Panel: The Business Value Of CMMI ML 5

Lynn Penn	Lockheed Martin
Rushby Craig	Hill AFB
Rick Heffner	Northrop Grumman
Gene Miluk	SEI

Sponsored by the U.S. Department of Defense

CMMI Maturity Level 5

- Describe CMMI ML 5 beyond OPP, QPM, OID and CAR
- How do you operationalize ML5
- What do you measure? What do you watch?
- What business value results:
  - For your customers
  - For your organization

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Lockheed Martin
Integrated Systems & Solutions

CMMI Maturity Level 5 Foundation

M. Lynn Penn
Director Quality Systems & Process Management

Integrated Systems & Solutions Process Improvement Structure

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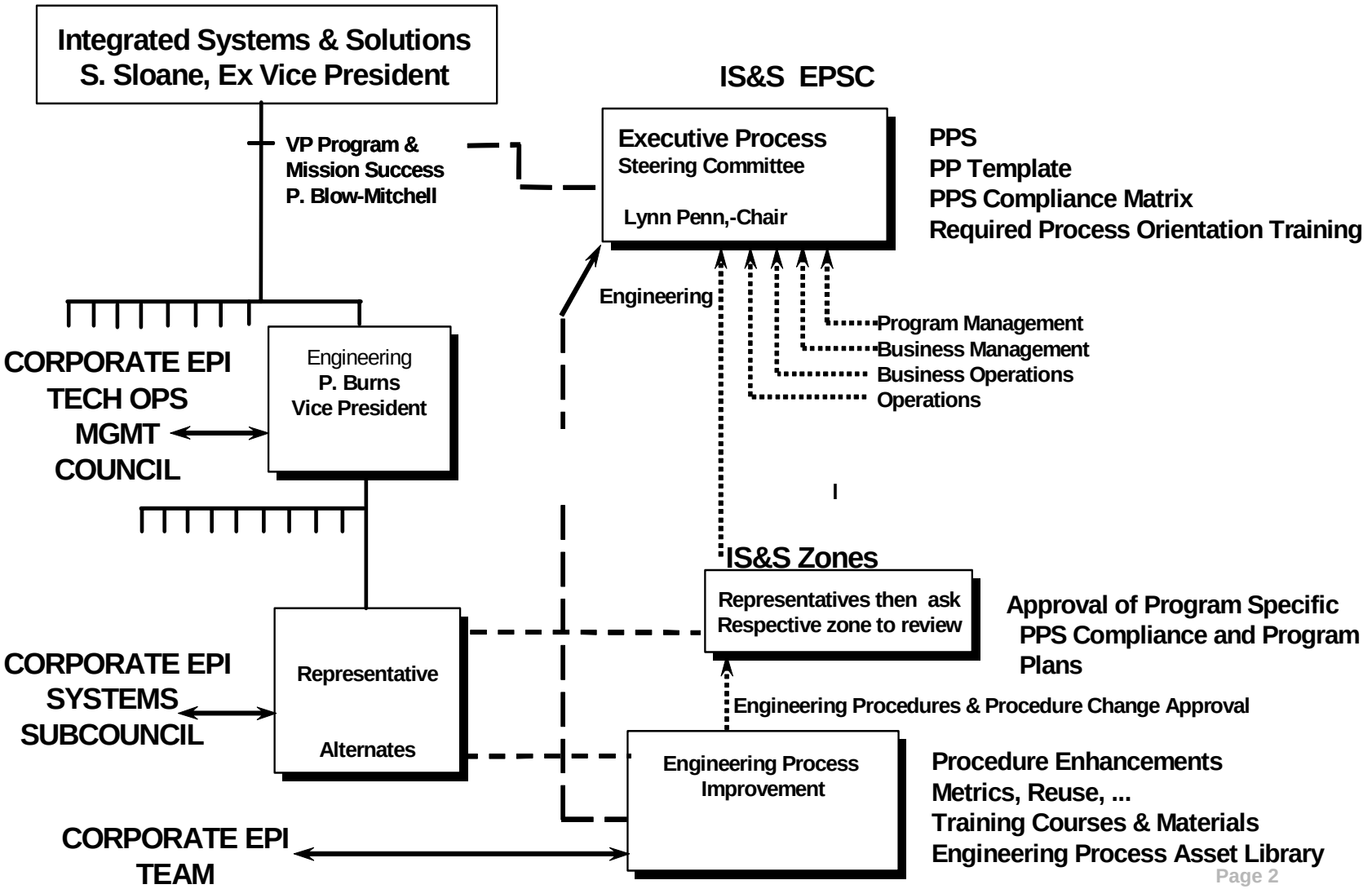
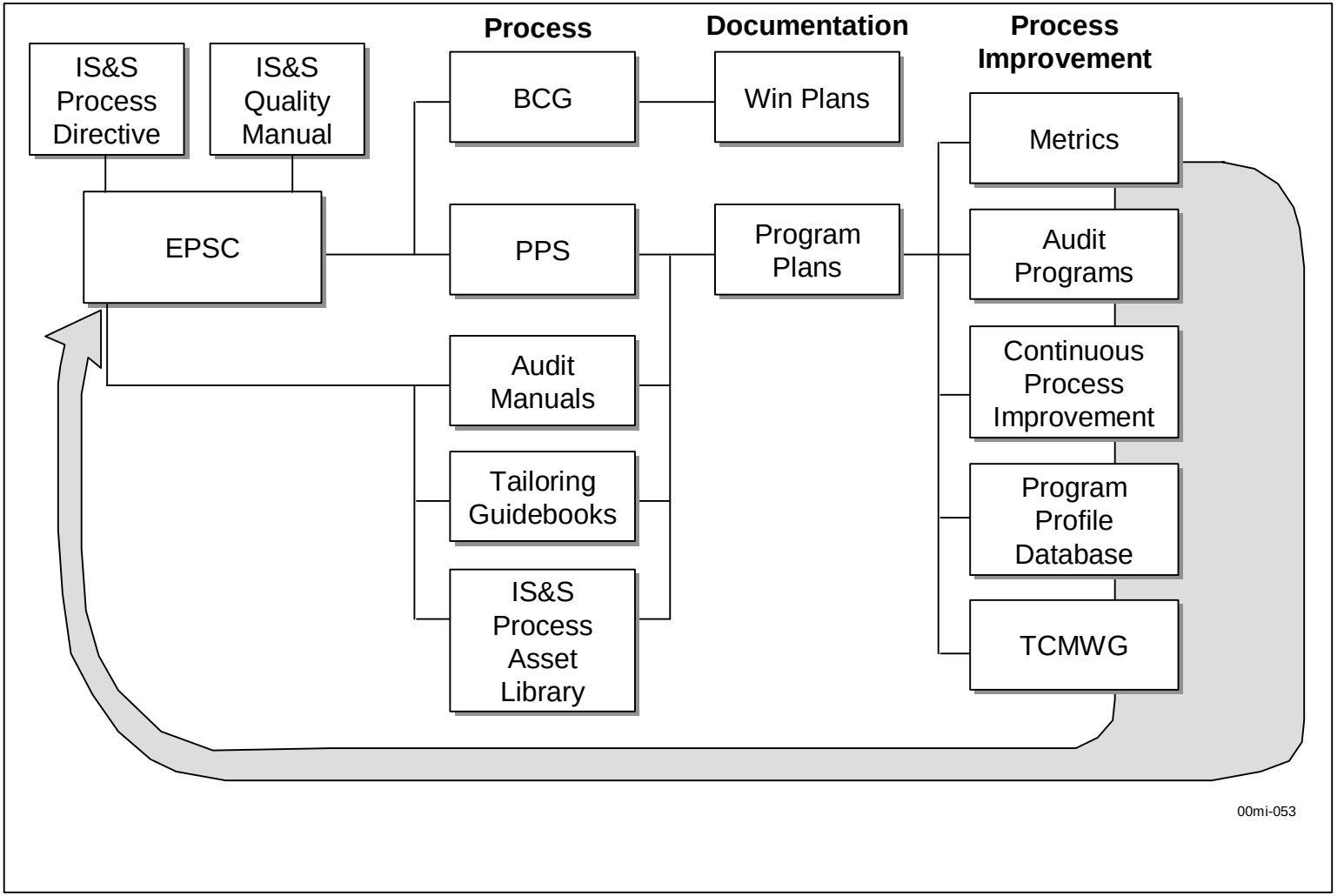




