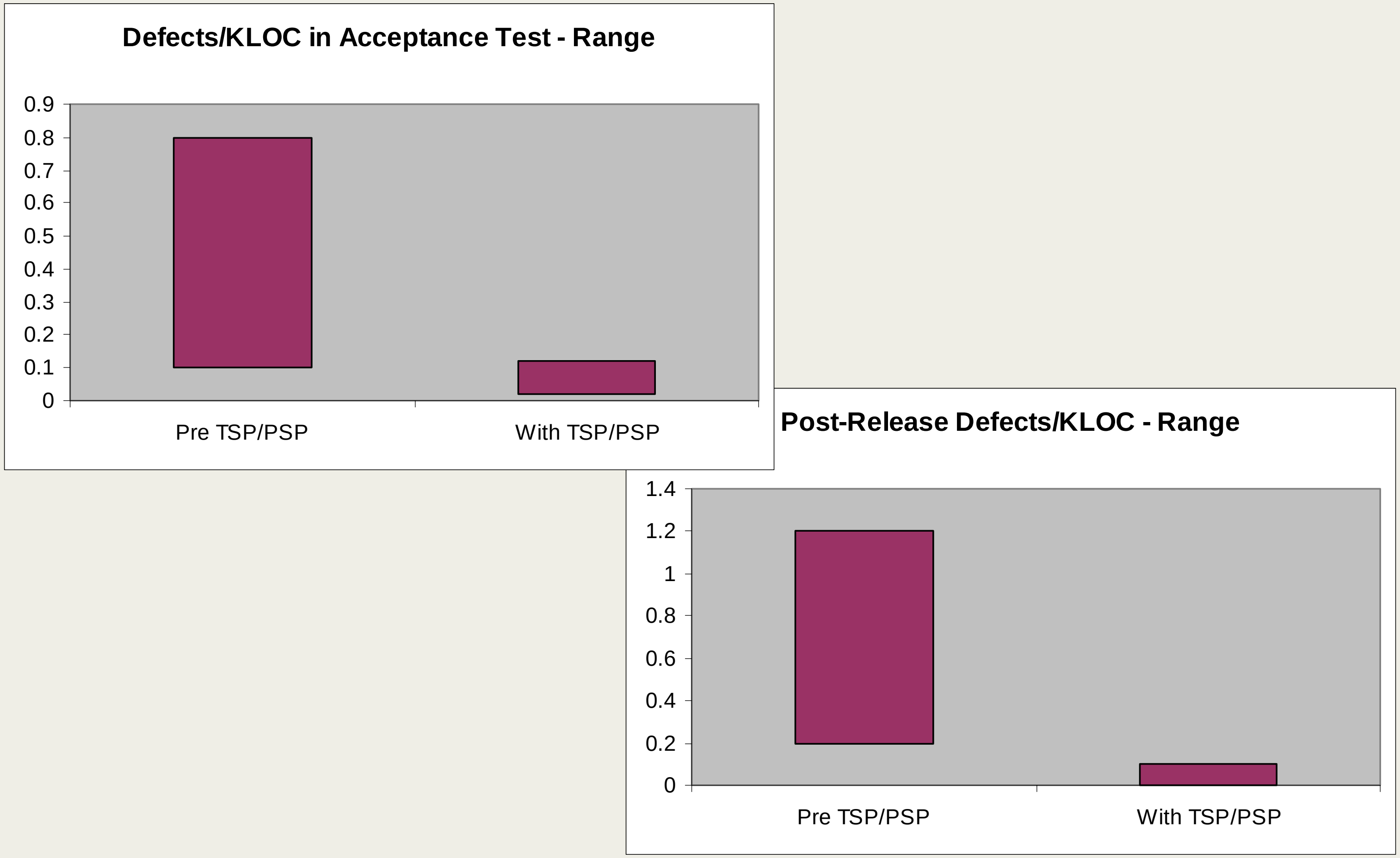
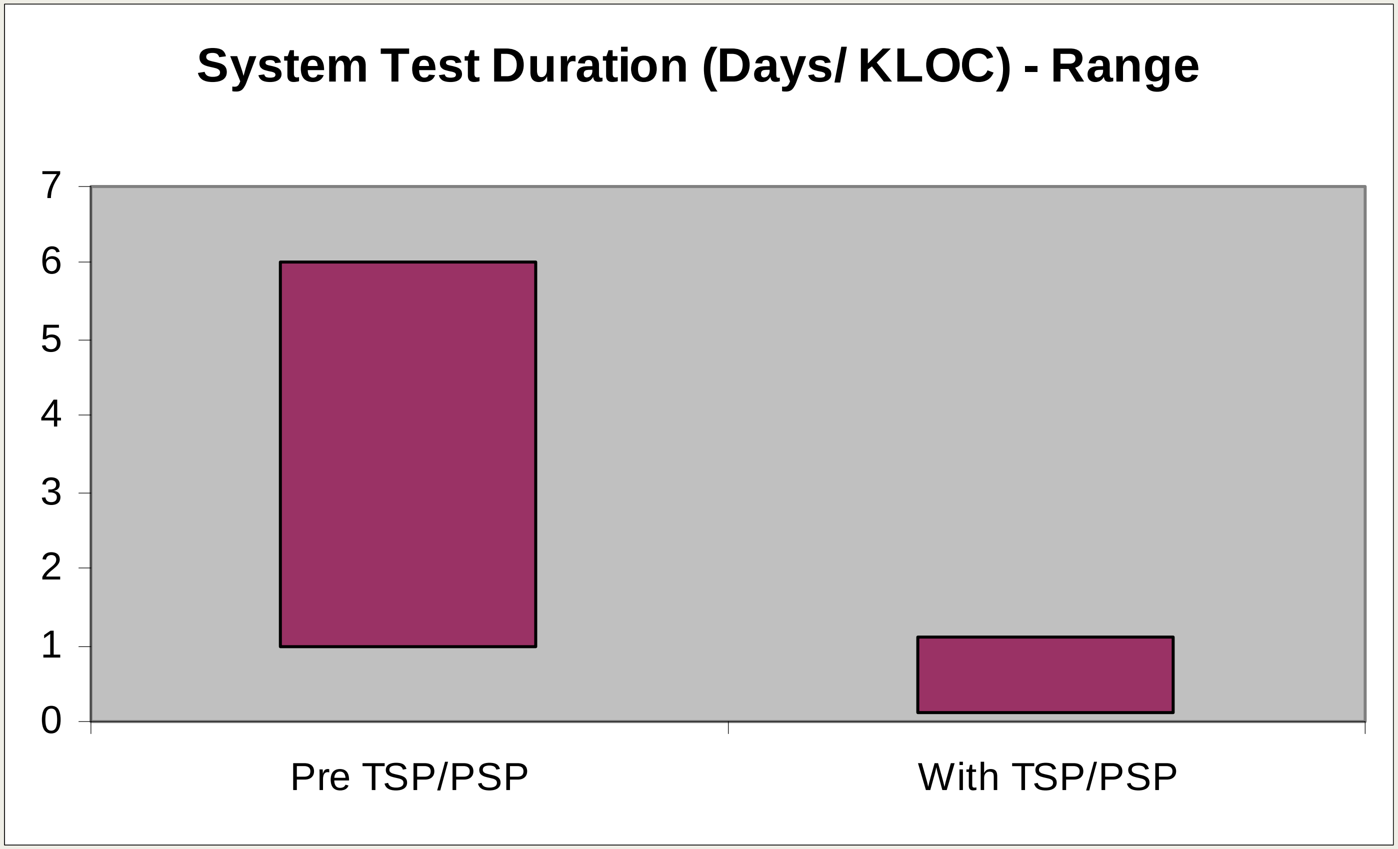
Effort and Schedule Deviation



