

estimate

estimate • analyze • plan • control

ISPA SCEA 2010 Galorath On Estimating

Dan Galorath

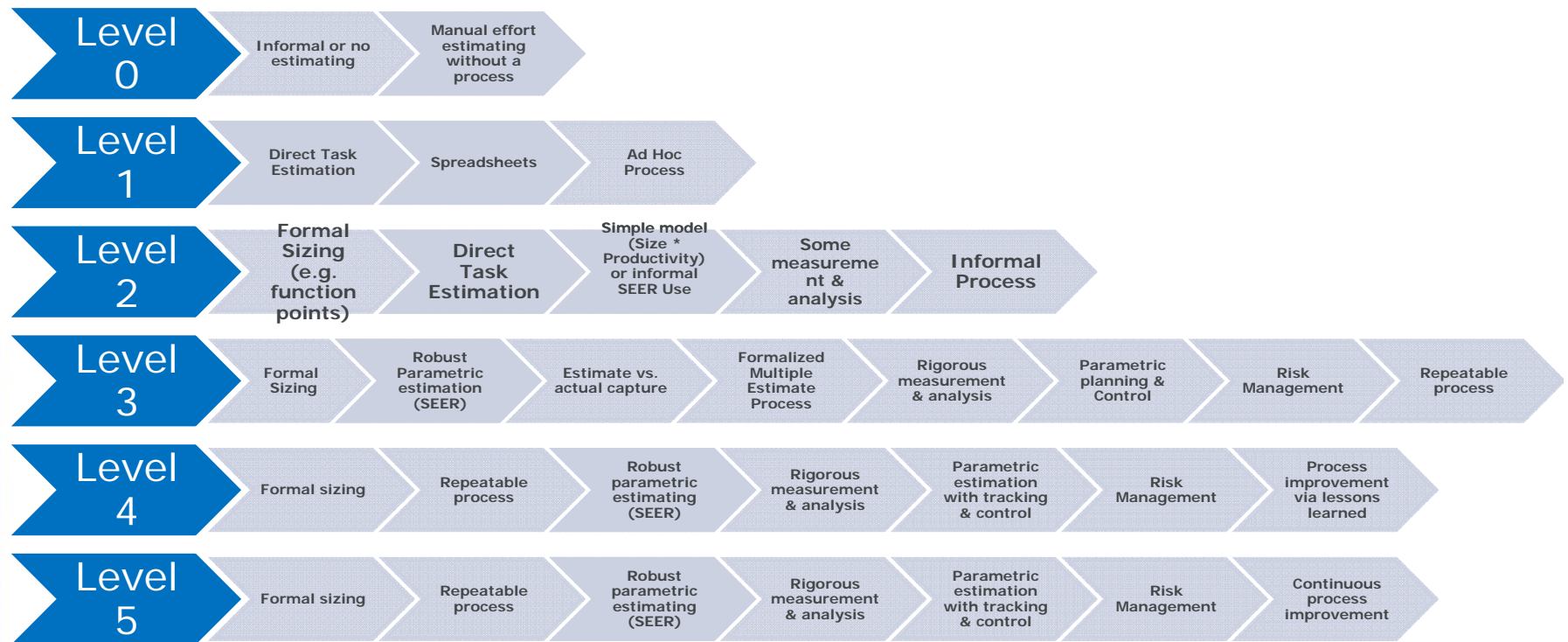
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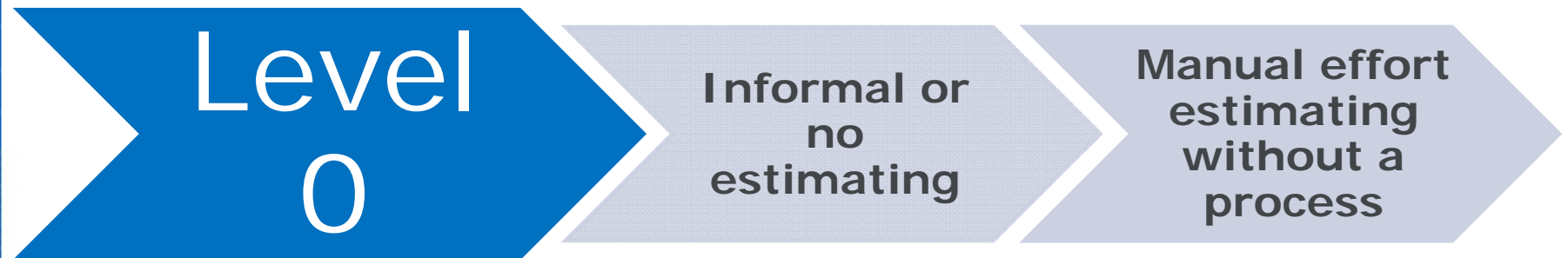


Estimation Organizational Maturity V1.7





Estimation Organizational Maturity Level 0



Guessing is the most widely used estimation technique

Poor Estimates Effects on Projects



- Inaccurate estimates can reduce project success:
 - Poor implementations
 - Critical processes don't scale
 - Emergency staffing
 - Cost overruns caused by underestimating project needs
- Scope creep from lack of well defined objectives, requirements, & specifications
 - Forever changing project goals
 - Frustration
 - Customer dissatisfaction
 - Cost overruns and missed schedules
 - Project Failures
- Poor estimates & plans are root cause of program risk

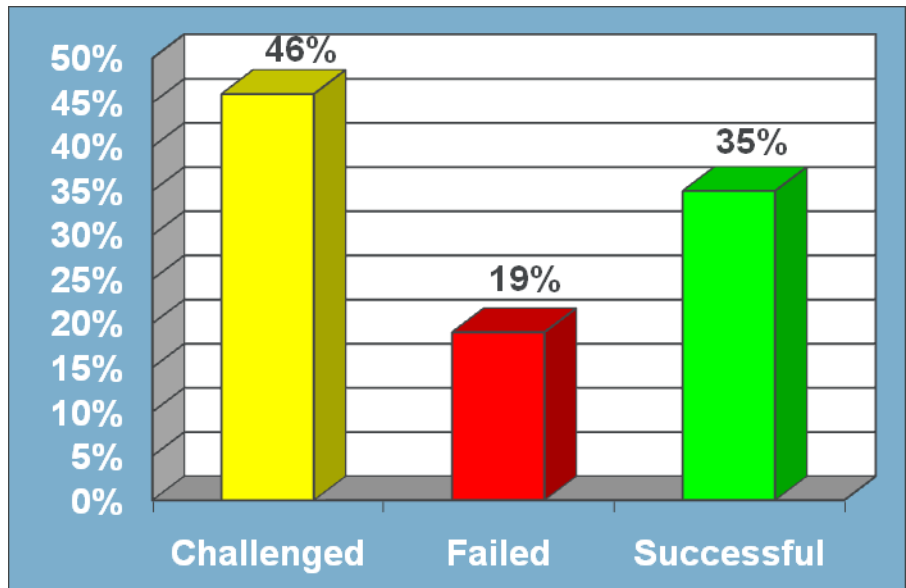
And important project business decisions made early
with *minimum knowledge & maximum uncertainty*



