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Evidence about Impact and Value Added: One Year Later

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Contents

Overall Objectives: The Big Picture

Provide credible, objective evidence about organizations' experiences with CMMI based process improvement

Focus:

- Impact and value added } **Current Emphasis**
- Investment and costs incurred
- Conditions of successful adoption, transition, and documented improvement
- Pitfalls and obstacles to successful adoption and use

Conduct objective studies that inform the development and evolution of the CMMI product suite

Publications & Presentations

SEI Special Report (October 2003)

- *Demonstrating the Impact and Benefits of CMMI®: An Update and Preliminary Results*
- Based on case studies, supplementary materials, and comprehensive literature review

Conference & related presentations in 2003 & 2004

- 3rd and 4th CMMI Technology Conference and User Group
  - Organized tracks on existing evidence on impact & ROI
  - Summary presentations
  - Panels
- SEPG, ESEPG, ISERC, PSM, Metrics 2004

Current Activities

Tutorial materials & Special Reports
- Guidance on calculating ROI
- Modeling & simulation for decision support

Conference presentations

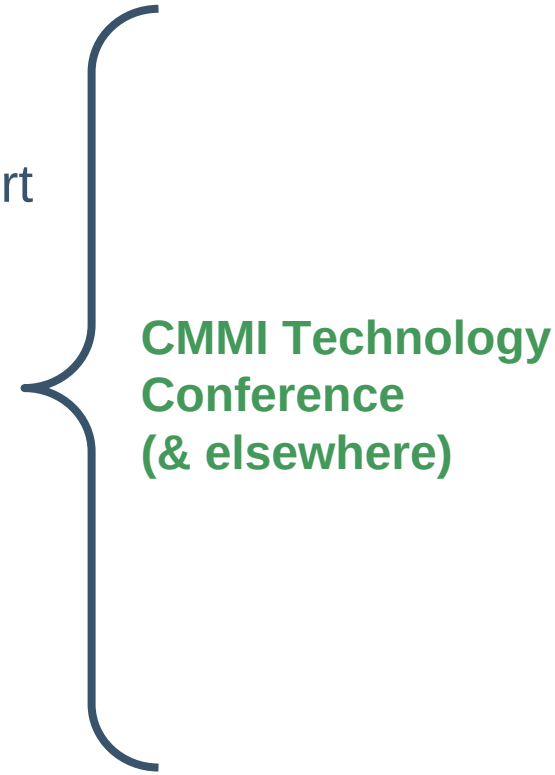
Case studies
- With industry partners

Benchmarking
- Data collection exercise & report
  - Contributors only Workshop
- Self-reported cases

ROI Workshop

Development of additional training assets

All contributing to capstone Technical Report



Why Do We Need Objective Evidence?

Increasing numbers of organizations are considering using CMMI models

Trustworthy evidence is essential for

- Addressing skepticism about model-based process improvement in general
- Demonstrating the value of CMMI over its source models

But also for

- Building commitment and obtaining resources within an organization
- Enhancing ongoing quantitative management
- Providing input for improving organizational processes and technologies
- Comparing results with those of comparable organizations

What is Legitimate Evidence of Impact?

Evidence based on:

- New processes or changes to existing processes due to CMMI
- Broadened organizational scope across disciplines
  - Especially for software intensive systems
- Process changes that are consistent with, but may predate, CMMI

How about?

- Recent evidence based on the SW-CMM, EIA 731, ISO/IEC 15504 or other improvement initiatives
  - Much of the same content is present in CMMI models
  - And, such evidence can be compelling to skeptics about any CMM-based process improvement

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Performance Results Summary
(as of 11/12/04)

23 organizations reported credible quantitative evidence in conference presentations and via direct communication with the SEI.

- Initial CMMI benefits and ROI report, October 2003
- CMMI Technology Conference, November 2003
- SEPG and European SEPG, March and June 2004
- Confidential communication with SEI

14 of these organizations reported results from which we can show percent change over time.

Future results will come from:

- Externally conducted case studies
- Collaborative case studies
- Community benchmarking

Organizations with Percent Change Results

1. Accenture
2. Boeing Ltd, Australia
3. Bosch Gasoline Systems
4. DB Systems, GambH
5. General Motors Corporation
6. Lockheed Martin Management and Data Systems
7. Lockheed Martin Maritime Systems & Sensors – Undersea Systems
8. Lockheed Martin Systems Integration
9. NCR
10. Northrop Grumman Defense Enterprise Systems
11. Raytheon North Texas Software Engineering
12. Siemens Information Systems Ltd, India
13. Anonymous Organization 1
14. Anonymous Organization 2

Performance Results Summary

Improvements	High	Low	Median	# of data points
Cost	83%	5%	26%	8
Schedule	90%	15%	55%	10
Productivity	75%	11%	28%	4
Quality	72%	33%	47%	6
Customer Satisfaction	55%	10%	33%	3
Return on Investment	13 : 1	2 : 1	3.8 : 1	4

What Does It All Mean?

Don't over interpret the results out of context

- The cases differ in:
  - Organization & model scope of their process changes
  - The time span of the process or other technology interventions they report
  - The specific measures they use
  - Measures of organizational context
- The results also may be atypical & exemplary

But…

- These many & varied cases already provide ample proof of concept about the potential of CMMI based process improvement
- Which can, and often does, lead to very impressive improvements in product quality, project performance and organizational performance

Performance Measures Summary$_1$

Of 23 organizations, some with multiple examples:

Cost: Six organizations provide eleven examples of cost-related benefits including reductions in the cost to find and fix a defect and overall cost savings

Schedule: Seven organizations provide fourteen examples showing evidence of schedule-related benefits including decreased time needed to complete tasks and increased predictability in meeting schedules

Productivity: Six cases provide evidence of increased productivity

Performance Measures Summary$_2$

Of 23 organizations/cases:

Quality: Seven cases provide eleven examples of measured improvements in quality, mostly related to reducing defects over time or by product life cycle

Customer Satisfaction: Three cases show five examples of improvements in customer satisfaction including demonstration of customer satisfaction through award fees

Return on Investment: Six cases report returns on investment from their CMMI-based process improvement

