5th Annual CMMI Technology Conference and User Group

Denver, CO

14-17 November 2005

Agenda

Monday, 14 November 2005

Tutorial Tracks

Track 1:

- Calculating CMMI-Based Return on Investment (ROI): Why, When, What, How?, Mr. Rolf W. Reitzig, Cognece, Inc.
- A Practical Guide to Implementing Levels 4 and 5, Mr. Rick Hefner, Northrop Grumman Corporation

Track 2:

- Agile/Lean Workshop, Mr. Jeffrey Dutton, Jacobs Sverdrup
- Mr. Tim Kasse, Kasse Initiatives, LLC:
  1. Leveraging ITIL Services (Suppport and Delivery) Capability and Maturity with the CMMI
  2. Service Management “A Process Led Approach”
  3. ITIL IT Infrastructure Library Overview
  4. Overview of Service Support & Service Delivery Functions
  5. Configuration Management & Change Management
  6. “Service Support” Change Management
  7. “Service Support” Configuration Management
  8. Configuration Management & Change Management ITIL - CMMI
  9. ITIL Process Maturity Self-Assessment & Action Plan

Track 3:

- The Look and Feel of a Successful CMMI Implementaiton, Mr. Tim Kasse, Kasse Initiatives, LLC
- How to Define CMMI Based Process That are Short and Usable and Using a Process Measurement Framework to Successfully Achieve Measurable Results, Mr. Timothy G. Olson, Quality Improvement Consultatnts, Inc.

Track 4:

- Using Simulation to Support Better Management Decisions, Dr. David M. Raffo, Portland State University
- Institutionalizing Resource Planning and Management Part I and Part II, Mr. Donald A. Borcherding, NexSummit, LLC

Track 5:

- The CMMI V1.2 ... A Tutorial, Mr. David M. Phillips, SEI

Track 6:

- Integrated Porject Management (IPM) - The CMMI and Collaborative Product Develop and Requirement Engineering: A Practicial Approach to Modeling and Managing Requirements, Mr. William J. Deibler, II Software Systems Quality Consulting - SSQC

Tuesday, 15 November 2005

General Sessions

LTG Joseph Yakovac, USA, Miliatry Deputy Office of the Secretary of the Army, Acquisition, Logistics & Technology

Executive Panel: "How Has CMMI Improved Our Program & Project Performance -- Or Has It?":

Mr. Mark Schaeffer, Director, Systems Engineering, OUSD(AT&L) Defense System and OSD Sponsor, CMMI
- Mr. Dev Banerjee, Division Director, Systems & Flight Engineering, Boeing Integrated Defense Systems
- Mr. John Evers, Raytheon Processes Program Manager, Raytheon Common Engineering Process Program
- Brig Gen Gary Salisbury, USAF (Ret), Executive Director Business Development, Defense Mission Systems, Northrop Grumman Mission Systems

Lunch: CMMI State of the Model, Mr. Bob Rassa, Raytheon; Mr. Clyde Chittister, SEI

Technical Sessions

Track 1: CMMI Process Improvement

- CMMI/ISO - "Can't we all just get along?", Mr. Dale R. Spaulding, The Boeing Company
- Real World Application of IEEE Software Engineering Standards to CMM/CMMI Software Process Improvement Initiatives, Ms. Susan K. Land, Norhtrop Gurmman IT/TASC
- The CMMI Product Suite and International Standards -- An Update, Mr. David H. Kitson, SEI

Track 2: Practical Guidance

- Verification in CMMI using Peer Reviews - Presentation and Paper, Ms. Jeanne H. Balsam, Georgia Tech Research Institute
- Process QA in the Information Age: Keep it Light!, Hillel Glazer, Entinex, Inc
- Defect Datat and Configuation Management, Ms. Julie E. Schmarje, Raytheon Company

Track 3: Appraisals

- Wasted Days and Wasted Nights - Leveraging Your Appraisal Team as a Resource, Dr. Timothy J. Davis, Raytheon Missile Systems
- Building a Credible SCAMPI Appraisal Representative Sample, Mr. Robert L. Moore, III., Business Transformation Institute, Inc.
- Top 10 Signs You're Ready (or Not) for an Appraisal, Mr. Gary Natwick, Harris Corporation

Track 4: ROI & Benefits of CMMI

- Measuring Performance: Evidence About the Results of CMMI, Ms. Diane Gibson, SEI
- Prioritizing Process Improvement Strategies in CMMI to Optimize Business Objectives, Dr. Aldo Dagnino, ABB, Inc. US Corporate Research
- Implementing a Plan for Controlling ROI for CMMI Process Improvement, Mr. J. M. Perry, BAE Systems
- Lessons Learned in the Engineering of Process Performance Models on the Journey to Higher Maturity Levels, Mr. Dr. Mary Anne Herndon, SAIC

Track 5: Acquisition / High Maturity

- Getting Lost on the Way to Level 5, Ms. Kathy King, The Center for Systems Management
- Understanding Why?, Mr. David N. Card, Q-Labs

Track 6: Transitioning to CMMI

- Migrating Best Practices Within an Organization: Experiences in Adapting CMMI Policies and Procedures Used in One Part of a Business to Another, Mr. Scott Sherrill, Georgia Tech Research Institute
- An Enterprise Wide CMMI Implementation at Accenture, Ms. Sarah S. Bengzon, Accenture
- Stakeholder Identification and Involvement in the CMMI, Mr. James R. Armstrong, Systems and Software Consortium
- Ensuring the Right Process is Deployed Right: Synchronizing Process Checkpoints with Business Rhythm, Ms. Joan Weszka, Lockheed Martin Corporation

Track 7: CMMI for Small Projects anhd Organizations

- Making PPQA Work on Small Projects Presentation and Paper, Ms. Jean M. Swank, Georgia Tech Research Institute
- Does Size Matter in CMMI Implementation or Was Yoda Wrong?, Mr. Paul H. Meyers, SAIC

Wednesday, 16 November 2005

Technical Sessions

Track 1: CMMI Process Improvement

- A Change Agent in a Level 1 Organization; How to Survive in a Hostile Environment, Mr. Andrew Cordes, ABB - United States Corporate Research Center
- "Sound Systems Engineering Using CMMI, Mr. Michael T. Kutch, Jr., SPAWAR - Charleston
- Using CMMI to "Dig Out" from an Ad Hoc Development?, Mr. Donald A. Borcherding, NexSummit, LLC
- Strategic Planning: Selling a CMMI-Based Improvement Effort to Senior Management, Dr. Aldo Dagnino, ABB, Inc., US Corporate Research
- Enterprise Process Intergration within the Space and Airborne Systems Business Area of Raytheon, Mrs. Deana A. Seigler, Raytheon Company
- Interpreting the CMMI: It Depends!, Mr. Rick Hefner, Northrop Grumman Corporation
- CMMI as Safeguard Against Software Entropy: A Manager's Perspective, Dr. Thomas F. Christian, Jr., 402 SMXG
- "Its how big? How will you deploy it without killing my team and my program?", Mr. William Borkowski, Jr., Raytheon Missile Systems

Track 2: Practical Guidance

- Are You Making the Most of Your Project Schedules?, Ms. Susan Byrnes, PMP, Natural SPI, Inc.

- Keeping the Team Motivated for Success and “Barrier Busting” – Obtaining Active Leadership Support, Mr. Michael D. Scott, Raytheon Missile Systems
- Using a Level 3 Process to Achieve CMMI Level 3, Mr. Stephen Ross, Raytheon Company
- Accelerating Process Improvement through Collaboratio: The NAVAIR Systems Process Improvement Community of Practice, Ms. Katie Smith, Naval Air Systems Command
- What the CMMI Doesn't Say About Training (But Should!), Sree Yellayi, Siemens Corporate Research
- CMMI CP 2.8 Interpretation and Implementation: Is This Practice Just About Numbers?, Mr. Lester Stamnas, Norausky Process Solutions, Inc.
- Creating Helpful process Directives, Mr. Kenneth I. Weinberg, Raytheon Company

Track 3: Appraisals

- Lessions Learned in Helping Large and Small Organizations Prepare for their First Appraisal, Mr. Robert J. Pomietto, Center for Systems Management
- Behind Closed Doors, Mr. Tom G. Lienhard, Raytheon Missile Systems
- CMMI Appraisal Results: The Shocking Truth Revealed and Lead Appraisers Gone Wild, Ms. Margaret A. Glover, SEI
- Improving Document Reviews for Appraisals, Mr. Kent McClurg, Raytheon Company
- Finding CMMI Compliant Artifacts and a Needle in a Haystack, Adrio J. DeCicco, Raytheon Company
- Lessons Learned and Best Practices for Evidence Collection in Preparation for a SCAMPI Appraisal, Mr. Ben Berauer, Raytheon Company
- Maximizing Value for SCAMPI(SM) Preparation, Ms. Joan Weszka, Lockheed Martin Corporation

Track 4: ROI & Benefits of CMMI

- Evaluating the Impact New Tools and Technologies Using Simulation, Dr. David M. Raffo, Portland State University
- The ROI Dashbord (c): Understanding the Benefits of CMMI, Mr. Thomas L. McGibbon, ITT Industries, AES
- Quality Assurance Involvement Compared to Program Results, Ms. Jill Brooks, Raytheon Company
- Rapidly Achieving Measurable ROI Using Early Defect Detection, Mr. Timothy G. Olson, Quality Improvement Consultants, Inc
- CMMI Process Improvement: Its not a technical problem, its a people problem, Mr. Rolf W. Reitzig, Cognence, Inc.
- A Project's Perspective of a CMMI Level 5, Mr. Warren Scheinin, Northrop Grumman Corporation
- Achieving the Promised Benefits of CMMI, Dr. Rick Hefner, Norhtrop Grumman Corporation
- Measuring Economic Benefits of Process Improvement in CMMI Level 1 Organization, Dr. Aldo Dagnino, ABB, Inc., US Corporate Research

Track 5: High Maturity

- Logarithms Can Be Your Friends: Controlling Peer Review Cost?, Dr. Richard L. W. Welch, Northrop Grumman Corporation
- Journeys on the Road to Level 5, Mr. Joseph V. Vanderville, Northrop Grumman Corporation
- Lessons Learned on the SCAMPI Road to CMMI-Software Level 5, Mr. Joseph N. Frisina, BAE Systems
- Merging Measurement in Mature Companies - A Success Story of Measurement Process Integration, Ms. Sharon Rohde, Lockheed Martin IS&S
- The Road to Process Improvement Successes: CMMI Level 5/ISO 9001-2000 Business Model, Mrs. Debra S. Roy, BAE Systems, National Security Solutions
- Reducing Variation at Each CMMI Maturity Level?, Mr. Timothy Kasse, Kasse Initiatives, LLC
- Ways to Ensure the Culture Supports Level 5, Mr. Warren Scheinin, Northrop Grumman Corporation
- Analyzing Defects Can Tell a Story About a Company?, Ms. Diane A. Mitzukami-Williams, Northrop Grumman Corporation Mission Systems

Track 6: Transition to CMMI

- Combining Six IPTS and Transitioning to CMMI, Ms. Judy Overhouser-Duett, NAVAIR
- How to Transition Models and Disciplines - Looking for Transition in all the Wrong Places, Ms. Lori G. Smailes, TYBRIN Corporation
- Using SW-SMM SQA Independent Verificaiton as a First Step for the Transition to CMMI, Mr. Alfredo N. Tsukumo, CenPRA-Centro de Pesquisas Renato Archer
- Service Extensions to the CMMI, Mr. Craig R. Hollenbach, Northrop Grumman Corporation
- Applying CMMI to Services, Mr. Juan C. Ceva, Raytheon ITSS
- Management Challenges & Lessons Learned Implementing CMMI in a Services Environment, Mr. Thomas E. Zience, BAE Systems Information Technology
- CMMI v1.1 for a Service Oriented Organization, Mr. Steven K. Hall, Raytheon Corporation

Track 7: Measurement

- Software Size Growth and Uncertainity - Both Affect Estimate Quality and Project Risk Presentation and Paper, Mr. Michael A. Ross, Galorath, Inc.
- Building an Automated System to Support Measurement in CMMI, Dr. Richard Hayden, Pragma Systems Corporation
- Team of Three - How to Get Program, Functional and Process Management Working Together, Mr. Mark A. Marsh, Raytheon Company
- Parametric Project Monitoring and Control: Performance-Based Progress Assessment and Prediction Presentation and Paper, Mr. Michael A. Ross, Galorath, Inc.
- Measuring and Estimating Process Performance, Dr. Richard D. Stutzke, SAIC

Thursday, 17 November 2005

Technical Sessions

Track 1: CMMI Process Improvement

- “Barrier Busting” – Obtaining Active Leadership Support, Mr. Michael D. Scott, Raytheon
- Don’t Write the Wrong Processes!, Ms. Suzanne B. Zampella, The Center for Systems Management

- Contrasting CMMI Contrasting CMMI and the PMBOK, Mr. Wayne Sherer, Anteon Corporation
- Being Customer Oriented, Mr. Tim Kasse, Kasse Initiatives, LLC
- Learning from Lessons Observed - Mitigating Resistance to Process Improvement, Mr. Bob Norris, National Geospatial-Intelligence Agency

Track 2: Practical Guidance

- Supplier Management Strategy Considerations with CMMI, Mr. Rick Hefner, Northrop Grumman Corporation
- Simplifying Process Tailoring To Enhance Project Execution, Mr. Howard T. Kaplan, Raytheon Company
- CMMI and agile: a High Tech R&D Success Story, Mr. Gene Miluk, SEI
- How to Incorporate “Lessons Learned” for Sustained Process Improvements, Mr. Anil K. Midha, BAE Systems
- Data Management: The Hidden Enabler or (The Key Data and Work Product Integrator), Mr. Lester Stamnas, Norausky Process Solutions

Track 3: Appraisals

- Techniques for Shortening the Time and Cost of CMMI Appraisals, Mr. Sam Fogle, Systems and Software Consortium, Inc.
- Using Classified Programs in CMMI Appraisals, Mr. Kenneth I. Weinberg, Raytheon Company
- The Best Intentions of SCAMPI V1.1: What We Meant and What Some People Heard, Mr. Will Hayes, SEI
- A Quantitative Comparison of SCAMPI A, B, and C, Mr. Dan Luttrell, Northrop Grumman Mission Systems
- Performing Consistent Appraisals in a Global Organization, Ms. Jeanine Courtney-Clark, Integrated System Diagnostics, Inc

Track 4: ROI & Benefits of CMM I / SCAMPI B/C

- The Effects of CMMI on Program Performance, Mr. Joseph P. Elm, SEI
- Squeezing Variation for Profit, Mr. Donald R. Corpron, Northrop Grumman Corporation
- Process In Execution Review (PIER) and the SCAMPI B Method, Ms. Lorraine J. Adams, SEI
- Planning a SCAMPI C Appraisal from a Strategic Perspective, Mr. John P. Kennedy, The Mitre Corporation
- Critical Path SCAMPISM Getting Real Business Results from Appraisals, Mr. Michael J. West, Natural SPI, Inc.
- Using SCAMPI C for Collective Improvement Across a Multi-Business Program, Mr. Oktawian Nowak, Motorola, Inc.