"Run IT Like a Business"

- **Cutter Consortium Software Project Survey:**
 - 62% overran original schedule by more than 50%
 - 64% more than 50% over budget;
 - 70% had critical product quality defects after release
- **Standish Group CHAOS Report**
 - 46% challenged
 - 19% failed
 - 35% successful

~\$875 billion spent on IT
~\$300 billion spent on IT projects
~\$57 billion wasted annually





Estimation Organizational Maturity Level 1



Basic Estimation Tribes (Adapted from DCG/Galorath Webinar)

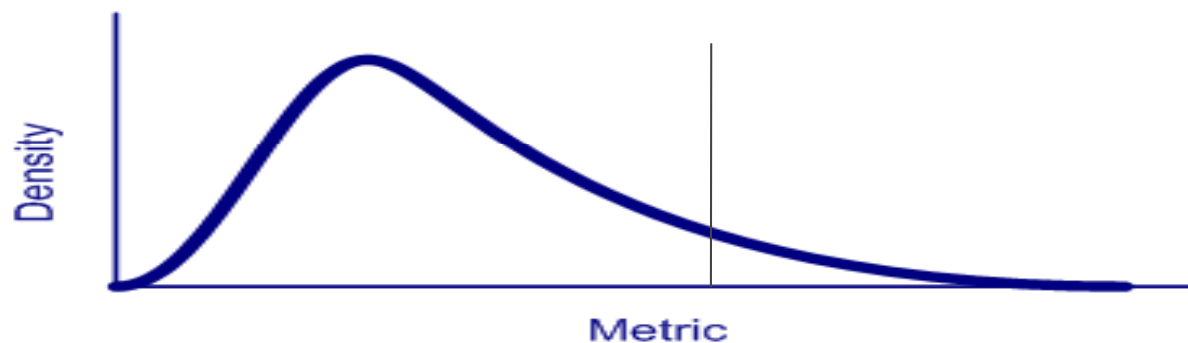


1. **Napkins** – Ad-hoc, hero driven estimators ...past successes are legendary... napkin scribbling taken as gospel
2. **Guts** – Feeling /experience oriented project managers...years of experience, good and bad...trusted regardless of actual results (tenure benefits of being a survivor)
3. **Spreadsheets** – Former Napkins and Guts translating tribal knowledge onto spreadsheets
 - Bestows mathematical accuracy and empirical integrity on home-grown estimation algorithms
 - Tribal estimation knowledge can and does work
 - However, it comes with high risk and cost
 - Rarely repeatable
 - Consistency is sporadic
 - Heroic energy is kept in reserve used to mitigate risk
 - Knowledge almost never institutionalized outside of personal knowledge and desktop PC files
 - Knowledge lost when heroes retire or leave

Manual Estimates: Human Reasons For Error (Metrics Can Help)



- Manual Task estimates yield **SIGNIFICANT** error
- Desire for “credibility” motivates overestimate behavior (80% probability?)
 - So must spend all the time to be “reliable”
 - Better approach force 50% probability & have “buffer” for overruns
- Technical pride sometimes causes underestimates





Estimation Organizational Maturity Level 2



Gartner says even Level 2 reduces estimate vs actual variance by 50% (Source "Why Galorath Matters", Gartner)

Many Viable Size Metrics: Depends On Organization & Goals



Software type in this column...	... is best characterized by...				
	Lines	Functions	SEER-FBS	Use Cases	COTS
Traditional Information Technology	X	X	X	X (ROM)	
Algorithmic Processing	X	X	X	X (ROM)	
Auto-gen Code		X	X	X (ROM)	
COTS Integration			X	X (ROM)	X
Non-Line Based		X	X	X (ROM)	X

Estimate a range to best quantify size early

Estimation Should Use More Than Simple Productivity Measures



- Just simple size over productivity measures may not adequately project the effort for a new system
 - Unless the system is VERY similar
- Additional estimation parameters are required to describe the situation
 - Quality
 - Reuse
 - Retest
 - Staffing
 - Technology & Environment (e.g. requirements volatility)

