

**Measurement:
A Required Path for
Achieving Operating Excellence**

PSM Users' Group Conference

Vail, CO

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LOCKHEED MARTIN



***Jim Sturges
Director, Engineering Process
Lockheed Martin Corporation***



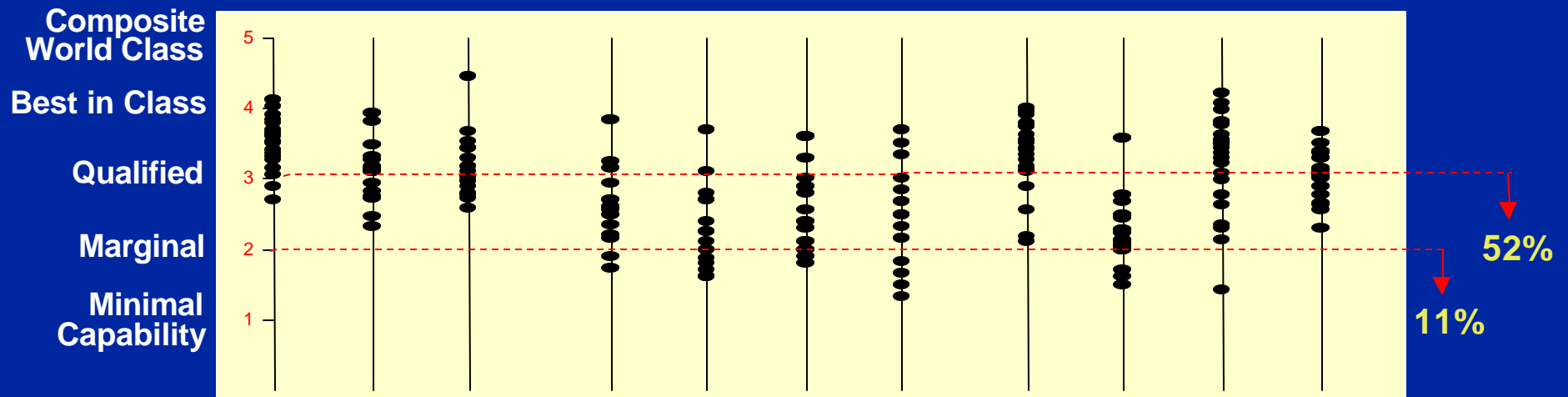
LM21 History as viewed from Corporate HQ

- *Value to the ultimate customer is achieved when products that perform reliably are delivered within cost and budget and satisfy or delight the end-user*
- *Some divisions are much better at some things than the average*
- *We needed to identify the best and educate the rest*
- *We embarked on the largest benchmarking project in Aerospace/Defense history*

Capability Assessment



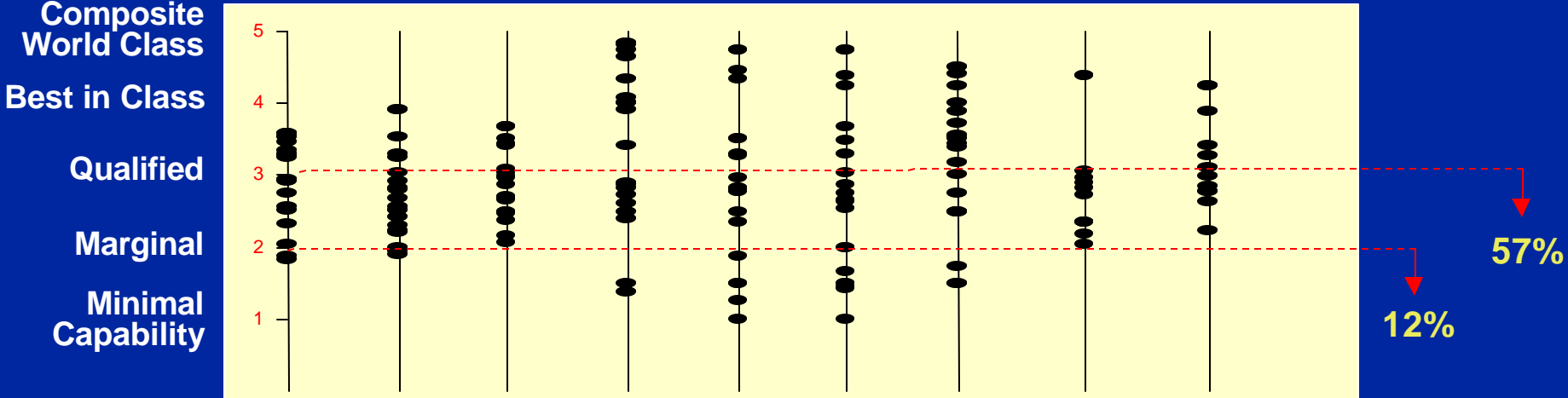
LM Fundamental Best Practice



Capability Assessment



LM Fundamental Best Practice



LM21 Performance



- *LM21 declared goal was \$2.3B recurring savings in 5 years*
- *Achieved in less than two years*
- *We believed there was lots more to be saved*



“Lockheed Martin will use lean processes with six-sigma capability.”

