

Models for Product Quality

**The Capability Maturity Model Integrated
for Systems Engineering
and Software Engineering,
Version 1.1**

***Integrated Project Management (IPM):
The CMMI and collaborative
product development***

Course Guide



© Copyright Software Systems Quality Consulting All rights reserved. No portion of this material may be reproduced without the prior, written permission of SSQC, 2269 Sunny Vista Drive, San Jose CA 95128, Tel 408-985-4476 FAX 408-248-7772, E-mail ssqc@concentric.net, Home Page <http://www.ssqc.com>

® CMM, Capability Maturity Model, Capability Maturity Modeling, and Carnegie Mellon are registered in the U.S. Patent and Trademark Office.

CMMI is a service mark of Carnegie Mellon University.

About SSQC and Its Services

Since 1990, SSQC has specialized in supporting organizations in the definition and implementation of Software Engineering Practices, Software Quality Assurance and Testing, Business Process Reengineering, ISO 9000 Registration and CMM implementation. SSQC is an official SEI transition partner licensed to provide SCAMPI appraisal services and the SEI's *Introduction to Capability Maturity Model Integration*.

SSQC also offers HM², a unique, hybrid appraisal method that defines and correlates the position of an organization with respect to both ISO 9001 and the CMM. HM² grew out of SSQC's ground-breaking 1993 paper *Comparing, contrasting ISO 9001 and the SEI Capability Maturity Model*, which was published in IEEE **Computer**. The results of an HM2 assessment are a plan and framework for improving software engineering processes and for implementing the requirements of the two models.

The principals of Software Systems Quality Consulting are William J. Deibler and Robert C. Bamford.

William J. Deibler II has an MSc. in Computer Science and over 20 years experience in the computer industry, primarily in the areas of software and systems development, software testing, and software quality assurance. Bill has extensive experience in managing and implementing CMM- and ISO 9001-based process improvement in software engineering environments. Bill is an SEI Authorized CBA IPI Lead Assessor and SCAMPI Lead Appraiser for CMMI.

Robert C. Bamford has an MA in mathematics, and has managed training development, technical publications, professional services, and third-party software development. His over 20 years of experience include the facilitating the definition and implementation of management processes, designing and instructing courses, and managing engineering teams.

Bob and Bill have developed and published numerous training courses, auditing tools, research papers, and articles on interpreting and applying the ISO 9000 standards and guidelines and the SEI Capability Maturity Model for Software. Their articles have appeared in McGraw Hill's **Quality Systems Update**, **IEEE COMPUTER**, McGraw Hill's **ISO 9000 Handbook**, **CrossTALK**, and **Software Marketing Journal**. They were the principal authors and project editors of **A Guide to Software Quality System Registration under ISO 9001**.

They have presented research papers at numerous national and international conferences, including those sponsored by the American Society for Quality (ASQ), Pacific Northwest Software Quality (PNSQC), the Software Publishers Association (SPA), Software Technology Support Center (STSC), the Software Engineering Institute (SEI) and Software Research Inc. Their courses have been attended by software engineering professionals from many of the world's leading technology companies. Their courses have been sponsored for their members by professional associations, including the ASQ, CSU Long Beach's Software Engineering Forum for Training, Semiconductor Equipment and Materials International (SEMI), Software Engineering Institute (SEI), UC Berkeley and UC Santa Cruz.

They have been active United States TAG members in the ISO/IEC JTC1 SC7 - Software Engineering Standards subcommittee which is responsible for the development and maintenance of ISO 12207 and ISO 15504 (SPICE). Their software development clients have successfully achieved ISO registration and advanced CMM maturity levels.

They have also performed ISO 9000 registration and TickIT audits as external resources under contract to the British Standards Institution (BSI).

Relationship with the SEI

Since 1993, when SSQC received permission from the SEI to reproduce various SEI CMM 1.1 technical reports for resale to the public, SSQC has maintained a close relationship with the SEI. Since 1996, SSQC has offered a variety of presentations and tutorials at the annual SEI-sponsored conferences (SEPG) and symposia in both the US and Europe (ESEPG). SSQC has presented numerous tutorials and presentations at local SPINs in the Silicon Valley.

Since early 1999, SSQC courses, tutorials, presentations, and panels have been successfully promoting the CMMI transition efforts (both staged and continuous representations) at a variety of conferences to include ESEPG 1999-2002, SEPG 1999-2002, Quality Week 1999-2001, PNSQC 1999-2000.

Integrated Project Management (IPM)

The CMMI and collaborative product development



Getting started

- About the presenters
- Audience
 - Some level of familiarity with the Software CMM Version 1.1 or CMMI Version 1.1 (Staged or Continuous)
 - Maintaining SW CMM 1.1, migrating to CMMI, starting CMMI
- Experience breeds ... , well, opinions, concerns, etc.

Project management: prioritized issues

- Develop an individual list of the challenges your organization needs to address in managing projects or programs
 - On-going problems
 - Impending needs
- Prioritize individual list
- Develop a single prioritized list of five items as a team
- Pick a representative who will present list in 3 minutes
- Ensure tutorial addresses your concerns to greatest possible extent

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



About the rest of the presentation

- Brief orientation
 - Structure of CMMI SE/SW v1.1 - staged and continuous
 - Process Areas, Goals, Practices, and Process Categories
 - A warning: Chasing levels
- Integrated Project Management (IPM) - The Specific Practices
 - Metrics, models, Key Performance Indicators
 - IPM and the Project Management Category Process Areas
 - Project Planning (PP)
 - Process Monitoring and Control (PMC)
 - Team exercise: Case study
 - Risk Management (RM)
- Integrated Product and Process Development (IPPD)
 - IPM and the Support Process Category Process Areas
- IPM and the Generic Practices
- Tools, tips, checklists and implementation opportunities

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



Orientation to the CMMI

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



The model

Capability Maturity Model Integration (CMMI), Version 1.1, CMMI for Systems Engineering, Integrated Product and Process Development, and Supplier Sourcing (CMMI-SE/SW/PPD/SS, V1.1), Continuous Representation, CMU/SEI-2002-TR-011, Carnegie Mellon University, March 2002, available at:

www.sei.cmu.edu/publications/documents/02.reports/02tr011.html

Capability Maturity Model Integration (CMMI), Version 1.1, CMMI for Systems Engineering, Integrated Product and Process Development, and Supplier Sourcing (CMMI-SE/SW/PPD/SS, V1.1), Staged Representation, CMU/SEI-2002-TR-012, Carnegie Mellon University, March 2002, available at:

www.sei.cmu.edu/publications/documents/02.reports/02tr012.html

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



A few words about

Continuous and Staged

- CMMI is provided in two representations

CONTINUOUS
REPRESENTATION

PRIORITY: Improve organizational capability in specific processes (like CM or Requirements)

STAGED
REPRESENTATION

PRIORITY: Customer requirement for a standardized organizational maturity level

- Your organization diligently studied the two representations and picked one (see the Introduction)
- Content – the individual requirements - is the same; the organization and nomenclature is different

7 

A few words about

Levels

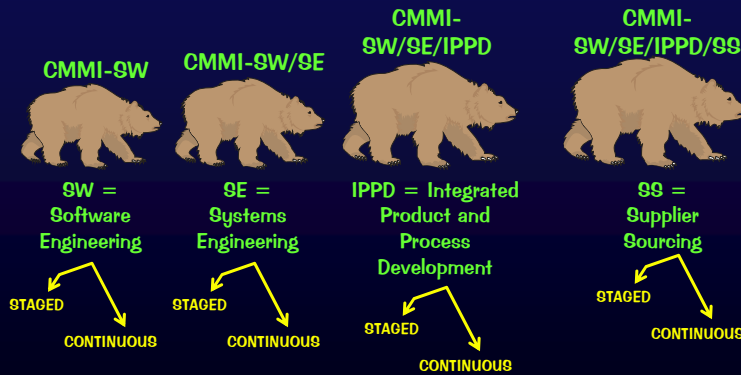
- Staged supports *organizational maturity*
 - Level 2 through 5
- Continuous supports *process capability*
 - Levels 0 through 5
- Your organization diligently studied the current state of its development practices and established a realistic target for capability or maturity level
- Each increase in level adds requirements

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

8 

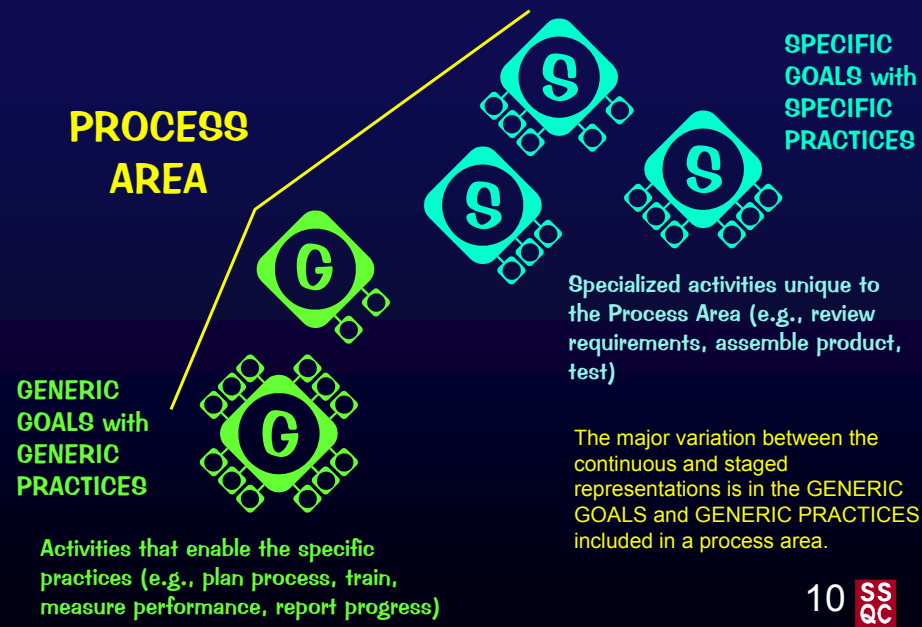
A few words about Disciplines

- Each CMMI representation is provided in four versions based on disciplines



- Your organization diligently studied the four versions and picked one
- Each discipline adds requirements and/or clearly labeled guidance

Process Areas, Goals and Practices



Required, expected, informative

- **Required CMMI components ...**

are essential to achieving process improvement in a given process area. These components are used in appraisals to determine process capability. **Specific goals and generic goals** are required model components. Goal achievement (or satisfaction) is ... the basis upon which process area satisfaction and organizational maturity are determined.
- **Expected CMMI components ...**

explain what **may** be done to satisfy a required CMMI component. Model users can implement the expected components explicitly or implement **equivalent alternative practices** to these components. **Specific and generic practices** are expected model components.
- **Informative CMMI components ...**

help model users understand the required and expected components of a model. These components may contain examples, detailed explanations, or other helpful information. **Subpractices, notes, references, goal titles, practice titles, sources, typical work products, discipline amplifications, and generic practice elaborations** are informative model components.

The 25 CMMI Process Areas

CAR	Causal Analysis and Resolution	OPP	Organizational Process Performance
CM	Configuration Management	OT	Organizational Training
DAR	Decision Analysis and Resolution	PI	Product Integration
IPM	Integrated Project Management for IPPD	PMC	Project Monitoring and Control
ISM	Integrated Supplier Management	PP	Project Planning
IT	Integrated Teaming	PPQA	Process and Product Quality Assurance
MA	Measurement and Analysis	QPM	Quantitative Project Management
OEI	Organizational Environment for Integration	RD	Requirements Development
OID	Organizational Innovation and Deployment	RM	Requirements Management
OPD	Organizational Process Definition	RSKM	Risk Management
OPF	Organizational Process Focus	SAM	Supplier Agreement Management
		TS	Technical Solution
		VAL	Validation
		VER	Verification

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

12 **SS**
QC

CMMI Process Areas by Category

CATEGORY	Type	Process Area	
Process Management (PCM)	Basic	OPF	Organizational Process Focus
		OPD	Organizational Process Definition
		OT	Organizational Training
	Advanced	OPP	Organizational Process Performance
		OID	Organizational Innovation and Deployment
Project Management (PJM)	Basic	PP	Project Planning
		PMC	Project Monitoring and Control
		SAM	Supplier Agreement Management
	Advanced	IPM	Integrated Project Management for IPPD
		RSKM	Risk Management
		ISM	Integrated Supplier Management
		IT	Integrated Teaming
		QPM	Quantitative Project Management
Engineering (ENG)		RM	Requirements Management
		RD	Requirements Development
		TS	Technical Solution
		PI	Product Integration
		VER	Verification
		VAL	Validation
Support (SUP)	Basic	MA	Measurement and Analysis
		PPQA	Process and Product Quality Assurance
		CM	Configuration Management
	Advanced	DAR	Decision Analysis and Resolution
		OEI	Organizational Environment for Integration
		CAR	Causal Analysis and Resolution

Categories and interactions

CMMI, Section 5, Four Categories of CMMI Process Areas

Although we are grouping process areas this way to discuss their interactions, process areas often interact and have an effect on one another regardless of their defined group.

You must be aware of the interactions that exist among CMMI model components to apply the model in a useful and productive way.

Employ established principles

CMMI, Section 1, About CMMI Models

Use professional judgment to interpret CMMI specific and generic practices. Although process areas depict behavior that should be exhibited in any organization, all practices must be interpreted using an in-depth knowledge of the CMMI model being used, the organization, the business environment, and the circumstances involved.

CMMI, Section 1, Introduction

CMMI models are not processes or process descriptions. The actual processes used in an organization depend on many factors, including application domain(s) and organization structure and size. In particular, the process areas of a CMMI model typically do not map one to one with the processes used in your organization.

Employ established principles (cont.)

Before you begin using a CMMI model for improving processes, you **MUST** map your processes to CMMI process areas. This mapping enables you to control process improvement in your organization by helping you track your organization's conformance to the CMMI model you are using. It is not intended that every CMMI process area maps one to one with your organization's processes [sic]. (CMMI, Section 2, Structural Overview)

When using any CMMI model, you **MUST** interpret the practices so that they work for your organization. (CMMI, Section 3, Common Terminology with Special Meaning, under "Adequate, Appropriate, As Needed")

The intended scope of CMMI

Within Engineering

The Engineering process areas are written in a general engineering terminology so any technical discipline involved in the product development process (e.g., software engineering, mechanical engineering) can use them for process improvement.

(CMMI, Chapter 5, Four Categories of CMMI Process Areas)

Establish and Maintain

When using a CMMI model, you will encounter goals and practices that include the phrase “establish and maintain.” This phrase connotes a meaning beyond the component terms; it includes documentation and usage. For example, “Establish and maintain an organizational policy for planning and performing the organizational process focus process” means that not only must a policy be formulated, but it also must be documented and it must be used throughout the organization.

CMMI, Section 3, Establish and maintain

Processes and process descriptions

A **managed** process

... is a performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description. (CMMI, Chapter 3)

A **defined** process

... is a managed process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines; has a maintained process description; and contributes work products, measures, and other process-improvement information to the organizational process assets. (CMMI, Chapter 3)

A defined process clearly states:

CMMI Continuous, Chapter 4, Capability Level 3, Defined

- Purpose
- Inputs
- Entry criteria
- Activities
- Roles
- Measures
- Verification steps
- Outputs
- Exit criteria

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT



19 **SSQC**

Process description defined

Process description

A documented expression of a set of activities performed to achieve a given purpose that provides an operational definition of **the major components** of a process. The documentation specifies, in a complete, precise, and verifiable manner, the requirements, design, behavior, or other characteristics of a process. It also may include procedures for determining whether these provisions have been satisfied. Process descriptions may be found at the activity, project, or organizational level.

(CMMI, Glossary)

The level of detail is not specified. Consider process complexity, operator skills and training, frequency of execution, and risk.

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

20 **SSQC**

SEI commentary (and what appraisers look for)

The concept of documented procedure is handled by the generic goal that says that you perform a process according to a managed or defined process. The definition of a "managed process" includes documenting the process and procedures that you use. The term "according to a documented procedure" is not explicitly used in the model.

(CMMI FAQ, Feb. 2002, under "Model Interpretation")

The intended scope of CMMI (cont.)

Beyond Engineering

- Numerous references to Support, Sustainment, Manufacturing

OPD SP 1.2-1 Establish Life-Cycle Model Descriptions

Establish and maintain descriptions of the life-cycle models approved for use in the organization.

Typically, the organization needs both product and project life-cycle models ... for defining the phases of the project.

Product life-cycle models partition the product life cycle into phases for which activities and requirements can be defined to promote a complete solution, from initiating development of the product to its ultimate disposal.



Chasing levels

Maturity levels are measured by the the achievement of the specific and generic goals that apply to each pre-defined set of process areas. [2000-TR-30, paragraph 2, p. 23]

Conformance with a process area means that in the planned and implemented processes there is an associated process (or processes) that addresses either the specific and generic practices of the process area or alternatives that clearly and unequivocally accomplish a result that meets the goal associated with that specific or generic practice. [2000-TR-30, paragraph 2, p. 26]

... trying to skip maturity levels is usually counter-productive. [2000-TR-30, paragraph 2, p. 24]

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

23 

Why Integrated Project Management (IPM)?

Shouldn't it wait until Level 3?

- For small organizations, small projects, level 3 PAs can be set as the initial goal
 - Support for cross-functional teams
 - Significant benefits in going beyond monitoring and control (Level 2)
- S/W CMM v1.1 - transition, inspiration
- Because sometimes skipping levels is productive
 - Or, because sometimes not skipping levels is counterproductive

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

24 

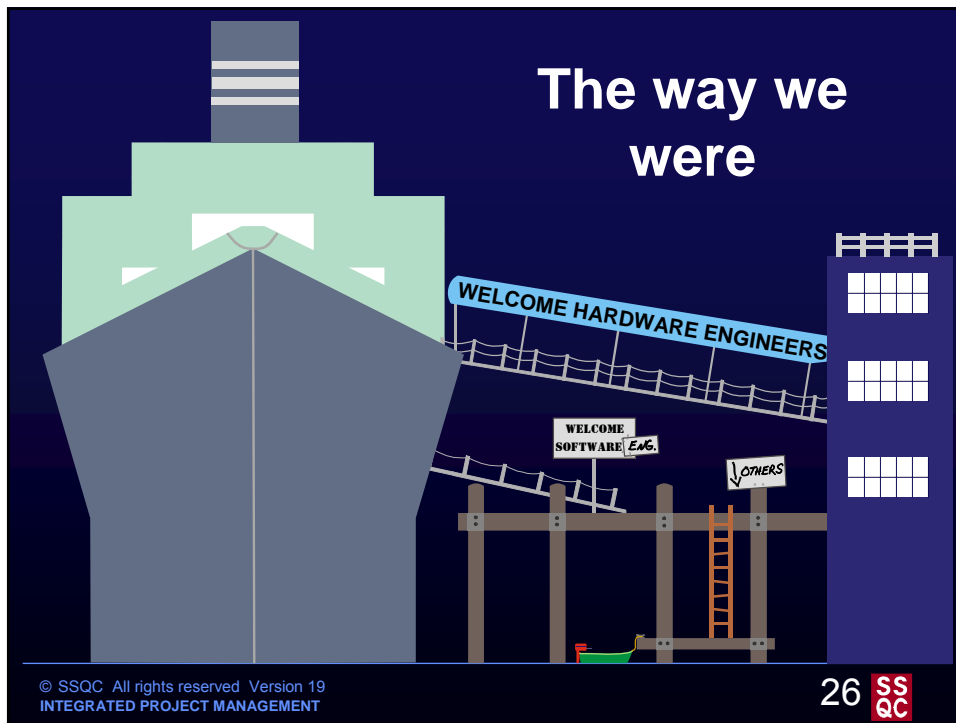
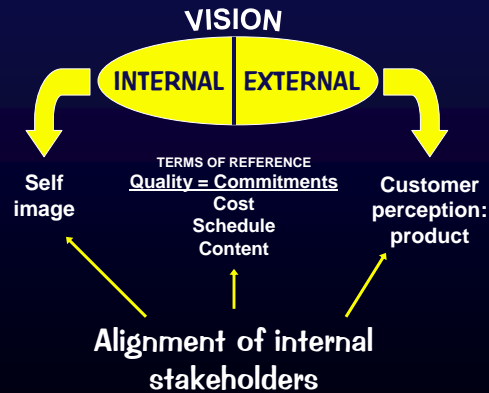
Importance TO PROCESS IMPROVEMENT Support FOR VISION AND BUSINESS OBJECTIVES

Establish and manage the project and the involvement of relevant stakeholders according to an integrated and defined process

[v1.1, IPM, Purpose]

IPM is a cornerstone of process improvement. It enhances every Engineering, Support, and Project Management PA.