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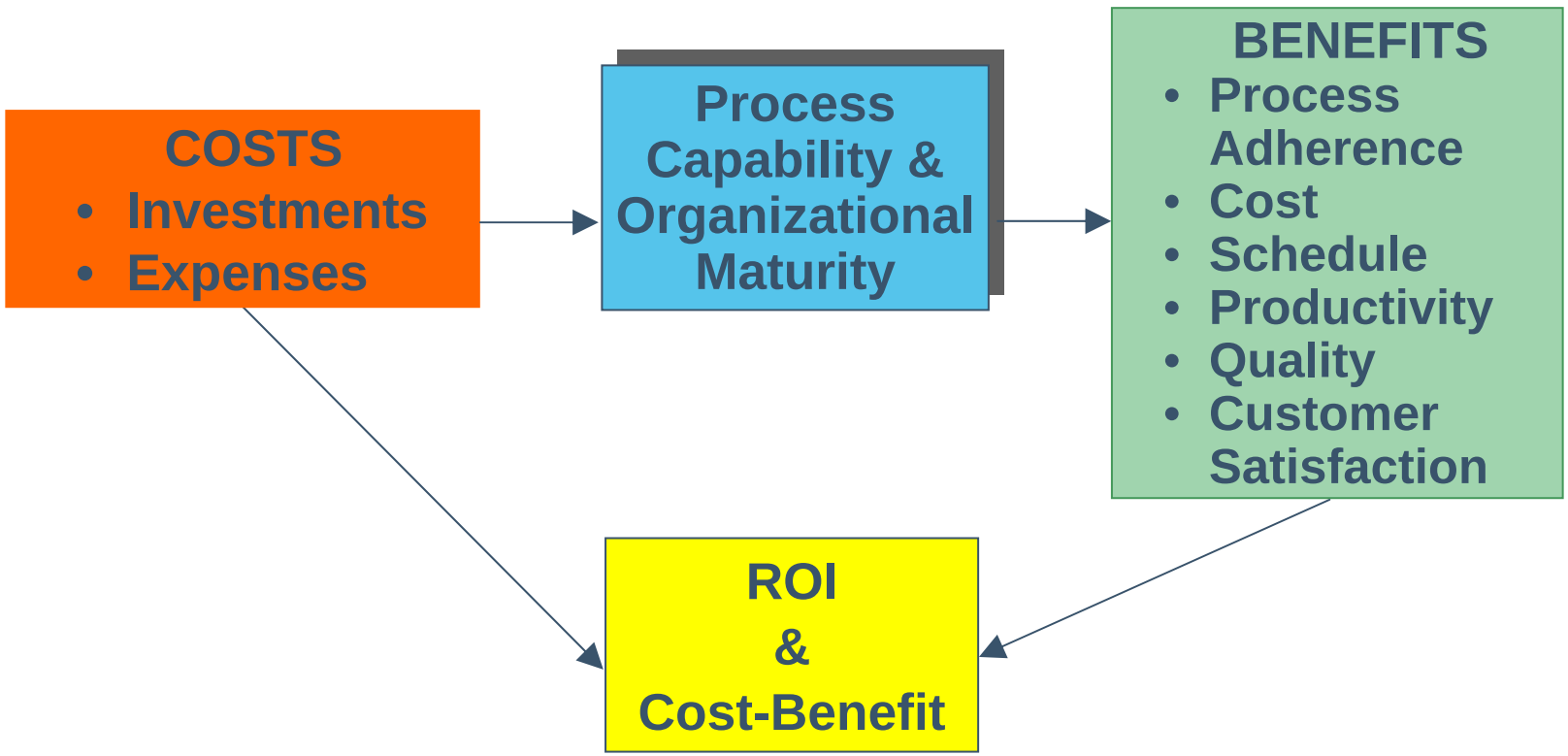
Impacts: Costs and Benefits of CMMI



Selected Examples$_1$

Process Adherence

- Work product completion improved dramatically (CMS Information Services, Inc.)
- Improved adherence to quantitative management practices (Raytheon North Texas Software Engineering)

Cost

- 5 percent improvement in average cost performance index with a decline in variation (Raytheon North Texas Software Engineering)
  - As the organization improved from SW-CMM level 4 to CMMI level 5
- $2.1 Million in savings in hardware engineering processes (reported under non disclosure)

Selected Examples$_2$

Schedule

- Increased through-put resulting in more releases per year (JP Morgan Chase)
- Reduced schedule variance over 20 percent (reported under non disclosure)
- Achieved 95 percent on time delivery (reported under non disclosure)

Productivity

- Increased productivity after adoption of CMMI (Harris Corporation)
- 25 percent productivity improvement in 3 years (Siemens Information Systems Ltd, India)
- Used Measurement & Analysis to realize an 11 percent increase in productivity, corresponding to $4.4M in additional value (reported under non disclosure)

Selected Examples$_3$

Quality

- Reduced software defects substantially, with “significantly more rigorous engineering practices” due to CMMI (Fort Sill Fire Support Software Engineering Center)
- Substantial decrease in code defects after adoption of CMMI (Harris Corporation)
- Reduced defect rate at CMMI ML5 approximately one third compared to performance at SW-CMM ML5 (Lockheed Martin Maritime Systems & Sensors – Undersea Systems)
- 44 percent defect reduction following causal analysis cycle at maturity level 2 (reported under non disclosure)

Customer Satisfaction

- Received more than 98 percent of possible customer award fees (Northrop Grumman Defense Enterprise Systems)
- Improved average customer satisfaction rating 10 percent (Siemens Information Systems Ltd, India)

Selected Examples$_4$

Return on Investment

- 5:1 ROI for quality activities (Accenture)
- 13:1 ROI calculated as defects avoided per hour spent in training and defect prevention (Northrop Grumman Defense Enterprise Systems)
- Avoided $3.72M in costs due to better cost performance (Raytheon North Texas Software Engineering)
  - As the organization improved from SW-CMM level 4 to CMMI level 5
- 2:1 ROI over 3 years (Siemens Information Systems Ltd, India)
- 2.5:1 ROI over 1st year, with benefits amortized over less than 6 months (reported under non disclosure)

Lockheed Martin M&DS

SW CMM ML2 (1993) to ML 3 (1996) to CMMI ML5 (2002)

Results

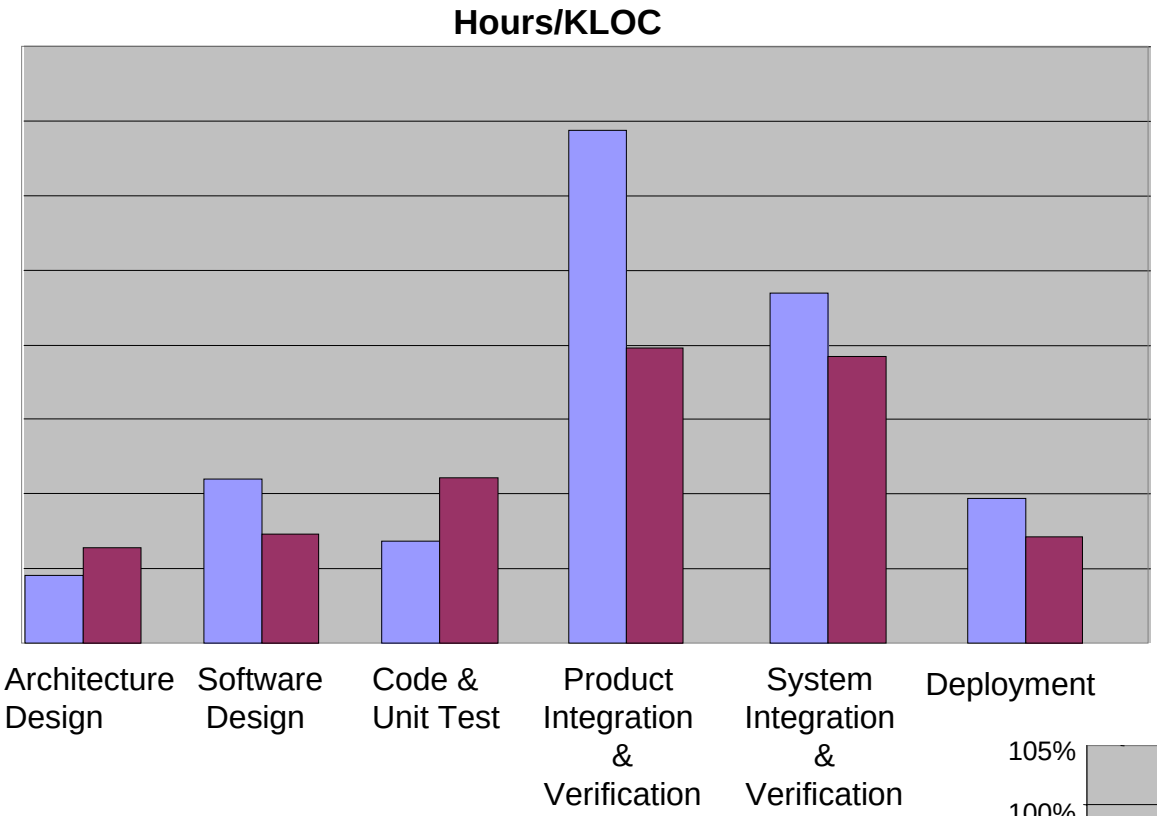
- captured a greater percentage of available award fees, now receiving 55 percent more compared to the baseline that remained unrealized at SW-CMM level 2