Track 5: High Maturity

- A Statistical Approach to Product Quality Assurance, mr. Randall J. Varga, BAE Systems
- The Key to a High Maturity Rating is - ORGANIZATION, Mrs. Karen M. Pelletier, Northrop Grumman Corporation
- Paladin Drives Forward To CMMI® Maturity Level 5, Mr. Victor Elias, M.S., Armament Software Engineering Center, US Army
- Business Improvements Achieving CMMI®Level 5 at SAIC: Who Keeps Moving My Process?, Ms. Sharon Cobb Flanagan, SAIC
- Extending CMMI Level 4/5 Organization Metrics Beyond Software Development, Ms. Linda R. Brooks, Northrop Grumman Corporation

Track 6: CMMI Extensions

- Capability Maturity Model Integration (CMMI®) Tailoring for an IT/MS Services Environment, Ms. Stacy Savage, BAE Systems Information Technology
- Adapting CMMI for Acquisition Organizations: A Preliminary Report, Dr. Hubert Hofmann, General Motors
- How to Become Your Customer’s Software Provider of Choice, Mr. David Herron, DCG, Inc.
- Space and Missile Systems CenteSpace and Missile Systems Center, Mr. Keith Wright, SPARTA, Inc.
- Software Outsourcing with CMMI, Dr. John W. Mishler, SEI

Track 7: Systems Engineering

- Sound Systems Engineering using CMMI®, Ms. Sandee D. Guidry, TECHSOFT
- Systems Engineering Influence Throughout the CMMI, Mr. Tim Kasse, Kasse Initiatives, LLC
- Future of System and Software Engineering Project Management and the CMMI, Dr. Kenneth E. Nidiffer, Systems and Software Consortium

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

5th Annual

CMMI® Technology Conference and User Group

Conference Agenda

Sponsored by:

The National Defense Industrial Association

Systems Engineering Division

in conjunction with the

Software Engineering Institute,

Carnegie Mellon University

Carnegie Mellon
Software Engineering Institute

Event # 6110
November 14 - 17, 2005
Hyatt Regency Tech Center
Denver, CO

Sunday, November 13, 2005

12:00 PM - 4:00 PM
Registration for Conference and Tutorial — Atrium

Monday, November 14, 2005

7:00 AM - 5:00 PM — Atrium
Tutorial Registration ($200 Tutorial Fee)

7:00 AM - 8:00 AM — Atrium
Continental Breakfast (Tutorial Attendees Only)

8:00 AM - 5:00 PM — See Following Pages
CMMI Tutorial Tracks (Tutorial Attendees Only)

12:00 PM - 1:00 PM — Grand Mesa ABC
Lunch (Tutorial Attendees Only)

5:00 PM - 6:30 PM — Display Area
Reception **(All CMMI Conference Attendees)**

Tuesday, November 15, 2005

7:30 AM - 8:30 AM — Atrium
Registration and Continental Breakfast

8:30 AM - 8:45 AM — Grand Mesa DEF
Opening Remarks

8:45 AM - 9:30 AM — Grand Mesa DEF
Session A
LTG Joseph Yakovac, USA, Military Deputy, Office of the Secretary of the Army, Acquisition, Logistics & Technology

9:30 AM - 10:00 AM — Atrium
Break

10:00 AM - 12:00 PM — Grand Mesa DEF
Session B
Executive Panel - “How Has CMMI Improved Our Program & Project Performance - Or Has it?”
Moderator:
Mr. Mark Schaeffer, Director, Systems Engineering, OUSD(AT&L) Defense Systems and OSD Sponsor, CMMI

Panelists:
Mr. Dev Banerjee, Division Director, Systems & Flight Engineering, Boeing Integrated Defense Systems
Mr. John Evers, Raytheon Processes Program Manager, Raytheon Common Engineering Process Program
Brig Gen Gary Salisbury, USAF (Ret), Executive Director, Business Development, Defense Mission Systems, Northrop Grumman Mission Systems

12:00 PM - 1:30 PM		Grand Mesa ABC
	Lunch CMMI - State of the Model ***Mr. Bob Rassa***, Raytheon; ***Mr. Clyde Chittister***, SEI	
1:30 PM - 5:00 PM		
	Technical Sessions	See Following Pages
3:00 PM - 3:30 PM		Display Area
	Break	
5:00 PM - 6:30 PM		Display Area
	Reception	

Wednesday, November 16, 2005

7:00 AM - 8:00 AM		Atrium
	Registration and Continental Breakfast	
8:00 AM - 5:00 PM		See Following Pages
	Technical Sessions	
9:30 AM - 10:30 AM		Display Area
	Break	
12:00 PM - 1:30 PM		Grand Mesa ABC
	Lunch Conference Best Paper Awards	
3:00 PM - 3:30 PM		Display Area
	Break	

Thursday, November 17, 2005

7:00 AM - 8:00 AM		Atrium
	Registration and Continental Breakfast	
8:00 AM - 2:30 PM		See Following Pages
	Technical Sessions	
9:30 AM - 10:30 AM		Display Area
	Break	
12:00 PM - 1:00 PM		Grand Mesa ABC
	Lunch	
2:30 PM		
	Conference Adjourns	

CMMI Tutorial Tracks - Monday, November 14, 2005

	Session A		Session B		Session C		Session D	
	8:00 AM		10:15 AM		1:00 PM		3 :15 PM	
Track 1 Grand Mesa D/E	*1A1 Calculating CMMI-based Return On Investment (ROI): Why, When, What, How? Mr. Rolf W. Reitzig, Cognence, Inc.*	BREAK (9:45 AM) (TUTORIAL ATTENDEES ONLY)	*1B1 Calculating CMMI-based Return On Investment (ROI): Why, When, What, How? (con't.) Mr. Rolf W. Reitzig, Cognence, Inc.*	LUNCH (12:00 PM) (TUTORIAL ATTENDEES ONLY)	*1C1 A Practical Guide to Implementing Levels 4 and 5 Dr. Rick Hefner, Northrop Grumman Corporation*	BREAK (2:45 PM) (TUTORIAL ATTENDEES ONLY)	*1D1 A Practical Guide to Implementing Levels 4 and 5 (con't.) Dr. Rick Hefner, Northrop Grumman Corporation*	RECEPTION IN DISPLAY AREA (5:00 PM) (ALL ATTENDEES)
Track 2 Grand Mesa F	*1A2 Agile/Lean Workshop Mr. Jeffrey Dutton, Jacobs Sverdrup*		*1B2 Agile/Lean Workshop (con't.) Mr. Jeffrey Dutton, Jacobs Sverdrup*		*1C2 Leveraging ITIL Services (Support and Delivery) Capability and Maturity with the CMMI Mr. Tim Kasse, Kasse Initiatives, LLC*		*1D2 Leveraging ITIL Services (Support and Delivery) Capability and Maturity with the CMMI (con't.) Mr. Tim Kasse, Kasse Initiatives, LLC*	
Track 3 Highlands	*1A3 The Look and Feel of a Successful CMMI Implementation Mr. Tim Kasse, Kasse Initiatives, LLC*		*1B3 The Look and Feel of a Successful CMMI Implementation (con't.) Mr. Tim Kasse, Kasse Initiatives, LLC*		*1C3 How to Define CMMI Based Processes That are Short and Usable Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1D3 How to Define CMMI Based Processes That are Short and Usable (con't.) Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*	
Track 4 Chasm Creek	*1A4 The ROI of CMMI: Using Process Simulation to Support Better Management Decisions Dr. David M. Raffo, Portland State University*		*1B4 The ROI of CMMI: Using Process Simulation to Support Better Management Decisions (con't.) Dr. David M. Raffo, Portland State University*		*1C4 Institutionalizing Resource Planning and Management Mr. Donald A. Borcherding, NexSummit LLC*		*1D4 Institutionalizing Resource Planning and Management (con't.) Mr. Donald A. Borcherding, NexSummit LLC*	
Track 5 Mesa Verde	*1A5 Using a Measurement Framework to Successfully Achieve Measurable Results Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1B5 Using a Measurement Framework to Successfully Achieve Measurable Results (con't.) Mr. Timothy G. Olson, Quality Improvement Consultants, Inc.*		*1C5 The CMMI V1.2 – An Update Mr. Mike Phillips, SEI*		*1D5 The CMMI V1.2 – An Update (con't.) Mr. Mike Phillips, SEI*	
Track 6 Wind River	*1A6 Integrated Project Management (IPM) – The CMMI and Collaborative Product Development Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1B6 Integrated Project Management (IPM) – The CMMI and Collaborative Product Development (con't) Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1C6 Requirements Engineering: A Practical Approach to Modeling and Managing Requirements Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*		*1D6 Requirements Engineering: A Practical Approach to Modeling and Managing Requirements (con't) Mr. William J. Deibler, II, Software Systems Quality Consulting - SSQC*	

CMMI Technical Tracks - Tuesday, November 15, 2005

Track	Session/Chair	Session C 1:30 PM	Session C 2:15 PM		Session/Chair	Session D 3:30 PM	Session D 4:15 PM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	2C1 CMMI / ISO - "Can't we all just get along?" ***Mr. Dale R. Spaulding***, The Boeing Company	2C1 Layering CMMI over ISO 9000 and BS 7799: A Case Study in Improvement ***Mr. Edwin B. Smith, III***, Hart InterCivic	**BREAK IN DISPLAY AREA (3:00 PM - 3:30 PM)**	***CMMI and Process Improvement con't.***	2D1 Real World Application of IEEE Software Engineering Standards to CMM® /CMMI® Software Process Improvement Initiatives ***Mr. Susan K. Land***, Northrop Grumman IT/TASC	2D1 The CMMI Product Suite and International Standards – an Update ***Mr. David H. Kitson***, SEI	**RECEPTION IN DISPLAY AREA (5:00 PM - 6:30 PM)**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Fred Schenker, SEI**	2C2 Verification in CMMI using Peer Reviews ***Ms. Jeanne H. Balsam***, Georgia Tech Research Institute	2C2 Process QA in the Information Age: Keep it Light! ***Mr. Hillel Glazer***, Entinex, Inc.		***Practical Guidance con't.***	2D2 Defect Data and Configuration Management ***Ms. Julie E. Schmarje***, Raytheon Company	2D2 Cancel	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	2C3 SEI Quality Assurance Activities for CMMI Appraisals ***Mr. Will Hayes***, Software Engineering Institute	2C3 Wasted Days and Wasted Nights - Leveraging Your Appraisal Team As A Resource ***Mr. Timothy J. Davis***, Raytheon Missile Systems		***Appraisals con't.***	2D3 Building a Credible SCAMPI Appraisal Representative Sample ***Mr. Robert L. Moore, III***, Business Transformation Institute, Inc.	2D3 Top 10 Signs You're Ready (or Not) for an Appraisal ***Mr. Gary Natwick***, Harris Corporation	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Ms. Diane Gibson SEI**	2C4 Measuring Performance: Evidence about the Results of CMMI® ***Ms. Diane Gibson***, SEI	2C4 Prioritizing Process Improvement Strategies in CMMI to Optimize Business Objectives ***Dr. Aldo Dagnino***, ABB, Inc. US Corporate Research		***ROI & Benefits of CMMI con't.***	2D4 Implementing a Plan for Controlling ROI for CMMI® Process Improvement ***Mr. J. M. Perry***, BAE Systems	2D4 Lessons Learned in the Engineering of Process Performance Models on the Journey to Higher Maturity Levels ***Dr. Mary Anne Herndon***, Transdyne Corporation	
Track 5 Mesa Verde	***Acquisition*** **Mr. Jerry Fisher, The Aerospace Corporation**	2C5 Cancel	2C5 Using CMMI to raise the capability bar within Australia ***Mr. Keith Korzec***, Defense Contract Management Agency		***High Maturity***	2D5 Getting lost on the Way to Level 5 ***Ms. Kathy King***, The Center for Systems Management	2D5 Understanding Why? ***Mr. David N. Card***, Q-Labs	
Track 6 Wind River	***Transitioning to CMMI*** **Mr. Hal Wilson, Northrop Grumman Corporation**	2C6 Migrating Best Practices Within an Organization: Experiences in Adapting CMMI Policies and Procedures Used In One Part of a Business to Snother ***Mr. Scott Sherrill***, Georgia Tech Research Institute	2C6 An Enterprise Wide CMMI Implementation at Accenture ***Ms. Sarah S. Bengzon***, Accenture		***Transitioning to CMMI con't.***	2D6 Stakeholder Identification and Involvement in the CMMI ***Mr. James R. Armstrong***, Systems and Software Consortium	2D6 Ensuring the Right Process is Deployed Right: Synchronizing Process Checkpoints with Business Rhythm ***Ms. Joan Weszka***, Lockheed Martin Corporation	
Track 7 Wind Star	***CMMI for Small Projects and Organizations*** **Dr. Rich Turner, OSD**	2C7 Implementing CMMI in Small Businesses: A Mission Success Approach ***Mr. James E. Jones***, Support Systems Associates, Inc.	2C7 CMMI Implementation Strategies, CMMI Level 3, A small company experience, Artifact Ideas and Implementation ***Ms. Allison J. Heinen***, Mnemonics, Inc.		***CMMI for Small Projects and Organizations con't.***	2D7 Making PPQA Work on Small Projects ***Ms. Jean M. Swank***, Georgia Tech Research Institute	2D7 Does Size Matter In CMMI Implementation or Was Yoda Wrong? ***Mr. Paul H. Meyers***, SAIC	