***-- Dr. Vance Coffman
Chairman & CEO
March, 2000***

Lean



- ***Specify Value: can be done only by the ultimate customer***
- ***Identify the Value Stream: specific actions from concept to delivery***
- ***Flow: organize by work, not by function***
- ***Pull: everything is just-in-time***
- ***Perfection: smarter and smarter and smarter***



Lessons from early LM21

- *Customers' ultimate value depends on lean operations with high productivity and quality*
- *Engineering discipline capability maturity strongly correlated with high performance and low variability – feeds high performance operations*
- *High performance companies have maintained their performance distance from others*
- *Corporate measures targeting business area productivity and quality force “pull” from operating units*

Capability Maturity Increases

Path to documented, repeatable processes



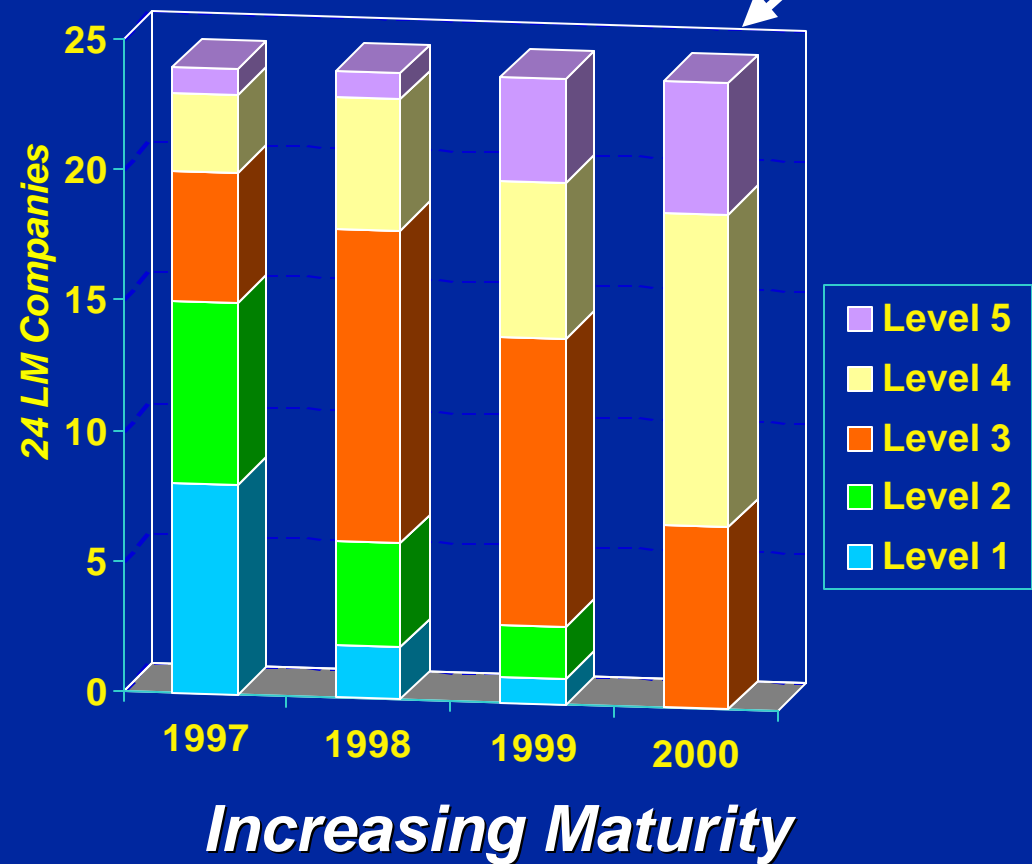
- ***Continuing emphasis on Software, adding emphasis on System Engineering, moving toward higher integration***
 - ***“Great Programmers will perfectly code bad requirements.”***
- ***Rigorous assessment process prevents “gaming”***
 - ***50% of assessors, including lead, from outside company***
- ***Not at risk for ACAT I source selection due to Maturity Levels***
- ***Nine companies increased SW levels in 1999***
- ***Three registered SE Assessments in 1999***



Software Maturity

- **LM Federal Systems, Owego, NY**
 - **>20% Annual Productivity Increase**
 - **52% Reduction in Defects Over Past 5 Years**
- **LM Management & Data Systems**
 - **30% Productivity Improvement from 1999-2001**

Best in the industry!