It enables continuous, systematic alignment of resources, activities, and business objectives - converging on customer value.



© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

26 SSQC

CMMI: Opportunities beyond S/W and the S/W CMM



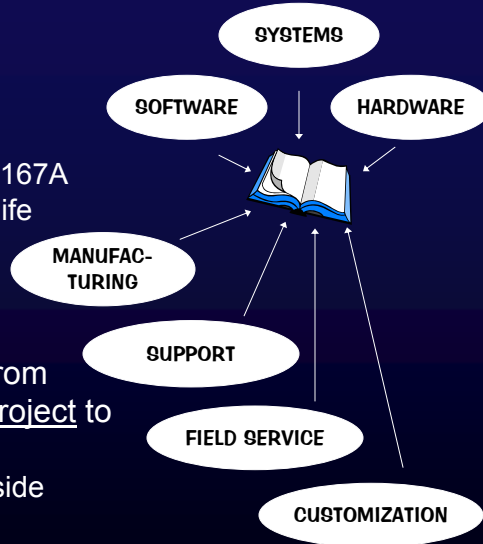
Integrate engineering disciplines - one "book"

- Reduce influence and language of MIL-STD-2167A
- Appears more flexible, life cycle independent
- More content for engineering



IPPD - Expands scope from (software) engineering project to product delivery

- Inclusion of groups outside engineering is explicit



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

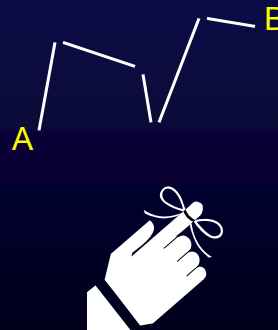
27 **SS**
QC

Benefits TO THE ORGANIZATION

Since the defined process of each project is tailored from the organization's set of standard processes, variability among projects is typically reduced and projects can more easily share process assets, data, and lessons learned. [v1.1, IPM, Introductory Notes]

Reduced variability and a systematic multi-discipline view of product delivery translates directly into satisfying commitments to all stakeholders, including customers.

Enforced reuse of assets minimizes the cost of reinvention and lays a stable foundation for continuous improvement.



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

28 **SS**
QC

Relationships and dependencies

WITHIN THE PROJECT MANAGEMENT CATEGORY

Integrated Project Management (IPM) ...

- Relies on Project Planning (PP) and Project Monitoring and Control (PMC) for basic project planning and management.
 - Adds requirements for systematic coordination.
 - Incorporates data to drive decisions.
- Integrates Supplier Agreement Management (SAM) to support outsourcing development.



IPM + PP + PMC

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

29 **SSQC**

IPM: Specific goals and practices

SPECIFIC GOALS

SG 1 The project is conducted using a defined process that is tailored from the organization's set of standard processes.

SG 2 Coordination and collaboration of the project with relevant stakeholders is conducted.

SPECIFIC PRACTICES

- SP1.1 Establish, maintain the project's defined process.
- SP 1.2 Use the organizational process assets and measurement repository for estimating and planning the project's activities.
- SP 1.3 Integrate the project plan and the other plans that affect the project to describe the project's defined process.
- SP 1.4 Manage the project using the project plan, the other plans that affect the project, and the project's defined process.
- SP1.5 Contribute work products, measures, and documented experiences to the organizational process assets.

From OPD

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

Send to OPF

30 **SSQC**

A critical specific practice

SPECIFIC PRACTICE

1.4 Manage the project using the integrated plans

WHY: product delivery is beyond any one group's capabilities, responsibilities

SIGNIFICANT INDICATOR(S):

SP1.3, SubPractice 5, peer reviews
SP1.4, SubPractice 2, thresholds

AFFECTED STAKEHOLDERS:

Project team (Mktg ... Mfg)

RESISTANCE:

Accountability - being measured, reporting progress

SPECIAL APPRAISAL CONSIDERATIONS AND

CHALLENGES: Prepare, prepare, and prepare
- Ensure there is adequate preparation time to review the volume of documentation

RECOMMENDATIONS:

Pilot - pick your project wisely

- IMS, IMP, or ...
- New Product Introduction
- Support
- Manufacturing Engineering
- Training
- Technology Transfer
- Manufacturing Master Plan



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

31 **SS QC**

Specific practice 1.4, subpractice 2

2. Monitor and control the project's activities and work products using the project's defined process, project plan, and other plans that affect the project.

This task typically includes the following:

- Using the defined entry and exit criteria to authorize the initiation and determine the completion of the tasks
- Monitoring the activities that could significantly affect the actual values of the project's planning parameters
- Tracking the project's planning parameters using measurable thresholds that will trigger investigation and appropriate actions
- Monitoring product and project interface risks
- Managing external and internal commitments based on the plans for the tasks and work products of implementing the project's defined process.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

32 **SS QC**

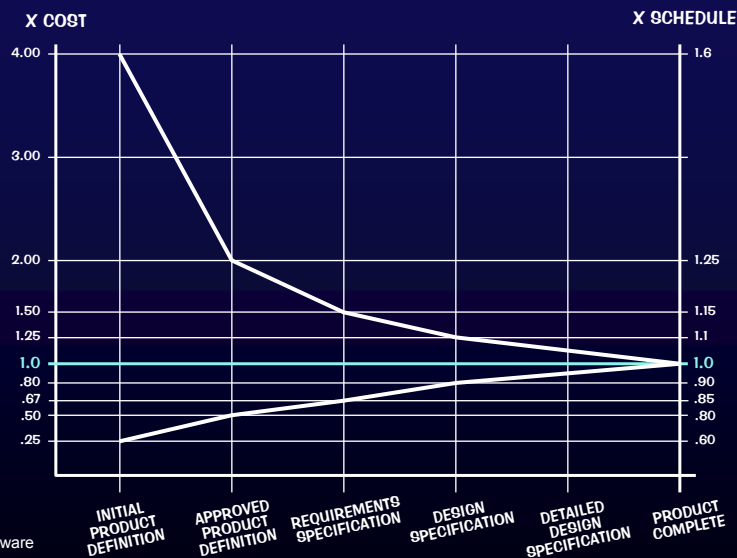
Project management

- Models - predict
- Metrics - track
- Key performance indicators

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

33 **SS**
QC

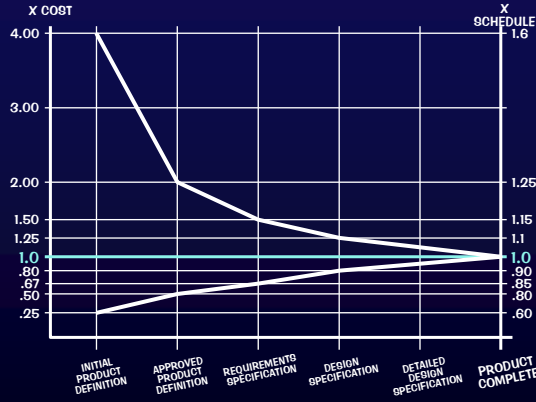
SP 1.2 Use the organizational measurement repository Model variation: set management expectations



Based on S. McConnell, "Software Project Survival Guide", page 7, MCC2

Manipulating the estimates for software

Myth 2: There is a way to get precise, valid estimates



**What is possible:
defined variance**

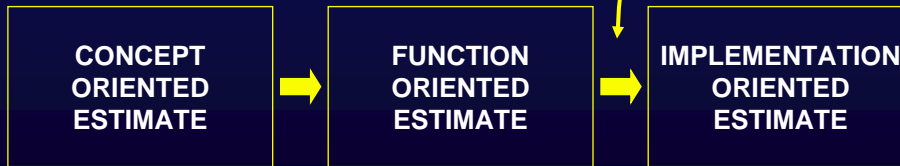
© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



Software estimation accuracy

Requirements hazy,
general purpose of
new software clear

Detailed
design done



± 50%

± 25%

± 10%

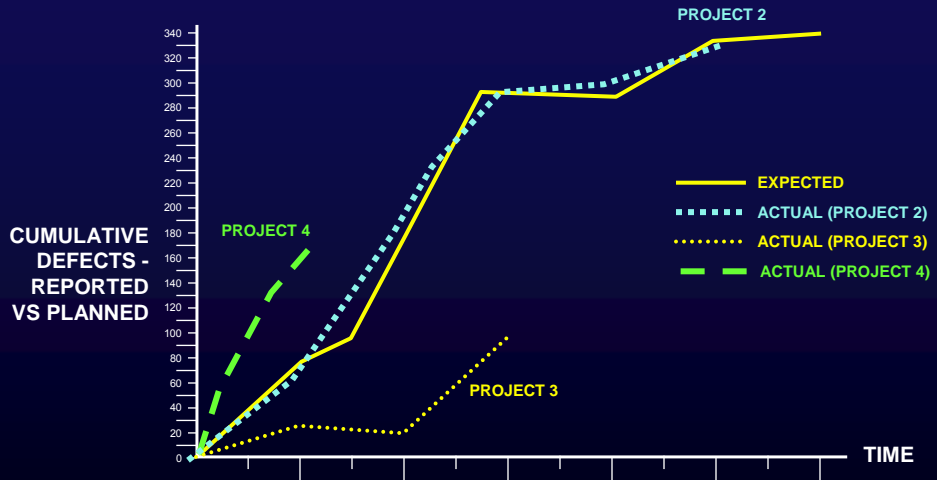
William Roetzheim, *Estimating Software Costs [Part 1 of 4]*, *Software Development*, Vol. 8, No. 10, October 2000

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT



SP 1.2 Use the organizational measurement repository

Model performance: defects

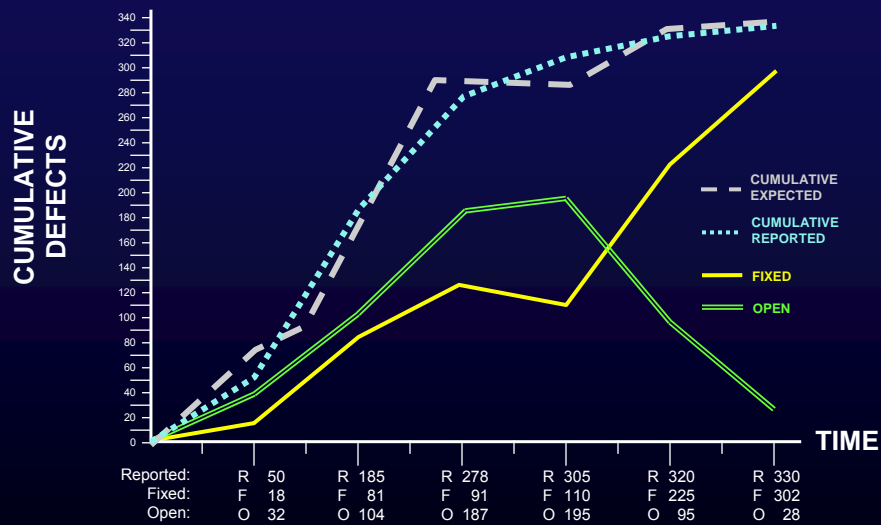


© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

37 **SS**
QC

SP 1.2 Use the organizational measurement repository

Planning and Tracking performance: defects

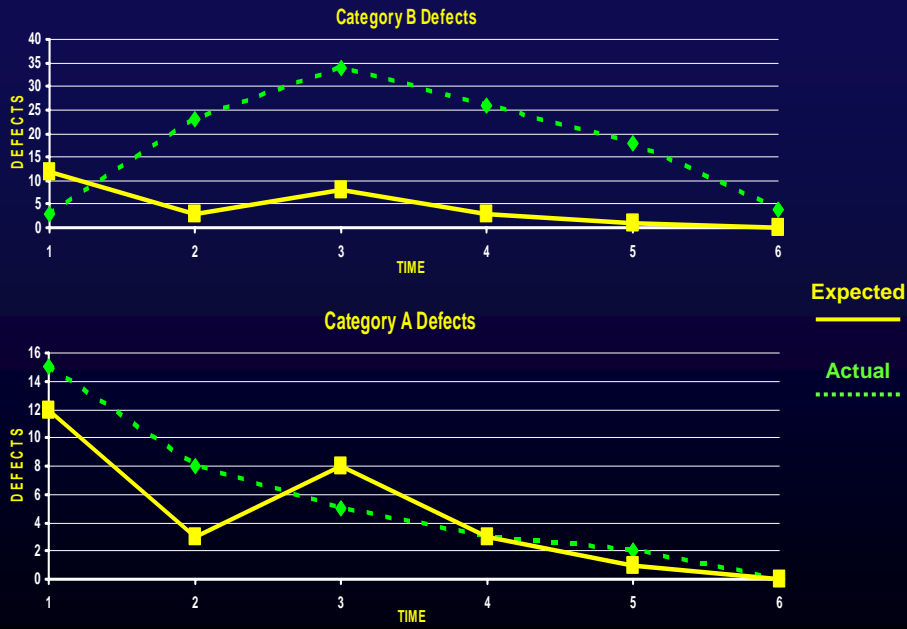


© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

38 **SS**
QC

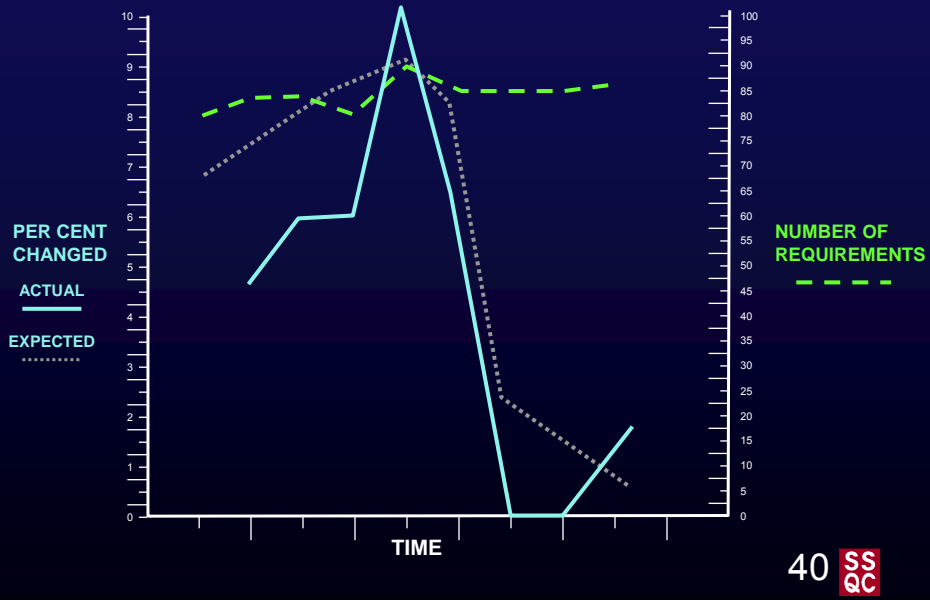
SP 1.2 Use the organizational measurement repository

Defects by severity

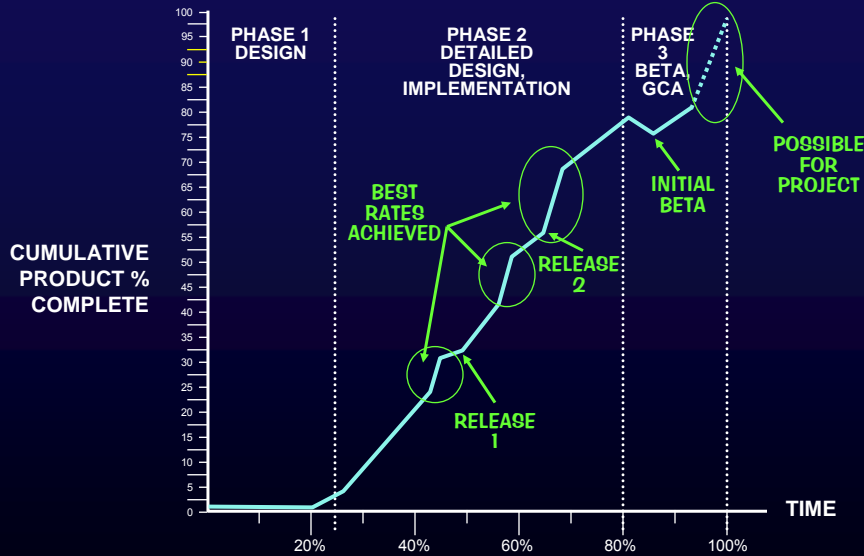


SP 1.2 Use the organizational measurement repository

Requirements stability

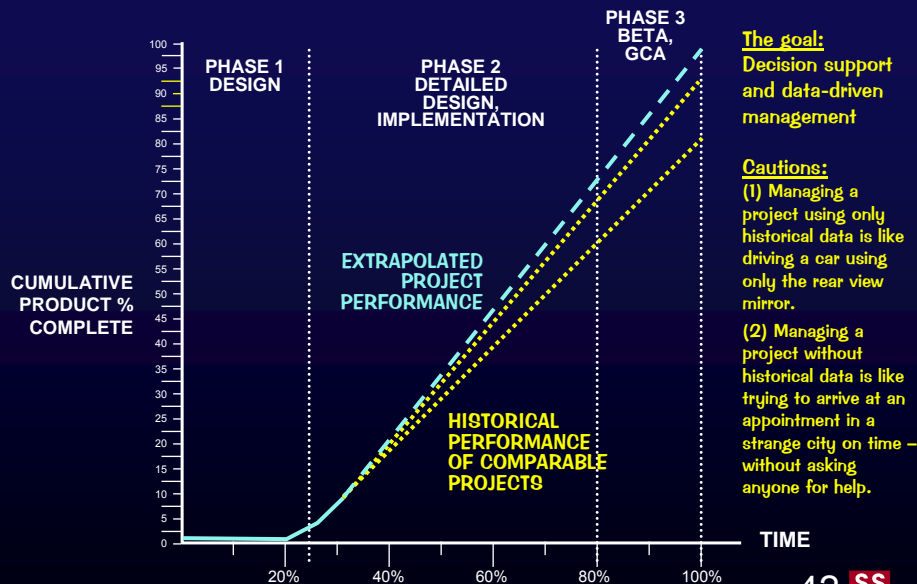


Tracking performance: product complete (Part 2 – with project data)



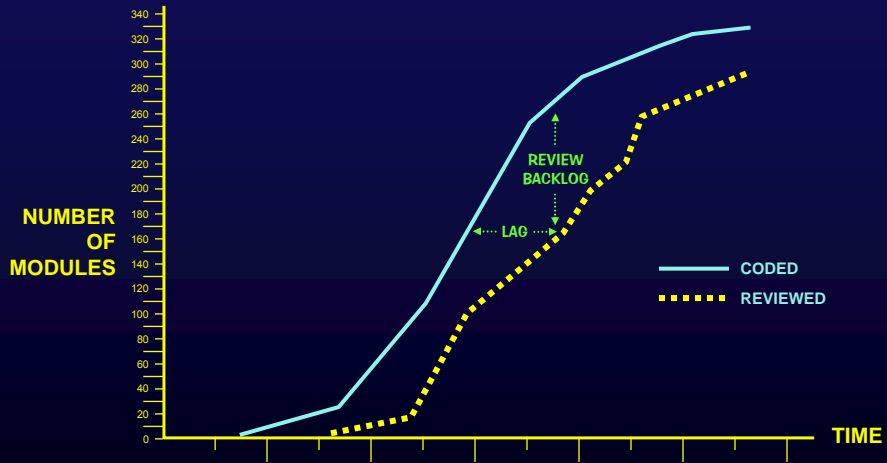
41 **SS**
QC

Tracking performance: product complete (Part 1 – early in the project)