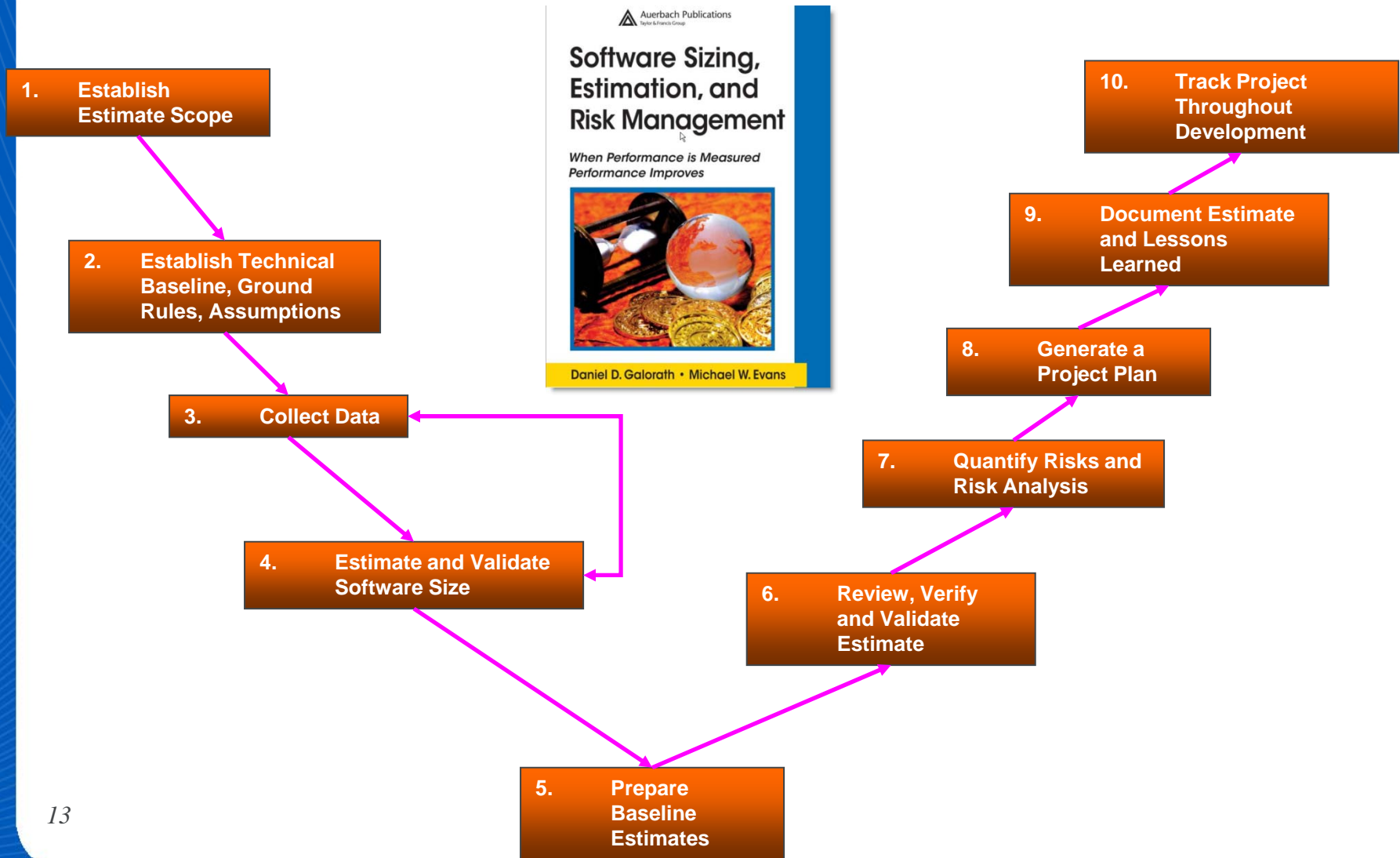
And productivity measures are generally based on Size... so low maturity organizations may lag there too



Estimation Organizational Maturity Level 3



10 Step Software Estimation Process: Consistent Processes = Reliable Estimates



Learn & Improve With Metrics



- Shows actual data, ranges, and correlations
- Plots estimates and contrasts with data points
- Plots actual data and / or trends

Scatterplot Plus Chart Properties

Inputs and Controls | Estimate Data | Format Axes | Show/Hide Points

Data Source | History Display Options | Benchmark Display Options

X & Y Metrics | Filter

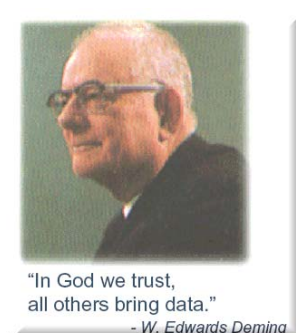
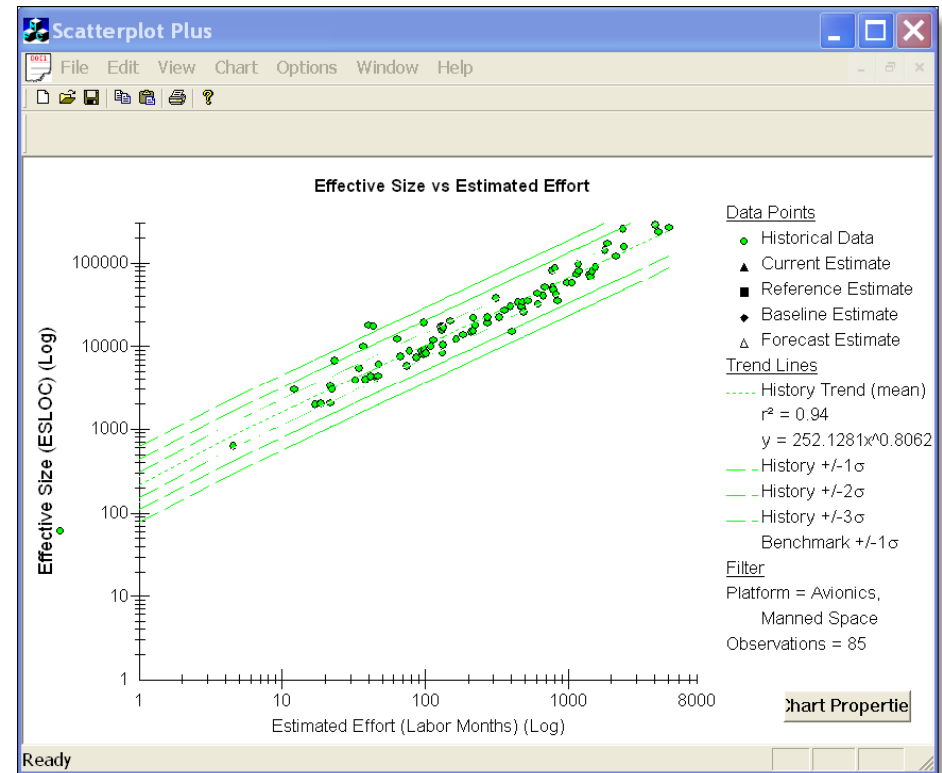
Downselect based on current estimate's knowledge base settings
 Display full range of project types
 Manually select project types to be included

Fields | Selection

Financial Processing
 Ground-Based Mission Critic
 Ground-System Non-Critical
 Internet Development
 Manned Space

!No Knowledge
 Artificial Intelligence
 Business Analysis Tool
 Command/Control
 Communications

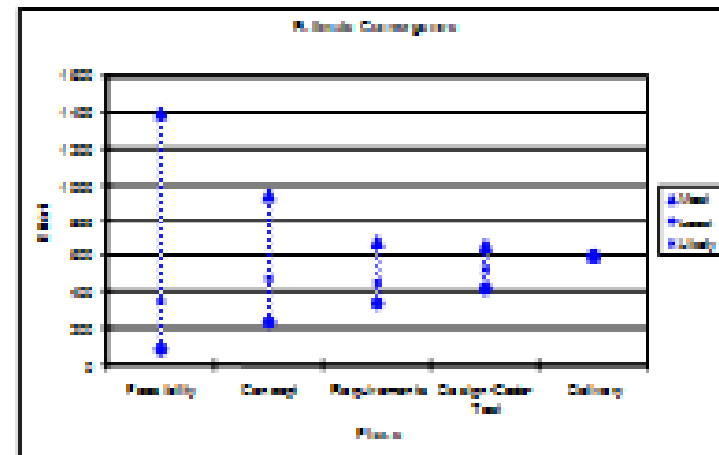
No items selected equals ALL items selected





When Do We Build Estimates

- Traditional Estimate Phases
 - During Feasibility
 - At Concept
 - After Requirements
 - After Design
 - After Drops if Incremental



Estimates typically become more accurate and less uncertain as the project progresses...