1996 - 2002

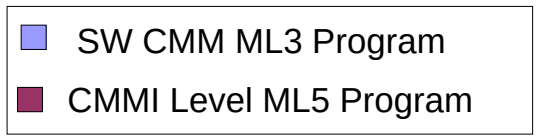
- Increased software productivity by 30%
- Decreased unit software cost by 20%
- Decreased defect find and fix costs by 15%

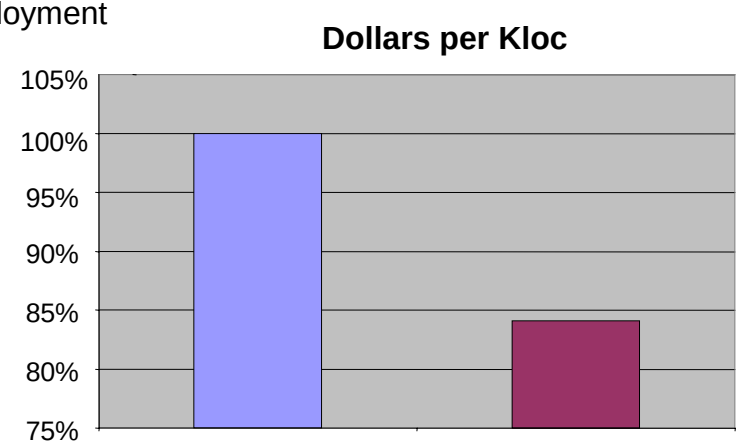
Proprietary sources with permission; August 2003.