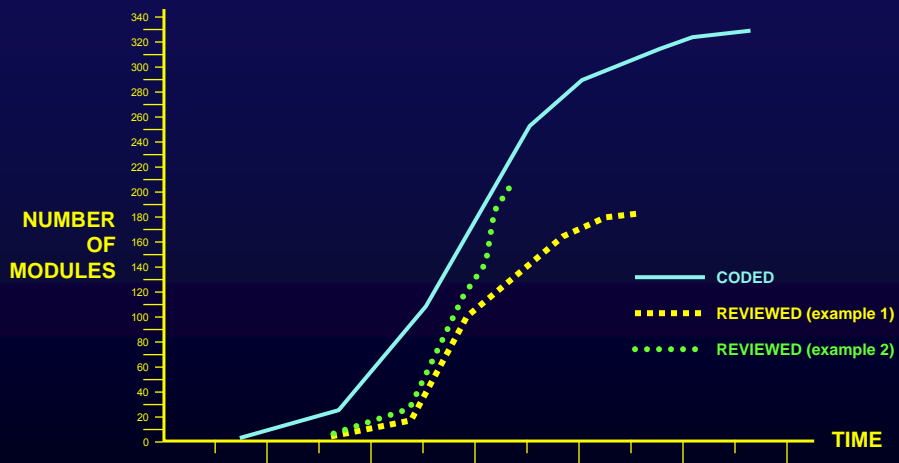
42 **SS**
QC

Tracking performance: reviews



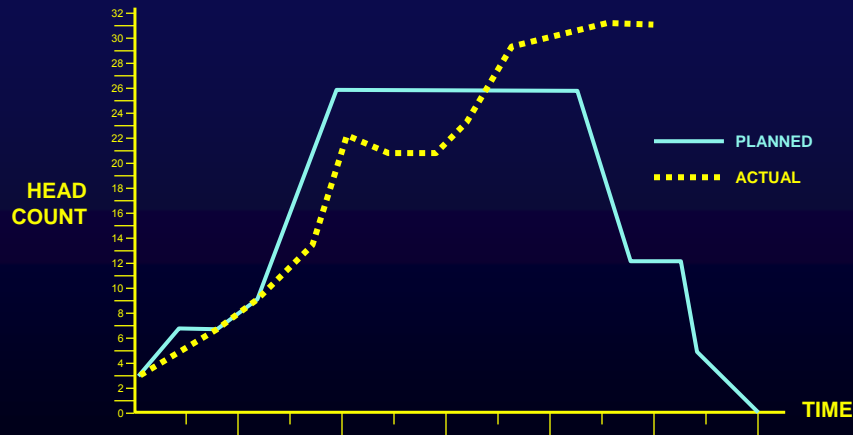
43 **SS**
QC

Tracking performance: reviews (cont.)



44 **SS**
QC

Tracking head count against the plan



45 **SS**
QC

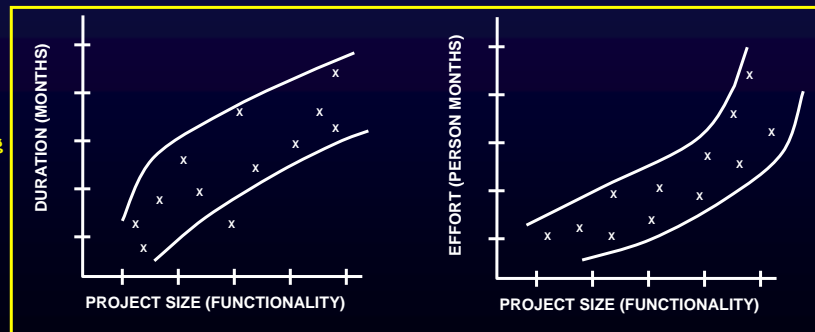
Manipulating the estimates for software

Myth 1: Add staff, compress the schedule

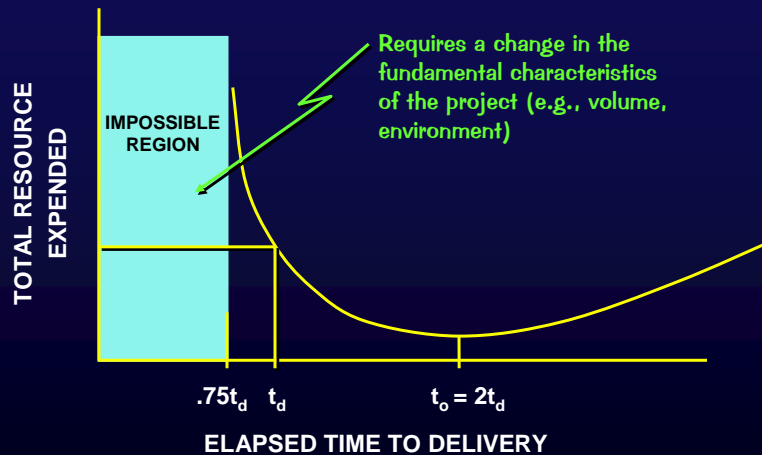
- Brooks' Law: manpower and time not interchangeable
- Based on a nominal schedule, 2x staff:
 - 20% faster
 - 6x defects
 - Coordination complexity = $(n^2-n)/2$
- Supported by core metrics: Size, Time, Effort, Defects (Anita Carleton, CAR1)
- GATHER DATA - Measure, learn from experience

Representing Experience

Michael Mah, MAH1



Myth 1: Add staff ... (cont.)



Roetzheim, ROEI; DODI;
DeMarco, Controlling Software Projects,
Yourdon Press, New York, 1982

t_d = Calculated time of first delivery (from
selected Rayleigh Curve or Boehm formula)
 t_o = Cost optimal time (least effort and cost)

Manipulating the estimates for software

Myth 3: Reuse will save us

- To build in reusability: 2x effort
 - Per class library - from 20 to 40 days
 - Design, inspection, documentation
- Library maintenance
 - Coordinating obsolescence
- Learning curve (6 to 12 months)
 - Library consultant per 4 projects
 - Maintain, communicate, advise, mentor

Myth 4: Assume we'll make it up later (somehow)

Arbitrarily cut time from activities that are further out (and for which estimates are inherently less accurate and defensible)

- Projects over budget when only 15% complete usually complete with overruns
- Actual completion costs will not improve by more than 10% of the current percent overrun
- For commercial projects
 - 10% late ~ 30% loss in profit
 - 50% cost overrun ~ 3% loss in profit

IPM: Specific goals and practices (cont.)

SPECIFIC GOALS

SG 1 The project is conducted using a defined process that is tailored from the organization's set of standard processes.

SG 2 Coordination and collaboration of the project with relevant stakeholders is conducted.

SPECIFIC PRACTICES

SP 2.1 Manage the involvement of the relevant stakeholders in the project.

SP 2.2 Participate with relevant stakeholders to identify, negotiate, and track critical dependencies.

SP 2.3 Resolve issues with relevant stakeholders.

A critical specific practice

2.2 Manage [critical] dependencies

WHY: make dependencies continuously visible, mitigate or prevent impact

SIGNIFICANT INDICATOR(S):

SP2.2, SubPractice 5 - document the critical dependencies and commitments

AFFECTED STAKEHOLDERS:

Project team (Mktg ... Mfg)

RESISTANCE:

Exposure - versus milestone chicken (or $R = v / \pi$)

SPECIAL APPRAISAL CONSIDERATIONS AND

CHALLENGES: Look carefully at SubPractice 6 - track and take action

RECOMMENDATIONS: Pick a pilot project with a strong manager who understands the big picture; ensure team focuses on critical dependencies - avoid blame, focus on solutions

- Identify
- Inform
- Manage - SP 2.2.6
 - On or near critical path; or risk
 - Track and take corrective and preventive action
 - Evaluate the effects of late and early completion for impacts on future activities and milestones

I wish someone had told me ...

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

51 **SS
QC**

Specific practice 2.2, subpractice 5

5. Document the critical dependencies and commitments.

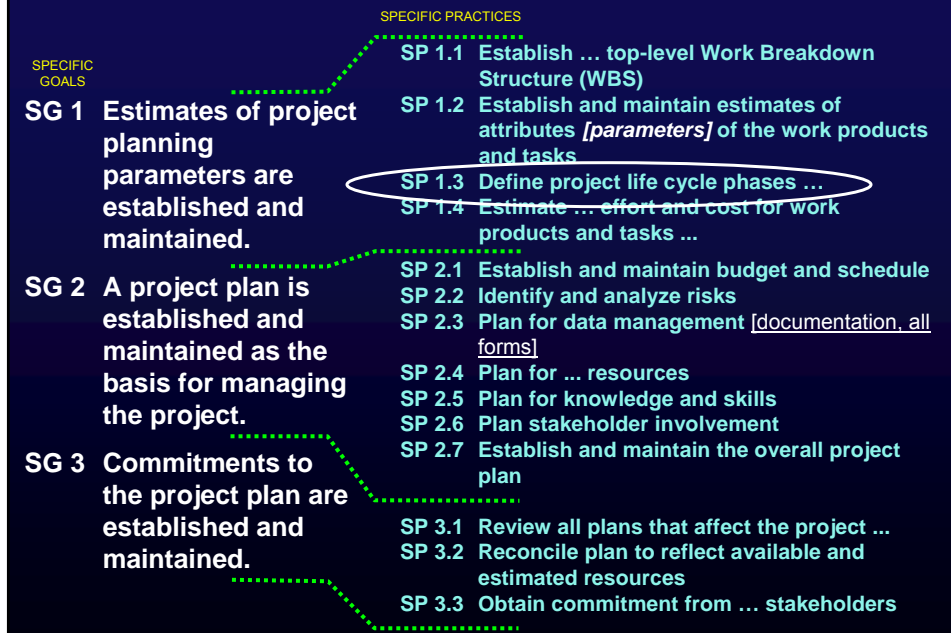
Documentation of commitments typically includes the following:

- Describing the commitment
- Identifying who made the commitment
- Identifying who is responsible for satisfying the commitment
- Specifying when the commitment will be satisfied
- Specifying the criteria for determining if the commitment has been satisfied

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

52 **SS
QC**

Project Planning (PP)



Life cycles and life cycles

From Project Planning (PP), Specific Practice 1.3

Define the project life-cycle phases upon which to scope the planning effort.

The determination of a project's life-cycle phases provides for planned periods of evaluation and decision making. These are normally defined to support logical decision points at which significant commitments are made concerning resources and technical approach. Such points provide planned events at which project course corrections and determinations of future scope and cost can be made.

For Software Engineering

The determination of project phases for software typically includes selection and refinement of a software development model to address interdependencies and appropriate sequencing of software project activities.

For Systems Engineering

Identify the major product phase (e.g., concept exploration, development, etc.) for the current state of the product ...

Life cycles and life cycles (cont.)

More from Project Planning (PP), Specific Practice 1.3

The project life cycle consists of phases that need to be defined depending on the scope of requirements, the estimates for project resources, and the nature of the project. Larger projects may contain multiple phases, such as concept exploration, development, production, operations, and disposal. Within these phases, subphases may be needed. A development phase may include subphases such as requirements analysis, design, fabrication, integration, and verification. Depending on the strategy for development, there may be intermediate phases for the creation of prototypes, increments of capability, or spiral model cycles.

Understanding the project life cycle is crucial in determining the scope of the planning effort and the timing of the initial planning, as well as the timing and criteria (critical milestones) for re-planning.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

55 

Life cycles and life cycles (cont.)

Guidance from IPM Specific Goal 1

The project's defined process must include those processes from the organization's set of standard processes that address all processes necessary to develop and maintain the product. The product-related life-cycle processes, such as the manufacturing and support processes, are developed concurrently with the product.

From Chapter 3

A "product life cycle" is the period of time, consisting of phases, that begins when a product is conceived and ends when the product is no longer available for use. ... A product life cycle could consist of the following phases: (1) concept/vision, (2) feasibility, (3) design/development, (4) production, and (5) phase out.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

56 

Life cycles and life cycles (cont.)

From the Glossary

Integrated Product and Process Development	A systematic approach to product development that achieves a timely collaboration of relevant stakeholders throughout the <u>product life cycle</u> to better satisfy customer needs.
---	---

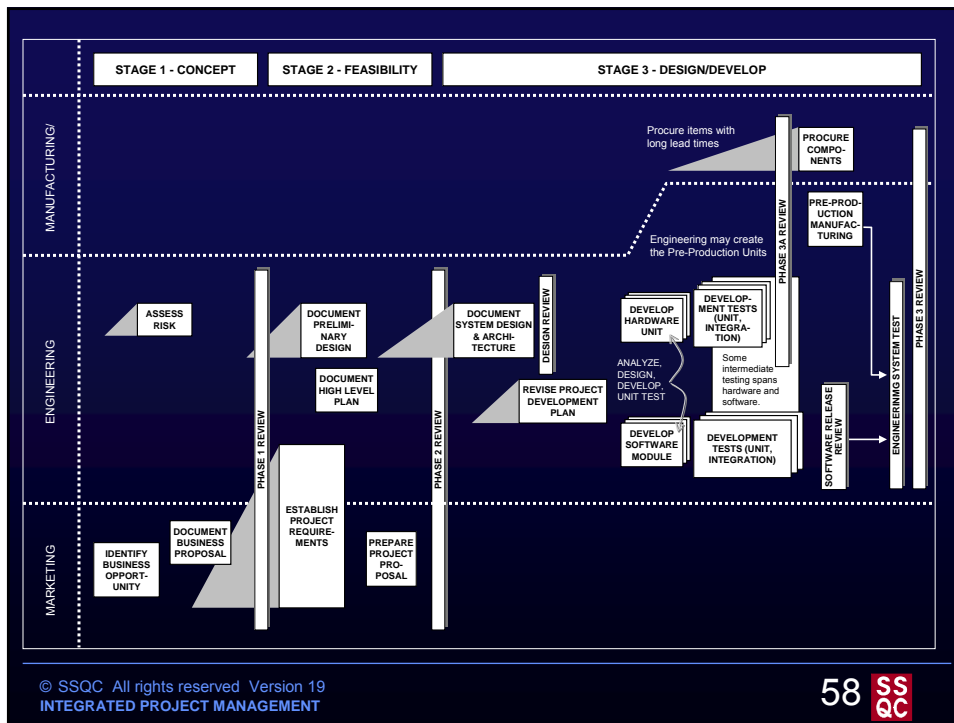
Guidance from RD Specific Practice 1.2

For Integrated Product and Process Development

Relevant stakeholders representing all phases of the product's life cycle should include business as well as technical functions. In this way, concepts for all product-related lifecycle processes are considered **concurrently** with the concepts for the products.

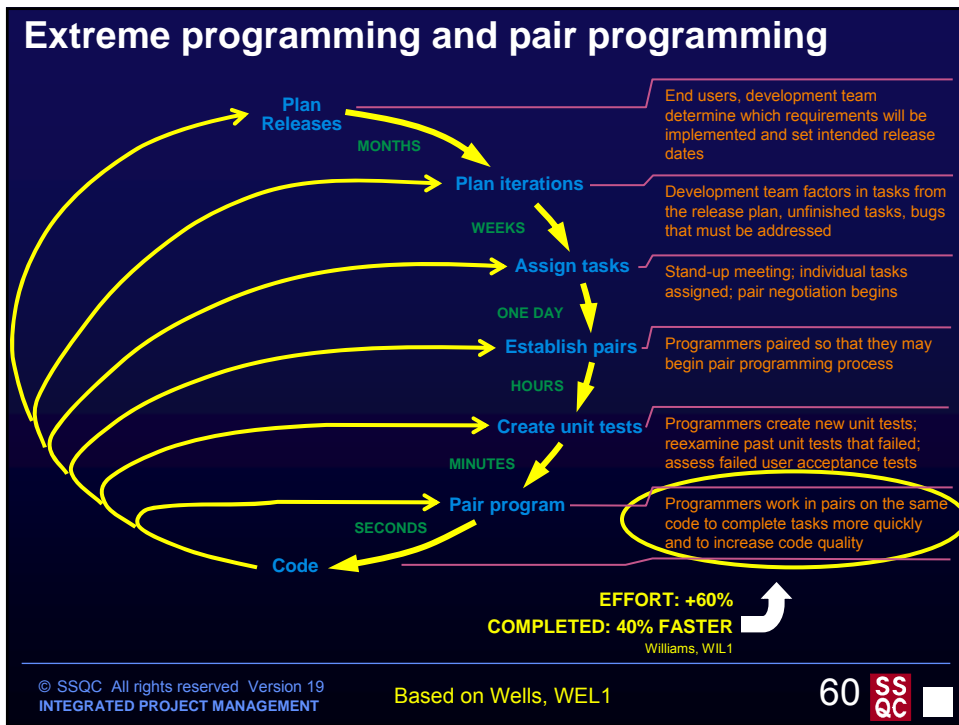
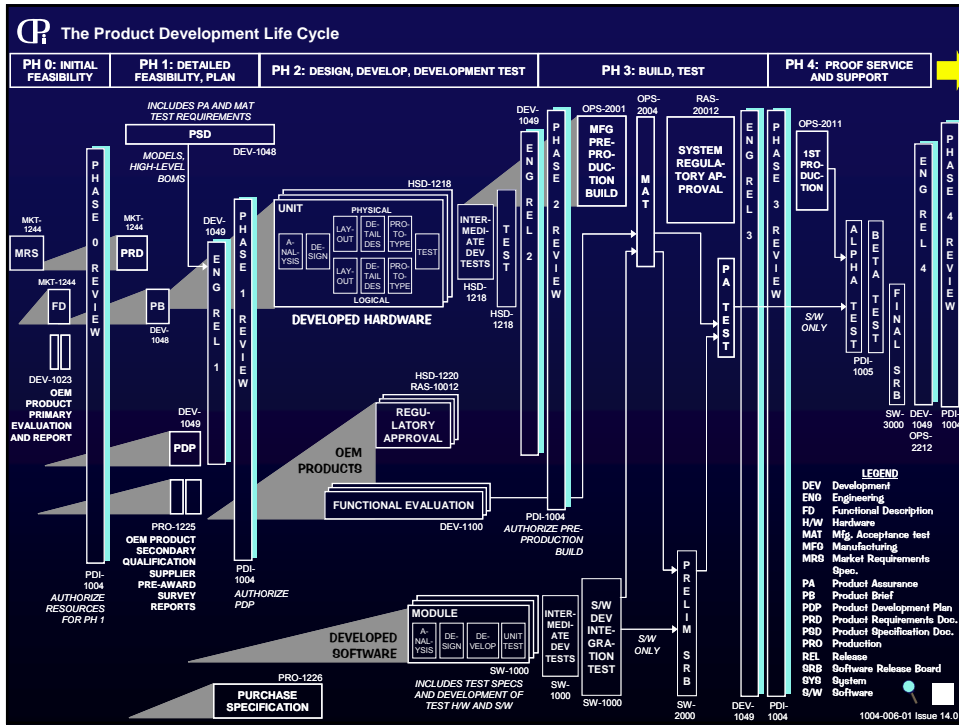
© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