Quality


Defects/KLOC in Acceptance Test - Range
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Pre TSP/PSP
With TSP/PSP
Post-Release Defects/KLOC - Range
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Pre TSP/PSP
With TSP/PSP

Reduction in System Test Time



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➡ TSP for CMMI Implementation

Getting Started

TSP: Not “Just” About Software

The PSP teaches quantitative process principles in a software development context.

The TSP requires that project teams collectively take control of their engineering processes in order to do the job right the first time.

TSP teams very often include members who are not software engineers.

- systems engineers
- hardware engineers
- test engineers
- business analysts
- documentation specialists
- EPG and other support functions

Personal Processes for All

To address the reality that most of our TSP teams included non-software engineers, SEI developed a two-day course, “An Introduction to Personal Process.”

It does *not* replace the 10-day “PSP for Engineers” course.

- Software engineers need a lot of convincing.
- Software engineers often have to coach their non-software counterparts.

Although some non-software personnel still have difficulty adapting to disciplined methods, we find many that take to it naturally.

Early CMMI-TSP Mapping Results

A preliminary survey of TSP practices (leading to another TR in mid-2003) with respect to the CMMI-SE/SW/IPPD shows these results.

- Project Management SPs: most fully or largely implemented
- Process Management SPs: majority partially or largely implemented
- Engineering SPs: majority fully or largely implemented
- Support SPs: no consistent pattern as yet
- Generic practices: no policies in the TSP, but most other GPs at *all* capability levels are either taught in PSP training, or practiced by TSP teams, or both