Improved Defect Find & Fix



Improved Product Quality With Real Cost Savings



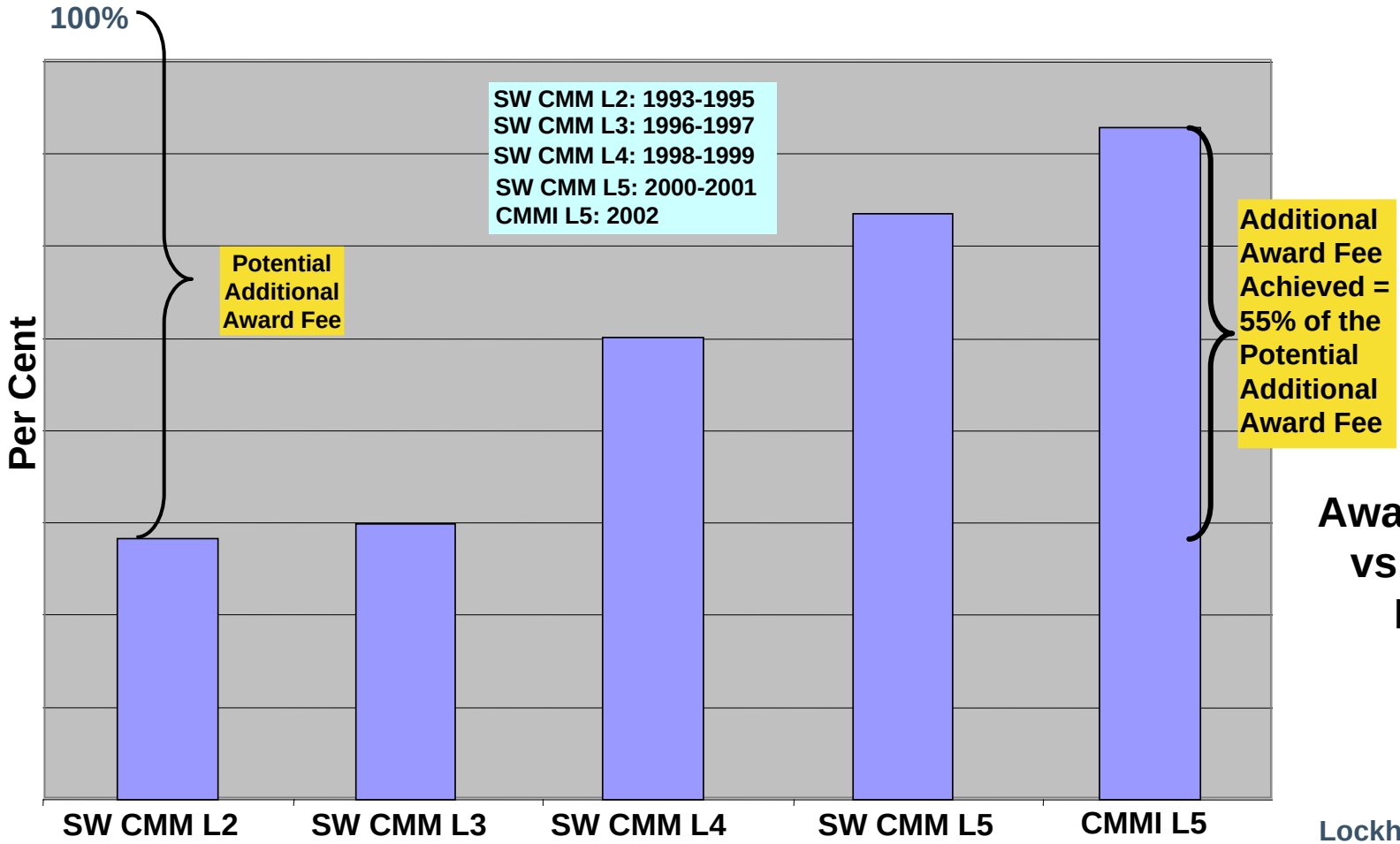


15 % decrease in defect find & fix costs

Lockheed Martin Management & Data Systems

Customer Satisfaction: Award Fees

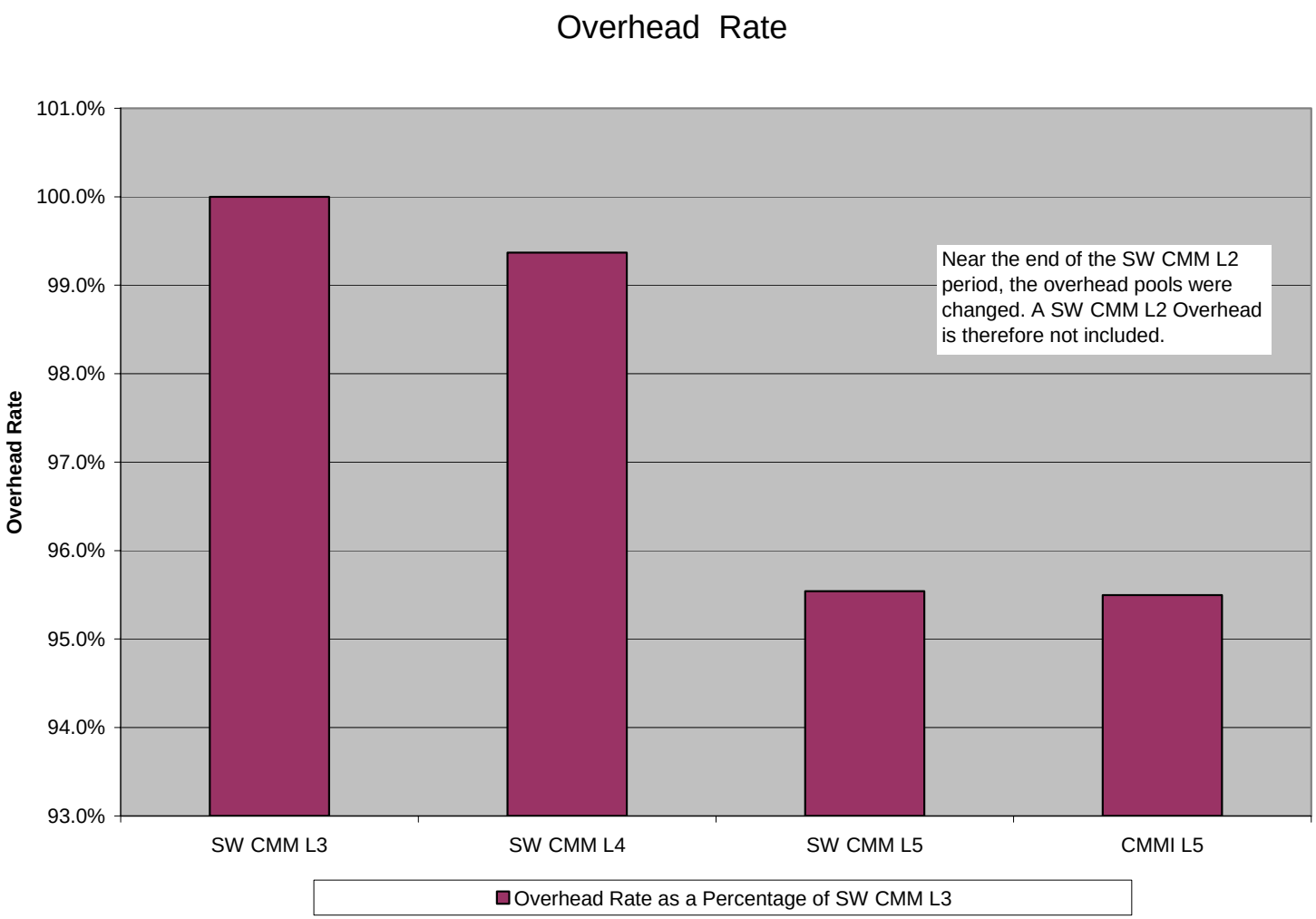
Award fees increased by 55% compared to an earlier SW-CMM ML2 baseline.



Award Fees vs. CMM Level

Customer Satisfaction Continues to Improve

Overhead Rates: LM M&DS



CMMI Does Not Come with Overhead Baggage

Northrop Grumman IT

Appraised at CMMI ML 5 in December 2002

Results

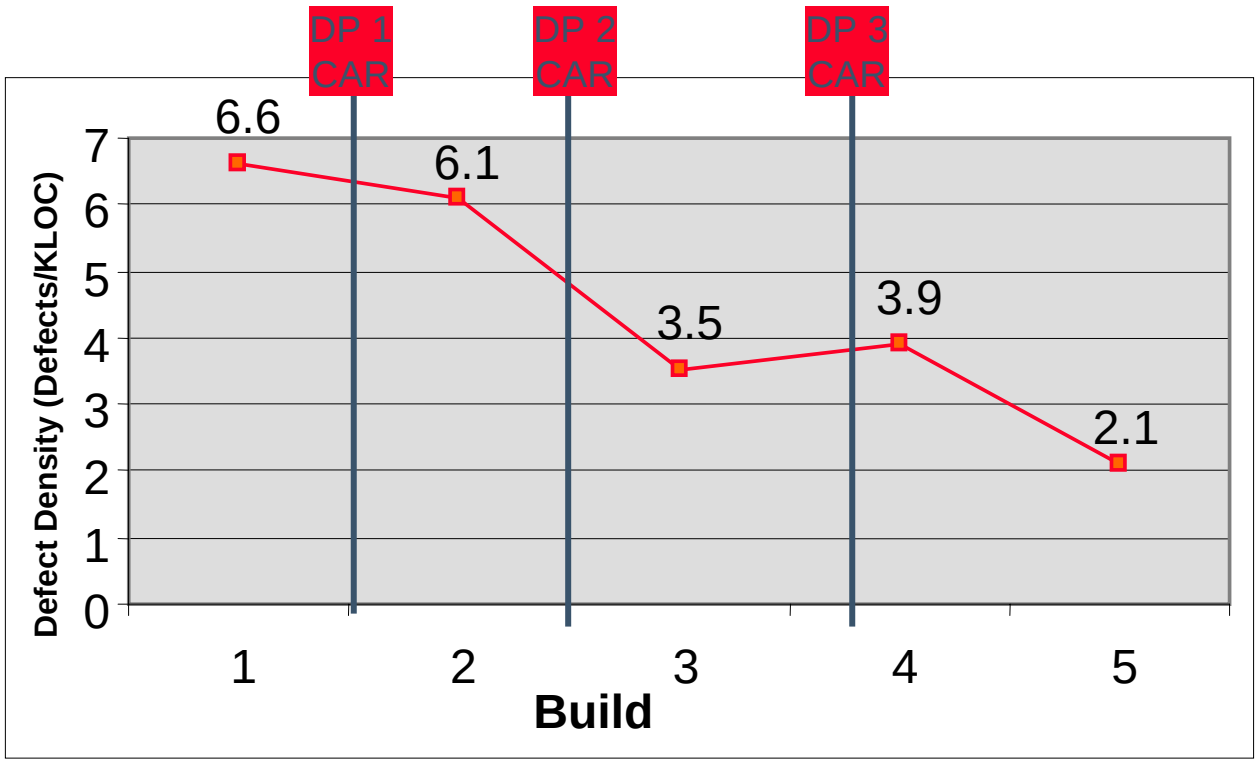
- met 25+ milestones in a row
- earned a rating of “Exceptional” in every applicable category on a formal Contractor Performance Evaluation Survey

- Hours Invested: 124 in Defect Prevention (CAR)
- Hours saved: 1650 hours (15 hours per defect)
- **ROI:** 13:1

Integrating PSP℠ and CMMI® Level 5. Gabriel Hoffman, Northrop Grumman IT . May 1, 2003