Communication…Training…Communication…Training

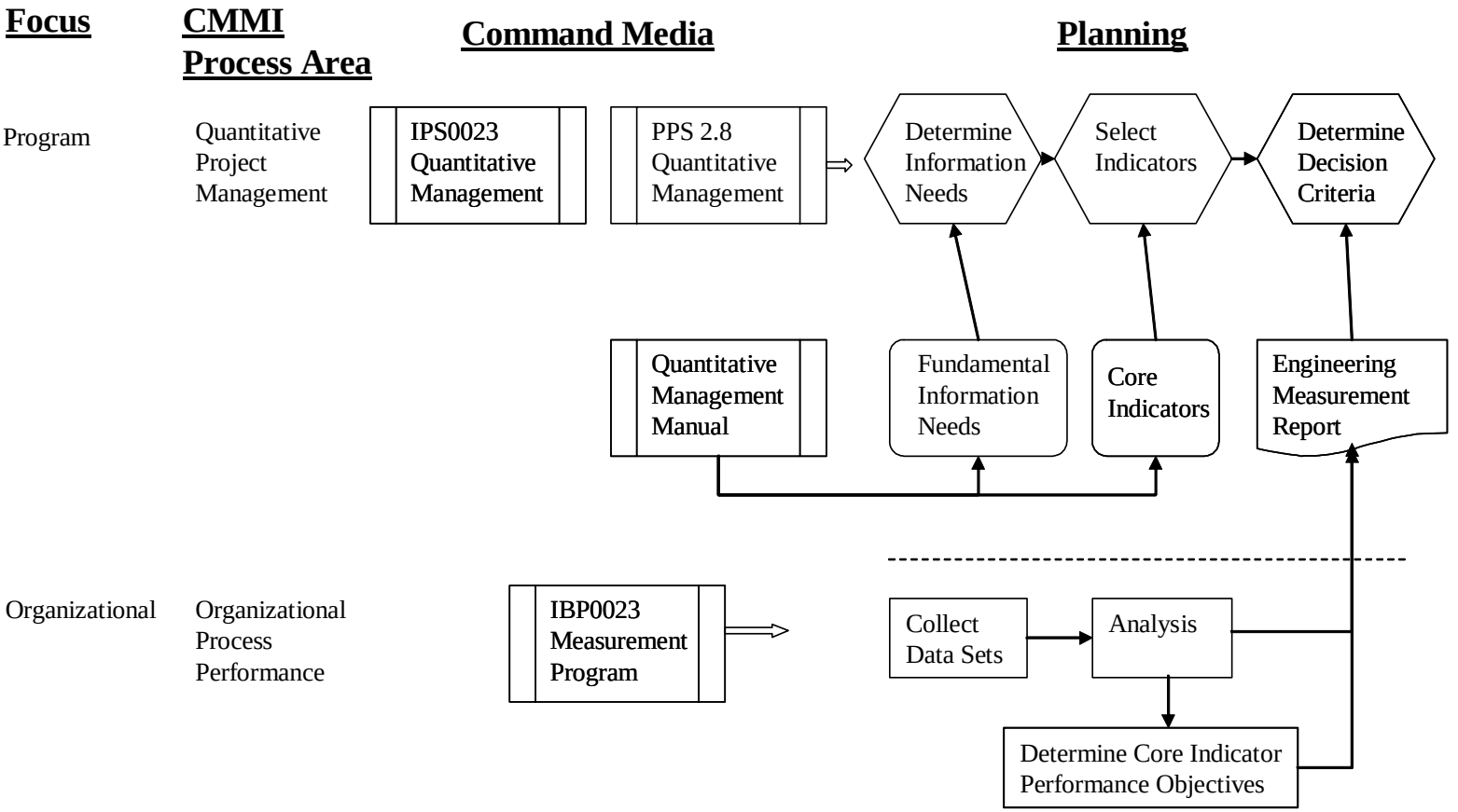
IS&S Measurement Program

Objective: The IS&S Measurement Program provides the infrastructure, data, and analysis that

- facilitates program level quantitative management,
- establishes the organization's process performance baselines,
- facilitates the alignment of organizational process performance with business objectives,
- identifies opportunities to improve program and/or organizational processes,
- models program performance to establish deployment initiatives, and
- facilitates cost, schedule, and quality estimation.