CMMI Technical Tracks - Wednesday, November 16, 2005

Track	Session/Chair	Session A 8:00 AM	Session A 8:45 AM		Session/Chair	Session B 10:30 AM	Session B 11:15 AM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Ms. Lorraine Adams, SEI**	3A1 A Change Agent in a Level 1 Organization; How to Survive in a Hostile Environment ***Mr. Andrew Cordes***, ABB - United States Corporate Research Center	3A1 "Sound Systems Engineering Using CMMI®" ***Mr. Michael T. Kutch, Jr.***, SPAWAR - Charleston	**BREAK IN DISPLAY AREA (9:30 AM - 10:30 AM)**	***CMMI and Process Improvement con't.***	3B1 Using CMMI to "Dig Out" from an Ad Hoc Development ***Mr. Donald A. Borcherding***, NexSummit, LLC	3B1 Strategic Planning; Selling a CMMI-based Improvement Effort to Senior Management ***Dr. Aldo Dagnino***, ABB USCRC	**LUNCH IN GRAND MESA ABC (12:00 PM - 1:30 PM)**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Fred Schenker, CSC**	3A2 Are You Making the Most Of Your Project Schedules? ***Ms. Susan Byrnes***, PMP, Natural SPI, Inc.	3A2 Dual-Shore Program Management Experience In Packaged Solution Development, Testing & Implementation ***Mr. Rajakumard Duraimurugan***, Infinite Computer Solutions		***Practical Guidance con't.***	3B2 Keeping the Team Motivated for Success ***Mr. Michael D. Scott***, Raytheon Missile Systems	3B2 Using a Level 3 Process to Achieve CMMI Level 3 ***Mr. Stephen Ross***, Raytheon Company	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	3A3 Lessons Learned in helping large and small organizations prepare for their first appraisal ***Mr. Robert J. Pomietto***, Center For Systems Management	3A3 Behind Closed Doors ***Mr. Tom G. Lienhard***, Raytheon Missile Systems		***Appraisals con't.***	3B3 CMMI Appraisal Results: The Shocking Truth Revealed ***Ms. Margaret A. Glover***, SEI	3B3 Appriasers Gone Bad ***Ms. Margaret A. Glover***, SEI	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	3A4 Evaluating the Impact New Tools and Technologies Using Simulation ***Dr. David M. Raffo***, Portland State University	3A4 The ROI Dashboard (c) : Understanding the Benefits of CMMI ***Mr. Thomas L. McGibbon***, ITT Industries, AES		***ROI & Benefits of CMMI con't.***	3B4 Quality Assurance Involvement Compared to Program Results ***Ms. Jill Brooks***, Raytheon Company	3B4 Rapidly Achieving Measurable ROI Using Early Defect Detection ***Mr. Timothy G. Olson***, Quality Improvement Consultants, Inc.	
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	3A5 Logarithms Can Be Your Friends: Controlling Peer Review Costs ***Dr. Richard L. W. Welch***, Northrop Grumman Corporation	3A5 Journeys on the Road to Level 5 ***Mr. Joseph V. Vandeville***, Northrop Grumman Corporation		***High Maturity con't.***	3B5 Lessons Learned on the SCAMPI Road to CMMI-Software Level 5 ***Mr. Joseph N. Frisina***, BAE Systems	3B5 Merging Measurement in Mature Companies - A Success Story of Measurement Process Integration ***Ms. Sharon Rohde***, Lockheed Martin IS&S	
Track 6 Wind River	***Transitioning to CMMI*** **Mr. Hal Wilson, Northrop Grumman Corporation**	3A6 ACncel	3A6 Combining Six IPTS and Transitioning To CMMI ***Ms. Judy Overhauser-Duett***, NAVAIR		***Transitioning to CMMI con't.***	3B6 How to Transition Models and Disciplines - Looking for Transition in all the Wrong Places ***Ms. Lori G. Smailes***, TYBRIN Corporation	3B6 Using SW-CMM SQA Independent Verification as A First Step for the Transition To CMMI ***Mr. Alfredo N. Tsukumo***, CenPRA - Centro de Pesquisas Renato Archer	
Track 7 Wind Star	***Measurement*** **Mr. Jeff Dutton, Jacobs Sverdrup**	3A7 Software Size Growth and Uncertainty - Both Affect Estimate Quality and Project Risk ***Mr. Michael A. Ross***, Galorath, Inc.	3A7 COCOMO II and COQUALMO Estimation Modeling ***Mr. Qingchuan Liu***, Motorola (China) Electronics, Ltd.		***Measurement con't.***	3B7 Building an Automated System to Support Measurement in CMMI ***Dr. Richard Hayden***, Pragma Systems Corporation	3B7 Team of Three - How to get Program, Functional and Process Management Working Together ***Mr. Mark A. Marsh***, Raytheon Company	

CMMI Technical Tracks - Wednesday, November 16, 2005

Track	Session/Chair	Session C 1:30 PM	Session C 2:15 PM	Session/Chair	Session D 3:30 PM	Session D 4:15 PM
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	3C1 Enterprise Process Integration within the Space and Airborne Systems Business Area of Raytheon ***Mrs. Deana A. Seigler***, Raytheon Company	3C1 Interpreting the CMMI: It Depends! **Dr. Rick Hefner**, Seimens Corporate Research	***CMMI and Process Improvement con't.***	3D1 CMMI as Safeguard Against Software Entropy: A Manager's Perspective ***Dr. Thomas F. Christian, Jr.***, 402 SMXG	3D1 "Its how big? How Will You Deploy It Without Killing My Team and My Program?" ***Mr. William J. Borkowski, Jr.***, Raytheon Missile Systems
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Paul Croll, CSC**	3C2 Accelerating Process Improvement through Collaboration: The NAVAIR Systems Process Improvement Community of Practice ***Ms. Katie Smith***, Naval Air Systems Command	3C2 What the CMMI Doesn't Say About Training (But should!) ***Mr. Sree Yellayi***, Northrop Grumman Corporation	***Practical Guidance con't.***	3D2 CMMI GP 2.8 Interpretation and Implementation: Is This Practice Just about Numbers? ***Mr. Lseter Stamnas***, Norausky Process Solutions, Inc.	3D2 Creating Helpful Process Directives ***Mr. Kenneth I. Weinberg***, Raytheon Company
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	3C3 Improving Document Reviews for Appraisals ***Mr. Kent McClurg***, Raytheon Company	3C3 Finding CMMI Compliant Artifacts and a Needle in a Haystack ***Mr. Adrio J. DeCicco***, Raytheon Company	***Appraisals con't.***	3D3 Lessons Learned and Best Practices for Evidence Collection in Preparation for a SCAMPI Appraisal ***Mr. Ben Berauer,*** Raytheon Company	3D3 Maximizing Value for SCAMPI(SM) Preparation ***Ms. Joan Weszka***, Lockheed Martin Corporation
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	3C4 CMMI Process Improvement: Its not a technical problem, its a people problem! ***Mr. Rolf W. Reitzig***, Cognence, Inc.	3C4 A Project's Perspective of CMMI Level 5 ***Mr. Warren Scheinin***, Northrop Grumman Corporation	**ROI & Benefits of CMMI *con't.***	3D4 Achieving the Promised Benefits of CMMI ***Dr. Rick Hefner***, Northrop Grumman Corporation	3D4 Measuring Economic Benefits of Process Improvement in CMMI Level 1 Organizations ***Dr. Aldo Dagnino***, ABB, Inc. US Corporate Research
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	3C5 The Road to Process Improvement Successes: CMMI Level 5/ISO 9001:2000 Business Model ***Mrs. Debra S. Roy***, BAE Systems National Security Solutions	3C5 Reducing Variation At Each CMMI Maturity Level ***Mr. Tim Kasse***, Kasse Initiatives, LLC	***High Maturity con't.***	3D5 Ways to Ensure the Culture Supports Level 5 ***Mr. Warren Scheinin***, Northrop Grumman Corporation	3D5 Analyzing Defects Can Tell a Story About a Company ***Ms. Diane A. Mizukami-Williams***, Northrop Grumman Mission Systems
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	3C6 Service Extensions to the CMMI ***Mr. Craig R. Hollenbach***, Northrop Grumman Corporation	3C6 Applying CMMI to Services ***Mr. Juan C. Ceva***, Raytheon ITSS	***CMMI Extensions con't.***	3D6 Management Challenges & Lessons Learned Implementing CMMI in a Services Environment ***Mr. Thomas E. Zience***, BAE Systems Information Technology	3D6 CMMI v1.1 for a Service Oriented Organization ***Mr. Steven K. Hall***, Raytheon Corporation
Track 7 Wind Star	***Measurement*** **Mr. Jeff Dutton, Jacobs Sverdrup**	3C7 Cancel	3C7 Parametric Project Monitoring and Control: Performance-Based Progress Assessment and Prediction ***Mr. Michael A. Ross***, Galorath, Inc.	***Measurement con't.***	3D7 Measuring and Estimating Process Performance ***Dr. Richard D. Stutzke***, SAIC	3D7 Cancel

BREAK IN DISPLAY AREA (3:00 PM - 3:30 PM)