How Much Waste Is Out There?

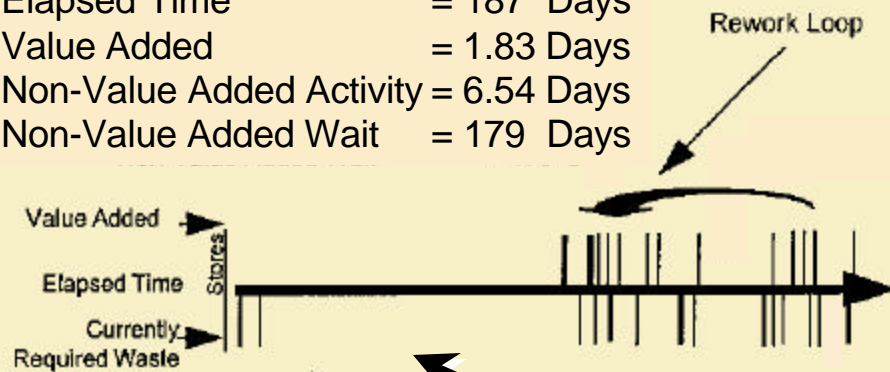


Time Value Analysis Reveals the Opportunity!

➔ *A typical analysis shows value is being added around 1% of the time*

“AS IS”

Elapsed Time = 187 Days
Value Added = 1.83 Days
Non-Value Added Activity = 6.54 Days
Non-Value Added Wait = 179 Days



“TO BE”

Elapsed Time = 20 Days
Value Added = 1.83 Days
Non-Value Added Activity = 5.17 Days
Non-Value Added Wait = 13 Days



Most of the Lead Time is "White Space" or Product Waiting Time!