Led by: IS&S Measurement Coordinator
Reports to: Director, Quality Systems & Process Management, Mission Success
Oversight: Measurement Program Steering Committee

IS&S Approach to CMMI Measurement Requirements



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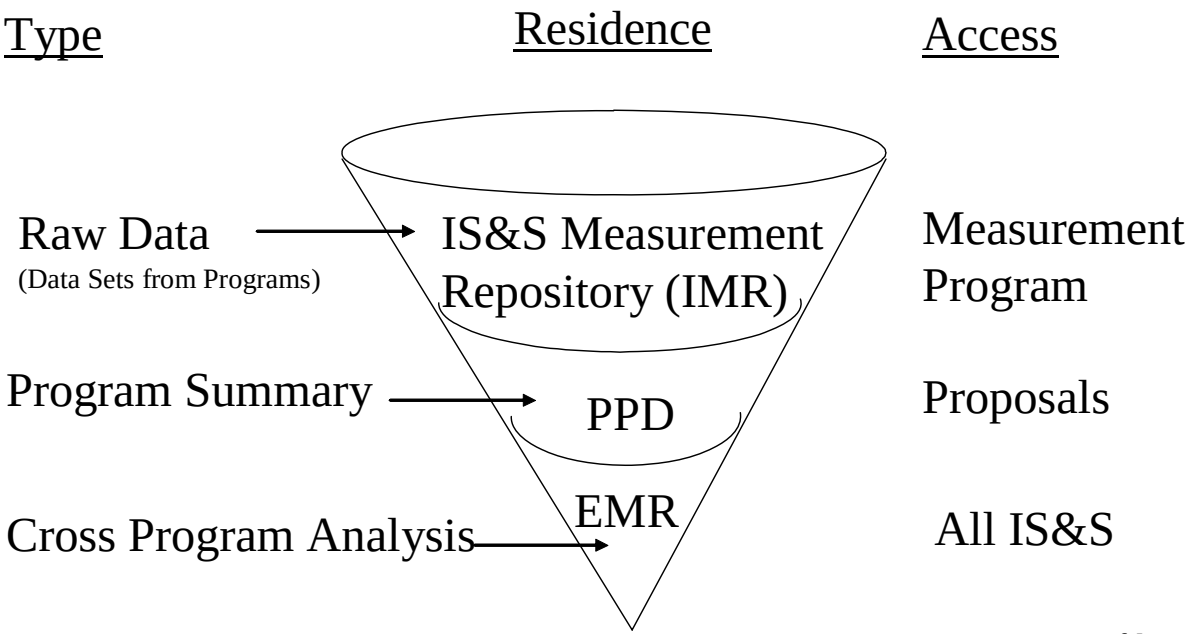
Quantitative Project Management

The process to the right is quantiatively managed using the indicator below	System Requirements Analysis	Architecture Design	Software Requirements Analysis	Software Design	Code and Unit Test	Product Integration and Verification	System Integration and Verification	Deployment
Earned Value, Schedule								
Earned Value, Cost								
Product Progress								
Requirements Traceability								
Requirements Stability								
TBDs and TBRs								
Design Stability								
Breadth of Testing								
Monthly Fault Profiles								
Cumulative Fault Profiles								
Defect Density								
Staffing								
Product Growth and Progress								
In-process Productivity								
Defect Detection Profile								
Effort Profile								
Technical Performance Measurements								
The critical subprocess to the right is statistically managed using the indicators below	Inspections	Inspections	Inspections	Inspections	Inspections			
Preparation Rate Control Chart								
Pace Rate Control Chart								
Defect Density Control Chart								

Organizational Measurement Analysis



EMR: Engineering Measurement Report

PPD: Program Profile Database

World Class Processes...