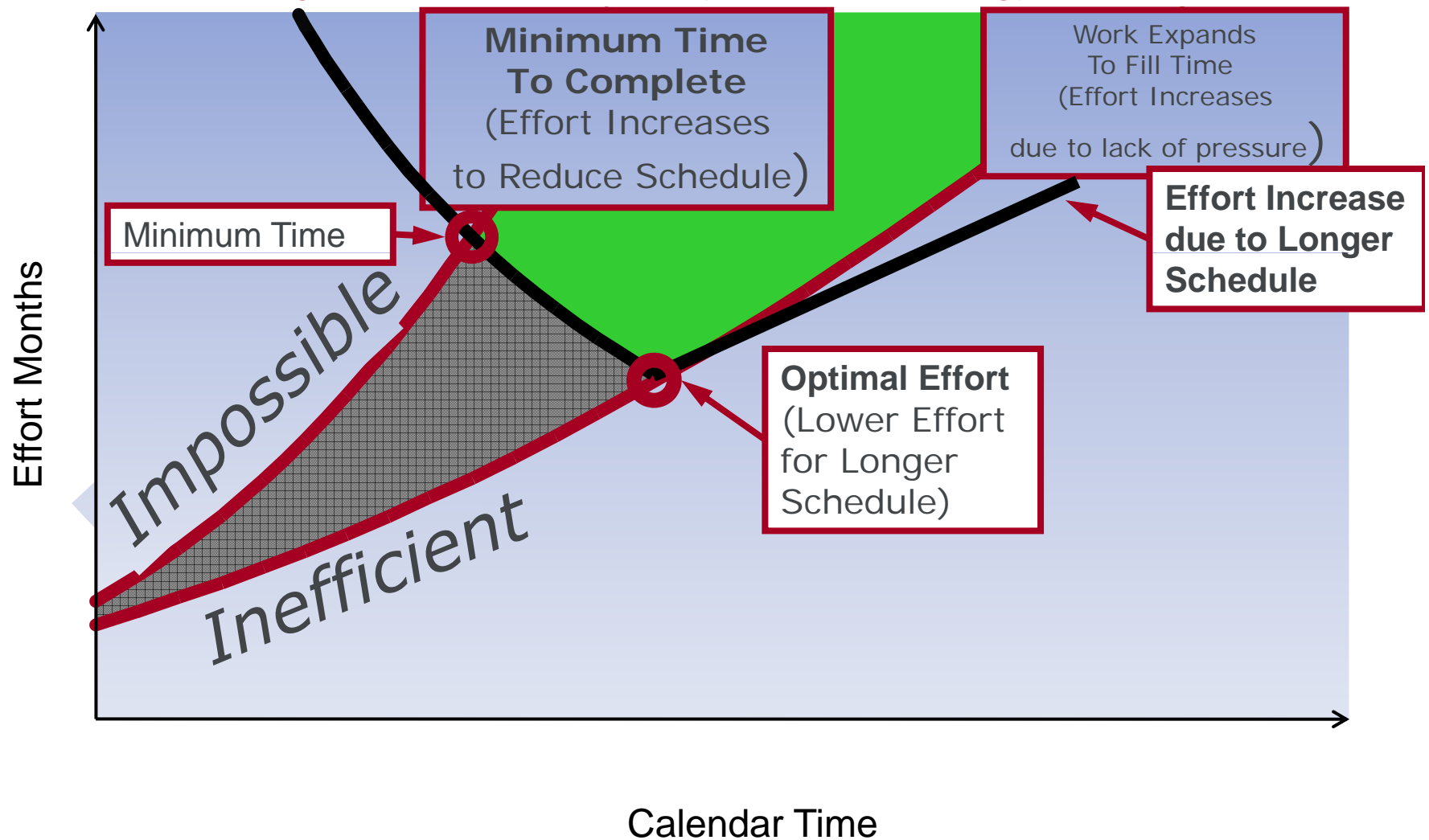
- Agile Estimate Phases
 - At Requirements (Use Cases, User Stories, etc.)
 - Before Each Release

The Development Method Is Part Of The Solution Not The Problem

Balancing Resources & Schedule Is A Science



For a given Size, Complexity and Technology



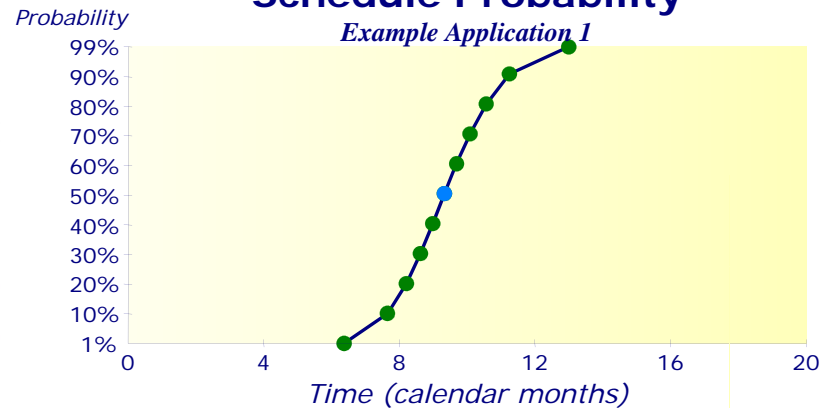
Understand Project Risks Include Them In Planning Decisions

(Example SEER-SEM Outputs)