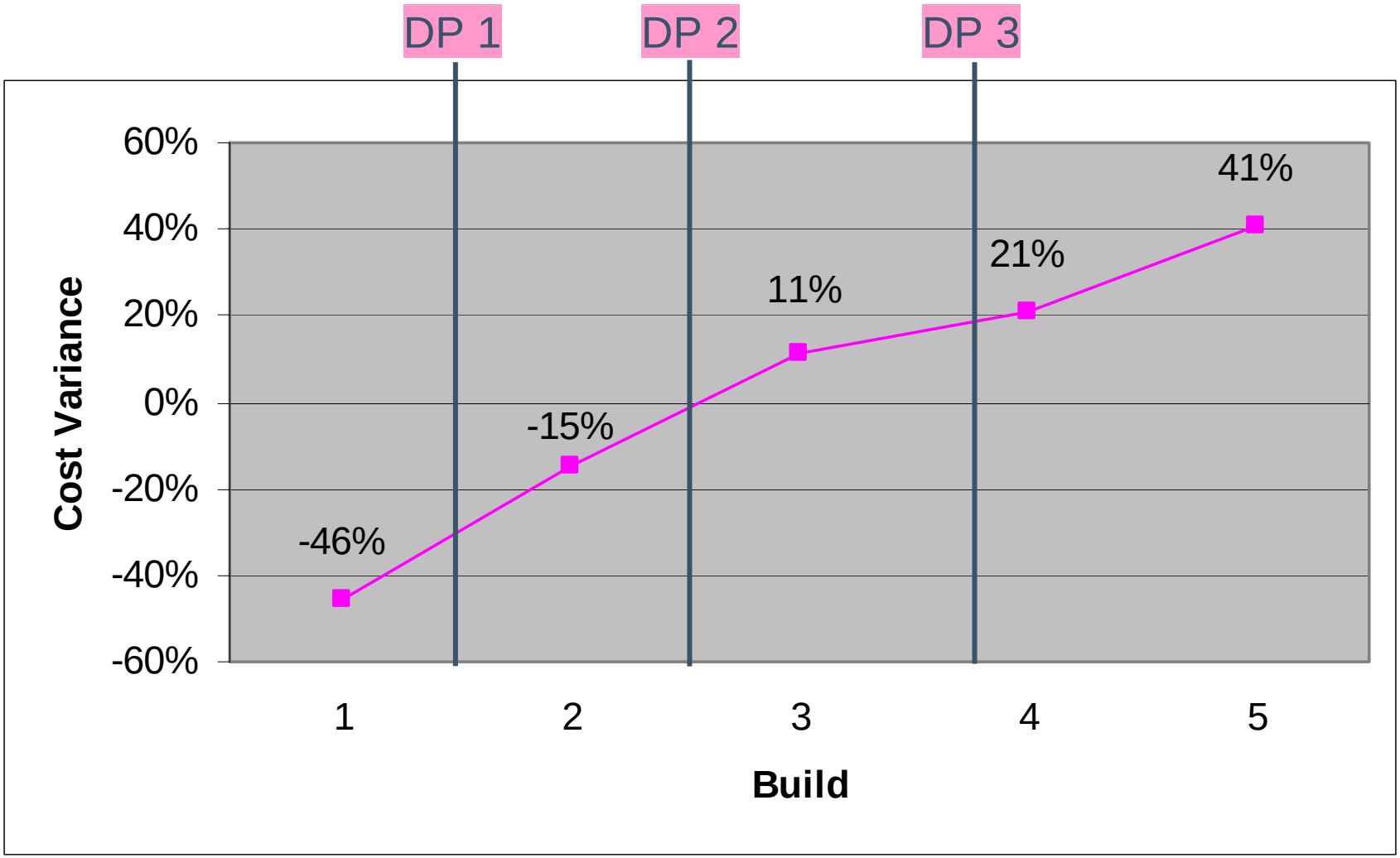
Northrop Grumman IT

Defect prevention using PSP and CAR at CMMI ML5

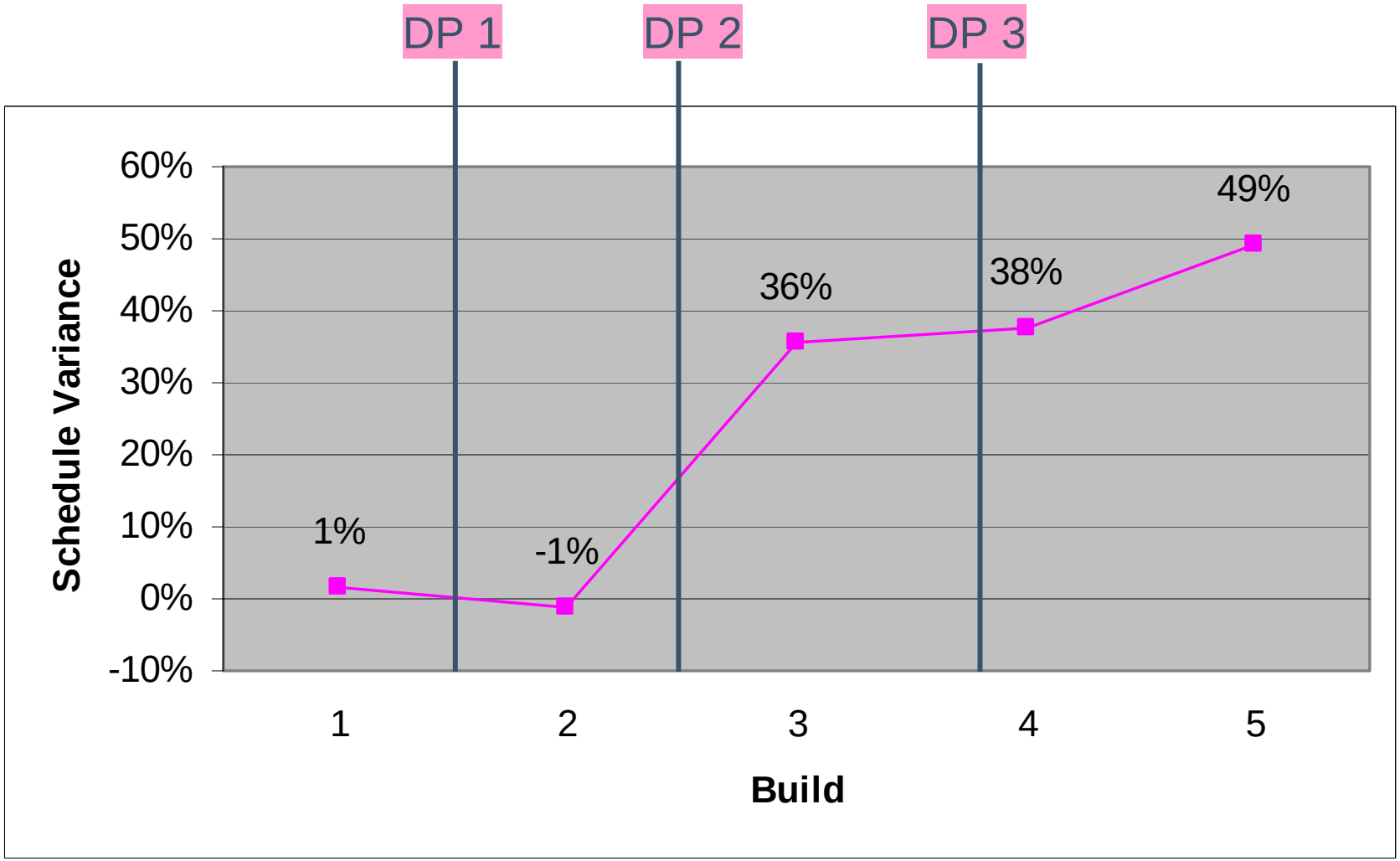


Integrating PSP℠ and CMMI® Level 5. Gabriel Hoffman, Northrop Grumman IT . May 1, 2003.