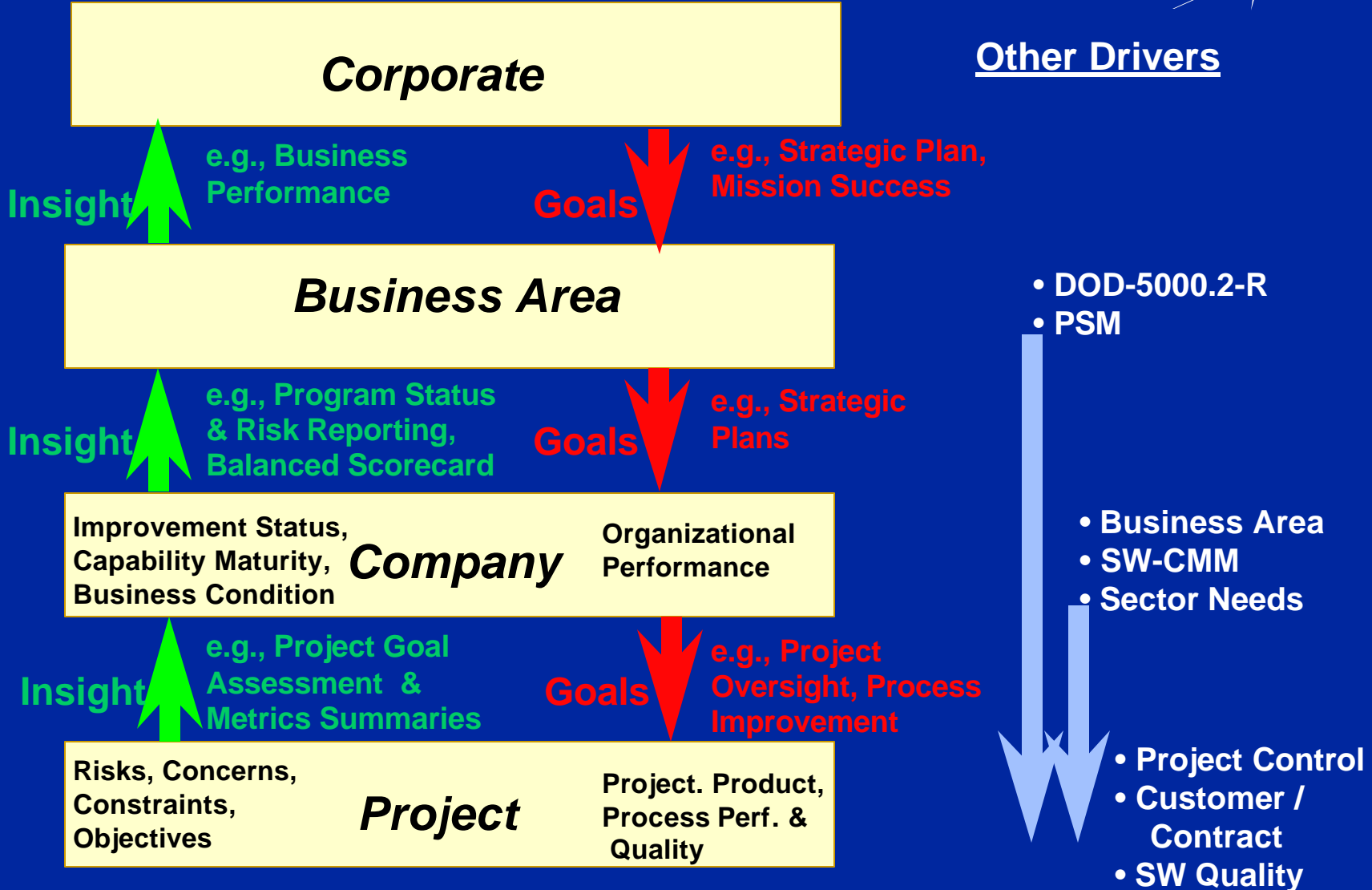
What we look for

Measurement in LMC

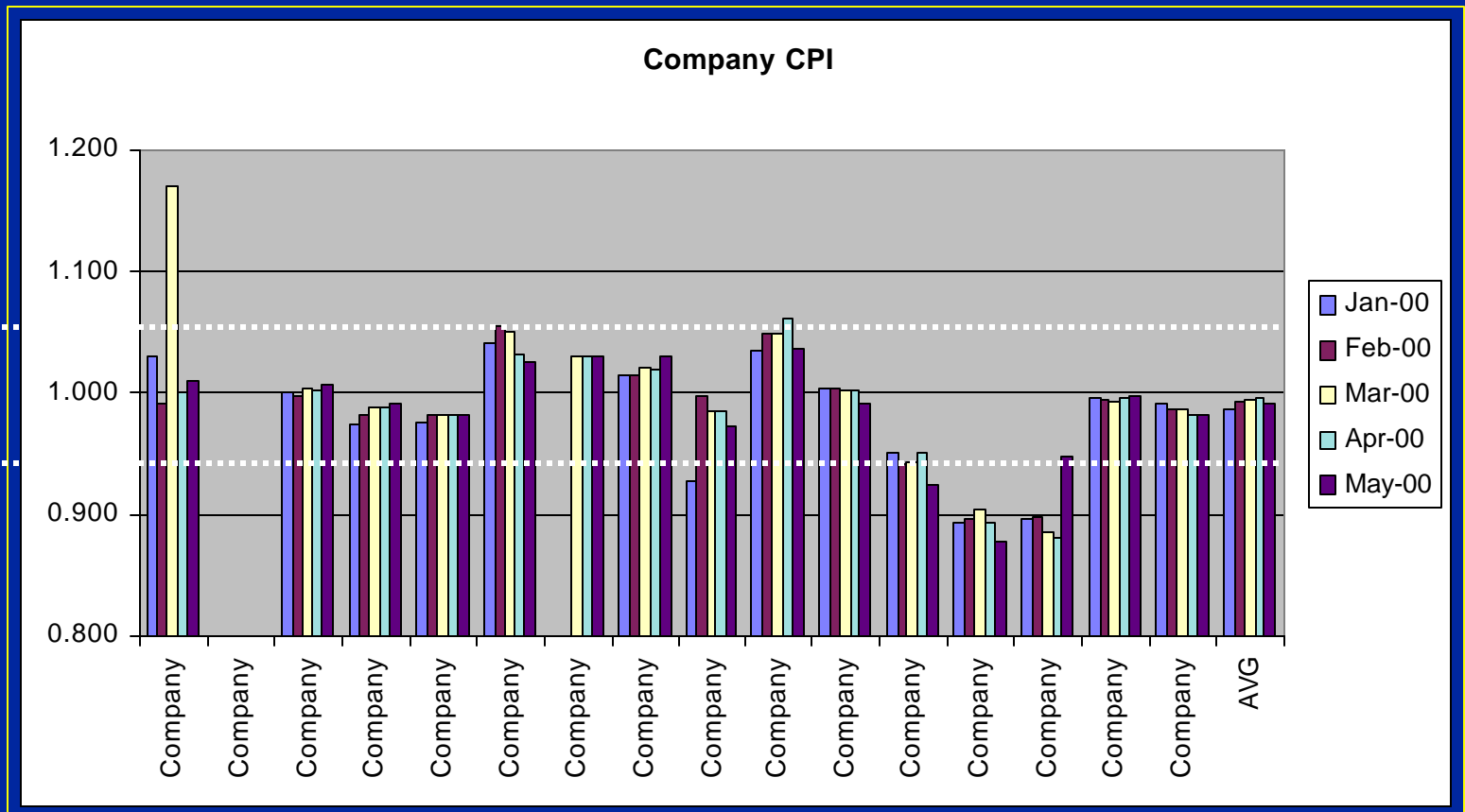


- Measurement guidance is integrated with SW & SE processes
- Identification of relevant metrics in EPI Software Life Cycle Process Standard
 - Metrics activities noted
 - Annex D has matrix of metrics associated with process elements
- Corporate EPI guidebooks for SW & SE measurement