57 **SSQC**

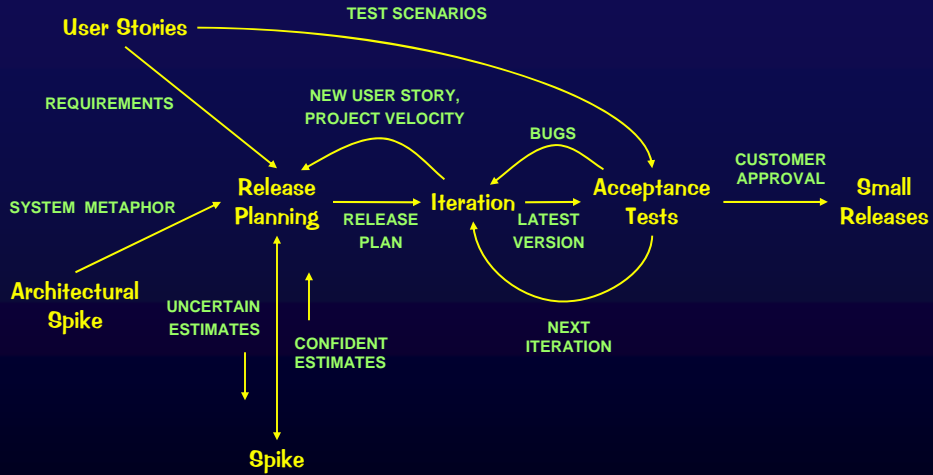


© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

58 **SSQC**



Extreme programming - as a process flow

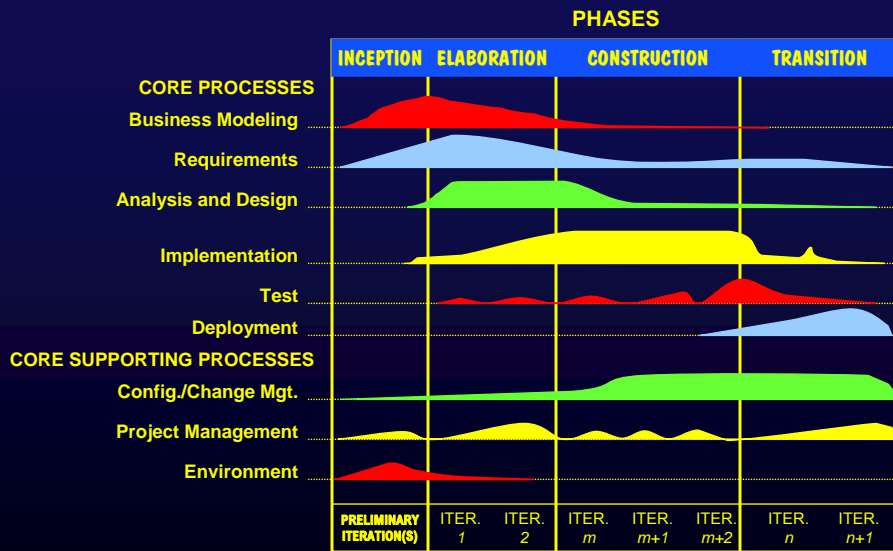


Wells, WEL2

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

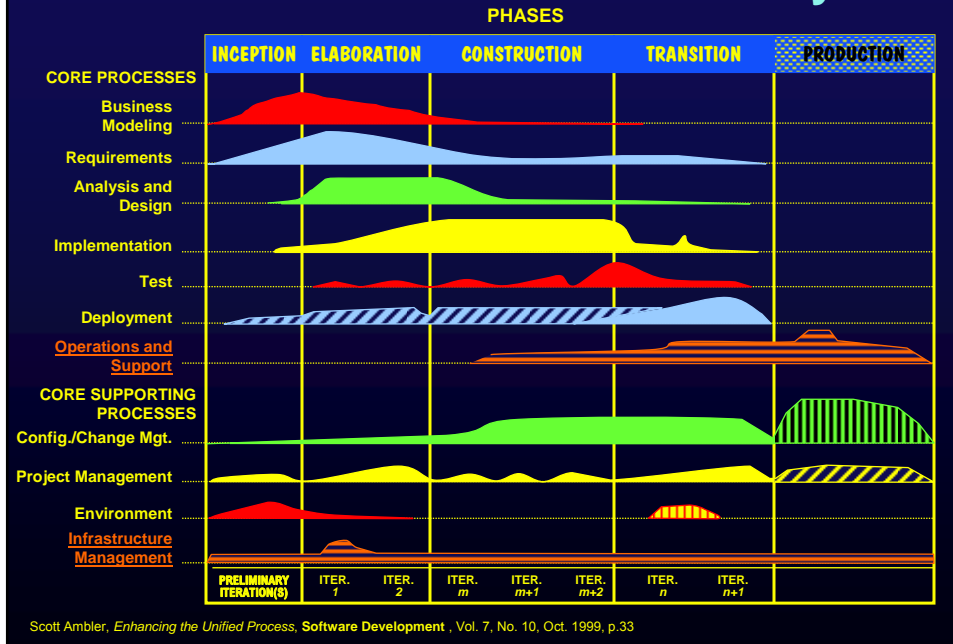
61 **SS**
QC

Unified Process Life Cycle

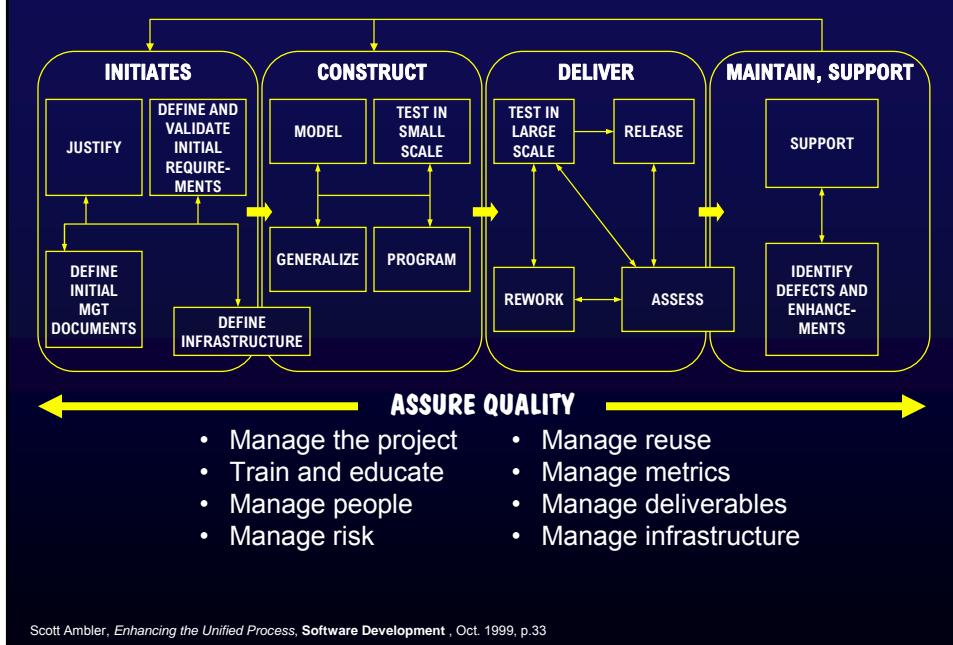


Scott Ambler, *Enhancing the Unified Process*, Software Development, Vol. 7, No. 10, Oct. 1999, p.33

Enhanced Unified Process Life Cycle



The Object-Oriented Process (OOSP) Life Cycle



Project Monitoring and Control (PMC)

SPECIFIC GOALS

SG 1 Actual performance and progress of the project are monitored against the project plan.

SG 2 Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.

SPECIFIC PRACTICES

Monitor actuals against the plan:

- SP 1.1 Parameters
- SP 1.2 Commitments
- SP 1.3 Risks
- SP 1.4 Data management
- SP 1.5 Stakeholder involvement
- SP 1.6 Periodically review progress, performance, issues
- SP 1.7 Review accomplishments and results at selected milestones

- SP 2.1 Collect and analyze the issues and determine the corrective actions necessary to address the issues.
- SP 2.2 Take corrective action on identified issues.
- SP 2.3 Manage corrective actions to closure ... *complete ... effective.*

NOTE The word *dependency* does not appear in Project Monitoring and Control.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

65 **SS**
QC

Integrated Product and Process Development (IPPD)

- With IPPD you get:
 - Two new specific goals for Integrated Product Management (IPM)
 - Two new Process Areas (PA)s
 - Amplification in various other Process Areas
 - Only 64 more pages

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

66 **SS**
QC

IPPD: Specific goals for Integrated Project Management (IPM)

SG 1 The project is conducted using a defined process that is tailored from the organization's set of standard processes.

SG 2 Coordination and collaboration of the project with relevant stakeholders is conducted.

SPECIFIC GOALS

SG 3 The project is conducted using the project's shared vision.

SG 4 The integrated teams needed to execute the project are identified, defined, structured, and tasked.

SPECIFIC PRACTICES

SP3.1 Identify expectations, constraints, interfaces, and operational conditions applicable to the project's shared vision.

SP 3.2 Establish and maintain a shared vision for the project.

SP 3.3 Resolve issues with relevant stakeholders.

IPPD: Specific goals for Integrated Project Management (IPM) (cont.)

SG 1 The project is conducted using a defined process that is tailored from the organization's set of standard processes.

SG 2 Coordination and collaboration of the project with relevant stakeholders is conducted.

SPECIFIC GOALS

SG 3 The project is conducted using the project's shared vision.

SG 4 The integrated teams needed to execute the project are identified, defined, structured, and tasked.

SPECIFIC PRACTICES

SP 4.1 Determine the integrated team structure that will best meet the project objectives and constraints.

SP 4.2 Develop a preliminary distribution of requirements, responsibilities, authorities, tasks, and interfaces to teams in the selected integrated team structure.

SP 4.3 Establish and maintain teams in the integrated team structure.

Case Study: AJ OY



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

69 **SS**
QC

Integrated Product and Process Development (IPPD) - Beyond IPM

- Two new Process Areas
 - Level
 - Category
 - Goals
- Implementation considerations and recommendations
 - Tools and techniques
 - A road map

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

70 **SS**
QC

Integrated Product and Process Development (IPPD): Process Areas

Maturity Level 2: Managed	Maturity Level 3: Defined
<ul style="list-style-type: none"> ▪ Requirements Management ▪ Project Planning ▪ Project Monitoring and Control ▪ Supplier Agreement Management ▪ Measurement and Analysis ▪ Process and Product Quality Assurance ▪ Configuration Management 	<ul style="list-style-type: none"> ▪ Requirements Development ▪ Technical Solution ▪ Product Integration ▪ Verification ▪ Validation ▪ Organizational Process Focus ▪ Organizational Process Definition ▪ Organizational Training ▪ Integrated Project Management for IPPD ▪ Risk Management ▪ Integrated Teaming ▪ Decision Analysis and Resolution ▪ Organizational Environment for Integration
Maturity Level 4: Quantitatively Managed	Maturity Level 5: Optimizing
<ul style="list-style-type: none"> ▪ Organizational Process Performance ▪ Quantitative Project Management 	<ul style="list-style-type: none"> ▪ Organizational Innovation and Deployment ▪ Causal Analysis and Resolution

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

71 **SSQC**

Integrated Product and Process Development (IPPD): Process categories

Category	Type	Level	Process Area
Process Management	Basic	3	Organizational Process Focus
		3	Organizational Process Definition
		3	Organizational Training
	Advanced	4	Organizational Process Performance
		5	Organizational Innovation and Deployment
Project Management	Basic	2	Project Planning
		2	Project Monitoring and Control
		2	Supplier Agreement Management
	Advanced	3	Integrated Project Management for IPPD
		3	Risk Management
		3	Integrated Teaming
		4	Quantitative Project Management
Engineering		2	Requirements Management
		3	Requirements Development
		3	Technical Solution
		3	Product Integration
		3	Verification
		3	Validation
Support	Basic	2	Measurement and Analysis
		2	Process and Product Quality Assurance
		2	Configuration Management
	Advanced	3	Organizational Environment for Integration
		3	Decision Analysis and Resolution
	5	Causal Analysis and Resolution	

Organizational Environment for Integration (OEI)

SPECIFIC GOALS

- SG 1** An infrastructure that maximizes the productivity of people and affects the collaboration necessary for integration is provided.
- SG 2** People are managed to nurture the integrative and collaborative behaviors of an IPPD environment.

Integrated Teaming (IT)

SPECIFIC GOALS

- SG1** A team composition that provides the knowledge and skills required to deliver the team's product is established and maintained.
- SG2** Operation of the integrated team is governed according to established principles.

Suggestions and comments: tools and techniques for integrated teams

- Periodic project reviews
 - The Key Deliverables Review (KDR)
 - Risk Management
- Milestone/Phase reviews
 - Checklists
- Earned Value as an approach
- Planning and replanning
 - Granularity

KDRs - The simple truth

KDR REPORT - 01/14 - PHLM Project

WBS/DESCRIPTION	ORIGINAL	START		
		LAST	CURRENT	ACTUAL
1 Requirements baselined	01/07		01/21	01/13
2 System design baselined	01/31		2/6	
3 <u>Control subsystem</u>	7/4			
3.1 Design baselined	3/07	3/21	3/14	
3.2 Prototype completed	5/4			
3.3 Prototype concept test completed	7/4			
4 <u>Propulsion subsystem</u>	9/15			
4.1 Design baselined	2/18		2/25	
4.2 Prototype completed	7/21			
4.3 Prototype concept test completed	9/15			
5 Control/Propulsion Integrated	12/01			
6 Control/Propulsion Integration Test	12/31			

COMMENTS

- 2 Resources not available to take advantage of early completion of 1
 - 3.1 Adjusted for 1 week slip in 1
- Expect to make up time and not slip subsequent steps by adding 1 engineer to project.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

75 

How do you already incorporate risk prevention and mitigation into your projects?

A COMMENT

Some activities, which are not perceived as having intrinsic importance, may be parts of a mitigation strategy (cross training, reviews, investigation of alternatives).

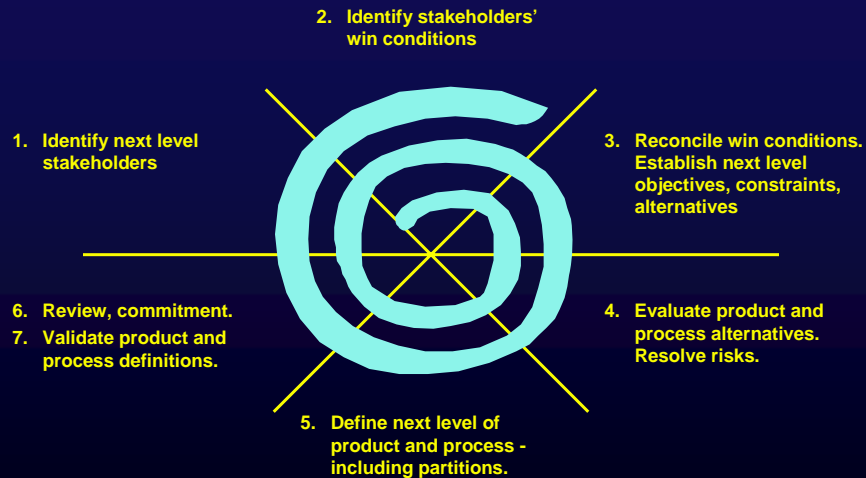
If the mitigation strategy is not clearly communicated and managed, there is a significant risk that the mitigation will be OBE*.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

* OBE Overcome by Events

76 

Risk and the new spiral model - the win-win elaboration



[BOE1]

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

77 **SS**
QC

Top 10 Risks

1989

1. Personnel shortfalls
2. Schedules and budgets
3. Wrong software functions
4. Wrong user interface
5. Gold plating
6. Requirements changes
7. Externally-furnished components
8. Externally-performed tasks
9. Real-time performance
10. Straining computer science

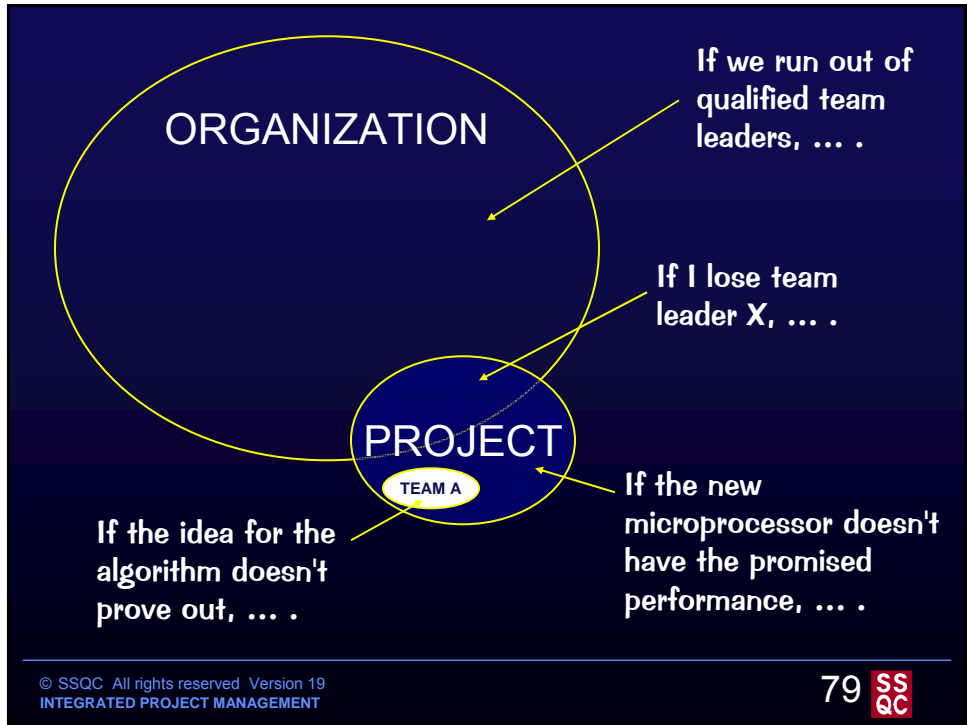
1995

1. Personnel shortfalls
2. Schedules, budgets, process
3. COTS, external components
4. Requirements mismatch
5. User interface mismatch
6. Architecture, performance, quality
7. Requirements changes
8. Legacy software
9. Externally-performed tasks
10. Straining computer science

Barry Boehm

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

78 **SS**
QC



Risks to be managed

- Future
- Significant probability of future occurrence
- Significant potential impact
- Specific and manageable

IF ... THEN ... SO ...

CONDITION	EFFECT	CONSEQUENCE
How a specific planned behavior or outcome is adversely affected		Specific relationship to defined process, plan, assigned responsibility, customer commitment, schedule, cost

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

SSQC

We won't be able to support our customers. We'll get too many customer calls We won't have enough engineers.

If Engineering personnel are unavailable, we won't be able to support our customers.

If key Engineering personnel are unavailable, then we won't be able to respond to escalated calls from customers with our legacy Accounting software.

IF knowledgeable Engineering personnel are unavailable, THEN we won't be able to respond in a timely manner to calls from customers with our legacy Accounting software. [SO] We won't be able to fulfill these customers' current maintenance contracts.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

81 **SSQC**

A common failing in software projects is optimism.

As engineers, we do not clearly communicate the risks we know about.