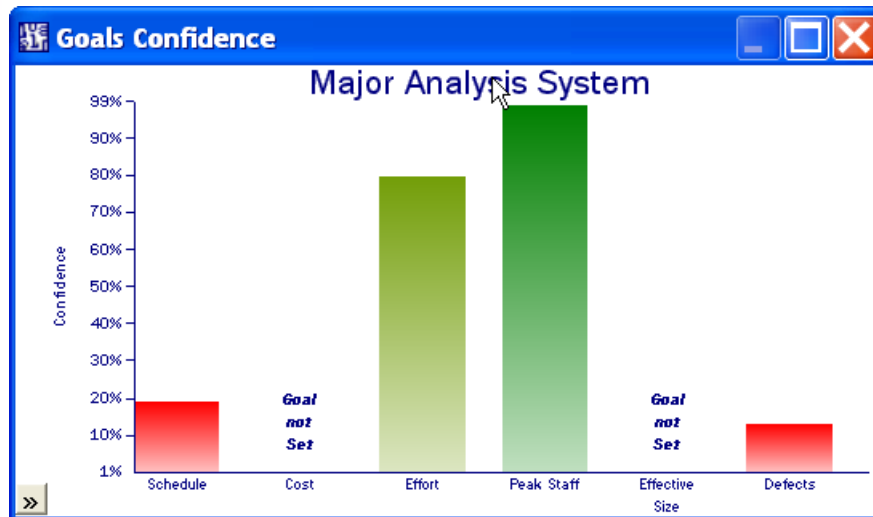
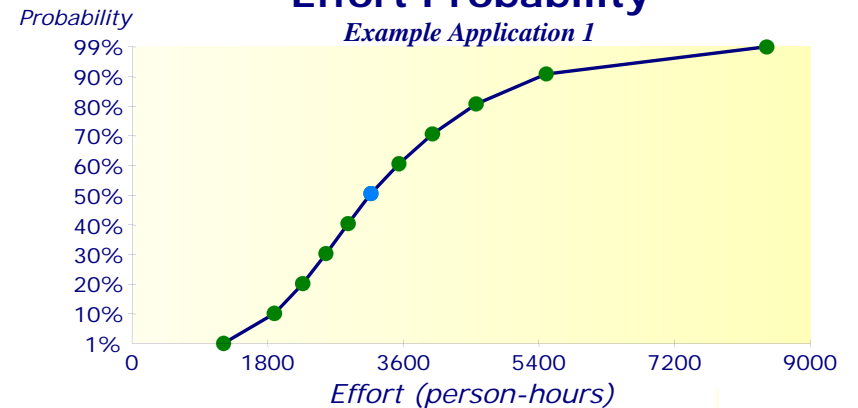
Schedule Probability