 - PSM and INCOSE guidance used as basis
- Training in measurement consistent with this guidance (PSM; SSRC Courses; Company specific)
- Corporate/Business Area metrics requirements

Measurement Needs Hierarchy



Watchlisted Programs (Large, high-risk, or troubled)

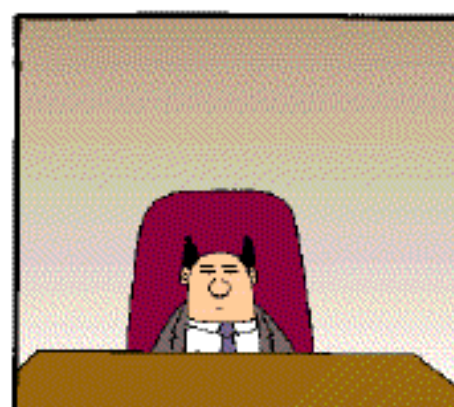
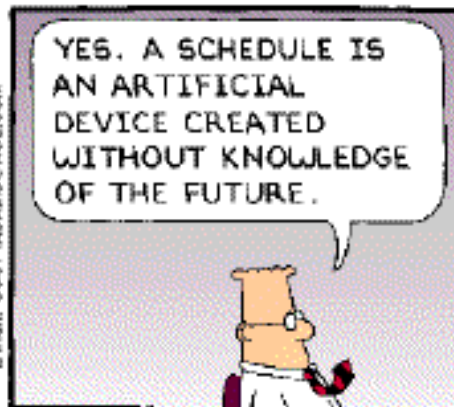
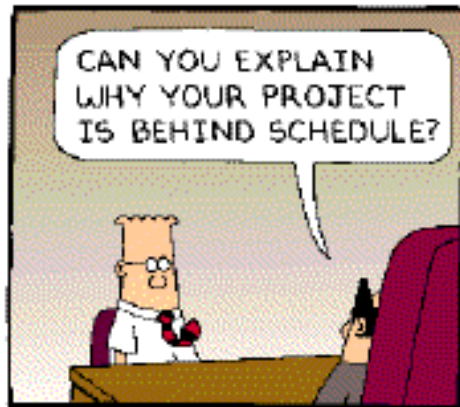
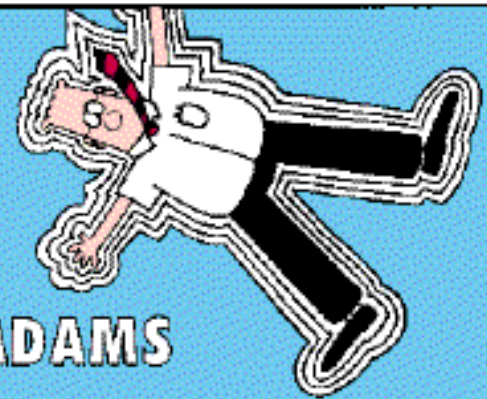