ADJOURN FOR THE DAY

CMMI Technical Tracks - Thursday, November 17, 2005

Track	Session/Chair	Session A 8:00 AM	Session A 8:45 AM		Session/Chair	Session B 10:30 AM	Session B 11:15 AM	
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Brian Gallagher, SEI**	4A1 "Barrier Busting" – Obtaining Active Leadership Support ***Mr. Michael D. Scott***, Raytheon	4A1 Cancel	**BREAK IN DISPLAY AREA (9:30 AM - 10:30 AM)**	***CMMI and Process Improvement con't.***	4B1 Don't Waste Time Writing the Wrong Processes ***Ms. Suzanne B. Zampella***, The Center for Systems Management	4B1 Contrasting CMMI and the PMBOK ***Mr. Wayne Sherer***, Anteon Corporation	**LUNCH IN GRAND MESA ABC (12:00 PM - 1:00 PM)**
Track 2 Grand Mesa F	***Practical Guidance*** **Mr. Paul Croll, CSC**	4A2 Supplier Management Strategy Considerations with CMMI ***Dr. Rick Hefner***, Northrop Grumman Corporation	4A2 Simplifying Process Tailoring To Project Execution ***Mr. Howard T. Kaplan***, Raytheon Company		***Practical Guidance con't.***	4B2 CMMI and Agile: A High Tech R&D Success Story ***Mr. Gene Miluk***, SEI	4B2 How to Incorporate "Lessons Learned" for Sustained Process Improvements ***Mr. Anil K. Midha***, BAE Systems	
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	4A3 Techniques for Shortening the Time and Cost of CMMI Appraisals ***Mr. Sam Fogle***, Systems and Software Consortium, Inc.	4A3 Using Classified Programs in CMMI Appraisals ***Mr. Kenneth I. Weinberg***, Raytheon Company		***Appraisals con't.***	4B3 The best intentions of SCAMPI V1.1; what we meant and what they heard ***Mr. Will Hayes***, SEI	4B3 Success the First Time: How to Get the Rating You Want or How to Fool Your Lead Appraiser ***Mr. Paul H. Meyers***, SAIC	
Track 4 Chasm Creek	***ROI & Benefits of CMMI*** **Dr. Dennis Goldenson, SEI**	4A4 The Effects of CMMI® on Program Performance ***Mr. Joseph P. Elm***, SEI	4A4 Squeezing Variation for Profit ***Mr. Donald R. Corpron***, Northrop Grumman Corporation		***SCAMPI B/C***	4B4 Process In-Execution Review (PIER) for Contract Monitoring ***Ms. Lorraine J. Adams***, SEI	4B4 Planning a SCAMPI C Appraisal from a Strategic Perspective ***Mr. John P. Kennedy***, The MITRE Corporation	
Track 5 Mesa Verde	***High Maturity*** **Mr. Jerry Fisher, The Aerospace Corporation**	4A5 Cancel	4A5 A Statistical Approach To Product Quality Assurance ***Mr. Randall J. Varga***, BAE Systems		***High Maturity con't.***	4B5 A Key to a High Maturity Rating is - ORGANIZATION ***Mrs. Karen M. Pelletier***, Northrop Grumman Corporation	4B5 Extending CMMI Level 4/5 Organization Metrics Beyond Software Development ***Ms. Linda R. Brooks***, Northrop Grumman Corporation	
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	4A6 Tailoring CMMI for Use in an IT Services Environment ***Ms. Stacy Savage***, BAE Systems Information Technology	4A6 Interpretation of CMMI for Outsourcing and Associated Measures ***Dr. Hubert Hofmann***, General Motors		***CMMI Extensions con't.***	4B6 How to Become Your Customer's Software Provider Of Choice ***Mr. David Herron***, DCG, Inc.	4B6 CMMI® and Process Improvement at the LA AFB Space and Missile Center (SMC) ***Mr. Keith Wright***, SPARTA, Inc.	
Track 7 Wind Star	***Systems Engineering*** **Mr. Mike Phillips, HSBC**	4A7 Practical Experiences and Lessons Learned In Implementing CMMI ***Ms. Sandee D. Guidry***, TECHSOFT	4A7 Cancel		***Systems Engineering con't.***	4B7 Systems Engineering Influence Throughout the CMMI ***Mr. Tim Kasse***, Kasse Initiatives, LLC	4B7 Does Process Capability buy Product Assurance? – Implications for Safe and Secure Systems ***Mr. Paul R. Croll***, CSC	

CMMI Technical Tracks - Thursday, November 17, 2005

Track	Session/Chair	Session C 1:00 PM	Session C 1:45 PM
Track 1 Grand Mesa D/E	***CMMI and Process Improvement*** **Mr. Gene Miluk, SEI**	4C1 Being Customer Oriented ***Mr. Tim Kasse***, Kasse Initiatives, LLC	4C1 Learning from Lessons Observed- - Mitigating Resistance to Process Improvement ***Mr. Bob Norris***, National Geospatial-Intelligence Agency
Track 2 Grand Mesa F	***Practical Guidance*** **Lorraine Adams, SEI**	4C2 Cancel	4D2 Data Management: The Hidden Enabler or (The Key Data and Work Product Integrator) ***Mr. Lester Stamnas***, Norausky Process Solutions, Inc.
Track 3 Highlands	***Appraisals*** **Mr. Geoff Draper, Harris Corporation**	4C3 Quantitative Comparison of SCAMP A, B, and C ***Mr. Dan Luttrell***, Northrop Grumman Mission Systems	4C3 Performing standard and consistent global appraisals in large multi-cultural organizations ***Ms. Jeanine Courtney-Clark***, Integrated System Diagnostics, Inc.
Track 4 Chasm Creek	***SCAMPI B/C*** **Mr. Jerry Fisher, The Aerospace Corporation**	4C4 Critical Path SCAMPIs: Getting Real Business Results from Appraisals ***Mr. Michael J. West***, Natural SPI, Inc.	4C4 Using a SCAMPI C for Collective Improvement Across a Multi-Business Program ***Mr. Oktawian Nowak***, Motorola, Inc.
Track 5 Mesa Verde	***High Maturity*** **Mr. Andrew Boyd, Northrop Grumman Corporation**	4C5 Paladin Drives Forward to CMMI Maturity Level 5 ***Mr. Victor Elias, M.S***, Armament Software Engineering Center, US Army	4C5 Business Improvements Achieving CMMI(R) Level 5 at SAIC: Who Moved My Process? ***Ms. Sharon Cobb Flanagan***, SAIC
Track 6 Wind River	***CMMI Extensions*** **Mr. Randy Walters, Northrop Grumman Corporation**	4C6 Software Outsourcing with CMMI ***Dr. John W. Mishler***, SEI	4C6 Cancel
Track 7 Wind Star	***Systems Engineering*** **Mr. Jeff Dutton, Jacobs Sverdrup**	4C7 Future of Software Engineering Project Management and the CMMI ***Dr. Kenneth E. Nidiffer***, Systems and Software Consortium	4C7 Cancel

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Process In Execution Review (PIER) and the SCAMPI B Method

Lorraine Adams, SEI
Lynda Rosa, MITRE
Fred Schenker, SEI
Dale Swanson, MITRE

November 17, 2005

Sponsored by the U.S. Department of Defense

Agenda

→ Problems and Challenges

Assessment Alternatives

Process In-Execution Reviews

ESC Case Studies

Summary

DOD Weapon Systems Acquisition Continues To Be High Risk Area

While DOD's acquisition process has produced the best weapons in the world, it also yields undesirable consequences in weapon system programs – cost increases, schedule delays, and performance shortfalls

Problems occur because weapon programs do not capture early on the requisite knowledge that is needed to effectively manage risks

Programs move forward with unrealistic cost and schedules estimates, lack clearly defined and stable requirements, use immature technologies, and fail to solidify design and manufacturing processes at appropriate junctures in development

As a result, programs require more resources than planned, the buying power of the defense dollar is reduced, and funds are not available for other competing needs

Paul Francis, Director
Acquisition and Sourcing Management
U.S. Government Accountability Office
May 18, 2004

Problem Statement

A statement of organizational process maturity or capability level does not guarantee performance to that same level of proficiency on an individual project

Most DoD contractors claim high maturity/capability levels, yet from the perspective of the acquirer, systems engineering and program management practices are severely lacking

Teaming arrangements further cloud the issue of process execution and proficiency

Associated problems may not be evident until significant cost, schedule, or performance objectives have been missed at a late point in the program where corrective actions are very costly

How can the acquirer gain the necessary insight into process execution and proficiency as well as reinforce desired behaviors?

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Development Challenges

Huge system/software engineering endeavors in aircraft, space vehicles, ground systems, C2, C4ISR, battle mgt, etc

Significant risks for acquisition programs

- Multi-million SLOC programs; “hybrid” systems combining legacy re-use, COTS, new development
- Multi-contractor teams using different processes; Dispersed engineering & development locations
- New technologies create opportunities/challenges; products change/evolve
- Business/operational needs change - often faster than full system capability can be implemented
- Contractor and Acquirer skills shortfalls; Cost and schedule constraints

Acquirers' Concerns

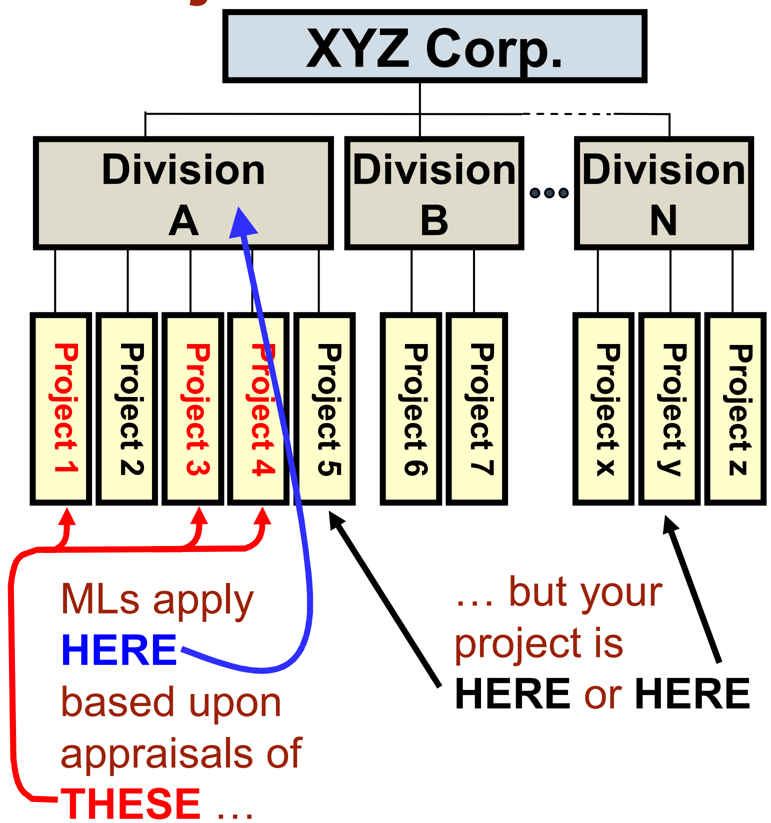
- Appraisals are conducted just for the "ratings"
- Appraisal team/lead objectivity and expertise is questionable, especially with high maturity appraisals
- Appraisals are conducted on dissimilar projects and/or in unrelated organizations/sites
- The effect of teaming arrangements on project process performance is not accounted for
- There is a lack of insight into contractor process execution on specific projects
- The effect of process immaturity in acquiring organizations

High Maturity Organizations ≠ High Maturity Projects

Maturity Levels are indicators of organizational *potential performance*.

They describe how the next project may *perform* based on a sampling of existing projects.

Maturity Levels reside at the organizational level and are not an indication of how an individual project *is performing*.



Acquirer Needs

A means to assess developer process execution on their project

- Process performance
- Process capability
- Process adherence

A means to assess project process execution across large, distanced, and diverse teams

A means to assess all technical and project management process areas

- Engineering
- Project Management
- Financial Management
- Support Processes

A means to assess project risks driven by developer process execution

A means to assess the potential process execution risks in source selection

Agenda

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Summary

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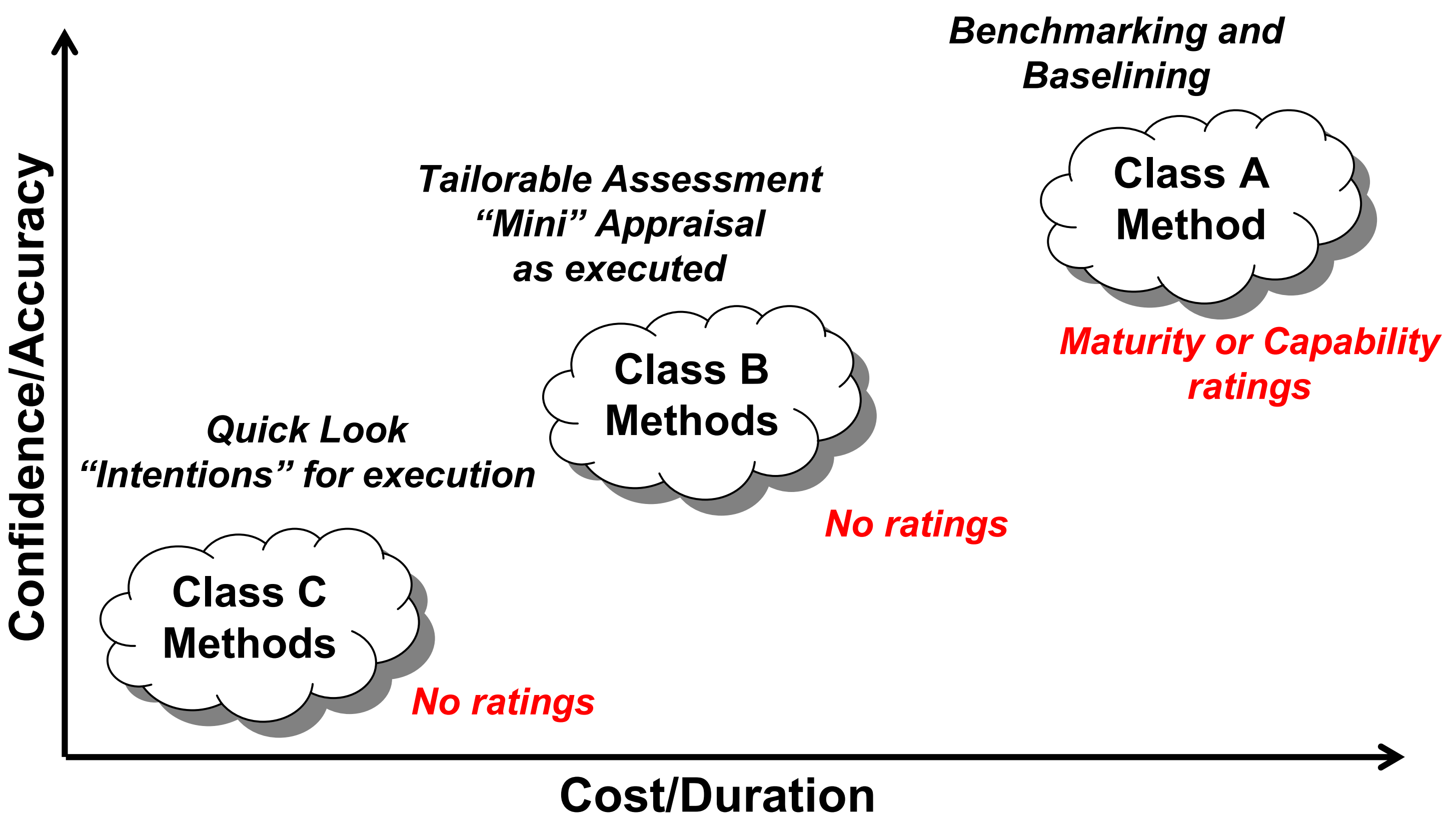
Standard CMMI Appraisal Method for Process Improvement (SCAMPI)