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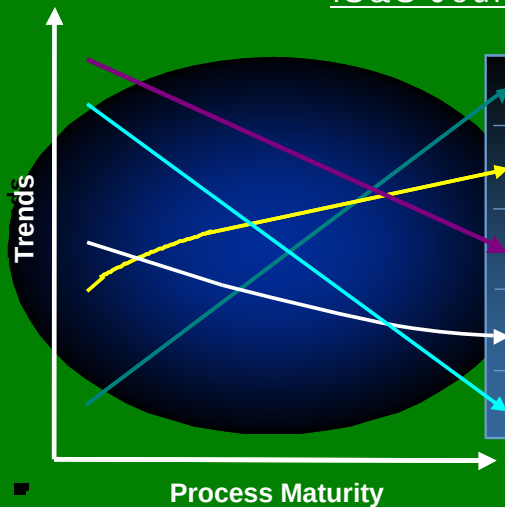
IS&S Journey to CMMI L5

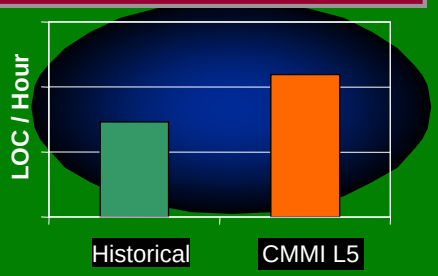


Software Productivity	Up 52%
Potential Additional Award Fee Achieved	52.5%
SW Development Cost	Down 23%
Wrap Rate	Down 5.5%
Defect Find / Fix Cost	Down 21 %

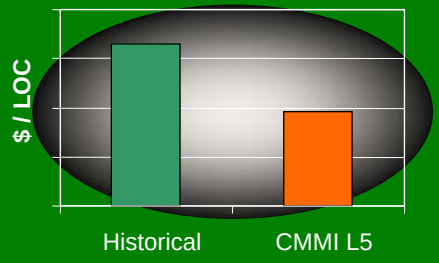
Program Performance

- 95.5% of programs > $50M have no serious problems.
- Improved Award Fee performance continues

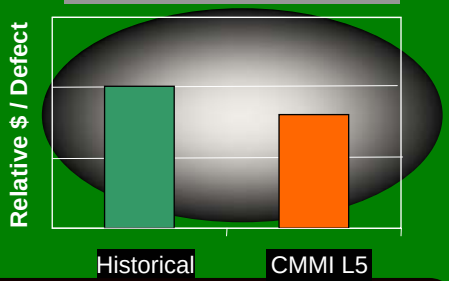
S/W productivity increased 52% over baseline average capability



S/W cost decreased 23% in Constant 2004 dollars



Defect Find / Fix cost down by 21%



Drive World Class Performance / Competitiveness

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IS&S Benchmarking Maintenance

Initial Benchmark
- SCAMPI C 6-9 months after ATP

One year after Initial Benchmark:

SCAMPI B
- All programs over $X contract value
- Some programs between $X and $X
  - FFP, numerous subs, not co-located team, high risk, corporate or IS&S visibility

SCAMPI C
- Non-SCAMPI B programs between $X and $X
- All programs (>$X) that are following the “primes” or “customers” processes
  - A PPS mapping is required and this is done for process risk determination

REVISITS depend on “Process Risks” identified in previous benchmark – ALL PROGRAMS VISITED EVERY TWO YEARS

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The Challenge

COAST-TO-COAST LOCATIONS

200+ PROGRAMS

4 BUSINESS UNITS

15,000 TECHNICAL EMPLOYEES

PROCESS COMPLIANCE

PROCESS PERFORMANCE

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Questions ?