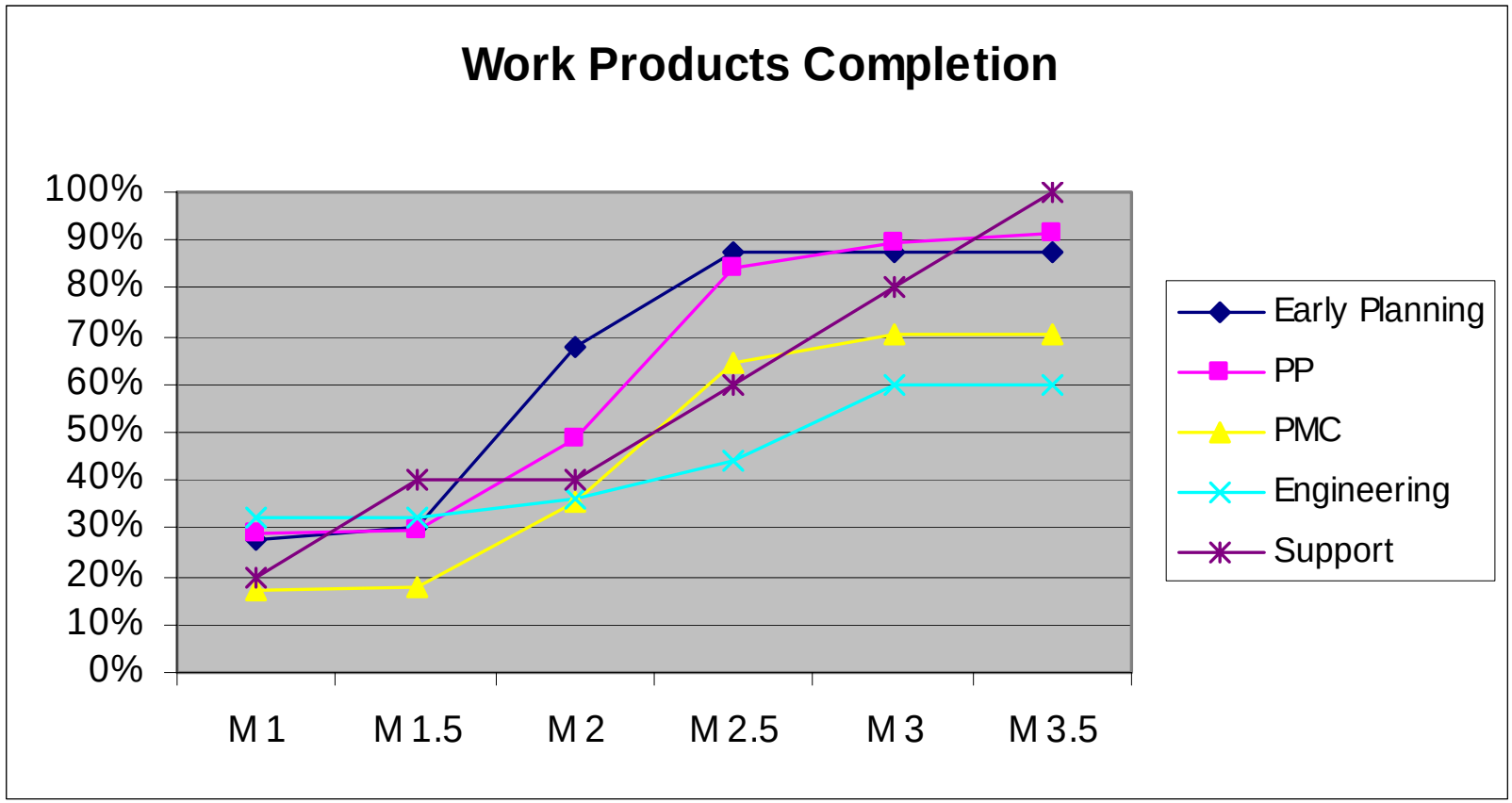
Cost Variance by Build: NG IT



Schedule Variance by Build: NG IT



Progress during PI Effort at CMS



Work product completion improved dramatically
CMS Information Services, Inc. – ML3

Accenture

Transition SW-CMM to CMMI ML 3

- May 2001 to May 2002
- Transition Time: 1149 person hours

Key Content

Measurement and Analysis
DAR ➡ TS, RM, Change Control
IPPD ➡ visions, OEI
Generic Goals

Results

- **ROI**: 5:1 (for quality activities)

Innovation Delivered. CMMI® Level 3 in a Large Multi-Disciplinary Services Organization. Bengzon, SEPG 2003

Hot Off the Press

IBM Australia – New Zealand

- Application Management Services

Part of IBM Global Services

- Major outsourcing contract
- 1,000 projects; 3,000 deliverable work products per year

Six years from ML1 to CMMI ML5

- ML1 in June 1997
- SW-CMM ML2 in June 1999
- SW-CMM ML3 for outsourced commercial accounts in April 2001
- CMMI ML5 for Commercial Delivery in November 2003

ROI approximately 8 : 1

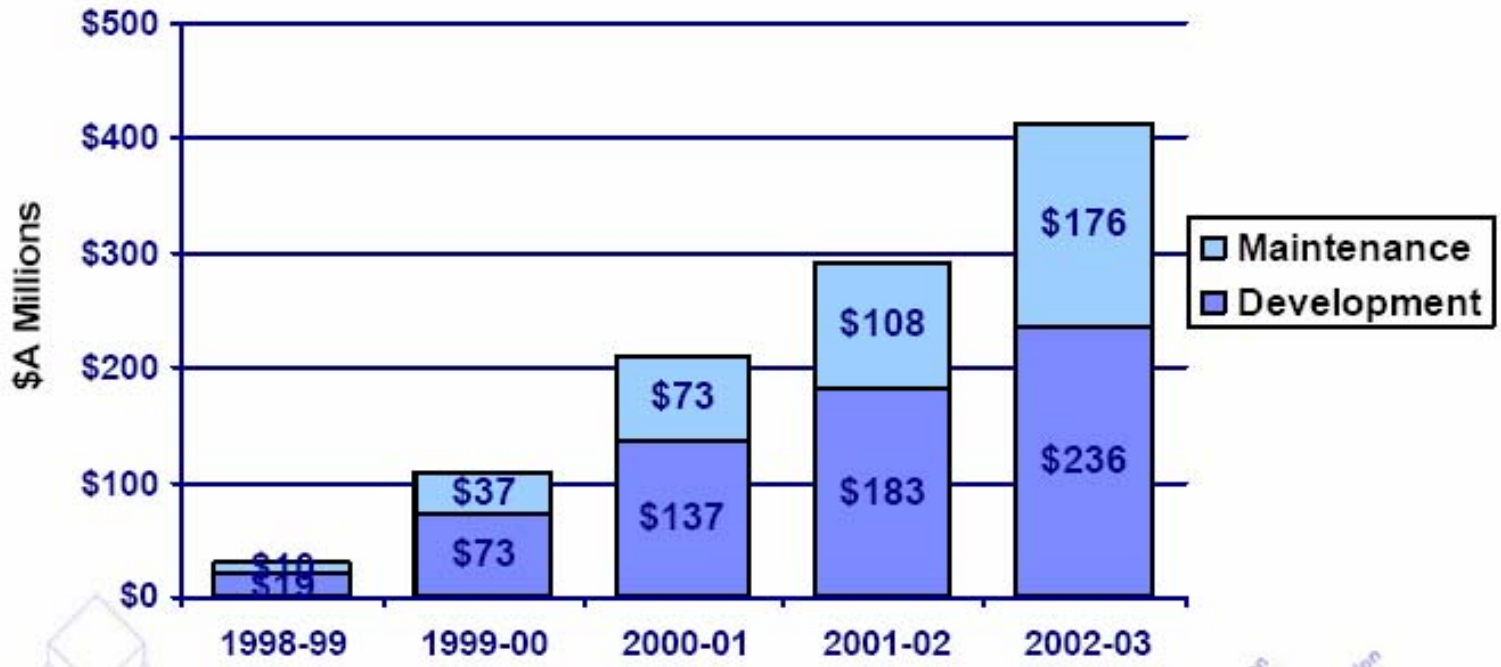
Colin Connaughton, "Practical Process Improvement: the Journey and Benefits, Australian SEPG," September 2004.