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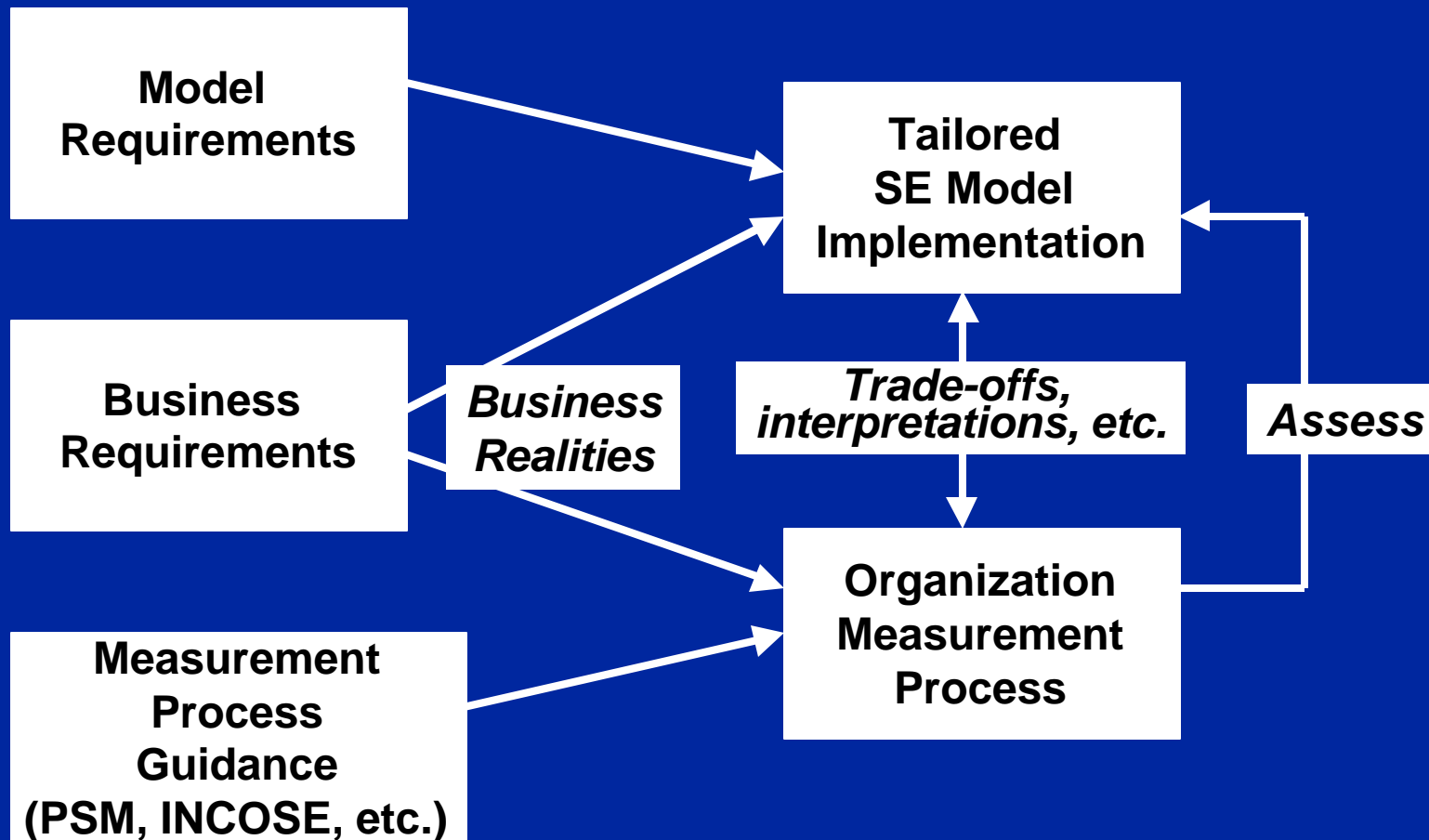
BY

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Aligning Measurement to Meet Business Requirements



Basis of Metrics Program



- **Measurement process based on:**
 - **Corporate and Company Level guidance**
 - **Practical Software and Systems Measurement (PSM)**
 - *PSM Guidebook*
 - *PSM: Measurement for Process Management*
 - **Software Productivity Consortium Measurement Guidance**
 - *SW Measurement Guidebook*
 - *Quantitative Management Guidebook*
 - **INCOSE Measurement Guidance**
 - *SE Measurement Primer*
 - *SE Metrics Guidebook*
- **Process consistent with current standards and capability models**