***Why would that be the case?
What can we do about it?***

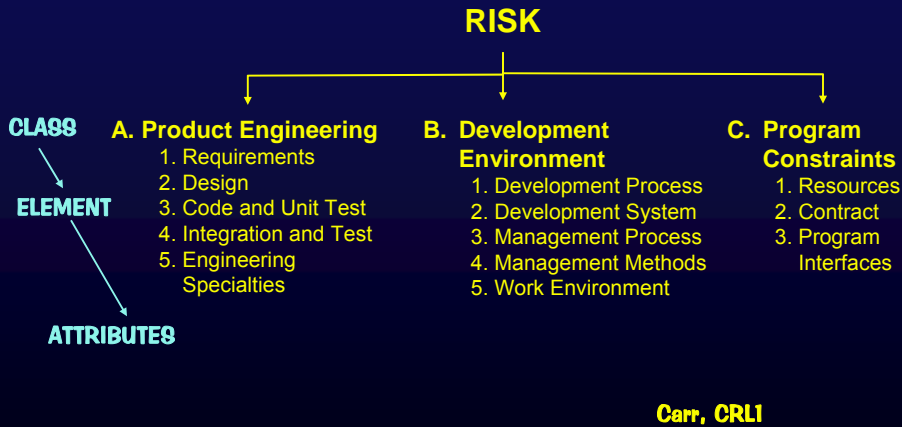
© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

See Carr, CRL1

82 **SSQC**

Formal risk identification

■ Systematic investigation



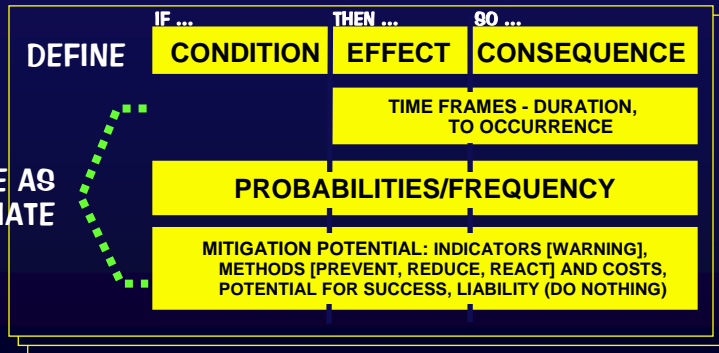
© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

83 **SSQC**

Formal Risk Analysis

① STATE

ELABORATE AS APPROPRIATE



② PLAN

APPROPRIATE DETAIL - BASED ON IMPACT

**PRIORITIZE AND AGGREGATE RISKS
SELECT STRATEGIES FOR MITIGATION
SELECT METHODS TO CONTROL
IDENTIFY RESOURCES**

③ MANAGE

MONITOR, ADJUST, COMMUNICATE

© SSQC All rights reserved. Version 19
INTEGRATED PROJECT MANAGEMENT

84 **SSQC**

Elaborate as appropriate

#	Condition	Effect	Consequence	Impact	Prob	REL RISK
1	If knowledgeable engineering personnel are unavailable	We won't be able to respond in a timely manner to escalated calls from customers with our legacy Accounting software	So we won't be able to fulfill these customers' current maintenance contracts.	LO (1) MED (5) HI (7) V HI (9)	LO (1) MED (5) HI (7) V HI (9)	45

When we release the next version of the new accounting package and if we get the WPI outsource contract, we will be really stretched in engineering

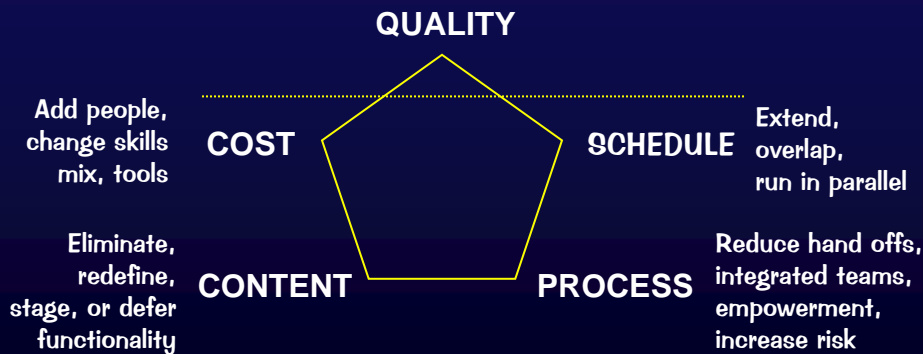
Last year Support received 20 calls about the accounting package, 3 were escalated to Engineering, one required a patch, which took 2 weeks.

We don't quote response times in our maintenance contracts, but these are loyal customers who only call with obscure problems, when they need help. We have 16 customers with our legacy package. None of them are candidates to upgrade and all are happy with what they have.

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

85 **SS**
QC

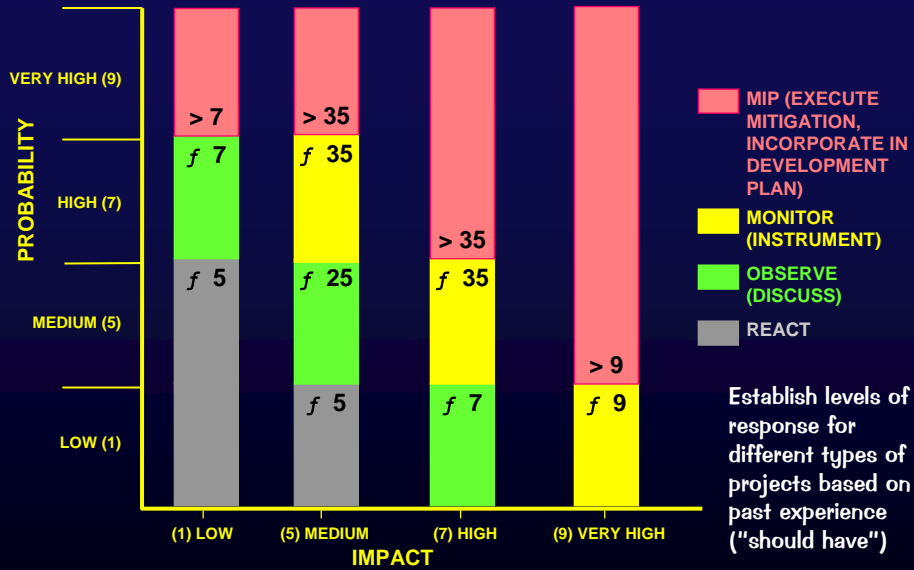
Plan: Variables and mitigation techniques



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

86 **SS**
QC

Manage risks: levels of response and thresholds



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

87 **SS**
QC

Report to executive management: the risk profile

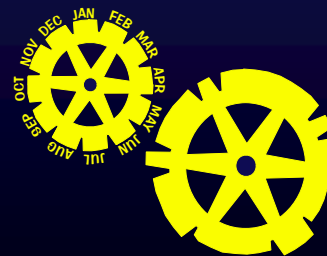
Impact	Response Level				Total
	REACT	OBS	MON	MIP	
LOW	-	-	11	2	-
MED	2	17	8	0	27
HIGH	0	8	4	7	19
V. HIGH			6	1	7

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

88 **SS**
QC

Tracking performance against the plan: Earned Value

- Assumes regular time or effort reporting
 - Sufficient detail to identify work product and activity
- System(s) to report
 - Cost or effort against plan
 - Completion of work against plan



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

89 **SS**
QC

Planning versus reality



As planned

As performed



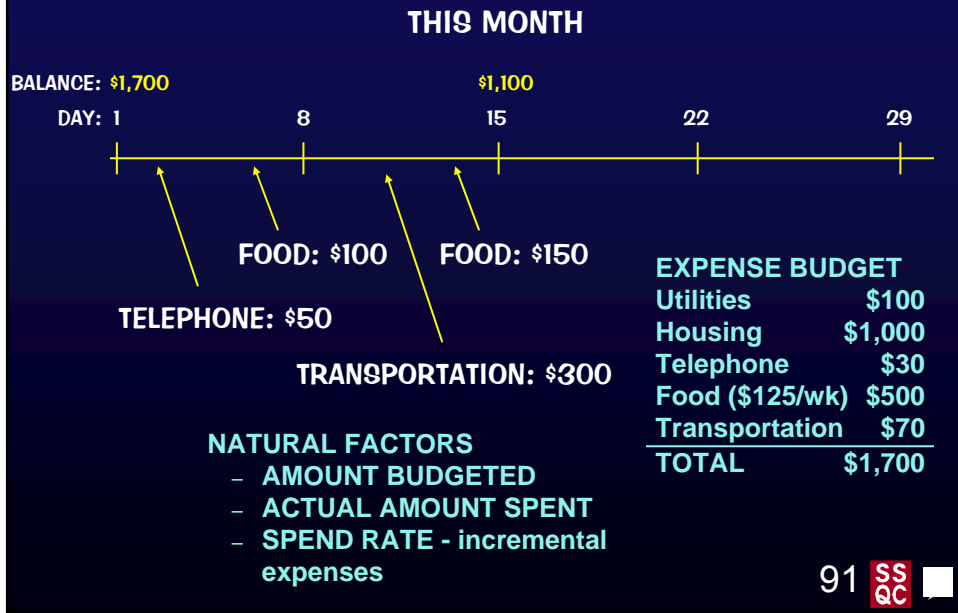
Q May I please see the design.

A Well, we just pulled it back to do some more work on it, but we're way ahead of schedule on the code and we're about to start some testing.

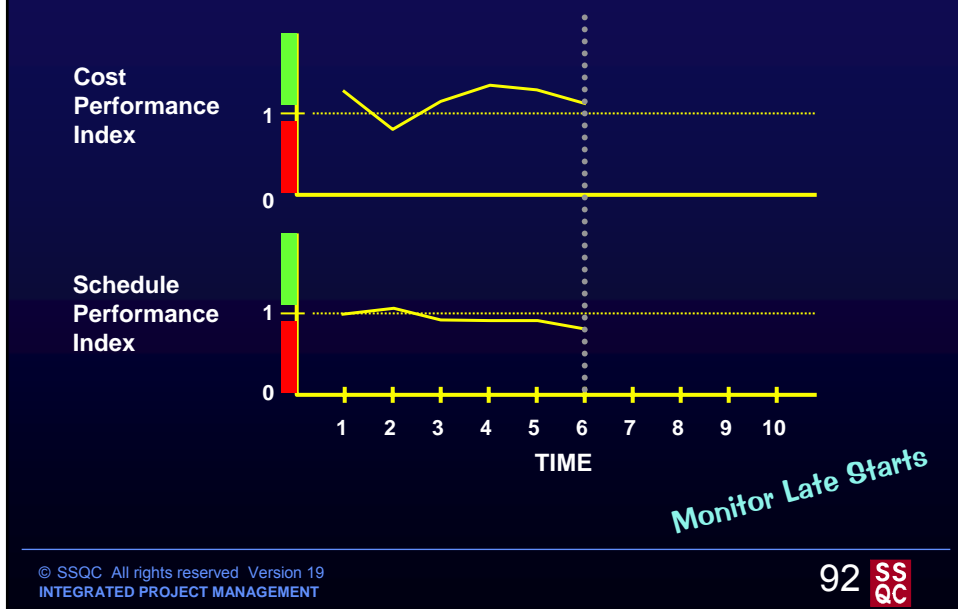
© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

90 **SS**
QC

A familiar example: *How am I doing?*



Performance indices



A Better KDR - Monitor late starts

DEFERRED START REPORT - 01/14

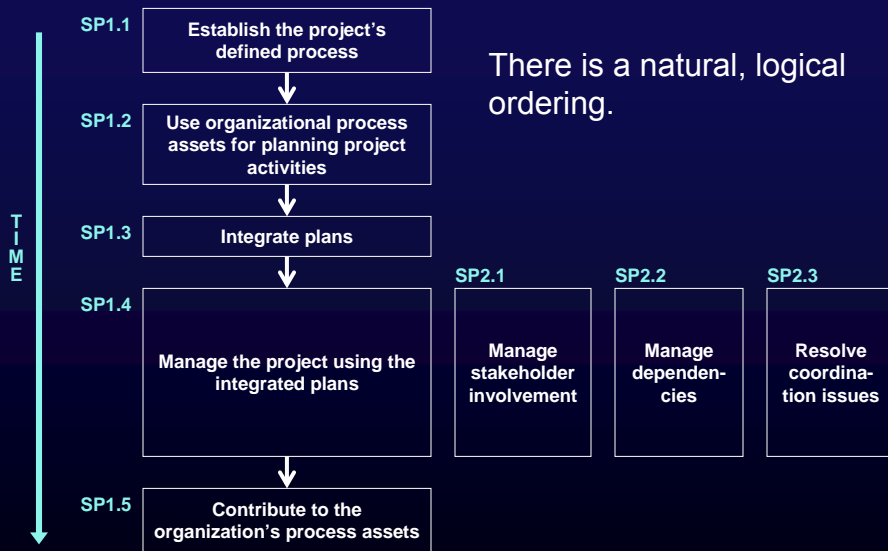
WBS	DESCRIPTION	ORIGINAL	START			RISK
			LAST	CURRENT	ACTUAL	
12.1	Beta Algorithm Detailed Design	01/07		01/21		HI
15.1	Alpha Algorithm Test Specification	01/07		01/14	01/13	
15.1	Fault Tree Test Specification	01/07	01/14	01/21		LO
19.1	High Performance Beta Plan	12/01	01/14	01/21		HI

COMMENTS ON HIGH RISK ITEMS

12.1 The assigned engineer has still not been released from the previous assignment. Current release date is 1/15. Another engineer has been assigned as a back up, but is just starting to learn the class library.

19.1 Marketing has still not identified a target customer. This is not a significant issue since the generic high-performance beta plan only needs to be tailored for the specific customer's configuration.

IPM: Required ordering? *No, but ...*



Examining the Generic Practices through 3.2

GG2 The [Integrated Project Management] process is institutionalized as a managed process	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3 The [Integrated Project Management] process is institutionalized as a defined process	3.1	Establish a defined process
	3.2	Collect improvement information

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

95 **SS**
QC

Examining the Generic Practices through 3.2

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

Address in Project Planning policy: require processes be followed ... or in a general policy that requires that processes be followed

Address as tasks in Project Planning procedures for planning and re-planning throughout life cycle – augmented for Integrated Project Management activities

**MORE ON
GP 2.2
LATER**

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

96 **SS**
QC

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

Two stages of training

- During implementation and roll-out
 - Address development and delivery of initial training in Integrated Project Management portion of CMMI implementation plan
 - Identify role-based skills needs
 - Address development and piloting of on-going training capability as part of implementation plan
- On-going, post-implementation delivery
 - Address in "operator" skills requirements in Project Planning procedures
 - Add role-based skills needs to procedures **team related skills**
 - Identify sources of training
 - Assign responsibility for providing (e.g., immediate manager)
- See Organizational Training (OT) Process Area

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

97 SSQC

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

- Address as tasks in the Project Planning procedures
 - Identify, control [revise, update], status, audit
 - Configuration management of planning work products
 - Examples of the work products of the project planning process include:
 - Estimates and assumptions
 - Historical data
 - Models
 - WBS
 - Plans
 - Schedules
 - Team charters**
 - IPT processes**
 - IPT hierarchy (SEIT, IIPT) – responsibility and authority**
- See the Configuration Management (CM) Process Area

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

98 SSQC

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

☑ Address in tasks for planning, review and approval in Project Planning procedures (change requests, artifacts)

☑ Address as tasks in Project Planning procedures for planning the planning and replanning process (GP 2.2) and reporting (phase dependent)

- Based on selected product life cycle
- Consider whether planning tools can automatically produce relevant measures
 - Change requests - status, progress
 - Plan content - per cent complete
 - Effort expended in planning and replanning activities

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

☑ Address as tasks in Project Planning procedures (phase dependent, periodic) ... and as part of the Process and Product Quality Assurance (PPQA) process(es)

- Provide checklists to support objective evaluation of Project Planning work products and activities – as augmented by IPM work products and activities

☑ Address as tasks for review of activities by higher-level management in Project Planning procedures

... and as part of the standard reporting in the Project Monitoring and Control (PMC) Process Area

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

- ☑ Define in scope statement in the Project Planning policy or procedures
- ☑ Tailoring
 - Include a tailoring section in the Project Planning procedures
 - Options
 - Eligibility or selection criteria
 - Include as "if" statements in procedure
 - Allow for substitutions and exemptions
 - Contract or business requirements

Examining the Generic Practices through 3.2 (cont.)

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

- ☑ Define output and tasks in the Project Planning procedures
 - Process change requests
 - Submission (how, who to?), evaluation, approval
 - Identify process owner(s)
 - Ensure that the Project Planning processes and, if appropriate, the tool automatically generate suitable data to support management's information needs
 - Change requests - status, progress
 - Plan content - per cent complete
 - Effort expended in Project Planning (and replanning) activities
 - Integrated Project Management (IPM) SP 1.5: contribute work products and measures ...

Generic Practice 2.2 Revisited

GG2 The [Integrated Project Management] process is institutionalized as a managed process

GP 2.2 Establish and maintain the plan for performing the process.

The plan typically includes the following:

- Process description[s]
- Standards for the work products and services of the process[es]
- Requirements for the work products and services of the process (quality, time, etc.)
- Dependencies
- Resources
- Responsibility and authority
- Training needed
- Work products to be placed under configuration management, level of management
- Measurement
- Involvement of stakeholders
- Activities for monitoring and control
- Objective evaluation activities for processes and work products
- Management review activities for process and work products

- GG 2 and GP 2.2 apply to and appear in every Process Area
- For Project Planning, GP 2.2 addresses PLAN THE PLAN
 - May not be a project yet
 - Incorporate planning for IPM tasks and activities



Schedule: when in life cycle and what level

103 **SS**
QC

GP 2.2 and the other GPs

GP 2.2 Establish and maintain the plan for performing the process.

The plan typically includes the following:

- Process description[s]
- Standards for the work products and services of the process[es]
- Requirements for the work products and services of the process (quality, time, etc.)
- Dependencies
- Resources
- Responsibility and authority
- Training needed
- Work products to be placed under configuration management, level of management
- Measurement
- Involvement of stakeholders
- Activities for monitoring and control
- Objective evaluation activities for process and work products
- Management review activities for process and work products

GG2	2.1	Establish an organizational policy
	2.2	Plan the process
	2.3	Provide resources
	2.4	Assign responsibility
	2.5	Train people
	2.6	Manage configurations
	2.7	Identify and involve relevant stakeholders
	2.8	Monitor and control the process
	2.9	Objectively evaluate adherence
	2.10	Review status with higher level management
GG3	3.1	Establish a defined process
	3.2	Collect improvement information

104 **SS**
QC

Generic Practice 2.2 Revisited (cont.)

Generic Practice 2.2, Subpractice 3

3. Define and document the plan for performing the process.

This plan may be a stand-alone document, embedded in a more comprehensive document, or distributed across multiple documents. In the case of the plan being distributed across multiple documents, ensure that a coherent picture is preserved of who does what. Documents may be hardcopy or softcopy.



© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

105 **SS**
QC

Tools and tips

- No shortage of tools (free and otherwise) for collaboration,
- BUT ...
 - Process first
 - Tools second

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

106 **SS**
QC

Start-up checklist for Integrated Project Management

- ❶ Define product life cycles
 - Define and align subordinate life cycles and functional area processes
- ❷ Define interfaces with internal organizations
 - Establish risk management process (critical dependencies)
 - Establish change management process
 - Apply appropriate metrics
- ❸ Align organization with life cycle
- ❹ Align working environments and collaboration tools
- ❺ Ensure training takes place

107 

Typical implementation opportunities - Business acquisition and proposal

- ❶ Define interfaces with internal organizations
- ❷ Requirements analysis - capability
- ❸ Requirements definition
- ❹ Requirements change management
- ❺ Estimation

108 

Typical implementation opportunities - Development

- ① Engineering lifecycle definition
- ② Requirements management
- ③ Planning and project management
 - Estimation
 - Verification and validation

109 

- ④ Configuration management
 - Controls for change
- ⑤ Maintenance
 - Lifecycle scalability
 - External problem resolution

110 

Typical implementation opportunities - Manufacturing

- ① Define interface with Engineering/Development
- ② Planning to ensure capability to meet commitments
 - New business (resources and training)
 - New types of product (process engineering)
- ③ Integrate quality functions
- ④ Automate systems to greatest extent practical

111 

Typical implementation opportunities - Services and Support

- ① Define interfaces with internal organizations
- ② Planning to ensure capability to meet commitments
 - New business (resources and training)
 - New types of service (process engineering)
- ③ Automate systems to greatest extent practical

112 

Contact Information

Bill Deibler
Software Systems Quality Consulting
2269 Sunny Vista Drive
San Jose, CA 95128
Phone 408-985-4476 Fax 408-248-7772
deibs@ssqc.com

www.ssqc.com

© SSQC All rights reserved Version 19
INTEGRATED PROJECT MANAGEMENT

113 

Vignettes

1. The Devil's Advocate	MOTIVATION of Senior Engineer	IMPACT of Senior Engineer's Actions	YOUR ACTION (Project Engineering Manager)
<p>There is a senior engineer who is well-respected by his peers for his technical acumen, but who raises objection after objection to any proposed course of action. His objections are always supported by an overwhelming army of facts.</p> <p>His background and experience make him essential to the project team.</p> <p>You are a Project Engineering Manager, to whom the senior engineer reports. What can you do?</p>	<p>Control, risk avoidance, fear, or reinforced behavior. Behavior has been reinforced rewarded because he has been right some of the time (even a stopped clock is right twice a day) – and then he will earn the reputation as wise. When he's wrong, people will think he was cautious, which is not bad, either.</p>	<p>Influence on the team – prevent progress, change, waste time</p>	<p>Educate – if appropriate in conjunction with performance review.</p> <p>Look for alternative expertise.</p> <p>Determine whether team takes him seriously</p> <p>Take (some) objections seriously but do not let them divert you from the selected course of action – apply risk management techniques – reward constructive behavior</p> <p>Focus on external goal as a given – “if we listen to him we'll do nothing” – prioritize – substantiate most important</p> <p>Seek out peer input</p> <p>Listen, ignore, give specific assignments to which he can commit – will micromanaging work?</p>

2. The Pressure Cooker	MOTIVATION of Engineer	IMPACT of Engineer's Actions	YOUR ACTION (Project Engineering Manager)
<p>There is an engineer who dependably produces world-class work products, but who works best under pressure. He spends a great deal of time thinking about the assignment, working on problems, helping other people. As a result, the bulk of his truly brilliant work is produced just before the deadline.</p> <p>You are a Project Engineering Manager, to whom the engineer reports. What can you do?</p>	<p>Fear (of starting)</p> <p>Established pattern – he's been rewarded a number of times because he hasn't had to do any rework when major changes have occurred.</p>	<p>Unable to participate fully in intermediate discussions - design reviews.</p> <p>He always gets done on time – never early, available for additional assignment.</p> <p>Sometimes runs late – short cuts.</p> <p>Unable to transfer work to someone else if something better comes along for this person</p>	<p>Educate.</p> <p>More detailed intermediate deliverables.</p>

3. Teflon	MOTIVATION of Engineers	IMPACT of Engineers' Actions	YOUR ACTION (Project Manager)
<p>Engineers immediately label any schedule slippage or cost overrun as due to changes over which they have no control.</p> <p>Requirements changed. The design evolved based on experience with the product. People resigned and were replaced with less experienced engineers. People were added. Resources were temporarily reassigned to emergencies. Assigned resources were not available when they were supposed to be. They were held up on other projects that were (also) running longer than anticipated.</p> <p>You're the Project Manager, to whom the engineering project managers come with their explanations. What can you do?</p>	<p>Teflon = responsibility doesn't stick</p> <p>Defensive – bad estimates – lack of skill, learning curve, overly aggressive estimates</p> <p>Avoid responsibility</p> <p>Tell the truth – feels helpless</p> <p>Likes stability, dislikes change.</p>	<p>Shotgun approach does not get to the cause of the problem – and lead to correction.</p> <p>Creates an impossible problem – how to get on track with something new while finishing up other stuff that is off track</p>	<p>Ensure processes allow for changes</p> <p>Data</p> <p>Defined reserve</p> <p>Better requirements impact analysis – ensure resources available for requirements analysis</p> <p>Track time mentoring – new employee process</p> <p>Risk management</p>

4. Sinatra	MOTIVATION of Engineer	IMPACT of Engineer's Actions	YOUR ACTION (Project Engineering Manager)
<p>Based on a flash of inspiration, the software engineer saw a better way to implement the requirement. Not only was less code required, the code was less complex, more maintainable, offered better exception handling, and seemed to represent a more effective basis for any future enhancements that might be required.</p> <p>The simplicity of the new solution made it appear feasible to scrap what had been done and still finish the new code on time, by the end of the week.</p> <p>And he did.</p> <p>You are a Project Engineering Manager, to whom the engineer reports. What can you do?</p>	<p>Sinatra after Frank: My Way Control, truly brilliant insight, self-aggrandizement</p>	<p>Testing, documentation (internal), previous reviews, interfaces</p>	<p>Reward insight – technical quality</p> <p>Educate on dependencies and risk</p> <p>Evaluate change method – could the new insight have been incorporated into the project in time?</p> <p>How come no-one noticed what was going on?</p>

5. Cleo - the view from the top	MOTIVATION of Software Manager	IMPACT of Software Manager's Actions	YOUR ACTION (VP of Engineering)
<p>The software manager told the Vice-President (VP) of Engineering that, after some investigation, it appeared the software could not be ready as early as the new hardware. The software manager proposed an alternative date for system test that would slip the product release by 2 months (on a 9 month project).</p> <p>The VP's response was that a two month slip was unacceptable and that the software manager needs to find a way to bring his part of the project in line with the hardware schedule.</p> <p>You are the Vice-President of Engineering. What else can you do?</p>	<p>CLEO = Cleopatra, Queen of de Nile (Denial)</p> <p>Telling the truth – has lots of data</p> <p>Sandbagging – with or without data – self-protection or laziness</p> <p>Doesn't really know any better than the VP since there is no historical data</p> <p>Poor manager – promoted for technical competence – actually believes this is true</p> <p>Can't take the pressure</p> <p>Frustrated – put it off</p> <p>Pressured into unrealistic schedule – can later blame it on the VP – looks good</p>	<p>Project will be late</p> <p>If not do anything else, nothing will improve</p>	<p>Look at plan – try to improve – ask SPM to explain detail to you</p> <p>Agreement on goals – budget, etc. – more degrees of freedom</p> <p>Look at plan – support your people by presenting a revised schedule for project</p> <p>Get help – peers of SPM – senior members of Technical Staff or outside review.</p> <p>Train</p> <p>Fire – hire someone else (a toady)</p> <p>Take schedule seriously – actually monitor and correct as project evolves. Is it far enough out to matter? Fiction OK?</p>

6. Cleo - the other side	MOTIVATION of VP Engineering	IMPACT of VP Engineering's Actions	YOUR ACTION (Software Manager)
<p>The software manager told the Vice-President (VP) of Engineering that, after some investigation, it appeared the software could not be ready as early as the new hardware. The software manager proposed an alternative date for system test that would slip the product release by 2 months (on a 9 month project).</p> <p>The VP's response was that a two month slip was unacceptable and that the software manager needs to find a way to bring his part of the project in line with the hardware schedule.</p> <p>You are the Software Manager. What can you do?</p>	<p>Lack of technical knowledge – fear Control Pressure from above – job is on line Personality conflict Preconception from hardware background</p>	<p>Project will be late If not do anything else, nothing will improve SPM will fake up a plan that meets needs Lack of support from SPM</p>	<p>Agreement on goals and constraints (e.g., budget, technology, tools, resources) Look at plan – try to improve Ask for help in planning – from a peer Look at plan – back people by sticking to proposed schedule with VP Revise plan with high-risk assumptions, corner-cutting – someone else will be late anyway – plus the project will change so many times no-one will hold you accountable for this schedule anyway (FICTION) Ask for Training Stand up – tell him to try to find someone else who can</p>

7. Cleo, Part II - no problem	MOTIVATION of Software Manager	IMPACT of Software Manager's Actions	YOUR ACTION (Project Manager)
<p>The software manager told the Vice-President (VP) of Engineering that, after some investigation, it appeared the software could not be ready as early as the new hardware. The software manager proposed an alternative date for system test that would slip the product release by 2 months (on a 9 month project).</p> <p>The VP's response was that a two month slip was unacceptable and that the software manager needs to find a way to bring his part of the project in line with the hardware schedule.</p> <p><i>The software manager went back and did some backward planning. By overlapping previously sequential activities and replacing some estimates with the best case numbers, the software manager was able to tweak Microsoft project into producing a plan that ended close enough to the hardware date to satisfy the VP of Engineering.</i></p> <p>You are the Project Manager (responsible for delivering the hardware and software). What can you do?</p>	<p>Lack of planning or technical knowledge – fear</p> <p>Fear for job</p> <p>Desire to please</p> <p>Disgust</p> <p>Capitulation</p> <p>Resignation</p> <p>Who cares about plans – things change so much no-one will hold me accountable, anyway.</p> <p>Personality conflict</p>	<p>Project will be late</p> <p>If not do anything else, nothing will improve</p>	<p>Look at plan – ask how changes were made – what basis</p> <p>Don't look for easy solution.</p> <p>Examine constraints – ask why – particularly why didn't you do it this way the first time.</p> <p>Look at revised and original plan.</p> <p>Get help – peers</p> <p>Take schedule seriously – in for long haul – not just for one project.</p> <p>Give him enough rope to hang himself. Blame him, replace him, project will be late anyway.</p>

Risk Scenarios

The Forbes Project

The Forbes Project is developing a new product, which the VP of R&D promised the User Group as being available by the end of the year. It is now March 1st.

The Forbes Project requires the development of an algorithm which is based on a branch of Mathematics that is understood by only one engineer in the company. That engineer is currently developing an algorithm for another project and is committed full time to that other project for the next 4 months.

Development of the algorithm for the Forbes Project is planned to start in 4 months, so it will be ready for integration in 6 months.

The Port

To ensure the viability of its popular, cutting-edge product, MicroTome, the company has set up a project to port MicroTome from the DOS operating system to Windows NT. The project's charter is to duplicate the functionality exactly, but incorporate a real GUI, and make a few minor (well-defined) enhancements.

The charismatic project manager, Paul Miller, (PM) also plans to deliver a well-documented, object-based product that will be easily maintainable. The PM has set an aggressive schedule for the team, starting with training in Object-Oriented Techniques, C++, and GUI design. The team is made up of senior engineers who are familiar with the domain and the current product and who have excelled in maintaining the structured code in the DOS-based product.

Risk Taxonomy (see CRL1)

	CLASS		
	A. Product Engineering	B. Development Environment	C. Program Constraints
ELEMENT ATTRIBUTES	1. Requirements a. Stability b. Completeness c. Clarity d. Validity e. Feasibility f. Precedent g. Scale	1. Development Process a. Formality b. Suitability c. Process Control d. Familiarity e. Product Control	1. Resources a. Schedule b. Staff c. Budget d. Facilities
ELEMENT ATTRIBUTES	2. Design a. Functionality b. Difficulty c. Interfaces d. Performance e. Testability f. Hardware Constraints g. Non-Developmental Software	2. Development System a. Capacity b. Suitability c. Usability d. Familiarity e. Reliability f. System Support g. Deliverability	2. Contract a. Type of Contract b. Restrictions c. Dependencies
ELEMENT ATTRIBUTES	3. Code and Unit Test a. Feasibility b. Testing c. Coding/Implementation	3. Management Process a. Planning b. Project Organization c. Management Experience d. Program Interfaces	3. Program Interfaces a. Customer b. Associate Contractors c. Subcontractors d. Prime Contractor e. Corporate Management f. Vendors g. Politics
ELEMENT ATTRIBUTES	4. Integration and Test a. Environment b. Product c. System	4. Management Methods a. Monitoring b. Personnel Management c. Quality Assurance d. Configuration Management	
ELEMENT ATTRIBUTES	5. Engineering Specialties a. Maintainability b. Reliability c. Safety d. Security e. Human Factors f. Specifications	5. Work Environment a. Quality Attitude b. Cooperation c. Communication d. Morale	

Case Study – AJ Oy

BACKGROUND

Arvid Johnson Oy (AJ) is a large, established, and well-respected company based in Finland. One of AJ's products is KAL2 (for *Kalevala 2*), a system for automated inspection of discrete parts for form and finish. KAL2 includes a highly-efficient and intelligent robotic feeder and handler that selects and orients the part, a multi-mode holographic scanner, and PC-based analytical software that interprets the scanner data. The division of AJ responsible for KAL2 has pioneered and its employees hold numerous patents in robotics, in thermal and optical imaging, in ultrasonography, and in the pattern recognition algorithms embedded in the feeder, handler, and scanner firmware.

KAL2 is a worldwide product marketed and supported by sales subsidiaries responsible for a country or major market.

HARDWARE

KAL2 hardware design and manufacturing are in Finland. Major hardware projects may take from 18 to 30 months. Once the hardware detailed design is done and an accurate availability date is determined (typically at least 12 months in the future), the software organization is notified to begin analysis and planning. AJ's goal is to ensure that any required software or software changes are planned for the quarterly release that will correspond with the hardware availability date. Defects in released hardware are rare and are the responsibility of the Hardware Engineering organization in Tampere, Finland. AJ's strategy is to address hardware defects through software changes whenever practical.

SOFTWARE AND SERVICE

For software, AJ KAL2 Division Engineering has established Centres of Software Engineering Excellence (CSWEE) in major technology centers around the world. The CSWEEs range in size from 30 to 230 software engineers and test personnel and 10 to 20 telephone support engineers. In almost all cases, these software development centers have been created and staffed through the acquisition of subcontractors and competitors. Software releases for KAL2 occur four times each calendar year. Software releases typically alternate between maintenance releases and releases with new functionality. If necessary, this pattern is adjusted to accommodate new hardware availability.

In the United States, the sales subsidiary, responsible for the Americas, and the CSWEE are collocated in Costanoa California.

MANAGING KAL2

Changes to the core software and hardware product for KAL2 are approved by a KAL2 R&D Board of Governors that meets quarterly in Helsinki. The Board includes the Directors of the Engineering Centres of Excellence, of the Hardware Engineering organization, and of the sales subsidiaries. New core development projects are typically planned and funded at the January meeting. The other three meetings deal with reviewing proposals for consideration at the next January meeting, monitoring progress on approved programs, and setting priorities for approved programs based on changes in the marketplace.

Software bug fixes are handled by a technical committee made up of the Directors of the Engineering Centres of Excellence. Lately, the field organization (and some customers) have discovered that enhancements can be processed quickly if they are approved as bugs.

THE CSWEE'S

Each CSWEE receives funding from three sources:

- AJ KAL2 R&D funds core product development.
- AJ KAL2 sales subsidiaries fund projects to develop *minor*, market-specific features.
- Customers fund the development of special features for KAL2, which may include the integration of third-party hardware.

At each CSWEE, a team of software engineers, headed by a senior software engineer, is formed for each project, which may last from 1 to 9 months. Each project begins with the current version of KAL2 (or with the version the customer currently has installed). The team leader works with the funding sales subsidiary, and, as appropriate, with customers to complete the project and to secure any add-on work that might be identified in the course of the project.

The US-CSWEE currently has 2 core development projects and 16 non-core projects in progress. The largest project in the US CSWEE is jointly funded by the Americas and the Mediterranean sales subsidiaries. This project grew out of a proposal that was rejected for inclusion in the core product.

THE QUESTION

You are an internal process consultant from AJ OY. Relate the goals of Integrated Project Management (IPM), Project Planning (PP), and Process Monitoring and Control (PMC) to opportunities, situations, or potential problems you might encounter at the Costanoa CSWEE. How could implementing practices to satisfy a goal address the associated situation or problem or seize the associated opportunity to benefit the organization? The audience for your comments is senior management.

For your convenience, worksheets, with the goals and specific practices - and with room for recording potential issues and benefits - are found starting on page 71.

HUOM - WARNING - ATTENTION - ACHTUNG

Do not overtighten. Not all goals necessarily offer benefits to AJ OY. If, after a reasonable amount of individual reflection and team discussion, there does not appear to be a benefit worth presenting, move on.

Integrated Project Management (IPM)

Specific Goals (SG) and Practices (SP)	Opportunity, Situation, or Potential Problem	Benefit
<p>SG 1 The project is conducted using a defined process that is tailored from the organization's set of standard processes.</p> <p>SP 1.1 Establish and maintain the project's defined process.</p> <p>SP 1.2 Use the organizational process assets and measurement repository for estimating and planning the project's activities.</p> <p>SP 1.3 Integrate the project plan and the other plans that affect the project to describe the project's defined process.</p> <p>SP 1.4 Manage the project using the project plan, the other plans that affect the project, and the project's defined process.</p> <p>SP 1.5 Contribute work products, measures, and documented experiences to the organizational process assets.</p>		
<p>SG 2 Coordination and collaboration of the project with relevant stakeholders is conducted.</p> <p>SP 2.1 Manage the involvement of the relevant stakeholders in the project.</p> <p>SP 2.2 Participate with relevant stakeholders to identify, negotiate, and track critical dependencies.</p> <p>SP 2.3 Resolve issues with relevant stakeholders.</p>		
<p>SG 3 The project is conducted using the project's shared vision.</p> <p>SP 3.1 Identify expectations, constraints, interfaces, and operational conditions applicable to the project's shared vision.</p> <p>SP 3.2 Establish and maintain a shared vision for the project.</p>		
<p>SG 4 The integrated teams needed to execute the project are identified, defined, structured, and tasked.</p> <p>SP 4.1 Determine the integrated team structure that will best meet the project objectives and constraints.</p> <p>SP 4.2 Develop a preliminary distribution of requirements, responsibilities, authorities, tasks, and interfaces to teams in the selected integrated team structure.</p> <p>SP 4.3 Establish and maintain teams in the integrated team structure.</p>		

Project Planning (PP)

Specific Goals (SG) and Practices (SP)	Opportunity, Situation, or Potential Problem	Benefit
<p>SG 1 Estimates of project planning parameters are established and maintained.</p> <p>SP 1.1 Establish a top-level work breakdown structure (WBS) to estimate the scope of the project.</p> <p>SP 1.2 Establish and maintain estimates of the attributes of the work products and tasks.</p> <p>SP 1.3 Define the project life-cycle phases upon which to scope the planning effort.</p> <p>SP 1.4 Estimate the project effort and cost for the work products and tasks based on estimation rationale.</p>		
<p>SG 2 A project plan is established and maintained as the basis for managing the project.</p> <p>SP 2.1 Establish and maintain the project’s budget and schedule.</p> <p>SP 2.2 Identify and analyze project risks.</p> <p>SP 2.3 Plan for the management of project data.</p> <p>SP 2.4 Plan for necessary resources to perform the project.</p> <p>SP 2.5 Plan for knowledge and skills needed to perform the project.</p> <p>SP 2.6 Plan the involvement of identified stakeholders.</p> <p>SP 2.7 Establish and maintain the overall project plan content.</p>		
<p>SG 3 Commitments to the project plan are established and maintained.</p> <p>SP 3.1 Review all plans that affect the project to understand project commitments.</p> <p>SP 3.2 Reconcile the project plan to reflect available and estimated resources.</p> <p>SP 3.3 Obtain commitment from relevant stakeholders responsible for performing and supporting plan execution.</p>		

Process Monitoring and Control (PMC)

Specific Goals (SG) and Practices (SP)	Opportunity, Situation, or Potential Problem	Benefit
<p>SG 1 Actual performance and progress of the project are monitored against the project plan.</p> <p>SP 1.1 Monitor the actual values of the project planning parameters against the project plan.</p> <p>SP 1.2 Monitor commitments against those identified in the project plan.</p> <p>SP 1.3 Monitor risks against those identified in the project plan.</p> <p>SP 1.4 Monitor the management of project data against the project plan.</p> <p>SP 1.5 Monitor stakeholder involvement against the project plan.</p> <p>SP 1.6 Periodically review the project's progress, performance, and issues.</p> <p>SP 1.7 Review the accomplishments and results of the project at selected project milestones.</p>		
<p>SG 2 Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan.</p> <p>SP 2.1 Collect and analyze the issues and determine the corrective actions necessary to address the issues.</p> <p>SP 2.2 Take corrective action on identified issues.</p> <p>SP 2.3 Manage corrective actions to closure.</p>		

The Key Deliverables Review

An extract from the Product Development Incorporated **Engineering Handbook**.