AV-8B CMMI “Quick Look” Profile

PA ->	RM	RD	TS	PI	VE	VAL	CM	PPQA	MA	CAR	DAR	OEI	OPD	OPF	OID	OT	OPP	PP	PMC	IPM	QPM	SAM	RSKM	IT
Specific Goal 1	U	FI	NR	S	S	S	S	S	U	U	NR	S	S	S	U	S	U	S	S	U	U	U	U	S
SP1.1	FI	FI	NR	FI	FI	FI	FI	FI	PI	PI	NR	FI	FI	FI	LI	FI	PI	FI	FI	FI	FI	FI	FI	FI
SP1.2	FI	FI	NR	FI	FI	FI	FI	FI	PI	PI	NR	FI	FI	FI	LI	FI	PI	FI	FI	FI	PI	FI	LI	FI
SP1.3	FI		FI	FI	FI	FI	FI		LI		NR	FI	FI	FI	FI	FI	FI	FI	FI	FI	PI	LI	FI	FI
SP1.4	PI								PI		NR		FI		FI	FI	LI	FI	FI	FI	FI			
SP1.5	FI										NR		FI				PI		FI	PI				
SP1.6											NR								FI					
SP1.7																			FI					
Specific Goal 2		S	NR	S	S	S	S	U	U	U		NR		U	U	U		S	S	NR	U	U	S	S
SP2.1		FI	FI	FI	FI	FI	FI	LI	LI	PI		PI		FI	FI	LI		FI	FI	NR	PI	NR	FI	FI
SP2.2		FI	FI	FI	FI	FI	FI	FI	LI	PI		NR		FI	FI	FI		FI	FI	FI	PI	LI	FI	FI
SP2.3		FI	FI		FI				PI	NR		PI		FI	LI	FI		FI	FI	FI	LI	FI		FI
SP2.4			NR						LI					LI				FI			LI	FI		FI
SP2.5																		FI						FI
SP2.6																		FI						
SP2.7																		FI						
SP2.8																								
Specific Goal 3		NR	S	S	S		S											S		S			S	
SP3.1		NR	FI	FI	FI		FI											FI		FI			FI	
SP3.2		FI	FI	FI	FI		FI											FI		FI			FI	
SP3.3		LI		FI														FI						
SP3.4		NR		FI																				
SP3.5		NR																						
Specific Goal 4																				S				
SP4.1																				FI				
SP4.2																				FI				
SP4.3																				FI				
PA ->	RM	RD	TS	PI	VE	VAL	CM	PPQA	MA	CAR	DAR	OEI	OPD	OPF	OID	OT	OPP	PP	PMC	IPM	QPM	SAM	RSKM	IT
Generic Goal 2	S						S	S	U									S	S			S		
Generic Goal 3	S	U	U	S	S	S	S	S	U	U	NR	NR	S	S	NR	S	U	S	S	S	S	S	S	S

LEGENDS

Practices

- 🟩 FI Fully Implemented or Satisfied
- 🟩 LI Largely Implemented
- 🟧 PI Partially Implemented
- ⬜ NI Not Implemented
- ⬜ NR Not Rated

Goals

- 🟩 S Satisfied
- 🟥 U Unsatisfied (Goals)
- ⬜ NR Not Rated

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➡ Getting Started

TSP Introduction

SEI’s recommended strategy for introducing TSP involves these overlapping steps.

- Identify key areas for initial introduction.
- Hold executive seminar and transition planning session.
- Identify projects that could serve as pilots for TSP.
- Train the affected managers and engineers.
- Conduct a few (2-4) trial-use projects.
- Evaluate initial project results.
- Train and authorize an internal TSP/PSP transition team.
- Plan for and initiate broad rollout.

Introduction Adaptations -1

Some of the keys to successfully integrating TSP introduction with model-based improvement efforts include

- making an explicit connection between the efforts, from senior management through the management ranks to the engineering staff
- defining (and possibly redefining) the roles of the EPG
- adapting the TSP roles to interface smoothly with existing organizational roles/groups
- planning how the data both used and generated by the TSP teams will be accessed, summarized and stored
- developing an internal capability to train and coach PSP and TSP practices

Introduction Adaptations -2

Include all development personnel on TSP teams

- via a TSP launch or relaunch
- after they receive the appropriate training

If transitioning from the CMM to CMMI

- Train the EPG first.
- Don’t assume that TSP introduction can be accelerated (or must be postponed) because of a particular maturity level. Size of the staff, typical project size and duration, and the availability of training/coaching resources are the critical factors.
- Launch your EPG using the TSP.

TSP Alone is Not Enough

TSP by itself, even if used by every development team, does not cover all practices of *any* level or process area of CMM or CMMI.

Strong management support and significant organizational resources are essential

- to introduce and coach the TSP to all project teams
- to maintain and enhance CMM/CMMI organizational capabilities
- to achieve TSP and CMM/CMMI goals for quality, schedule and cost

Summary

Major Premise: CMMI *is* a model upgrade from the CMM.

Minor premise: TSP *does* provide an efficient, effective vehicle for implementing CMM-based improvement.

Conclusion: Therefore, TSP can provide an efficient, effective vehicle for implementing CMMI-based improvement.

For More Information

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SEI web sites / PSP & TSP Technical Reports

http://www.sei.cmu.edu/tsp/	CMU/SEI-2002-TR-008
CMU/SEI-2000-TR-022/023	CMU/SEI-2000-TR-015

Contact a PSP or TSP transition partner

http://www.sei.cmu.edu/collaborating/partners/trans.part.psp.html

Contact SEI customer relations

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