Application Management Services

IBM

Account Financial Benefits

Cumulative Cost Savings
(compared with year 1 productivity)



Dedication Innovation Trust

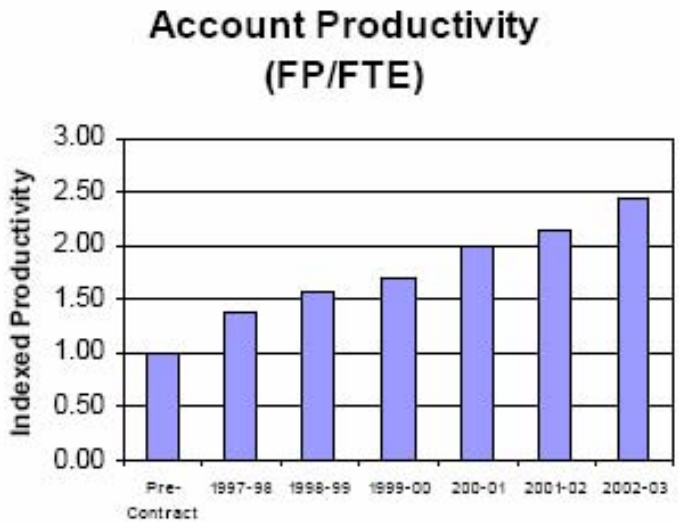
7

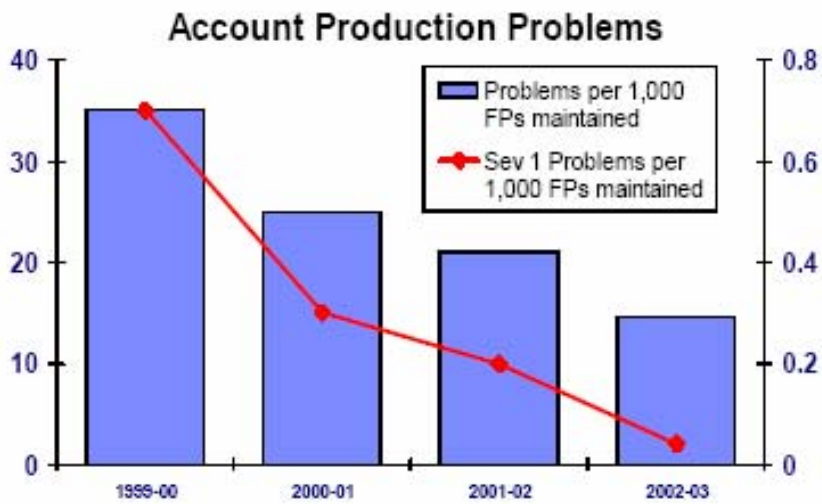
Application Management Services

IBM

Account Achievements

- 145% improvement in productivity since outsourcing
- 58% reduction in production problems & 94% reduction in severity 1 problems over the past 4 years





What about the employees?

- **Effective Communication**
  - CMM provides a common language
- **Improved morale**
  - More stable work environment
  - Better balance of personal and profession life
  - Reduction of 'all hand to the pumps' crisis situations
- **Lower staff turnover**
  - Quality people are unlikely to stay long in an overstretched and highly stressful environment
- **Better Customer Relationships**
  - Agreed, quantitative service goals

Culture

- Straight Talk communication
- Shared vision and teaming to delivery
- Prescriptive and consistent performance reviews
- IBM employee and manager training
- Personal change and how to manage change

Hot Off the Press

Reuters

- Global Business Group

Global Development

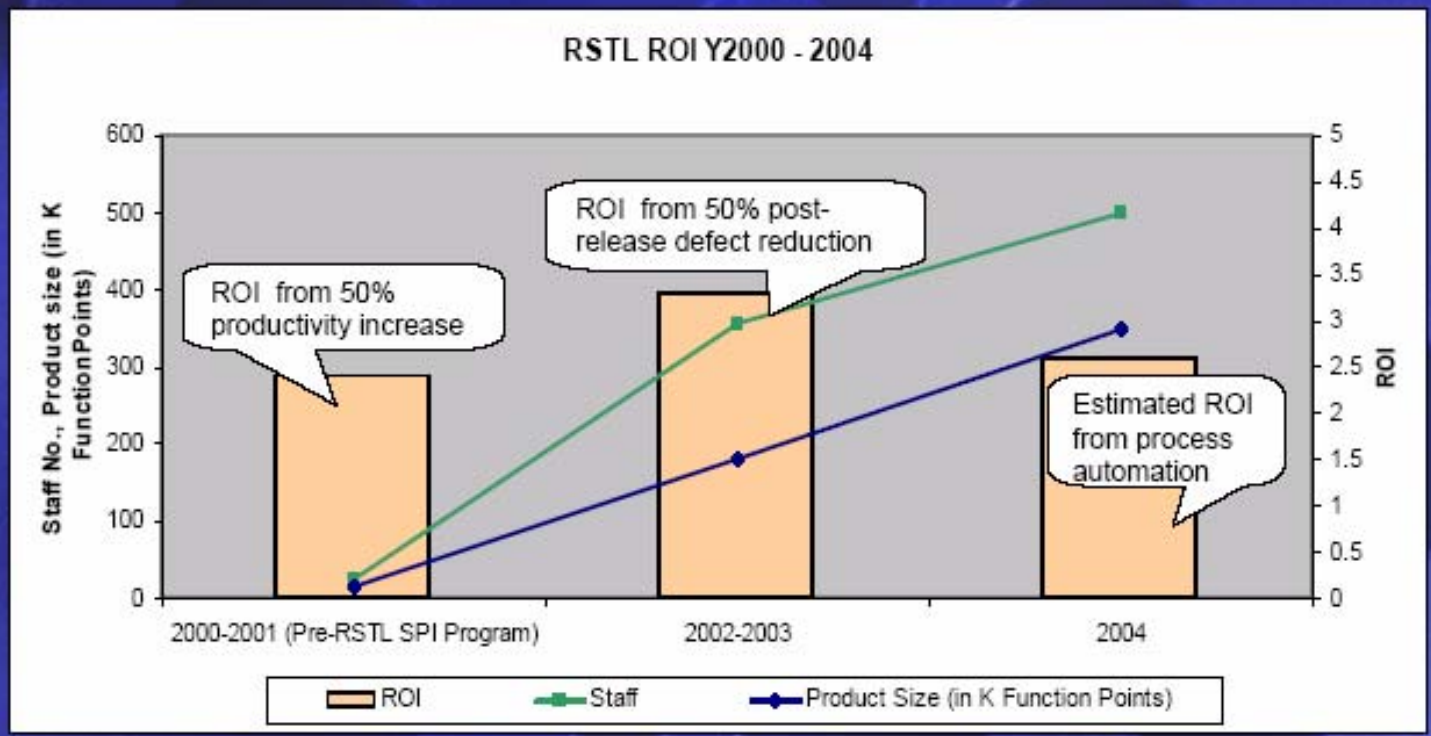
- 15+ Development groups in 12 Countries
- Group size from 5 -500

SPI History (abridged)

- 1996 – CMM adopted at corporate level
- 1997 – 1st SW-CMM ML2
- 1999 – 1st SW-CMM ML3
- 2002 – Software Center in Bangkok opens
- 2003 – PI organization in place for CMMI ML5
- 2004 – 1st CMMI ML5

Paul Iredale, The “Internal Offshore ”Experience at Reuters,” Australian SEPG, September 2004.