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Assessment Alternatives Mapped to Acquirer Needs

SCAMPI Method A

- Institutionalization
- Organizational focus
- Rigorous, expensive
- Ratings

Resource Intensive
Limited utility for source selection

SCAMPI Method B

- Deployment and execution
- Evidence of implementation
- What they are doing

Contract Monitoring
Competitive Downselect

SCAMPI Method C

- Approach
- Plan for execution
- What they will do

Contract Monitoring
Source Selection

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Summary

PIER Ground Rules

Use the process model – CMMI

- Interview questions based on model

Appraisal of process performance and adherence

Focus on risk assessment – risks associated with process performance, adherence, and capability

Observe strict confidentiality

- Results not attributable to individuals or interview groups

Approach SCAMPI collaboratively

Results in actionable findings by Program Office and/or Contractor

What a PIER Is and Is Not

Is an appraisal (SCAMPI-B) of the execution of and the risks associated with process implementation of the entire project team, including sub-contractors

Is an assessment of whether or not the contractor is operating the specific program at a level of maturity consistent with their organization's maturity level

Is not a formal appraisal (SCAMPI-A)

- No rating
- No multiple projects within the organization; focus on specific project
- No coverage of entire life cycle; focus on phase or near-term milestones

Phase 1: Plan and Prepare for the Appraisal

Appraisal Team/Lead

- Lead assists Sponsor in matching appraisal w/business objectives
- Lead and sponsor agree on details of appraisal plan
- Lead prepares team members
- Prepares in-briefs for contractor
- Lead performs readiness review

SEI/MITRE/ESC

- Templates and guidance on plan preparation & PIER execution
- Assist PMO
- Model scope guidance
- Role definition guidance for customer & contractor
- Security procedures

Contractor

- Coordinates with the PMO
- Identify site coordinator, process lead, and non-voting team member (as appropriate)
- Schedule facilities & resources to support the plan
- Collect relevant objective evidence
- Prepare project to support PIER (schedule interviews, briefings, demos)

PMO

- Establishes contractual arrangement
- Sponsors appraisal
- Establishes business goals
- Coordinates with Contractor
- Coordinates & approves appraisal plan

Phase 2: Conduct Appraisal

Appraisal Team/Lead

- Examines objective evidence
- Verifies the implementation of the organization's practices
- Validates findings
- Generate appraisal results
- Lead collects lessons learned
- Data & artifacts are appropriately archived or destroyed

SEI/MITRE/ESC

- Evidence collection tool
- Findings briefing template and guidance
- On-site scheduling guidance
- Guidance for preparation and delivery of preliminary findings
- Further definition of customer & contractor roles

Contractor

- Provide Project context briefing
- Ensure contractor responsibilities are met to support PIER (briefings, interviewees, demos)
- Support additional evidence requests in a timely manner
- Provide PIER team facilities in accordance with plan requirements

PMO

- Coordinate as necessary with Team Lead & Contractor
- Resolve any appraisal execution issues

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Phase 3: Report Results

Appraisal Team/Lead

- Delivers final findings to customer & to contractor
- Reports results to PIER steward as authorized by PMO

SEI/MITRE/ESC

- Findings template
- Final findings delivery guidance
- Disclosure statement guidance
- ESC PIER Custodian who retains information as observations & trends without project or Contractor attribution

Contractor

- Attend outbrief
- Analyze results & incorporate into next cycle of process improvements

PMO

- Attends outbrief
- Owns final findings & authorizes release of information to ESC PIER Custodian
- Analyzes results & integrates into project data for future use in award fee, program reviews, improvement initiatives, etc.

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Example
Integrated Supplier Management

Description:

The purpose of Integrated Supplier Management is to proactively identify sources of products that may be used to satisfy the project's requirements and to manage selected suppliers while maintaining a cooperative project-supplier relationship.

Strengths:

- Proactive engagement with suppliers on early Time and Materials subcontracts expedited the creation of supplier requirements documents and SOWs for the program.

Weaknesses:

- The lack of monitoring of supplier processes may cause execution of supplier agreements to be compromised. (SG 2)
- The Subcontract Management Plan is still in draft form. (GG 2)

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Example
Integrated Supplier Management

Notes:

- **Issues with critical subcontractors exist and continue to be worked**

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Example
Project Management Specific Practices

PA	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.3	[illegible]	3.5	4.1	4.2	4.3
PP	G	G	G	G				G	G	G	G	G	[illegible]	G	[illegible]	G	G					
PMC	G	G	G	G	G	G	G	G	G	G												
SAM	G	G	G					[illegible]	G	G	B											
IPM	G	G	G	G	[illegible]			G	G	G					G	G				G	G	G
RSK[illegible]	G	[illegible]	G					Y	Y						G	G						
I[illegible]	G	Y	G					G	G	G	G	G										
ISM	G	G						Y	G	G												

KEY

G	Green	Y	Yellow	R	Red	B	Blue	NY	Not Yet		Not Appraised		Not Applicable

Example Only

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PIER Commitment

Appraisal Team/Lead

- Ensure team composition is high-caliber
- Everyone shares work load based on team expectations
- Collect lessons learned to improve the PIER (SCAMPI-B) process

SEI/MITRE/ESC

- Support and refine PIER (SCAMPI-B) method
- ESC PIER Custodian
- Work with PMO to ensure appropriate interpretation & use of findings
- Ensure confidentiality of results
- Provide updated templates and materials

Contractor

- Participation
- Evidence prepared with adequate time to review prior to on-site
- Resolution of access to information issues in advance of on-site
- Relevant personnel provided for interviews
- Act on findings

PMO

- Contractual obligation
- Resources
- Act on findings

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PIER Lessons Learned

Appraisal Team/Lead
- Have consistent approach among team leads across program PIERs
- Train team on appraisal tools and templates prior to the appraisal
- Complete document review prior to start of the on-site
- Site coordinator needs to know the CMMI model
- Team building activities critical

SEI/MITRE/ESC
- Need guidance and templates to ensure consistency of PIERs
- Capture observations and trends to isolate potential systemic problems
- Plan PIERs to avoid impacting peak or critical activities
- Contractor non-voting team member proved very valuable
- Credibility counts!

Contractor
- Provides feedback on process implementation
- Non-trivial amount of effort to support the PIER activity
- Demonstration of organization's commitment to CMMI

PMO
- Provides confidence in contractor through insight
- Process proficiency and execution varies substantially
- Basis for assessing contractor responsiveness
- PMOs must work internal processes to complement Contractor

Agenda

Problems and Challenges

Assessment Alternatives

Process In-Execution Reviews

→ ESC Case Studies

Summary

ESC Case Studies

Joint Environmental Tool Kit (JET)

- Contract monitoring
- Risk identification
- Competitive downselect

KG-3X Crypto Modernization Program

- Contract monitoring
- Risk identification
- Competitive downselect

Joint Mission Planning System (JMPS)

- Contract monitoring
- Risk identification

Agenda

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→ Summary

Next Steps for PIER

Expand the scope of PIERs

Financial Management

- Assess execution of Earned Value Management System (EVMS) practices especially in correlating product maturity and performance to earned value – Technical Performance Measures (TPMs)

Product Quality

- Product quality in terms of technical maturity and product performance using models, simulations, prototypes, and early functional assessments

May integrate with the Integrated Baseline Review (IBR) process

Summary

SCAMPI-A appraisals and advertised CMMI ratings do not guarantee that individual projects will perform to those levels of proficiency

PIERs have validated the SCAMPI-B Method in a contract monitoring context

PIERS provide insight into project process execution, both for Program Office and for Contractor

PIERS demonstrate program office commitment to process

PIERs can be complementary components to other reviews and technical interchanges

PIERs can be used to support award fee evaluations

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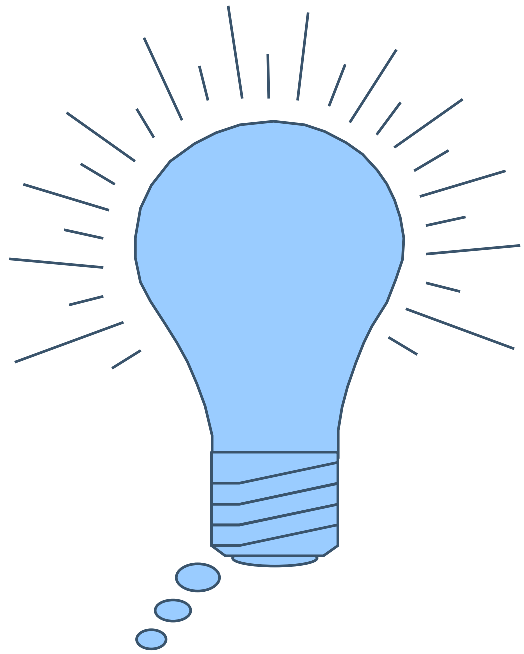
Questions



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Extending CMMI Level 4/5 Organizational Metrics Beyond Software Development

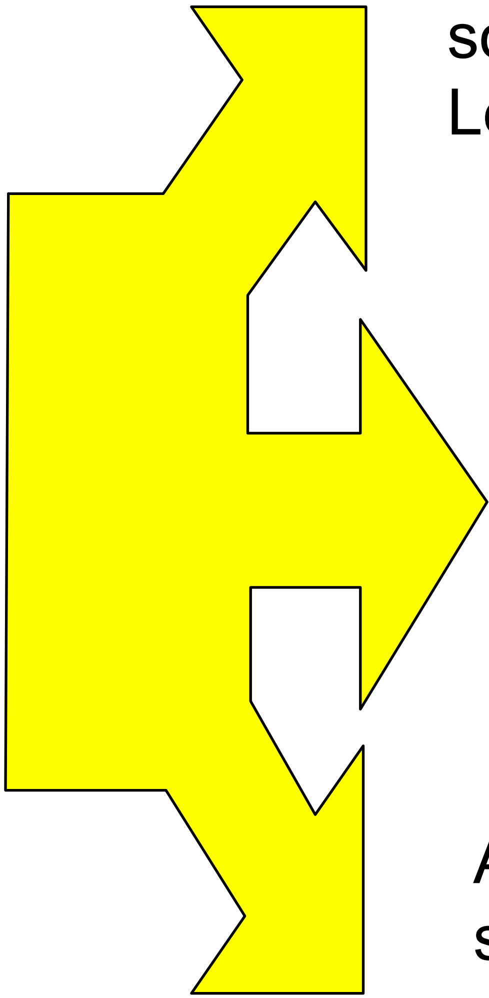
CMMI Technology Conference and User Group
Denver, Colorado
14-17 November 2005

Linda Brooks
Northrop Grumman Corporation

Topics

- The Challenge
- The Pitfalls
- Background
- Proposed Approach
- Northrop Grumman Mission Systems Case Studies
- Summary

The Challenge



Extending organizational metrics beyond software development to achieve CMMI Levels 4/5 requires breaking new ground.

Few examples exist for project types such as systems engineering (SE), operations and maintenance (O&M), services, hardware development.

A repeatable process for developing such metrics that avoids typical pitfalls is needed.