Example Application 1



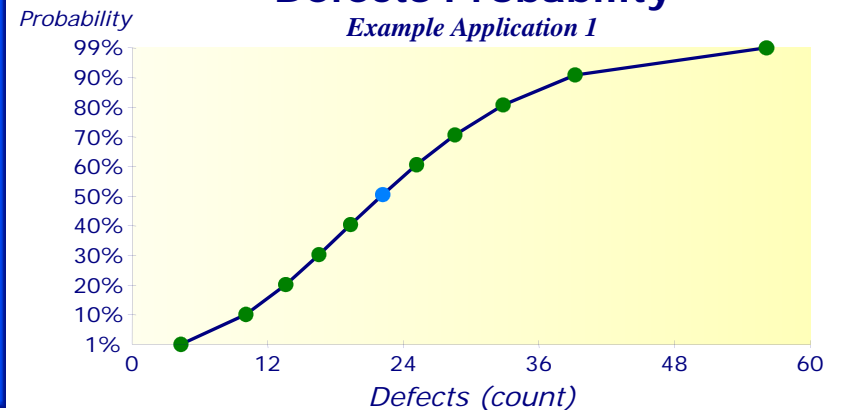
Effort Probability

Example Application 1

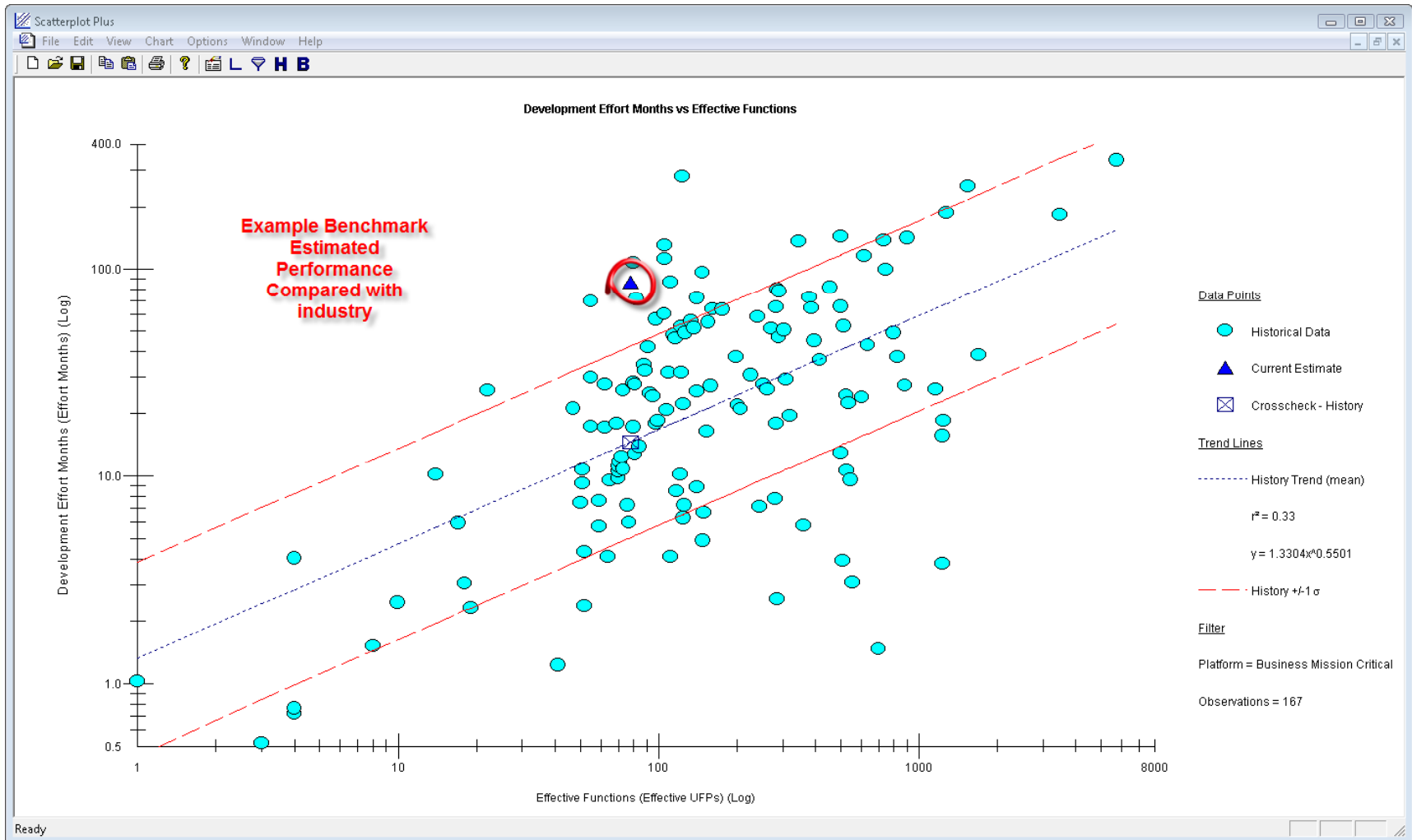


Defects Probability

Example Application 1



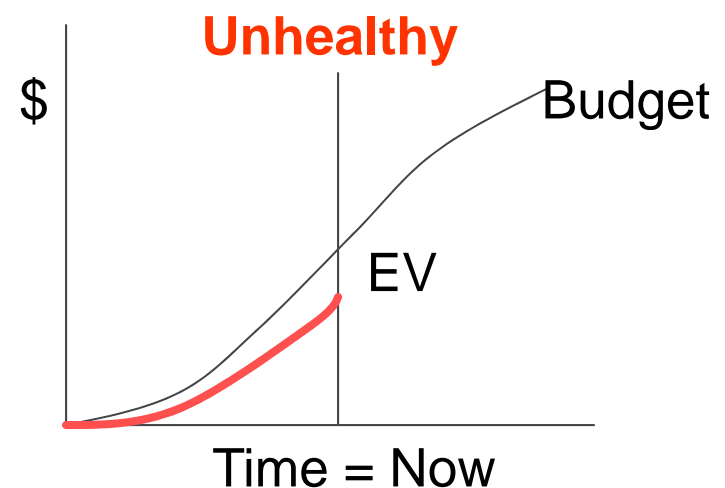
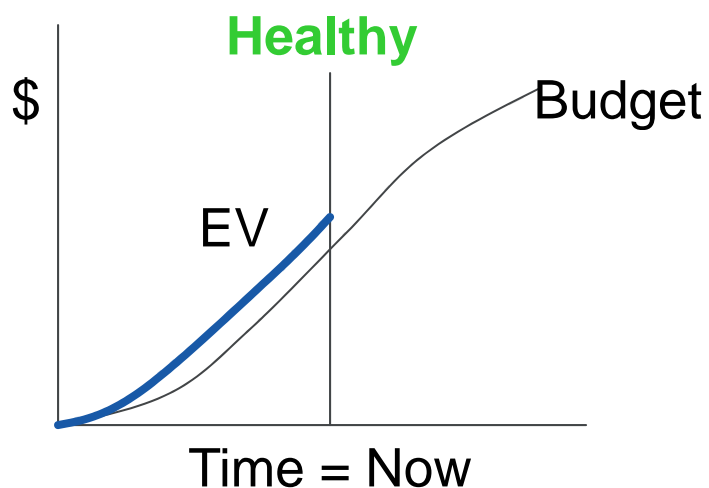
Example Benchmark Versus an Estimate.. Why Are We So Expensive?



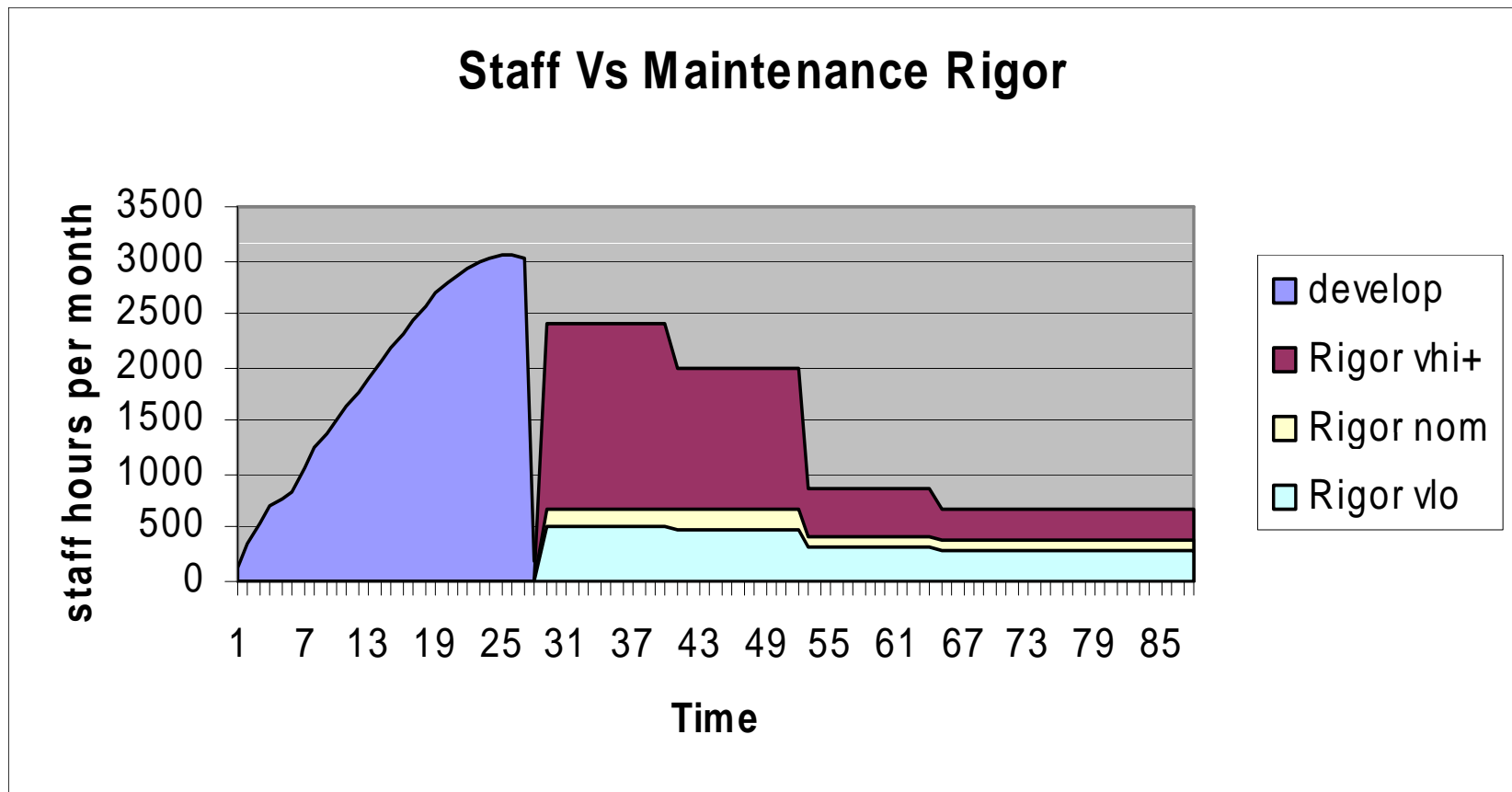
Use Earned Value To Quantify Progress Versus Effort FOR DEVELOPMENT AND MAINTENANCE