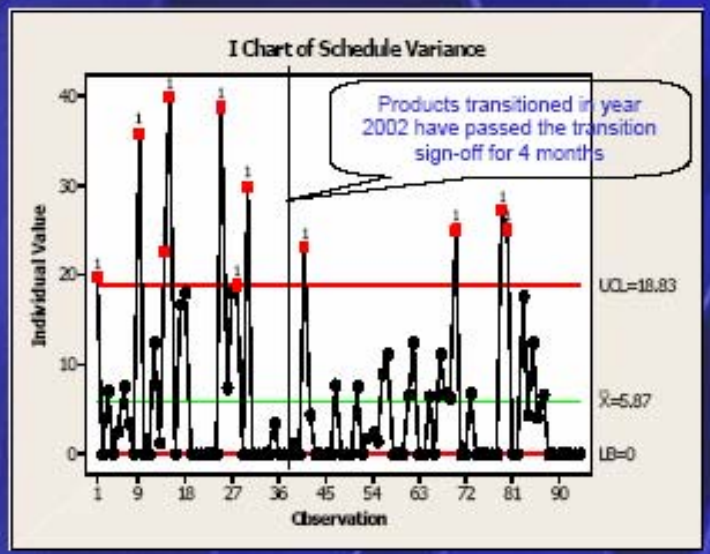
RSTL Improvement in Processes – Overall ROI (1)



Note: Figures for 2004 are forecast values.

REUTERS

RSTL Improvement in Processes – Schedule Variance (2)



Background

- Schedule Variance during Jan 2002 - Apr 2003 is around 25% with 25 initial project observations.

Issue

- With the high growth rate of both Staff (from 100 to 350) and Supported Product (from 100 to 180 K FP), How to maintain and improve the schedule predictability?

Action

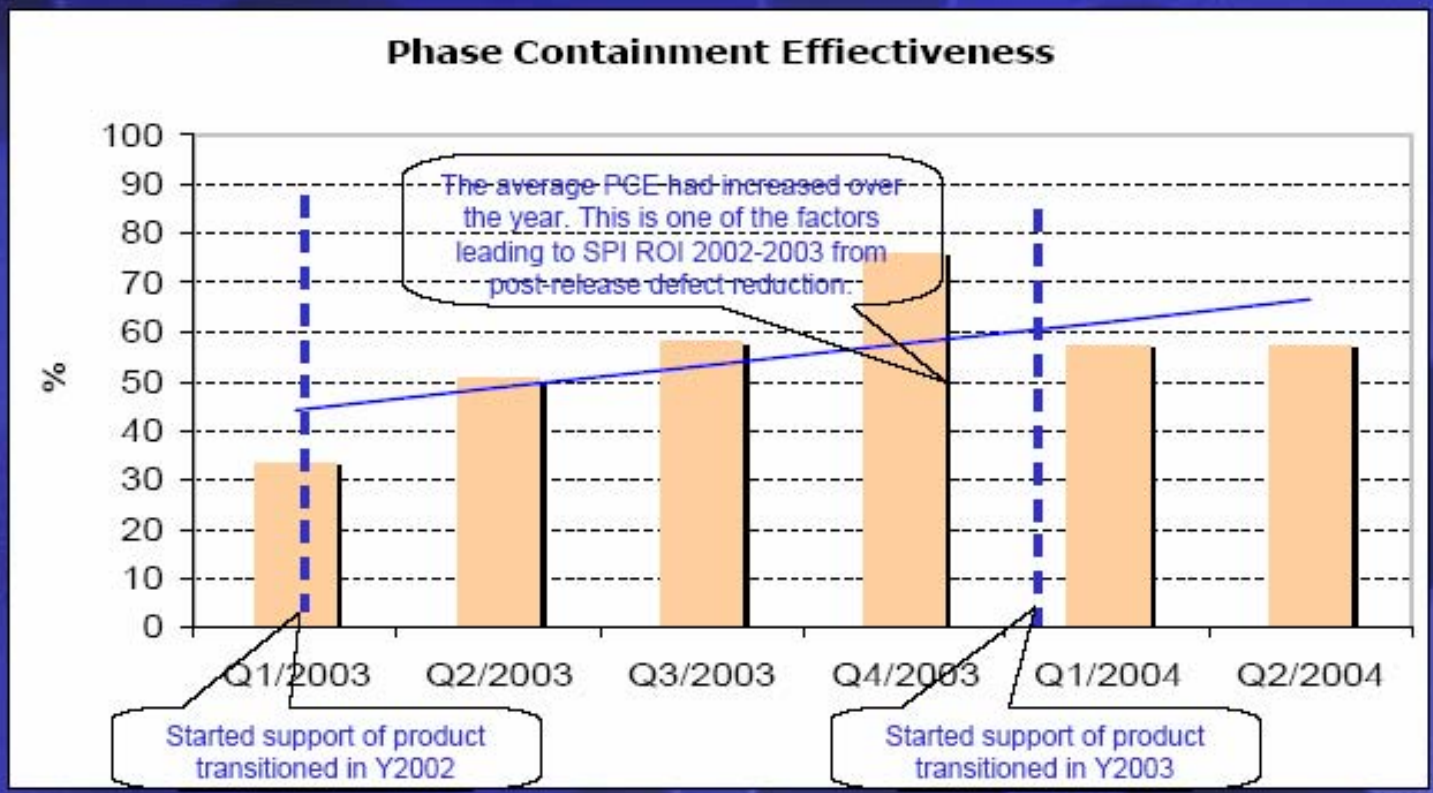
- RSTL SPI Programme 2003 - Focused on process training and quantitative project management

Result

- RSTL has improved the capability of Schedule Variance to be 15% with100 project observations up to Apr 2004.

REUTERS

RSTL Improvement in Processes – Phase Containment (3)



REUTERS

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Guidance on ROI_1

Basic measures and approaches

- Adoption of CMMI
  - Amortization of long term investments
  - Short term cost-benefit of selected CMMI interventions (tactical as well as strategic)
- Identification of proper measures and analytic techniques (context, cost, benefit, as well as ROI *per se*)
- Calculations after the fact to validate the wisdom of past decisions
- Estimation before the fact to help make informed decisions

Proactive decision analysis

- Business case, cost-benefit analyses and what-if scenarios
- Modeling and simulation
- Predictive validity, and model optimization

Guidance on ROI_2

Working Group meetings at SEI

- July 2004: Core group
- October 2004: Review of tutorials and preparation for subsequent Workshop

Expert workshop in March 2005

Deliverables

- Tutorials
  - Guidance about scoping and calculating ROI analyses
  - Processes and models for estimating ROI proactively
- Technical reports

Case Studies

In-depth & SEI assisted collaborative cases

- Early adopters with credible quantitative evidence of impact and benefits of CMMI
- Proactive, “action research” emphasizing:
  - ROI, cost of quality and poor quality
  - CAR / OID / DAR
  - Small organizational contexts
  - Lower maturity organizations
- Co-authored papers / presentations
- Consultation & review of evidence & reports

Self-reported cases

- Re design and prototype existing template
- Design and prototype SEIR functionality and interface

Continued review of published papers & presentations

Generalizability

Case studies

- Offer a great deal of valuable detail and context
- Provide lessons learned which can be used to guide future improvement efforts
- Demonstrate what can happen under the right organizational and technical circumstances
- However, results from individual case studies cannot be generalized

Our task is to design studies that better reflect the experiences of the wider CMMI community

Community Benchmarking

Exercise for 4th CMMI Technology Conference

- CMMI adoption
- Investment in process improvement
- Benefits & ROI of CMMI based process improvement
- CMMI implementation & appraisal strategies

First of a possible series

- Others to follow focusing on specific issues, e.g., ROI, more focused quantitative measures of impact
- Exploring collaboration with existing benchmarking services
- In collaboration with a current SEMA effort

Future Directions

Anticipated SEI Reports on collaborative case studies

Broadly based studies, e.g.,

- State-of-the-Practice survey of CMMI impact & predictive validity
- Community benchmarking

Effectiveness and improvement of appraisals and training

Model-based Process Improvement in Software and Systems Engineering (Australian Research Council)

Emphases Throughout

Baselining and ongoing measurement to enable credible robust ROI calculations

Validating estimates and improving ROI & process models

Eliciting qualitative experience reports of failures as well as successes

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