5 Major Pitfalls

1. Getting the cart before the horse - business needs not driving metrics definition
2. Not taking advantage of in-house and/or industry experience
3. Industry or in-house examples implemented organization wide without evaluating needs and/or impact
4. Insufficient stakeholder buy-in
5. Cost of collecting the metrics greater than the benefits to be derived

Northrop Grumman Mission Systems

- **A leading global integrator of complex systems**
  - Based on information technology and systems engineering expertise
  - Integrated solutions: architecture, development and sustainment
- **Over $5B 2004 Revenue**
- **18,000+ Employees**
- **Diverse business base**
  - 300 locations in 20 countries, 50 states
  - 2,000 active contracts and task orders

Command, Control & Intelligence

Missile Systems

Technical & Management Services

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CMMI Organizational Metrics Support Meeting Business Needs

- ✓ **Leverage organization historical data to ensure accurate estimates for new work**
  - Level 3: Historical data is the foundation for cost credibility and accuracy
- ✓ **Understand process performance to enable more effective management**
  - Level 4: Statistical process control – a means for understanding performance
- ✓ **Improve process performance to increase competitive edge**
  - Level 5: Improvement activities based on accurate measures

Level	Process Areas
5 Optimizing	Causal Analysis and Resolution Organizational Innovation and Deployment
4 Quantitatively Managed	Quantitative Project Management Organizational Process Performance
3 Defined	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Risk Management Integrated Project Management (for IPPD*) Integrated Teaming* Integrated Supplier Management** Decision Analysis and Resolution Organizational Environment for Integration*
2 Managed	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Performed	

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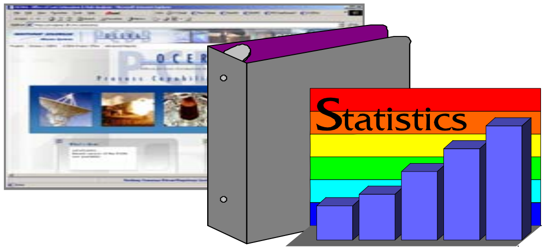
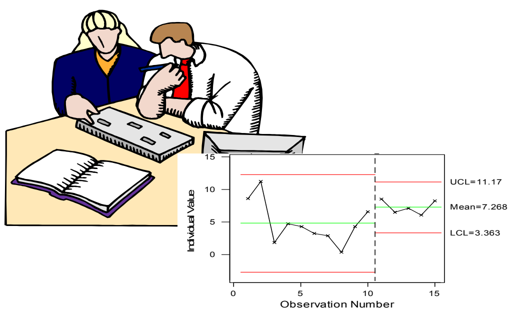
Supporting Infrastructure



Mature metrics collection
- Metrics repository
- Organization Metrics Manual
- Established organization baselines & models
- Established collection process

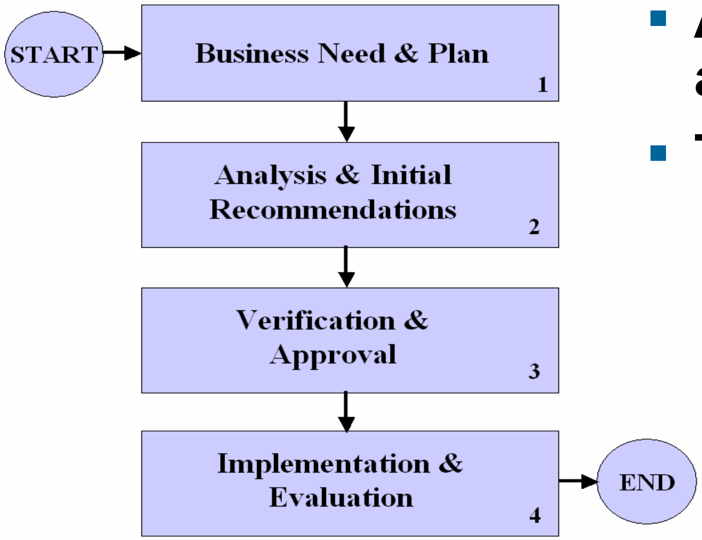
Engineering Process Group
- Provides stakeholder input
- Metrics/QM working group



Six Sigma/Lean
- Structure for improvement
- Tools & methods

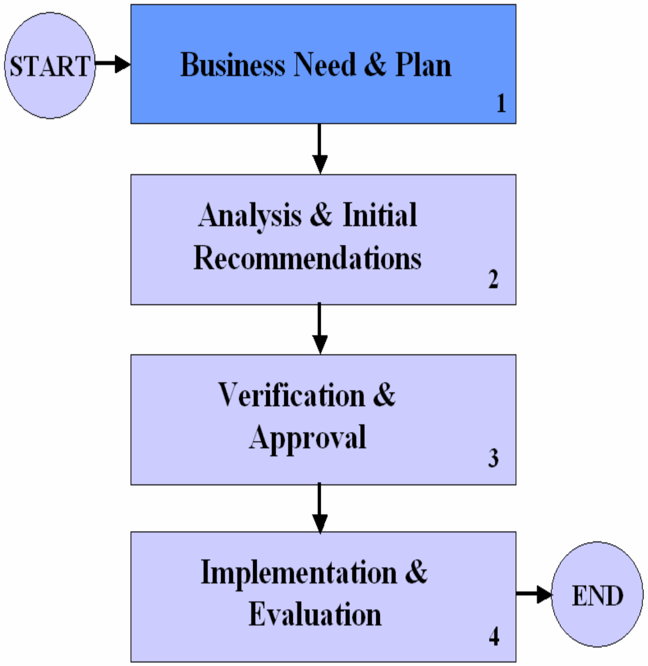
CMMI Level 5
- Mature processes
- Structure for sharing best practices

Standard Metric Development Process Overview



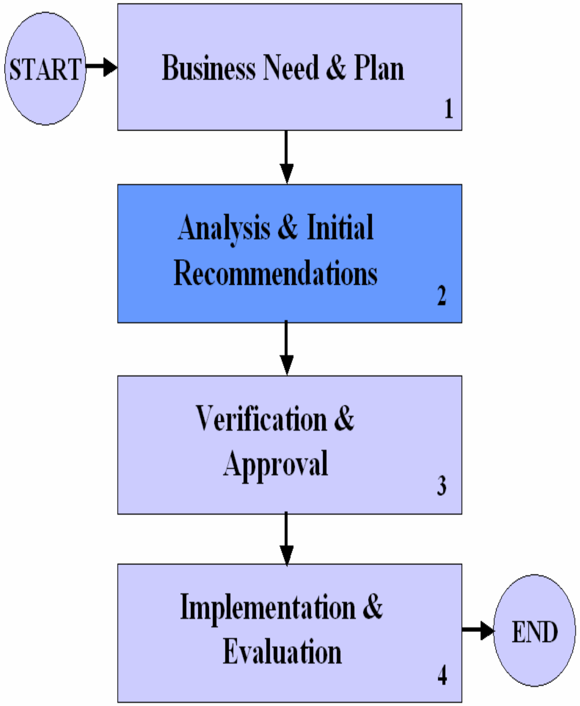
- **Starts when the metric sponsor identifies a business need**
- **A Metric Development Project Lead is appointed to lead the process**
- **The standard process ensures:**
  - Metric development is integrated into the annual overall organizational metrics planning;
  - The relationship and effect on the organizational standard processes is considered;
  - All stakeholders are kept informed and can provide inputs;
  - Results are documented and appropriate approvals are obtained.

Step 1 – Business Need & Plan



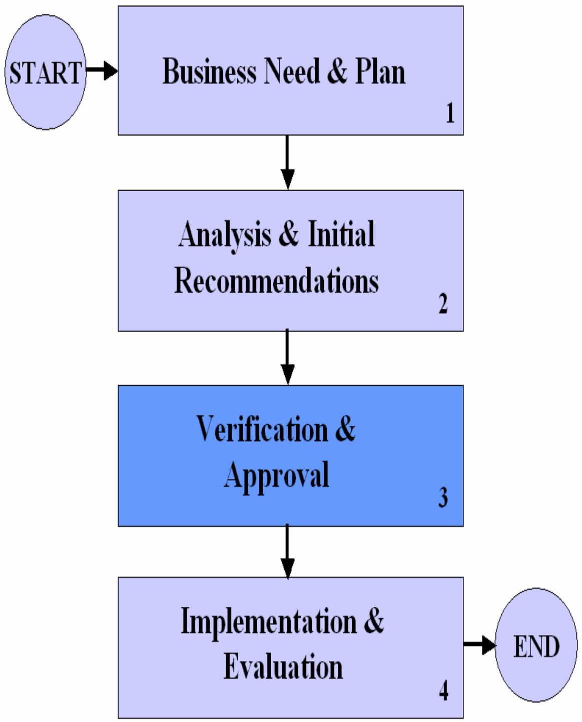
- Develop business need description
- Identify Metric Sponsor, Metric Development Project Lead, affected process owners, other stakeholders
- Establish initial schedule for each process step and identify resources
- Coordinate with the organization stakeholders for integration with organization priorities and plans
- Document results

Step 2 – Analysis & Initial Recommendations



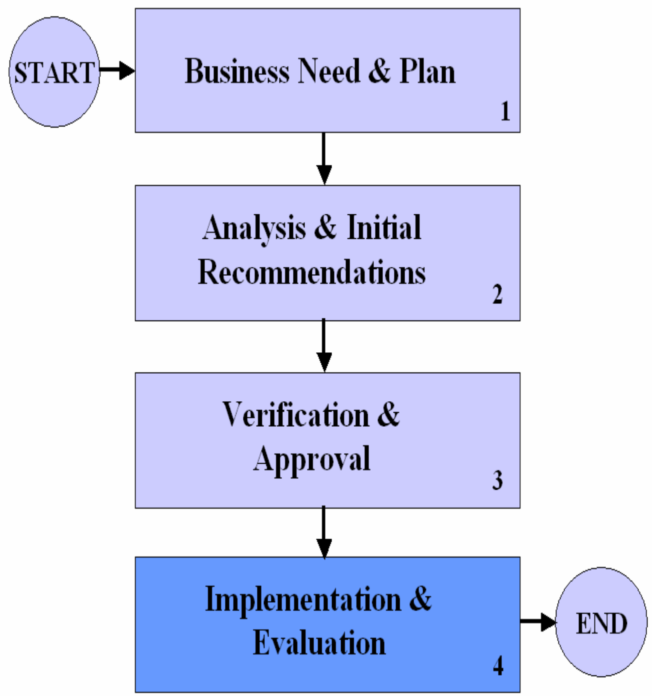
- Assess and evaluate related in-house metrics use
- Assess and evaluate related industry metrics use
- Analyze fit related to meeting business needs
- Evaluate potential impact on policy/processes/projects
- Specify proposed metrics
- Evaluate cost vs. benefit
- Document results

Step 3 – Verification & Approval



- Obtain stakeholder input and verification of satisfaction of business needs
- Update plans and metrics definition as needed
- Prepare draft Change Request and supporting documentation
- Document results
- Obtain required organization/CCB approvals (provide documented process results to approval authorities)

Step 4 – Implementation & Evaluation



- Implement metrics collection
- Analyze results
- Prepare results for use
- Prepare recommendations for changes or needed actions

Metric Development Documentation Outline

Business Need and Plan (documents results of process step 1)

- ✓ Business need description
- ✓ Metric Sponsor, Metric Dev Project Lead, stakeholder identification
- ✓ Target/actual completion date and status for each process step

Analysis and Initial Recommendation (documents results of process step 2)

- ✓ In-house metrics assessment
- ✓ Industry metrics assessment
- ✓ Other analysis results
- ✓ Impact evaluation
- ✓ Definition of proposed metric(s)

Verification and Approval (documents results of process step 3)

- ✓ Record of stakeholder input and review
- ✓ Mapping to business needs
- ✓ Change Request to related documentation
- ✓ Record of required org/CCB approvals

Post Collection Analysis and Recommendations (documents results of process step 4)

- ✓ Summary of analysis results and recommendations

Northrop Grumman Mission Systems Case Studies

- O&M Metrics Example
- Systems Engineering Metrics Example

O&M Metrics Development Example

Step 1 Highlight – Business Needs

- **Prediction of effort for new work requires productivity values for key O&M processes**
  - Defect Correction
  - Small Enhancements
  - Help Desk Support
  - Operations Support
- **Additional needs to provide the organization with more useful process performance baselines and/or models**

Background goal to limit impact on projects and the organization collection system

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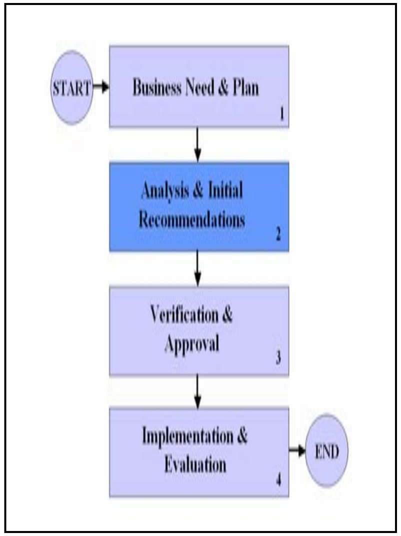
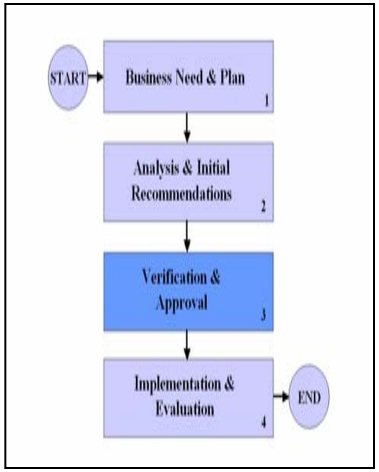
Step 2 Highlight – Analysis: Sources & Eval



- **In-house metric sources**
  - Projects A, B and C
    - Projects used defect related metrics similar to development projects for project specific baselines/models
    - Recommend expanding defect metrics to O&M project activities
  - Metrics currently collected as part of the organization data collection
    - Potentially useful productivity measures could be computed from metrics already being collected
    - Need more data points
- **Industry metric sources considered**
  - SEER-SEM and COCOMO cost models
    - Use to validate productivity values

Step 3 Highlight – Verification Against Business Needs

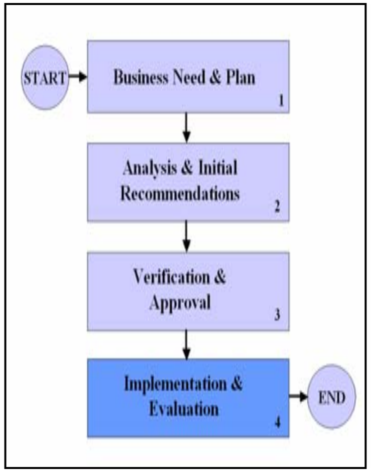


- **Prediction of effort for new work**
  - Currently collect potentially useful metrics to enable computation of needed productivity measures
- **Providing more useful organization process performance baselines/models**
  - Potentially this need will be met by the currently collected data and the addition of selected defect data
  - Analysis against productivities derived from existing data shows promise