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DEFINING THE FUTURE

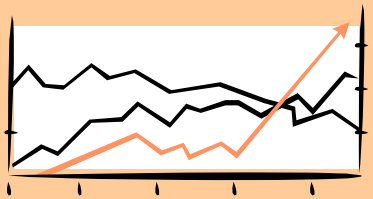
Business Value of CMMI Level 5

CMMI Technology Conference & User Group
13-16 November 2006

Rick Hefner, Ph.D.
Director, Process Management
Northrop Grumman Corporation

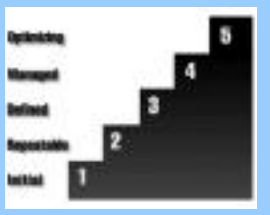
Two Complimentary Approaches to Process Improvement

Data-Driven (e.g., Lean Six Sigma)



- **Clarify what your customer wants (Voice of Customer)**
  - Critical to Quality (CTQs)
- **Determine what your processes can do (Voice of Process)**
  - Statistical Process Control
- **Identify and prioritize improvement opportunities**
  - Causal analysis of data
- **Determine where your customers/competitors are going (Voice of Business)**
  - Design for Six Sigma

Model-Driven (e.g., CMM, CMMI)



- **Determine the industry best practice**
  - Benchmarking, models
- **Compare your current practices to the model**
  - Appraisal, education
- **Identify and prioritize improvement opportunities**
  - Implementation
  - Institutionalization
- **Look for ways to optimize the processes**

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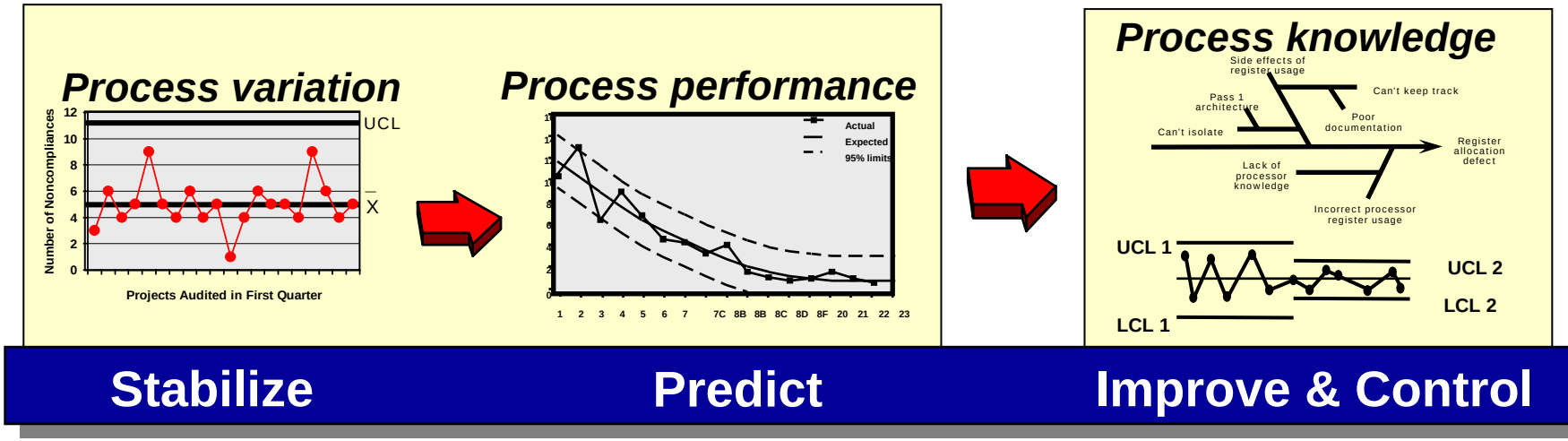
Lean Six Sigma Provides the Needed Tools to Implement CMMI High Maturity



Level 4

- Understand project's **process capabilities** based on process performance baselines
- **Control process variation** (remove "assignable causes")
- **Predict results** using process performance models
- **Manage** to achieve **goals**

Level 5

- Base **improvement goals** on future business needs
- **Eliminate problem and defect causes** ("common causes")
- Select, predict, and measure improvements to **change the process performance** baselines - shift the mean; tighten the variance
- **Manage change**