Measurement Process



Risk Management

Program and Project Planning

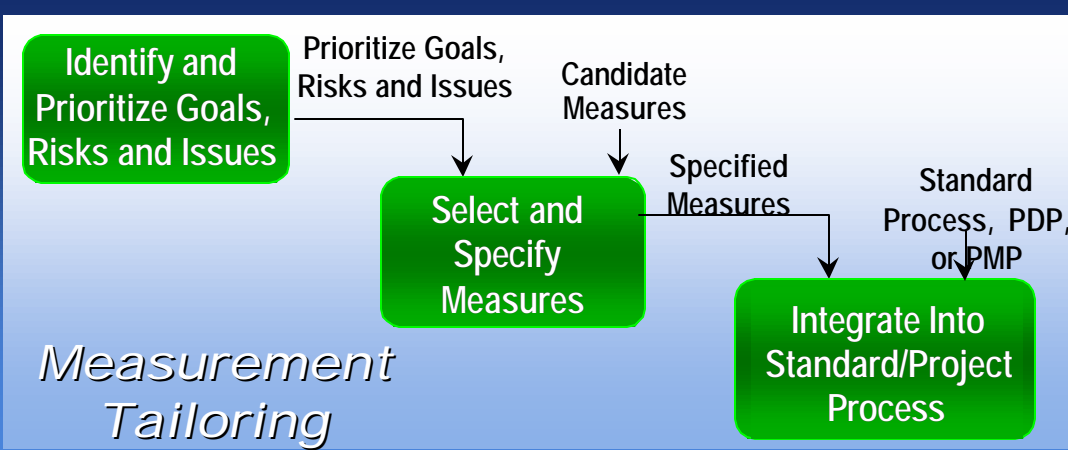
Monitor and Control

Risks and Issues

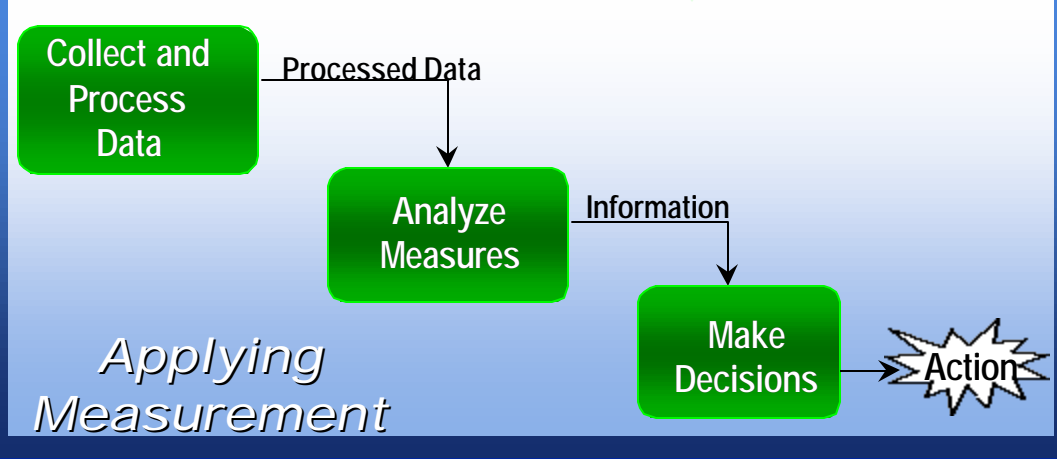
Goals and Objectives

Can be applied at any level in org. hierarchy

Process Inputs



Measurement Plan

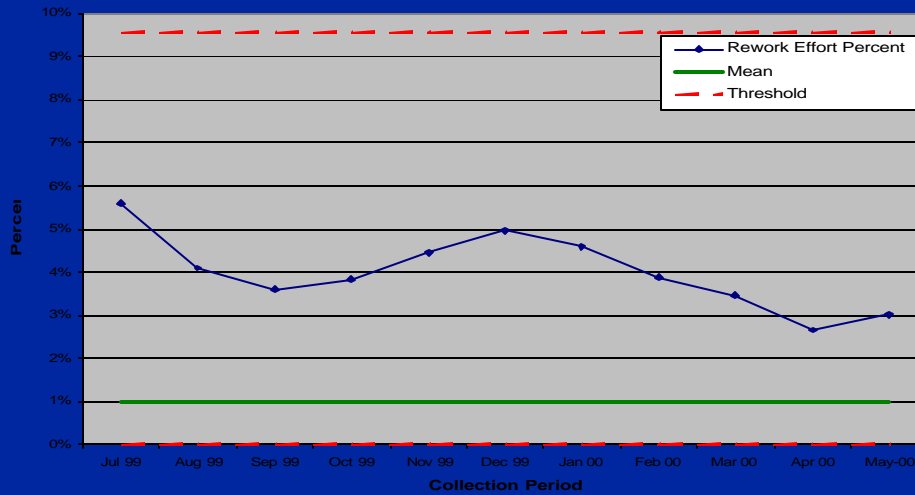


Process Outputs

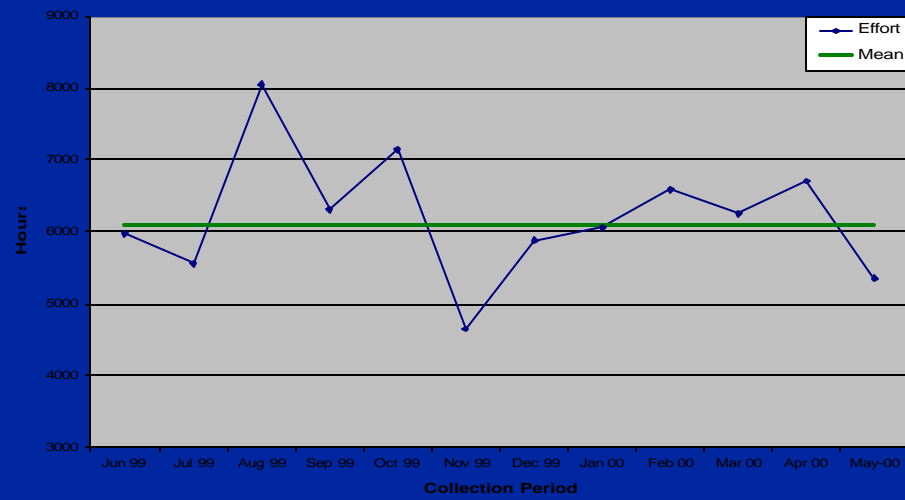
Study/Analysis Reports



Rework



Effort

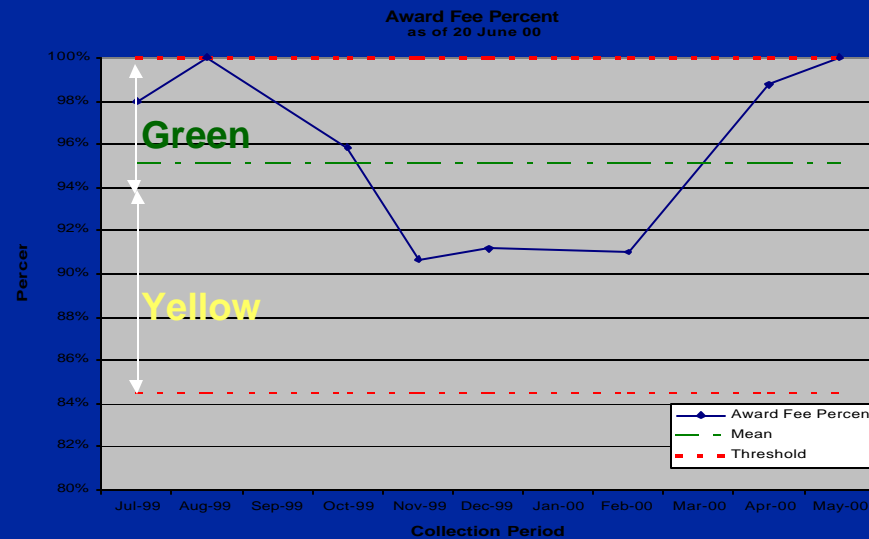


Award Fee Percent



The Award Fee Percent metric compares the award fee amount received to the amount available for a contract for each period of performance. This metric provides an overall satisfaction rating based on criteria derived by the customer and is an indication of whether or not the programs are meeting their customer's expectations. The organization will use the Award Fee Percent as an indicator of overall organizational process performance from the customer perspective and we will use the Award Fee Percent as a first line indicator of potential systemic problems in process performance leading to reduced customer satisfaction.

There was one data point for Award Fee Percent in the month of May. The overall Award Fee Percent for the month of May fell into the green range



Where we're headed



- *Recent Engineering VP Conference directed our Engineering subcouncils to provide a value-oriented measurement set for measuring engineering “lean”*
- *Set will become core measurement requirements*
 - *First-blush check shows high-performance companies share a set of “golden metrics”*
- *Business areas will use core measures to find and praise the best, educate the rest*
 - *No whipping or whining allowed!*
- *Corporate reports remain trends only*



Summary

- *LM21 Phase 1 transferred best practices and was a runaway success thanks to benchmarking*
- *Phase 1 success reinforced value of using measurable facts as basis for managing corporation*
- *Savings “left on the table” from Phase 1 greater than expected*
- *Chairman reinforced -- more aggressive lean, six-sigma*
- *Beyond savings, positive cultural changes position business for long-term success*