Productivity = Size/Effort

Process	Potential Size Metric(s)	Effort Metric From Related Standard WBS Line Item(s)
Software Defect Correction	# base code SLOC,	12.1.3 Software Defect Correction
Small SW Enhancements	# base code SLOC, # base code SLOC affected, # SLOC added, # SLOC changed # SLOC deleted	12.1.6 Software Enhancements
Help Desk Support	# sites supported, # users supported, # calls per week, # hours per week	12.1.9 Help Desk Support

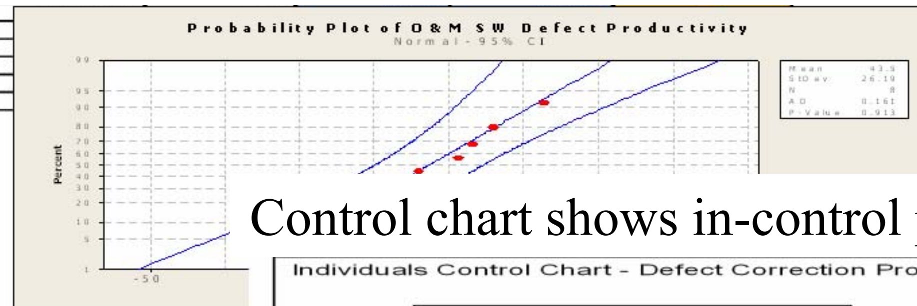
Step 4 Highlight – Eval of Collected Data



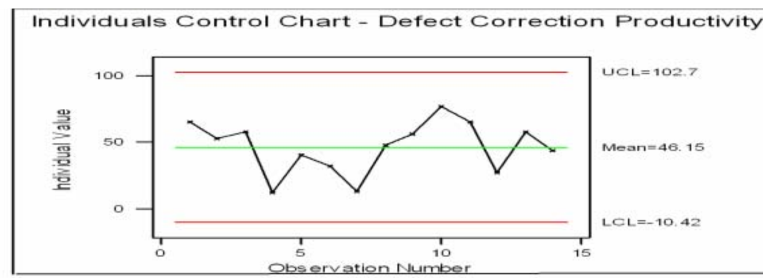
Notional raw defect correction productivity data

Proj	Duration in Months	Completion Date	Software Defect Correction Hrs	Software Defect Correction Hrs Annualized	Defect Correction SLOC Maintained	SW Maintenance Productivity (Base SLOC/ Hrs Annualized)
1	12	3/15/2002	11139	11139	722000	65
2	12	3/31/2002	60063	60063	3199663	53
3	19	6/1/2002	44813	28303	1640825	58
4	19	11/2/2002	20048	12662	150481	12
5	12					
6	12					
7	5					
8	6					
9	12					
10	18					
11	12					
12	12					
13	12					
14	18					

Check shows data to be normally distributed



Control chart shows in-control process



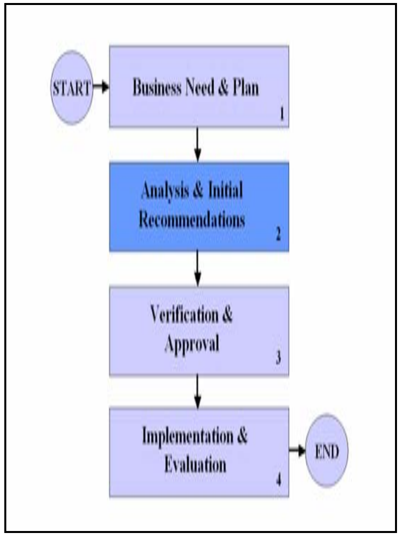
Productivity useful for estimating and as organization baseline data

Systems Engineering (SE) Metrics Development Example

Step 1 Highlight – Business Needs

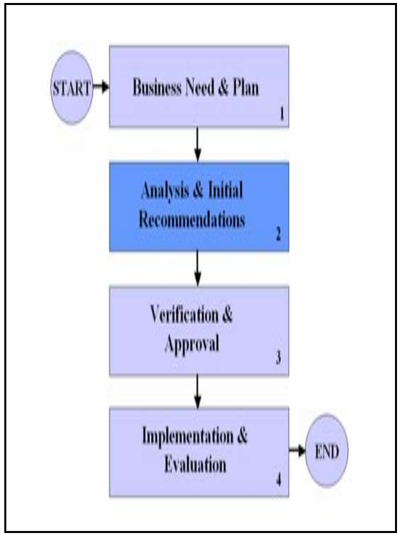
- **Prediction of effort for new work requires productivity values for key systems engineering processes**
  - Architecture definition, Concept of Operations Development (including scenario and use case development)
  - Requirements Analysis (including system, software, and hardware)
  - Major Interface Definition
  - Performance Modeling
- **Additional needs to provide the organization with useful process performance baselines and/or models**
- **Provide ability to support development and use of COSYSMO estimating model**

Step 2 Highlight – Analysis: Sources & Eval



- **In-house metric sources considered & eval**
  - Division Six Sigma Project on System Sizing Cost Estimating Relationships
    - COSYSMO size measures fit primary needs for division and organization use
  - Projects A, B use of cycle-time and other metrics for key processes
    - Metrics too specific for organization use
  - Currently collected SE metrics
    - Need a few additions to support desired productivity calculations
  - SE metrics discussion with stakeholders
- **Industry metric sources considered**
  - USC/Industry COSYSMO SE cost model
  - INCOSE Systems Engineering Measurement Primer
  - Papers and Presentations

Step 2 Highlight – Analysis: Candidate Process Performance Metrics

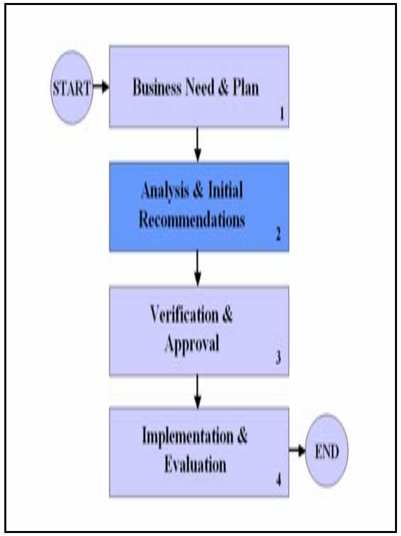


Productivity = Size/Effort

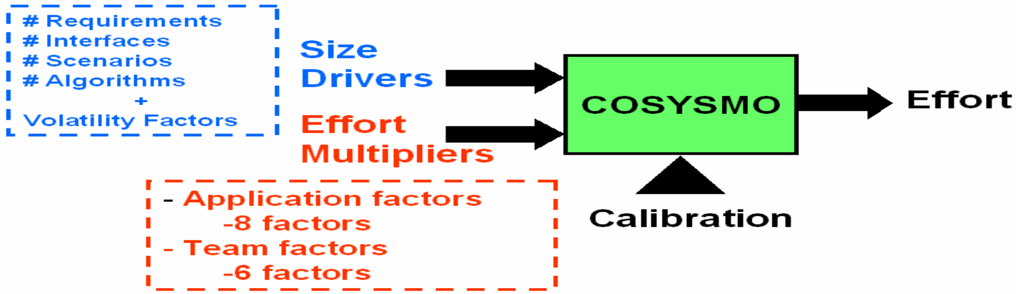
Size **Effort**

Process	Potential Size Metric(s)	Effort Metric From Related Standard WBS Line Item(s)
Requirements Analysis	# system reqs, # SW reqs, # HW reqs, # scenarios	2.3 System Requirements, 2.5 SW Requirements Analsyis, 2.4 HW Requirements Analysis,
Architecture/Concept of Operations	# system reqs, # SW reqs, # HW reqs, # scenarios	2.6 Architecture Analysis/System Design, 2.8 Operations Concept Definition
Major Interface Definition	# interfaces	2.7 Interface Definition

Step 2 Highlight – Analysis: Constructive Systems Engineering Cost Model (COSYSMO)



COSYSMO Operational Concept*



COSYSMO Background

- **Part of COCOMO Suite of models being developed under the guidance of Dr. Barry Boehm, the Director of the Center for Software Engineering at USC**
- **Goal to more accurately estimate the time and effort associated with performing the system engineering tasks defined by ISO/IEC 15288**
- **Development started in 2002, with industry (USC affiliates) and INCOSE involvement**
- **42 historical data points from** 6 **companies;** 15 **business units**
- **Northrop Grumman participating in the development and submittal of history data**

** Used with permission of Dr. Barry Boehm*

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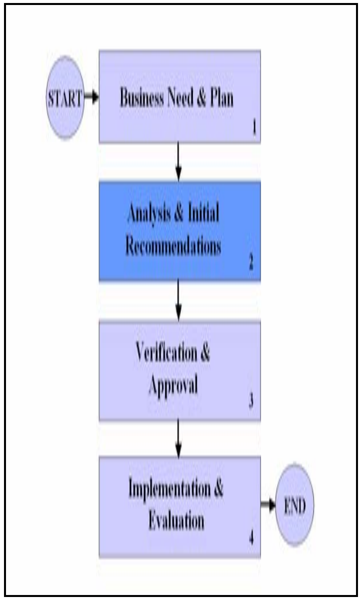
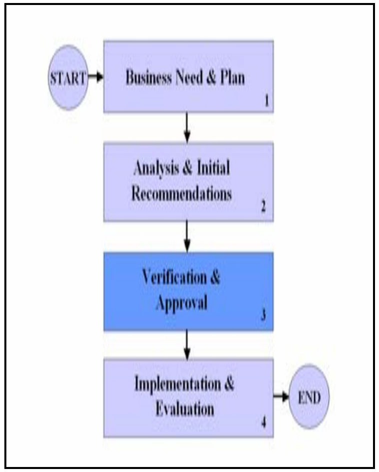
Step 2 Highlight – Initial Recommendations



- **Include the four COSYSMO size parameters, with difficulty level**
- **Add hardware requirements metrics**
- **Add collection of defect data for system requirements, hardware requirements and scenario/use case reviews**
- **Proposed Mods to the organization Standard WBS**
  - Separate architecture, SW COTS assessment, HW COTS assessment
  - Separate performance modeling and life cycle cost analysis

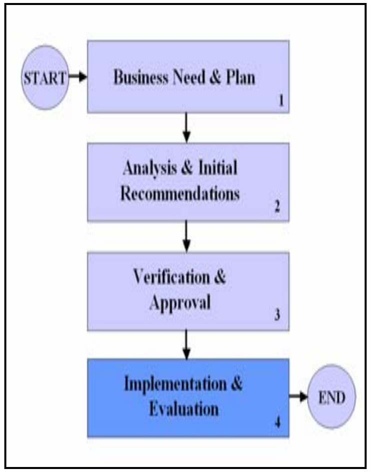
Modifications to the organization data collection, Metrics Manual and related documents

Step 3 Highlight – Verification Against Business Needs



- **Prediction of effort for new work**
  - Size and accounting data already collected or identified for addition can potentially meet this need
  - COSYSMO should be of use as well
- **Development of organization process performance baselines/models**
  - Potentially this need will be met by the recommended data
  - Analysis against productivities derived from existing data shows promise
- **Support of COSYSMO development & use**
  - Existing plus new metrics support this

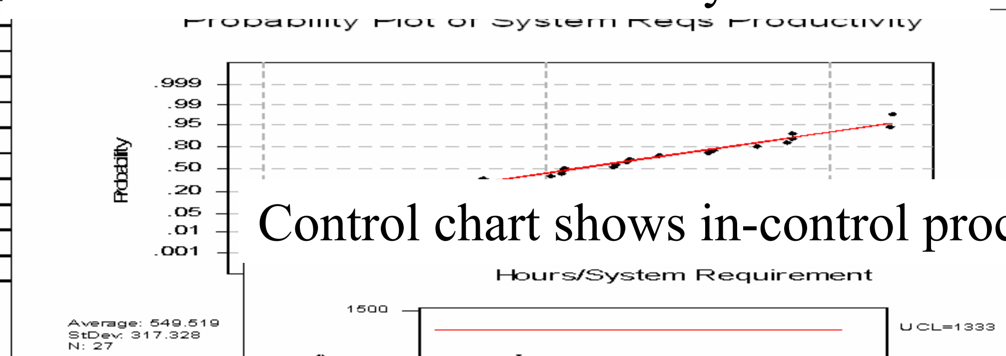
Step 4 Highlight – Eval of Collected Data



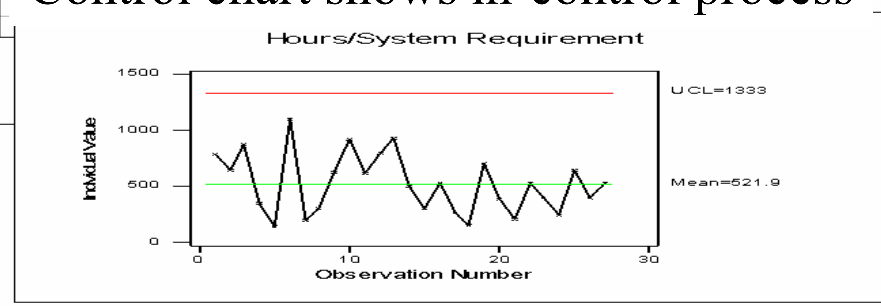
Notional raw system requirements productivity data