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Barriers and Challenges

- **Engineering process measurements are often difficult to analyze**
  - Inherent process variations when human creativity is involved
  - Dirty (or no) data
  - Vague measurement definitions, human recording errors
  - Infrequent measurements
  - Non-normal data
  - Need for stratification/aggregation
- **Must demonstrate the value of quantitative data to managers**
  - Management style - reactive vs. proactive vs. quantitative
  - Less value in a chaotic environment
  - Must involve customers

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Launch Workshop Strategy

Prerequisite
2 week Six Sigma Green Belt training

Launch 0
Executive Overview

Launch 1
Intro to Quantitative Management

- Finalize project goals
- Obtain measurement data for the subprocesses the project will put under SPC analysis
- Become familiar with Northrop Grumman Mission Systems QPM process
- Definition of related six sigma project(s)
- Incorporate and measure progress against the Level 4/5 plan tasks

Launch 2
Statistical Process Control

- Collect relevant project historical data, review it and perform initial "clean up"
- Collect data from project subprocesses and put on SPC charts
- Complete project profile
- Review business issues for clarity
- Identify Quantitative Measurement Plan data
- Measure progress against the Level 4/5 plan tasks

Launch 3
Quantitative Monitoring & Management

- Finish building models
- Begin tracking to models
- Draft Quantitative Measurement Plan
- Draft QPM evidence
- Measure progress against the Level 4/5 plan tasks

Launch 4
CMMI Level 5 (OID &CAR)

- Develop project CAR plan
- Start project CAR activities
- Submit improvements to support OID (when applicable)
- Measure progress against the Level 4/5 plan tasks

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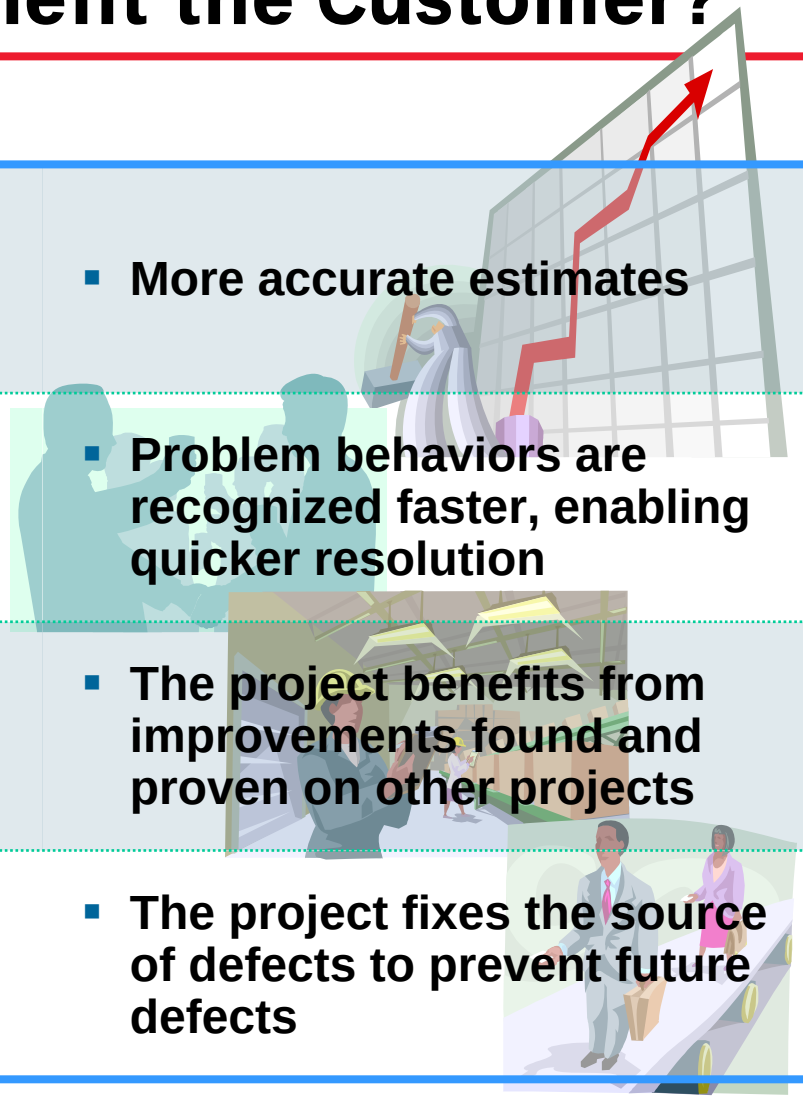
How Does Level 4 & 5 Benefit the Customer?