- Main concern of EVM: what has been accomplished in a given time and budget, versus what was planned for the same time and budget
 - A project is generally healthy if what has been accomplished is what was planned, or more
 - Project unhealthy if accomplishment lags expectations
- Definition: Earned value = budgeted value for the work accomplished (what you got for what it cost you)

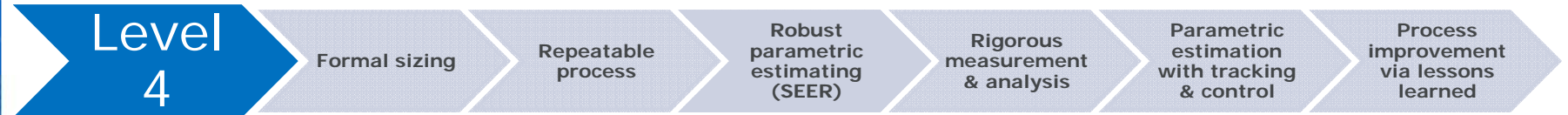


Considering Maintenance During Planning Can Yield More Successful Long Term Results





Estimation Organizational Maturity Level 4



What To Measure: Multiplicity of Metrics



1. Obvious: Status / Trend Metrics

- E.g. productivity, defects removal rate, cost, schedule

2. Most important for improvement: Effectiveness (5 max)

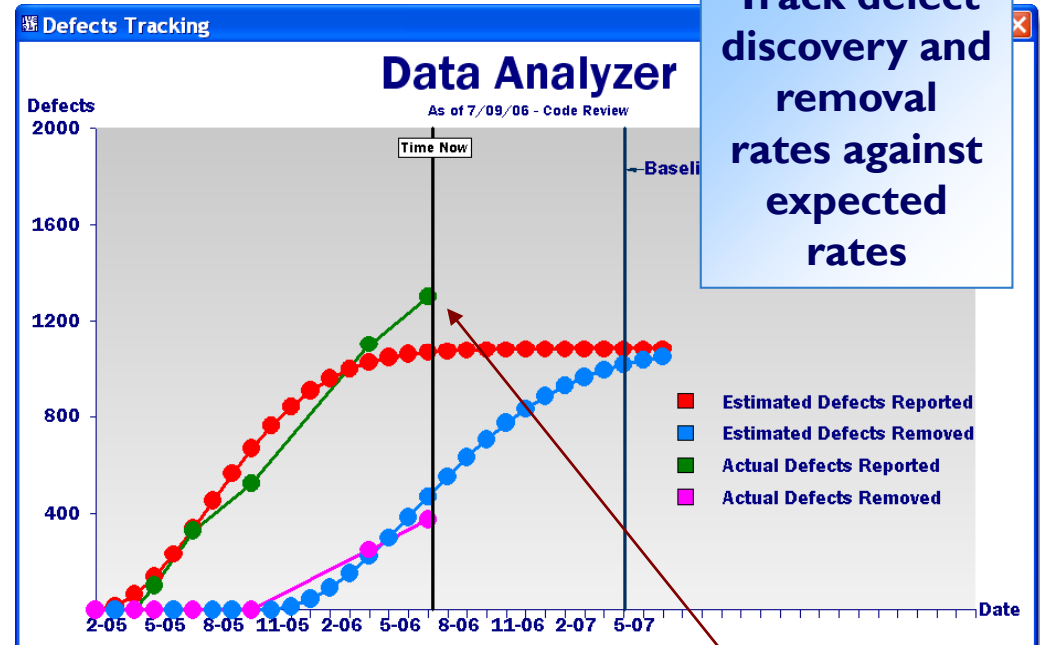
- “What we are doing that we should not do”
e.g. number of delivered critical defects
- “What we are not doing that we should do”
e.g. number of defects that got past inspections
- These metrics may change over time as we improve

Understanding & Tracking Defects, Growth And Other Metrics



Health and Status Indicator shows status and trends from the previous snapshot

- Including Size Growth and Defect Discovery/Removal Rate
- User defined control limits to control the transition between **red-yellow-green**



Track defect discovery and removal rates against expected rates

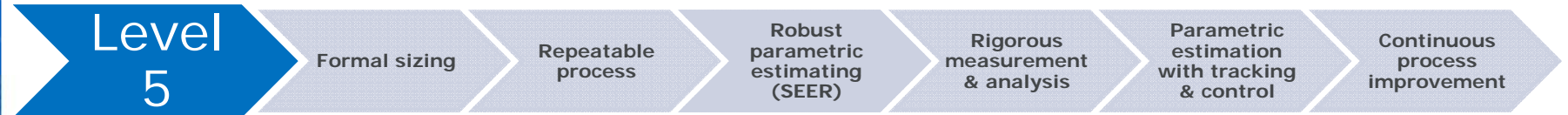
Increased defect reporting rate shows a worsening trend

Track software size growth

Health & Status Indicator					
	Schedule Variance	Time Variance	Cost Variance	Size Growth	Defects
Data Analyzer	WORSE	WORSE	WORSE	WORSE	WORSE



Estimation Organizational Maturity Level 5



Making Business Decisions Via Estimating Total Ownership Cost & ROI



Determine &
Quantify Benefits
over time

Determine total
ownership costs
against schedule

Determine if
project
worthwhile
(sufficient ROI)
on its own or as
part of a portfolio

Core Metric: Value Provided By Software



- Concept: Spend where you obtain the most value
 - Value = savings to company or additional revenue due to the software
- Software Fails to add value much too often
 - Users enamored with concept
 - Concept deployed
 - Little to no value contributed to company...
 - Bad assumptions: E.g. assuming saving 1 minute per day of employees filling in their time card has a huge savings in a year
 - Many reasons... often no changes in business rules
- MRP is a classic example of software hyped but which did not provide value
- Up to 80% of projects never produce positive ROI