Key Deliverables Review (KDR)

The Key Deliverables Review is held monthly. It is chaired by the Chief Operating Officer (COO) and is attended by the heads of the site Engineering organizations, Operations, and Technical Support and Services. Each project is allocated a half-hour during which the project manager presents the progress of the project against standard, high-level milestones. Dependencies, issues, and risks are reviewed. In addition, each presentation may be attended by the project managers for any projects that are dependent on the project being reviewed. Each project manager provides a presentation for the meeting. Each month's presentations, along with any action items developed in the review meeting are maintained in the Project Tracking Book by the COO Project Administrator.

A template for the presentation is provided on the next page.

Key Deliverables Review Project Presentation Template

Date	
Project	
Project Manager	

PROJECT STATUS

MARK ONE

GREEN
 YELLOW
 RED

▲	WBS Item	Description	Completion Date			
			Original	Last	Current	Actual
		Project PRD and PP				
		OEM Qualification COMPLETE				
		Major Sub-System 1 DTD				
		Major Sub-System 2 DTD				
		Major Sub-System 3 DTD				
		Hardware Specification				
		PIP				
		Prototype test				
		Software Integration START				
		Validation START				
		Manufacturing Pre-Production Plan				
		Regulatory COMPLETE				
		RTM				
		Beta START				
		RTS – LA				
		RTS – GA				

▲ = Mark if change from last KDR

Move **Current** to **Last** before changing **Current**

Changes

WBS Item	Justification

Issues

--

Previous Actions

Action	Progress	Target

Acronyms

GA	General Availability	LA	Limited Availability
DTD	Detailed Design	KDR	Key Deliverables Review
PP	Project Plan	PIP	Product Introduction Plan
PRD	Product Requirements Document	RTS	Release to Ship
RTM	Release to Manufacturing	START	Start
WBS	Work Breakdown Structure		

Sample Phase Completion Checklists

The following are selected, sample phase completion or milestone checklists.

Alpha Test Readiness Review Checklist

- Manufacturing Pre-Production Plan complete
- Validation Testing has confirmed:
 - Operation of new features, enhancements, and specified bug fixes
 - All identified operational defects are documented
 - Interoperability with previous releases, all identified interoperability exceptions are documented.
 - All identified performance shortfalls against the performance criteria in the Design Specification are documented

Approval

- Validation Manager
- Beta site coordinator(s)
- Manufacturing Manager

Beta Test Readiness Review Checklist

- Validation Testing has confirmed:
 - Features targeted for Beta are implemented and have been tested
 - No open Class A defects in the portion of the product to be exercised in the Beta Test
 - Established performance targets have been reached
 - All identified performance shortfalls against the Design Specification are documented
- Preliminary user documentation is available
- Preliminary release description is available
- Beta test planning complete (i.e., functionality to be exercised specified; agreements on file)
- Manufacturing Production Plan complete

Approval

- Product Manager
- Software Engineering development lead(s)
- Hardware development lead
- Validation Manager
- Beta site coordinator(s)
- Manufacturing Manager

Release to Ship (RTS) Readiness Review Checklist – for Limited Availability (LA)

- Validation has confirmed:
 - 100% of the features for the identified market/customer/etc. are implemented and tested
 - All performance targets are met
 - No open Class A defects
 - Four or less Class B defects
 - Load testing completed; report available
- Final user and field service documentation are available and reviewed.
- Release Description is complete and available
- Planned Beta Tests successfully completed
- Order Processing trained; order processing procedures, pricing, and part numbers are complete and available
- Sales trained; supporting external literature is complete and available
- Technical Support is trained on the new features
- Product Introduction and Support Services Plan approved
- Customer training is available for the new release
- Any approved waivers are documented with appropriate risk assessment and corrective action plans

Approval

- Product Manager
- Marketing (representing Sales)
- Project Manager
- Publications
- Manufacturing
- Regulatory compliance engineering
- Software Engineering development lead(s)
- Hardware development lead
- Validation Manager
- Legal
- Technical Support

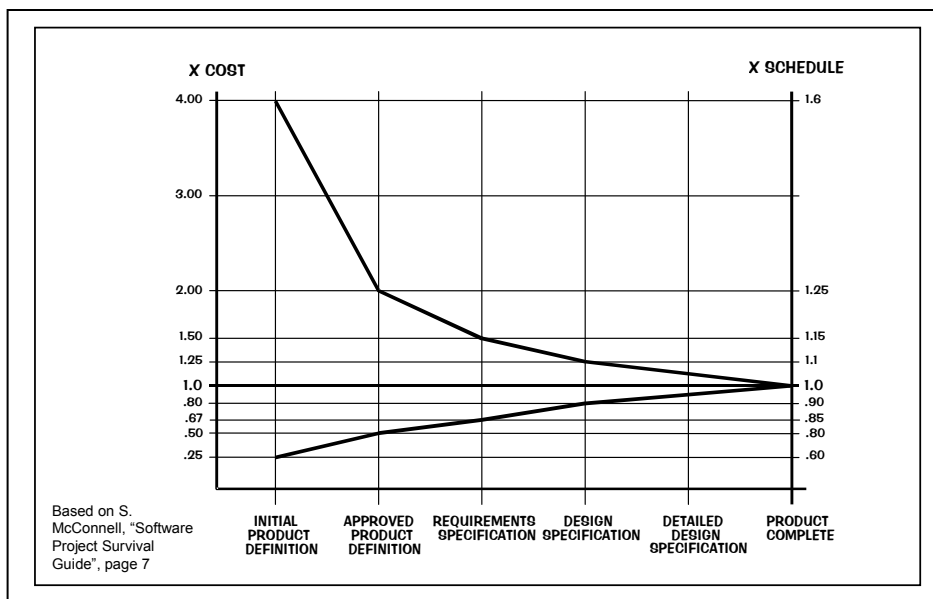
Key Performance Indicators (KPI)

Key Performance Indicators are metrics, attributes or dimensions, of products and processes which, when measured, provide information to support project planning and management. Historical measurement data forms models for predicting performance and for establishing thresholds for taking action. Current measurement data enables management to monitor performance and make appropriate adjustments to ensure that results comply with planned arrangements. As project management skills and resources mature, plans are more accurate and adjustments are less frequent. When adjustments are necessary, they are typically less disruptive, since problems are identified as or before they occur.

The goal of a metrics program is to continuously measure selected product and process attributes and provide a flow of information that is consistent in granularity, volume, and frequency with management's decision making capacity. Too much information, too little information, and information received too late all result in ineffective decision making.

Consider the following metrics, presented in no particular order, as key performance indicators, appropriate for various levels of management.

Metric 1: Estimation Accuracy - The Cone of Variability



The Cone of Variability models the performance of the organization's estimation processes. The X axis represents points in the life cycle at which the balance of the project is replanned. The Y axis is calibrated for cost, schedule, or, as illustrated, for both. The Y axis is the ratio of planned values to actual values, as determined at project completion.

In the example, for Cost, at Initial Project Definition, the historical data from completed projects demonstrates that estimates of total project cost are off by a factor of 4. At Requirements Specification, estimates from replanning are from 1.5 times actuals (50% high) to .50 times actuals (50% low).

In the example, for Schedule, at Initial Project Definition, the historical data from completed projects demonstrates that estimates of the project schedule range from 1.6 times the actual schedule (e.g., estimated 12 months, completed in 7.5 months) to .60 times the actual schedule (e.g., estimated 12 months, completed in 20 months). At Requirements Specification, estimates from replanning are from 1.15 times actuals (e.g., estimated 12 months, completed in 10.4 months) to .85 times actuals (e.g., estimated 12 months, completed in 14.1 months).

It is typically appropriate to maintain models for different technologies or types of projects.

Suggested Application

During planning, the model supports establishing realistic expectations, realistic schedule buffers, and realistic budgetary reserves. As part of lessons learned, it allows the organization to identify opportunities and techniques for improvement. During the execution of the plan, the model provides thresholds that flag activities for management attention.

In the example, activities that take place between Approved Product Definition and Requirements Specification are monitored against a plan that historically ranges from 1.15 times the actual schedule to .85 times the actual schedule. An

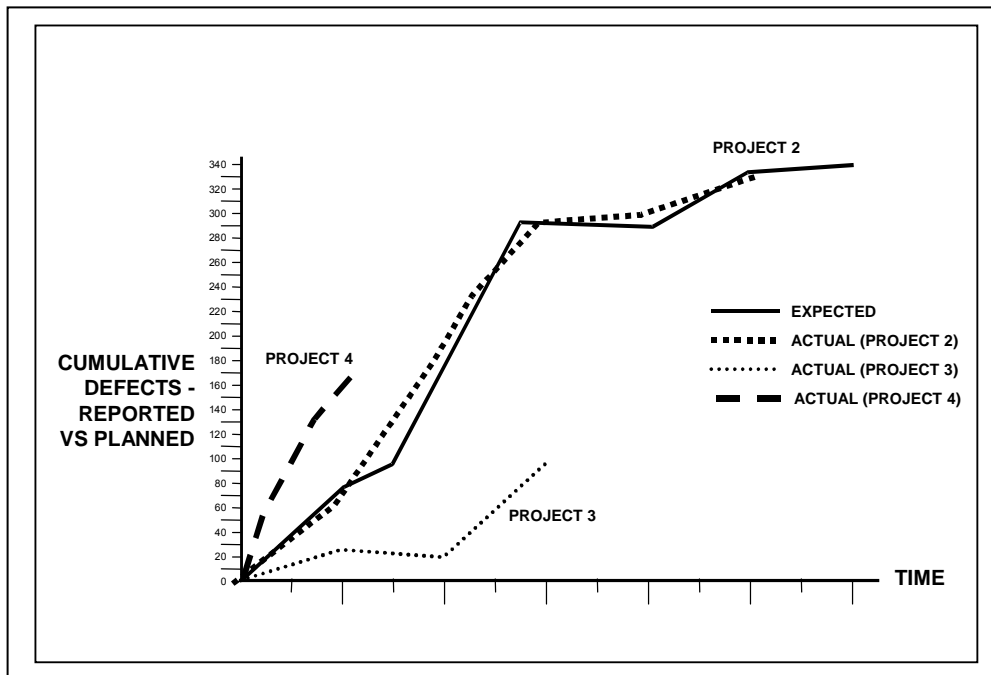
activity planned for completion in 20 days may extend to 24 days before management intervention is appropriate. Or, if it is completed in 17 days, there is no reason for management to be concerned that something is not done - or to reward the team for beating the clock.

Comments

The values in the example represent the results of large systems projects performed under government contracts. Such projects are required to prepare detailed plans as part of the proposal process; they also tend to have significant costs in hardware components. In commercial organizations, while time to market makes maintaining schedules the highest priority, effort is underestimated by a factor of 1.9 and schedules are maintained by removing 25% to 50% of the committed features (see The Standish Group, **Chaos**, 1995, available at www.standishgroup.com).

Metric 2: Defects

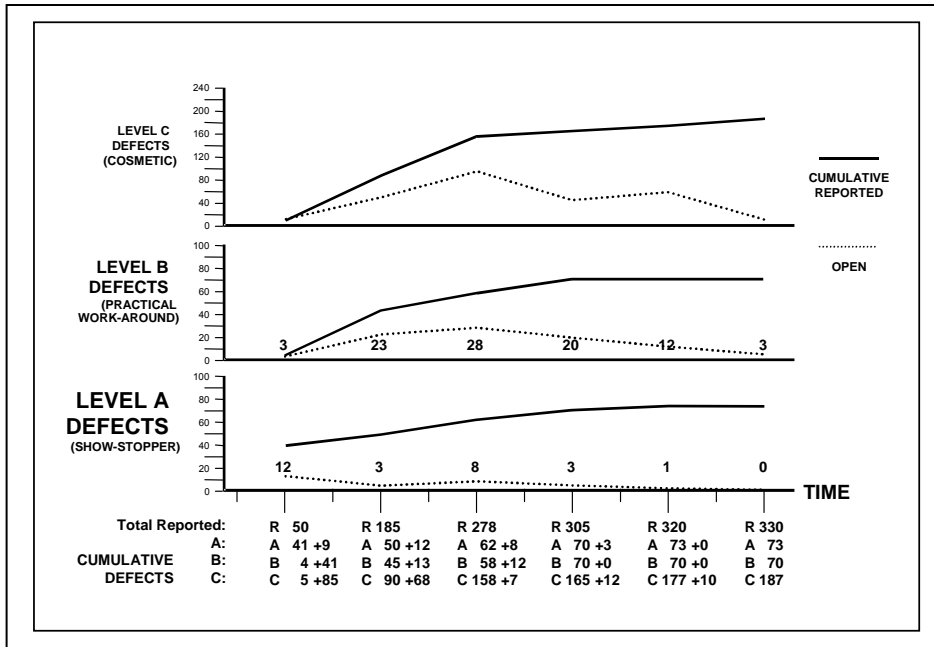
Defects can be measured within design and development (e.g., from first integration to release) or the measurement activity can extend across the product life cycle, to include post-release defects.



In this example, all defects are counted equally. The historical data on defects is used to establish a baseline. Any significant deviation from the baseline signals a need for management attention. In the example, Project 3 and Project 4 both require attention. Is Project 4 in trouble or has it instituted a more rigorous inspection or testing strategy, which should result in much lower numbers in the future? Or is Project 4 addressing a legacy component that is virtually unmaintainable? Is Project 3 an example of exceptional quality? Or has inspection and testing been deferred? Or are the inspection and testing inadequate?

Once again, separate models may be appropriate for projects categorized by size or technology.

Since not all defects are equal, the same approach is taken for modeling and monitoring defects by severity.



In this example, cumulative reported defects and remaining open defects are represented. Labels on the open defect line provide precise counts of the Level A and Level B defects remaining open. Spreadsheet-style captions below the X axis provide complete detail on the number of new defects added to the counts.

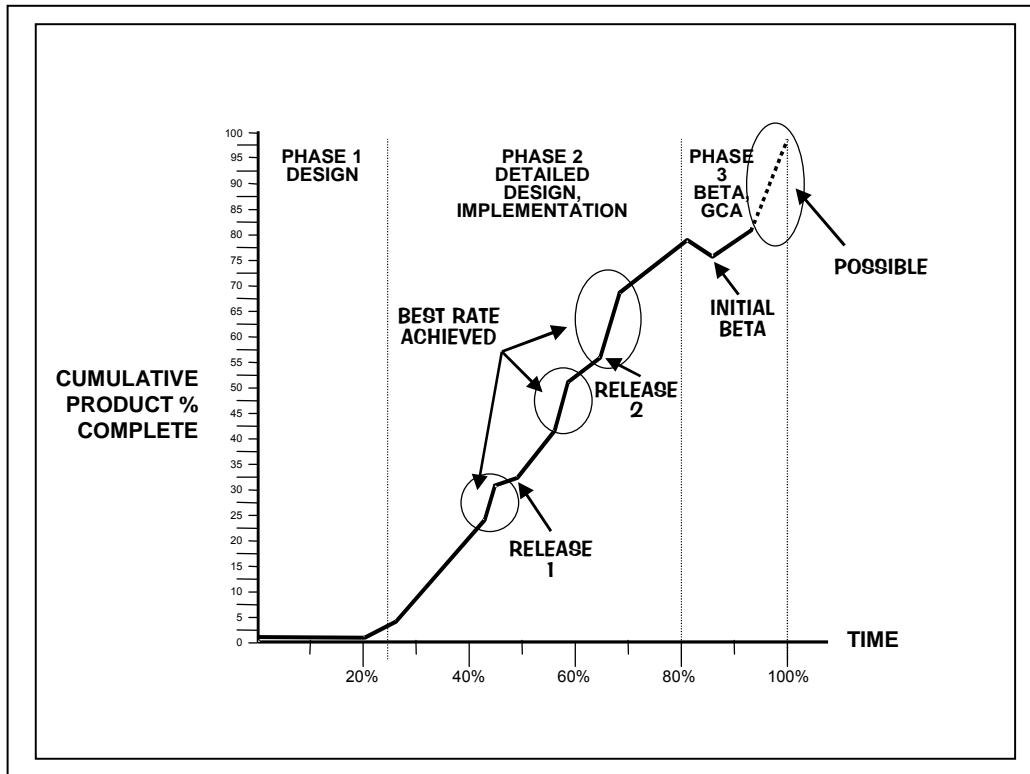
Suggested Application

During planning, an accurate defect model enables management to predict and plan accurately for rework. During the execution of the plan, comparing defect levels to the plan (or model) identifies potential problem areas. As part of lessons learned, comparing defect levels to the plan (or model) identifies product components that are candidates for reengineering. Monitoring defect find and closure rates without a plan or model is common and useful, but without any historical reference, it promotes unnecessary stress.

(The argument about not being able to afford to reengineer is most effectively countered by providing actual data on the cost of not reengineering.)

Metric 3: Project productivity

Since engineering work is rarely completed at a predictable, steady rate, measuring actual productivity enables management to identify potential problems without having to rely on questionable estimates of “per cent complete”.



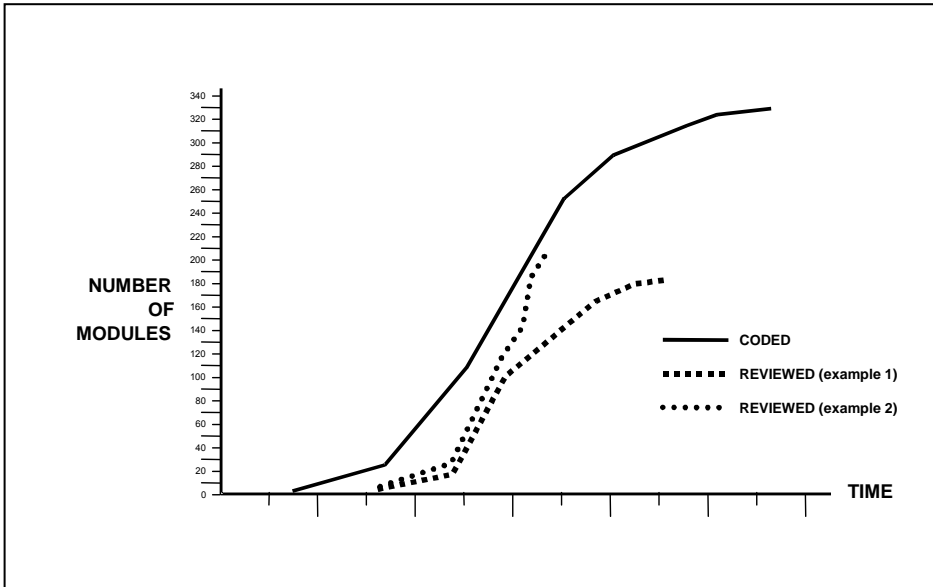
In this example, *time*, on the X axis, is the time remaining in the plan and *product per cent complete*, on the Y axis, is based on modules checked into the configuration management system as *ready to release*. The three segments of solid line that are circled represent the highest rates of productivity achieved by the project team, as they sprinted to the various intermediate release milestones. The circled, dotted line segment represents the rate of productivity that is required to complete the project on time (100% of product complete when 100% of the time is reached). By inspection, based on the productivity rates that have already been achieved, the amount of product to complete and the time available represent a reasonable goal. Unless, of course, the last five percent of the product is the part that no-one knows how to do.