▪ Organizational process performance	▪ More accurate estimates
▪ Quantitative project management	▪ Problem behaviors are recognized faster, enabling quicker resolution
▪ Organizational innovation and deployment	▪ The project benefits from improvements found and proven on other projects
▪ Causal analysis	▪ The project fixes the source of defects to prevent future defects



Level 5 reduces costs and improves quality (so we implement it on <u>all</u> projects)

Reference: ***How Does High Maturity Benefit the Customer?, R. Hefner, Systems & Software Technology Conference, 2005***

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Lessons Learned

Based on over 20 Northrop Grumman CMMI Level 5 organizations

- **Having multiple improvement initiatives helps encourage a change in behavior as opposed to "achieving a level"**
  - Reinforces that change (improvement) is a way of life
- **CMMI and Six Sigma compliment each other**
  - CMMI can yield behaviors without benefit
  - Six Sigma improvements based solely on data may miss innovative improvements (assumes a local optimum)
- **The real ROI comes in institutionalizing local improvements across the wider organization**
  - CMMI establishes the needed mechanisms
- **Training the staff as Six Sigma Green Belts has resulted in a change of language and culture**
  - Voice of Customer, data-driven decisions, causal analysis, etc.
  - Better to use the tools in everyday work than to adopt the "religion"

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Ogden Air Logistics Center

U.S. AIR FORCE

309 SMXG

Business Value of High Maturity

CMMI Technology Conference

Denver, CO

November 2006

Who We Are

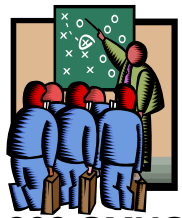
- 309th Software Maintenance Group, Hill AFB, Utah
- Approximately 700 engineering personnel
- Develop and maintain software for Air Force and other DoD customers
  - F-16 Block 30 OFPs
  - Mission Planning software
  - Aircraft and Missile Automatic Test Systems
  - Command and Control Software
  - IT software
- Majority of work is software maintenance
- 3 product lines--containing 40+ projects total

Our High Maturity Strategy

Customers

Needs

Needs



309 SMXG
Strategic Plan

Provides focus for what we want to measure

Metrics Implementation Guide

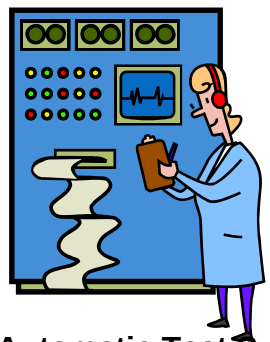
Input

Goals

Measures

Product Lines

- Standard Processes
- Quantitative Goals
- Models
- Baselines



Automatic Test Systems

Weapon Systems Software

Operational Flight Software

Product Lines

- In addition to an organization-level SEPG we have Extended SEPGs (ESEPGs) in each product line
- ESEPG leads are:
  - Accomplished Project Managers
  - Responsible for mentoring new and less experienced PMs
  - Responsible for leading process improvement in the product-line
    - Establishment of process baselines, and models and ensuring their use
    - Collection of measures
    - Leading CAR teams
- ESEPG members typically made up of PMs and project leads from within the product line

Benefits 1

- Improved Customer Relationships
  - Some customers were not initially supportive of our process improvement efforts
  - Now many customers can quantify their expectations to us
  - They are comfortable with reviewing project data and even understand it
  - They have more realistic expectations
  - They can see that they are getting more product for their dollar than in the past

Benefits 2

Three fold reduction in defect density while increasing Productivity by 60% (OFP)

417% increase in productivity (GTACS)

Cycle time reduced from 120 days to less than 60 days in past 2 years. (ATE)

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