Lessons Learned Reviews



- Document upon estimate complete AND project complete
 - Records lessons learned
 - Provides evidence of process validity
 - Shows estimate generated in good faith
 - Captures actuals to substantiate / calibrate estimation models
- Document missing or incomplete information
- Capture risks, issues, & problems process addressed
- Document key decisions made during the estimate & results
- Document dynamics that occurred during the process e.g.
 - interactions of your estimation team
 - interfaces with stakeholders
 - trade-offs made to address issues identified during the process
- Conduct lessons-learned session ASAP while memories are fresh

Every software project is opportunity to improve the estimating process

Weapon Systems Acquisition Reform Act (WSARA)



M I C H I G A N

Carl Levin
UNITED STATES SENATOR

FOR IMMEDIATE RELEASE
February 24, 2009

Contact: Senator Levin's Office
Phone: 202.224.6221

Summary of the Weapon Systems Acquisition Reform Act of 2009

Report after report has indicated that the key to successful acquisition programs is **getting things right from the start** with sound systems engineering, cost-estimating, and developmental testing early in the program cycle. Over the last twenty years, however, DOD has eliminated acquisition organizations and cut the workforce responsible for taking these actions, and has tried to “reform” the acquisition process by taking shortcuts around early program phases in which these actions should be taken. The result has been excessive cost growth in weapon systems and excessive delays in fielding those systems.

Weapon Systems Acquisition Reform Act (WSARA)



- WSARA is a good thing, but much (or some) of this has been tried before, e.g.
 - There were substantial change around 1987 associated with the Packard Commission report and the Goldwater-Nichols Act.
 - There was another around 1989-1990 when Donald J. Yockey was under secretary of Defense (Acquisition) from 1991 to 1993
 - Also see "The Cost Analysis Improvement Group: A History" by Srull, Margolis, and McNicol
- WSARA is being driven by the continued and "**sometimes surprising growth**" in the cost and schedule of Major Defense Acquisition Programs (MDAPs)
- The impact on estimating and analysis related to cost, schedule, and Earned Value is that this is a great opportunity for our community to have Milestone Decision Authorities (MDA) receive, understand, and utilize our products in the acquisition process



Root Cause Analysis

A root cause analysis with respect to a major defense acquisition program is an assessment of the underlying cause or causes of shortcomings in cost, schedule, or performance of the program, including the role, if any, of—

- Unrealistic performance expectations;
- Unrealistic baseline estimates for cost or schedule;
- Immature technologies or excessive manufacturing or integration risk;
- Unanticipated design, engineering, manufacturing, or technology integration issues arising during program performance;
- Changes in procurement quantities;
- Inadequate program funding or funding instability;
- Poor performance by government or contractor personnel responsible for program management; or
- Any other matters.

The Key Estimating Challenges



- Getting better at documenting, presenting, and defending our estimates
- Requirements Growth
- Parametric Relationships and Databases
- Basis of Estimate
- Assess Risk in multiple ways
- Models that can reflect dynamic and changing acquisition processes
- Organizational Conflict of Interest

WSARA Challenges

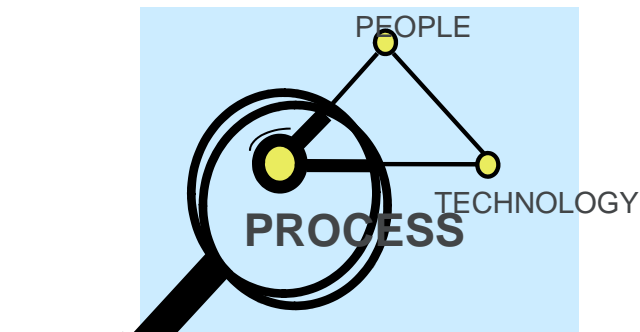


- **Increased Workload Requirements**
 - Increased Number of Independent Cost Estimates
 - New Requirement for continuous cost monitoring of MDAP Costs
 - New Requirement for Performance Assessments & Root Cause Analyses to be conducted
 - New Annual Congressional Reporting Requirements
 - “Retroactive” MS A & B Certification Reviews (to be conducted in less than a year timeframe)
- **Organizational/Personnel Issues**
 - Current “on-board” strengths inadequate to execute increased workload in specified timeframes
 - Lead time for identifying “right skill set” candidates and completing hiring activities is problematic
 - Organizational upheaval due to restructure necessary to establish four new directed positions and properly staff them.
- **Some Ambiguous Language**
 - OSD and the Services are still working out the details

Document – Present - Defend



- Process is the Key
- Everyone realizes the importance of having a motivated, quality work force but...
- ...even our finest people can't perform at their best when the process is not understood or operating "at its best."



Major determinants of product cost, schedule, and quality

Introduction: Software Projects Must Return Business Value



“Economics is primarily a science of choice, and **software economics should provide methods for analyzing the choices** software projects must make.”
Leon Levy

- Software projects should be based on choices that provide the **maximum business value** to the organization Eli Goldratt
- Some say business value is not our problem
 - While others generally need to perform benefit analysis
 - We need to start building systems that optimize the business
 - Make IT part of the solution

Projects Should Determine Business Value as well as Cost



Determine &
Quantify
Benefits over
time

Determine
total
ownership
costs against
schedule

Determine if
project
worthwhile on
its own or as
part of a
portfolio

Why Projects Fail (Source Bob Lawhorn)



- Some of the most common project risk factors include ...
 - Requirements Issues
 - Estimating Issues
 - Quality Issues
 - Productivity Issues
 - Personnel Turnover Issues
 - Project Management Issues
 - Cultural Issues
- Certainly Poor Communications and Lack of Visibility are also frequent contributors
- Usually there are multiple factors at play when failures occur

IT Project Chaos (Source Bob Lawhorn)



- Poorly defined applications (miscommunication between business and IT) contribute to a 66% project failure rate, costing U.S. businesses at least \$30 billion every year (Forrester Research)
- 60% - 80% of project failures can be attributed directly to poor requirements gathering, analysis, and management (Meta Group)
- 50% are rolled back out of production (Gartner)
- 40% of problems are found by end users (Gartner)
- 25% - 40% of all spending on projects is wasted as a result of re-work (Carnegie Mellon)
- Up to 80% of budgets are consumed fixing *self-inflicted* problems (Dynamic Markets Limited 2007 Study)

Additional Information



- www.galorath.com
- Dan on estimating BLOG: www.galorath.com/wp
- Email: galorath@galorath.com