Suggested Application

Because productivity is influenced by a number of variables and is highly dependent on the team make-up, an effective use of project productivity is during execution of the later parts of the plan. Management can monitor progress against time to ensure that expectations of heroic last minute efforts are reasonable.

Metric 4: Verification activities

Comparing the completion of verification activities, like reviews, to the availability of the target work products allows management to ensure that those activities take place and that, when other organizations are involved, plans are being effectively coordinated. Any significant deviation from the plan is a signal to management to investigate.

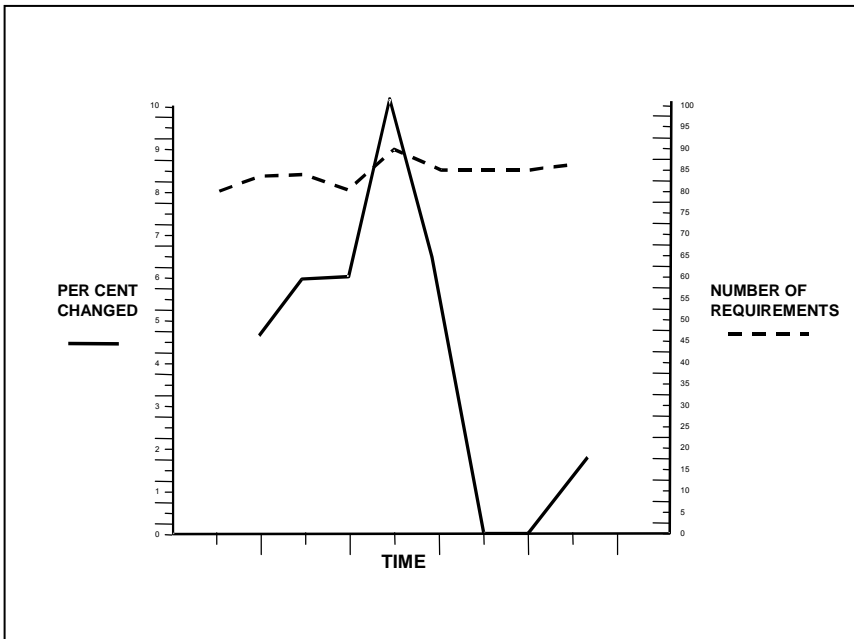


In this example, the number of modules that have completed code review is measured against the number of modules coded (e.g., ready for review). The number of coded modules is represented by the solid line. The assumption is that 100% of these modules undergo code review. In Example 1 (the lower, dotted line), the backlog of modules that are ready for code review is fairly constant for three time periods and then appears to start increasing, as the dotted line moves further from the solid line. Management attention is indicated. Why is the project falling behind?

In Example 2, the backlog decreases dramatically. Management attention is indicated. Is the project doing an exceptional job of completing reviews? Are participants given adequate time to prepare? Or are reviews considered an academic exercise, to be disposed of with minimum effort and attention?

Metric 5: Requirements stability

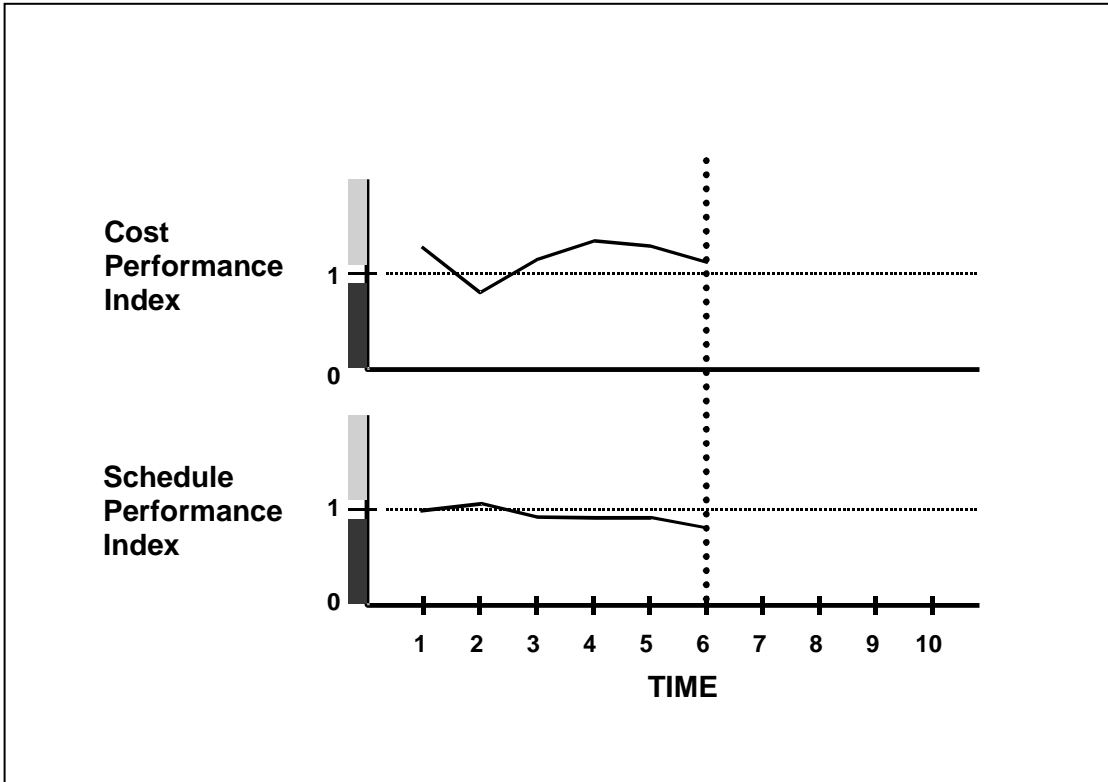
Requirements changes (as recorded by the change approval process) represent a significant risk to the project. Too many can negate even the best engineering and project management processes. Too few indicate that the project may not be hearing about needed changes in a timely manner. This pent up demand inevitably surfaces late in the project (e.g., beta test) when it poses the greatest risk to the project.



In this example, there are approximately 80 requirements, as indicated by the dotted line and the scale on the right. The relatively high rate of change (6% to 10%) appears to have stabilized in the 2 to 3% range.

Metric 6: Earned value

Earned value measures performance against schedule and against budget. The cost performance index compare the actual cost of work completed to the amount budgeted for that work. The schedule performance index compares the actual amount of work completed to the amount of work planned to be completed. Earned Value allows management a view of schedule and budget performance independent of the shifts in order and priority that are managed on a daily basis at the team level. With the tools currently available for data capture and reporting, Earned Value can be considered to supplement Key Deliverables Reviews in smaller organizations.



Each index is constructed so that a value of “1” indicates “on schedule” or “on budget”. Below 1 is “bad”; above 1 is “good”. By monitoring late starts, which can be used to hide problems by shifting activities to the end of the project, management can monitor the overall health of a project. A wealth of additional information is available to support managers who need to look at the causes of potential problems identified by the indexes.

In the example, the Cost Performance Index, consistently above 1, shows that the project is spending less than budgeted; the problem is that the Schedule Performance Index shows that the project is behind schedule.

References and Contacts

Ref	Item or Location	Description
BOE1	Boehm, Barry, Spiral Development: Experience, Principles, and Refinements , CMU/SEI-2000-SR-008, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, June 2000	For Spiral Model and Win-Win Elaboration http://www.sei.cmu.edu/ <u>Key Concepts</u> : Spiral Model implementation problems, anchor points (life cycle objectives [LCO], life cycle architecture [LCA], initial operational capability [IOC]), win-win elaboration of spiral model
BUR1	Burton, Dan; Over, Jim, PSP Tutorial SEPG '98 , provided at the SEPG '99 Conference, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, 1998.	For PROBE
CAR1	Carlton, Anita, Park, Robert, Goethert, Wolfhart. <i>The SEI Core measures</i> , Journal of the Quality Assurance institute , July 1994	<u>Key Concepts</u> : Size, Time, Effort, Defects See also MAH1.
CRL1	Carr, Marvin J., Konda, Suresh L. , Monarch, Ira, Ulrich, F. Carol, Walker, Clay F. , Taxonomy-Based Risk Identification , CMU/SEI-93-TR-6, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, June 1993	Available at http://www.sei.cmu.edu/
DOD1	Parametric Estimating Handbook , 2 nd Ed., Spring 1999	Available at http://www.ispa-cost.org/PEIWeb/newbook.htm
FIS1	Fisher, Roger; Ury, William. Getting to Yes, Negotiating Agreement without Giving in , (2 nd ed.), Penguin Books, 1991; ISBN 01401.5735 2	<u>Key Concepts</u> : Arriving at mutually-acceptable agreements – without voting, compromise, or dictate
HAD1	Hadden, Rita, <i>Credible Estimation, Proceedings of the Software Engineering Process Group (SEPG) Conference, 2001</i>	Held from March 12 – 15, 2001, New Orleans, co-sponsored by the Software Engineering Institute, Carnegie Mellon University
HAR1	http://www.nnh.com/ev/perform.html	For Earned Value : Excellent papers from Noel N. Harroff Enterprise (NNH)
HUM1	Humphrey, Watts S., Managing Technical People , Addison Wesley, 1997	
IFP1	www.ifpug.org	For Function Points : Homepage of the International Function Point Users Group
JON1	Jones, Capers. Assessment and Control of Software Risk , Prentice Hall, 1994	
JON2	Jones, Capers, <i>Sizing up Software</i> , Scientific American , December 1998, 104-109	For Function Points : Article available for a fee from www.sciam.com (To purchase and download, select Archive, select Log on, proceed to browse December 98.)
JON3	Jones, Capers, <i>Why Software Fails</i> , Software Development , July 1996, page 49	This article is not available on line. <u>Key Concepts</u> : Careful cost estimating and schedule planning are critical success factors for software projects. The larger the project, the more important [they are].”
KAT1	Katzenbach, Jon R., Smith, Douglas K.; The Wisdom of Teams , HarperBusiness (A Division of HarperCollins), 1993	Originally published in 1993 by the Harvard Business School Press; the book is copyright by McKinsey and Company, with which Katzenbach is and Smith was associated.
KAY1	Kayser, Thomas A.; Mining Group Gold , Serif Publishing (A Division of Xerox Corporation), 1990; ISBN 1-878567-02-0	Managing group interaction in meetings
LEW1	Lewis, James P., Fundamentals of Project Management , AMACOM (A Division of the American Management Association), 1997	
LEW2	Lewis, James P., The Project Manager's Desk Reference: A Comprehensive Guide to Project Planning, Scheduling, Evaluation, and Systems , McGraw-Hill; ISBN: 007134750X; 1999	
LEW3	Lewis, James P., Project Planning ,	

Ref	Item or Location	Description
	Scheduling & Control : A Hands-On Guide to Bringing Projects in on Time and on Budget (2nd edition), Probus Publishing Company; ISBN: 1557388695 ; 1995	
MAH1	Mah, Michael, <i>High-Definition Software Metrics, Software Development</i> , May 1999, page S9	Available on-line without the graphics at http://www.sdmagazine.com/articles/1999/0005/0005e/0005e.htm See also CAR1. <u>Key Concepts:</u> Discussion of core metrics (Size, Time, Effort, Defects) at end of article.
MCC1	McConnell, Steve, <i>Software Quality at Top Speed, Software Development</i> , August 1996, page 38	http://www.sdmagazine.com/articles/1996/0008/0008a/0008a.htm <u>Key Concepts:</u> “[While] Some project managers try to shorten ... schedules by reducing quality assurance practices such as design and code reviews ... [studies show that] projects that achieve the lowest defect rates also achieve the shortest schedules.” (page 39) The figures are not included in the online version, but the verbal description of Figure 1 identifies the 95% defect removal level as optimum for reducing development time. (page 40) “Reworking defective requirements, design, and code typically consume 40% to 50% of the total cost of software development.” (page 41) “Every hour you spend on defect prevention will reduce repair time from three to ten hours.” (page 41) “Reworking a ... requirements problem once the software is in operation typically costs fifty to two hundred times what it would take to rework the problem in the requirements stage.” (page 41) “... about 60% of all defects usually exist by design time.” (page 41) See the section on “Additional Reading” in the side bar at the end of the article, on page 42.
MCC2	McConnell, Steve, Software Project Survival Guide: How to Be Sure Your First Important Project Isn't Your Last . Microsoft Press, 1997, Redmond WA. ISBN: 1-57231-621-7	
NASA1	NASA Parametric Cost Estimating Handbook	http://www.jsc.nasa.gov/bu2/PCEHTML/pceh.htm
OSD1	http://www.acq.osd.mil/pm/	Program Management homepage of the Office of the Secretary of Defense. See http://www.acq.osd.mil/pm/paperpres/paperpres.html for a wealth of information.
PAG1	Page-Jones, Meilir, <i>Seduced by Reuse, Software Development</i> , September 1998, page 80	Impact of reuse, available at www.sdmagazine.com
PHI1	Phillips, Dwayne, <i>Proxy-Based Estimation, Software Development</i> , July 1998	For PROBE: Available through SD Magazine Online at http://www.sdmagazine.com/breakrm/features/s987f3.htm . [NOTE: While the formulas and method appear to be sound, the actual data reported is suspect.]
PMI1	http://www.pmi.org/	Homepage of the Project Management Institute (PMI)
POT1	Potter, Neil, Sakry, Mary, <i>Keep Your Project On Track, Software Development</i> , April 2001	Risk management; available at www.sdmagazine.com/articles/2001/0104/0104g/0104g.htm
PRE1	General Information Resources	An excellent set of references related to estimation techniques and various models is found at: http://www.premia.com/support/starestimator/weblibrary/resource.html
PRS1	Pressman, Roger, Software Engineering A Practitioner's Approach, 3rd ed. , McGraw Hill,	

Ref	Item or Location	Description
	Inc., New York, 1992, ISBN 0-07-050814-3	
PSM1	Practical Software Measurement, A Foundation for Objective project management , Office of the Undersecretary of Defense for Acquisition and Technology, 1998	www.psmc.com Homepage of the Practical Software Measurement Support Center (PSMSC). Download the PSM Guide, Guidebook, and Insight Tool
ROE1	Roetzheim, William H., <i>Estimating Internet Development</i> , Software Development , August 2000, page 70	http://www.sdmagazine.com/articles/2000/0008/0008d/0008d.htm <u>Key Concepts:</u> Parameters for estimation can include function points (for data-driven applications), GUI metrics (menus, dialogs, windows), and object metrics. A project schedule can be compressed or expanded within a range of 75% to 200%.
SDM1	http://www.sdmagazine.com/supplement/ppm/	Software Development Magazine Project Management home page
SEI1	http://www.sei.cmu.edu/psp/psp.html	For PROBE: The Personal Software Process (PSP) home page at the Software Engineering Institute
SEP1	http://sepo.spawar.navy.mil/docs.html or http://sepo.nosc.mil/docs.html	A complete set of downloadable documents for all KPAs from the Software Engineering Project Office (SEPO), Space and Naval Warfare Systems Center, San Diego, (SSC SD)
THI1	Thielen, David, <i>The Commando Returns</i> , Software Development , March 1999, page 80	Not available on line. <u>Key Concepts:</u> "As projects get larger and more complex, projects get larger and more complex, good practices, design, and planning are the best approaches to project management."
WEL1	Wells, J. Donovan, <i>Planning Feedback Loops</i>	For Extreme Programming http://www.extremeprogramming.org/map/loops.html <u>Key Concepts:</u> Time frames between phases; phase activities
WEL2	http://www.extremeprogramming.org	For Extreme Programming J. Donovan Wells Extreme programming home page <u>Key Concepts:</u> Detailed descriptions of activities, tools, references to articles, etc.
WIE1	Wiegers, Karl, <i>Know Your Enemy</i> , Software Development , October 1998, page 38	http://www.sdmagazine.com/articles/1998/0010/0010a/0010a.htm <u>Key Concepts:</u> Structured risk management
WIL1	Williams, Laurie, Kessler, Robert R, Cunningham, Ward, Jeffries, Ron, <i>Strengthening the Case for Pair Programming</i> , IEEE Software , July August 2001, pp 19 - 25	www.objectmentor.com/s4williams.lo.pdf <u>Key Concepts:</u> pairs spent 60% more time on project; completed tasks 40% faster

Partial List of Tools and Contacts

Provider	Planning	Tracking	Resource Management	Risk Management	Contact
ABT Corporation	Planner™ Workbench™	Publisher™ Team™ Connect™	Repository™ Resource™		ABT Corporation 361 Broadway New York, NY 10013 Tel: (212) 219-8945 www.abtcorp.com
Artemis Management Systems	Views 4				Artemis Management Systems 6260 Lookout Road Boulder, Colorado 80301 Tel: (800)477-6648 www.artemisp.com
Computer Associates	CA SuperProject	SuperProjectNet	CA SuperProject		One Computer Associates Plaza Islandia, NY 11749 631-Dial CAI (342-5224) Fax: 1-631-342-5329 www.cai.com
Microsoft Corporation	Project™	Project Central/ Project Server	Project™		Microsoft Corporation One Microsoft Way Redmond, WA 98052-6399 (800) 426-9400 www.microsoft.com
Nikū	Portfolio Manager Suite				Appears to include Bridge Modeler and Project Manager's Work Bench formerly from Applied Business Technology (ABT), which was acquired by Nikū in August 2000. World Headquarters 305 Main Street Redwood City, CA 94063 Tel: +1 650 298 4600 Fax: +1 650 298 4601
PlanView Inc.	PlanView				PlanView Inc. 7320 North MoPac #300 Austin, TX 78731 Tel: (512) 346-8600 www.planview.com
Primavera Systems, Inc.	TeamPlay™				Primavera Systems, Inc. Three Bala Plaza West Bala Cynwyd, PA 19004 Tel: (800) 423-0245 www.primavera.com
Scitor Corporation	Project Scheduler	Project Communicator			Scitor Corporation 256 Gibraltar Drive Sunnyvale, CA 94089 Tel: (800) 533-9876 www.scitor.com

Provider	Planning	Tracking	Resource Management	Risk Management	Contact
Software Program Managers Network		Project Control Panel		Risk Radar	SPMN 4600 N. Fairfax Drive Arlington, VA 22203 (703) 521.5231 www.spmn.com (both products are available for download at no cost)
Time Line Corporation	Time Line 6.5				Time Line Solutions Corp 1020 Railroad Ave. Suite D Novato, CA 94945 (415) 898-1919 www.tlsolutions.com
	On Target	Project Updater			

Provider	Cost/Size/Metrics	Contact
Galoreth, Inc.	SEER	Galoreth Incorporated 100 North Sepulveda Boulevard Suite 1801 El Segundo, CA 90245 Phone 310-414-3222 Fax 310-414-3220 http://www.gaseer.com
Marotz, Inc., Cost Xpert Group	Cost Xpert	Marotz Inc. Cost Xpert Group 13518 Jamul Drive Jamul, CA 91935-1635 (619) 669-3100 http://www.costxpert.com
Quantitative Software Management	SLIM	QSM 2000 Corporate Ridge Suite 900 McLean, Virginia 22102 TEL: 800-424-6755 FAX: 703-749-3795 http://www.qsm.com
Software Productivity Research (SPR)	KnowledgePLAN [®]	Software Productivity Research Three Bethesda Metro Center Suite 700 Bethesda, Maryland 20814 Tel. 301.657.6266 Fax 301.942.4361 http://www.spr.com
USC (Dr. Barry Boehm)	COCOMO II	http://sunset.usc.edu/available_tools/index.html USC Center for Software Engineering, free, downloadable tools, including COCOMO II The main address for COCOMO tools is http://sunset.usc.edu/research/cocomosuite/suite_main.html

45th printing



Software ♦ Systems ♦ Quality ♦ Consulting
2269 Sunny Vista Drive ♦ San Jose CA USA ♦ Tel 408-985-4476
Internet: ssqc@concentric.net ♦ <http://www.ssqc.com>