Project	# Sys Reqs	Hours	Hrs/Sys Requirement
1	464	365149	787
2	55	35663	648
3	[illegible]	[illegible]	[illegible]
4			
5			
6			
7			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Check shows data to be normally distributed



Control chart shows in-control process



Productivity useful for estimating and organization baseline data

Summary

A metrics development process should:

- Ensure business needs drive the process
- Take advantage of in-house and industry experience and best practices
- Include obtaining stakeholder input and buy-in
- Ensure benefits are worth the cost
- Include documentation and post-implementation evaluation

Performing Consistent Appraisals in a Global Organization

Agenda

- What are the Challenges
- What are the Strategies
- Processes that were put in place
- Successes and Lessons Learned

Organizational Challenges

- How to communicate
  - Similar goals
  - Lessons Learned
- What is “consistent”
  - Identical
  - Comparable
- Who are the sponsors
  - Local
  - Global
- How is the organization defined
  - Central Functional Process
  - Decentralized implementation

Appraisal Challenges

- Size of organization
  - 5 Organizational Groups
    - 36 Global Assessment Groups
      - North America
      - South America
      - Europe
      - Japan
      - Africa
      - Asia

- Local SEI-Authorized Lead Appraisers and Instructors

Appraisal Challenges

- Objective Evidence
  - Standard PIIDs across domains
  - Standard tools
  - Tailored processes
- Scope
  - Maturity Level
- Appraisal teams
  - Training
  - Experience / language
  - Size of team

Planning Challenges

- Multi-national
  - Team norms and values
- Multi-geographic in each appraisal
  - Languages
  - Time Zones / Locations
- Time Constraints
  - Class B, Level 3, 5 days

Strategies

- Central Accenture process imp organization
  - Develops vision
  - Works with individual business unit to develop Goals
  - Central appraisal scheduling
  - Centralized and standard training
    - Introduction to CMMI
    - Appraisal Method Team Training
  - Appraisal co-sponsors
    - Collect appraisal data
    - Coordinate global process improvement efforts

Strategies

- Accenture and ISD Planner
  - Regular meetings with field sites to review issues, goals, process improvements
  - Collect Lessons Learned and make changes
- Lead Appraiser Process Analysis
  - Expert review of organization's standard processes and map to Model and Practice Implementation Indicators (PIIDs)
  - Report compliances and weaknesses
    - Provide input for process improvement
    - Interpretation – model and method
  - Lead Appraiser "Boot Camp" and quarterly meeting

Strategies

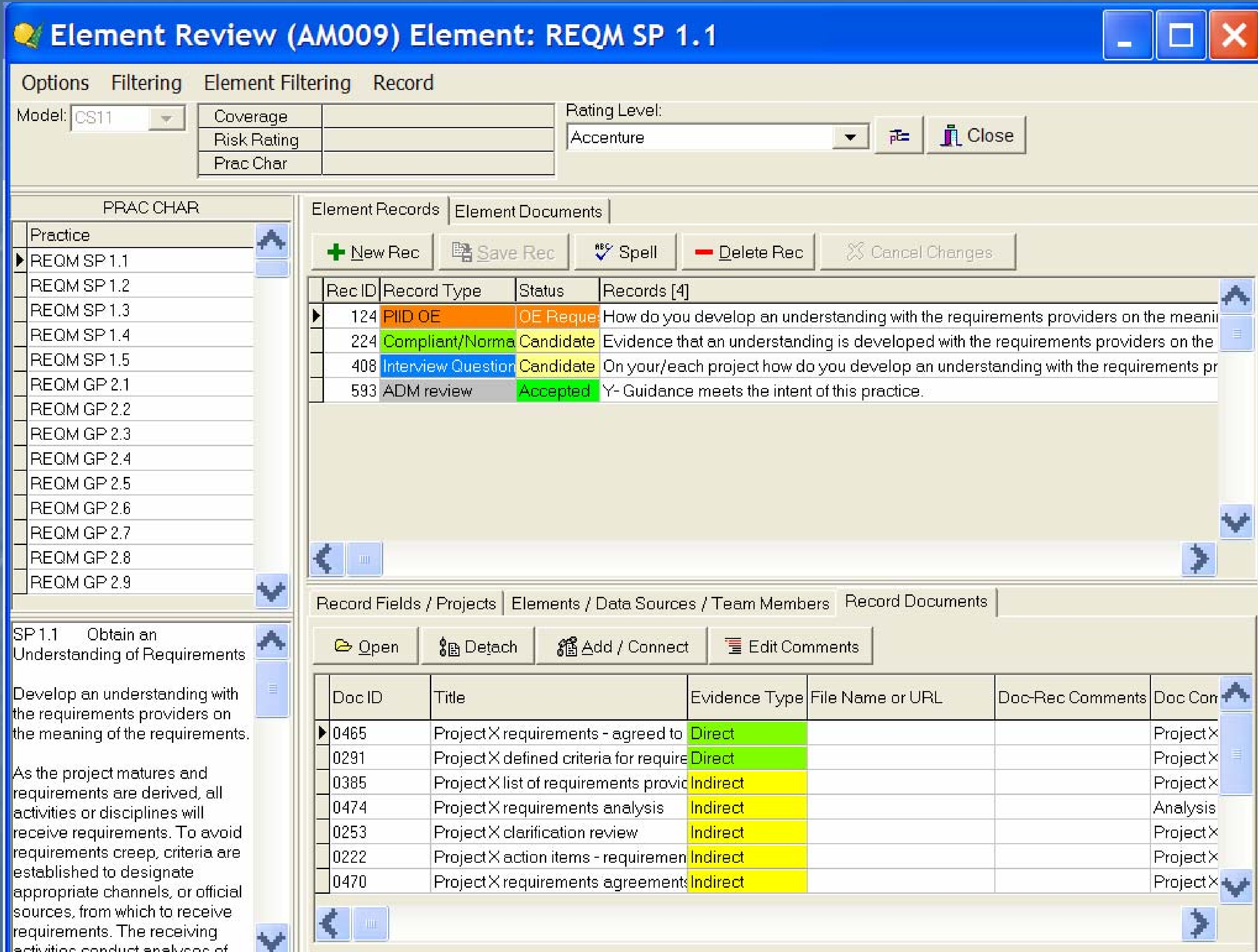
- Identify ‘common processes’ to appraise once
  - Global process development
  - Global environment for integration
  - Global training
  - Global process improvement
- Perform global appraisal and then division appraisals (reuse global findings)

Strategies


Global Program
Process Improvement and Deployment
Process and Tools
Training and Communications
Metrics

Processes put into Place

- Standard Appraisal Assets - Consistency
  - Planning Assets and Central Planner
    - Plan template and checklist
    - Schedule template
    - Tailoring Matrix
  - Conducting Assets
    - Briefing templates
    - Appraisal Wizard template
  - Reporting Assets
    - Standard deliverables
    - Report template


Element Review (AM009) Element: REQM SP 1.1
Options
Filtering
Element Filtering
Record
Model:
CS11
Coverage
Risk Rating
Prac Char
Rating Level:
Accenture
Close
PRAC CHAR
Practice
REQM SP 1.1
REQM SP 1.2
REQM SP 1.3
REQM SP 1.4
REQM SP 1.5
REQM GP 2.1
REQM GP 2.2
REQM GP 2.3
REQM GP 2.4
REQM GP 2.5
REQM GP 2.6
REQM GP 2.7
REQM GP 2.8
REQM GP 2.9
SP 1.1 Obtain an Understanding of Requirements
Develop an understanding with the requirements providers on the meaning of the requirements.
As the project matures and requirements are derived, all activities or disciplines will receive requirements. To avoid requirements creep, criteria are established to designate appropriate channels, or official sources, from which to receive requirements. The receiving activities conduct analyses of
Element Records
Element Documents
New Rec
Save Rec
Spell
Delete Rec
Cancel Changes
Rec ID
Record Type
Status
Records [4]
124
PIID OE
OE Reque
How do you develop an understanding with the requirements providers on the meani
224
Compliant/Norma
Candidate
Evidence that an understanding is developed with the requirements providers on the
408
Interview Question
Candidate
On your/each project how do you develop an understanding with the requirements pr
593
ADM review
Accepted
Y- Guidance meets the intent of this practice.
Record Fields / Projects
Elements / Data Sources / Team Members
Record Documents
Open
Detach
Add / Connect
Edit Comments
Doc ID
Title
Evidence Type
File Name or URL
Doc-Rec Comments
Doc Com
0465
Project X requirements - agreed to
Direct
Project X
0291
Project X defined criteria for require
Direct
Project X
0385
Project X list of requirements provic
Indirect
Project X
0474
Project X requirements analysis
Indirect
Analysis
0253
Project X clarification review
Indirect
Project X
0222
Project X action items - requiremen
Indirect
Project X
0470
Project X requirements agreement
Indirect
Project X

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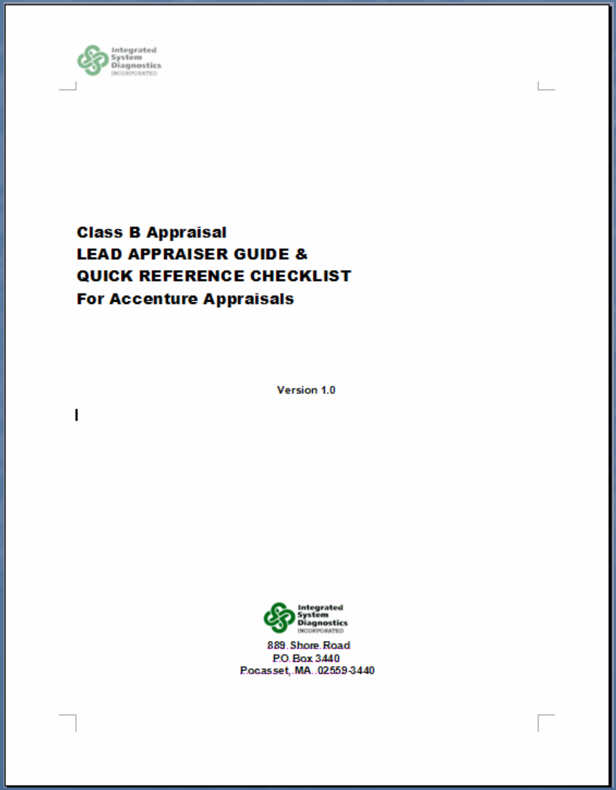
accenture

Processes put into Place

- Method
  - Lead Appraiser Guide – method of conduct
  - FAQs about the organization
  - Engagement Model – how to do business
  - QA Review of Results
    - Feedback forms
    - Verify consistency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Class B Appraisal
LEAD APPRAISER GUIDE &
QUICK REFERENCE CHECKLIST
For Accenture Appraisals

Version 1.0

Integrated System Diagnostics INCORPORATED
889 Shore Road
P.O. Box 3440
Pocasset, MA 02559-3440

Processes put into Place

- Standard Appraisal Tool
  - Appraisal Wizard™
    - Method encoded in Tool
    - Standard initial file with Accenture information
    - Standard settings – team members, interviews, initial standard observations, standard PIIDs mapped to Accenture process
    - Standard charts and briefings
  - Training provided to Leads and team members
    - Webinars
    - CAM training
    - Appraisal Wizard™ Training

Processes put into Place

- “Consistent” planning for Appraisals
  - Interview sessions
  - Participant list
  - Interview questions
  - Time constraints – length of appraisal
  - “Reuse” team members – build on experience

Successes

- Roll out of appraisals through organization
- Results that are being compared and used for global process improvement
- Quick start up “bootstrapping” with standard process, methods, and tools

Successes

- Improving efficiency using Appraisal Wizard™
  - Maintain Model and Accenture process relationship
  - Observation entry
  - Consolidation and consensus
  - Findings generation
  - Charting
  - Comparing results

Successes

- Completed Appraisals
  - All 36 Assessment Groups have completed at least one Class B appraisal since March
  - Organizational Class B appraisal complete
  - Global strategy for 2006 being developed

Lessons Learned

- Communicate global Process Improvement objectives, strategy and approach
- ISD/Accenture Engagement Model in place
- Global organization collects feedback from Assessment Groups
- ISD feedback forms
- Regular ISD/Accenture reviews and take corrective actions
- Weekly meetings with ISD Project Manager and Accenture representatives

Thank You

Questions?

NORTHROP GRUMMAN
DEFINING THE FUTURE

Squeezing Variation for Profit

CMMI® Technology Conference and User Group
Denver, Colorado

Thursday, November 17, 2005

D. R. Corpron
Division Manager & Six Sigma Master Black Belt
Northrop Grumman Corporation

Background…

Carnegie Mellon
Software Engineering Institute
Pittsburgh, PA 15213-3890

Capability Maturity Model®
Integration (CMMI SM),
Version 1.1

CMMI SM for Systems Engineering, Software Engineering, Integrated Product and Process Development, and Supplier Sourcing
(CMMI-SE/SW/IPPD/SS, V1.1)

Staged Representation
CMU/SEI-2002-TR-012
ESC-TR-2002-012

Improving processes for better products

CMMI Product Team

March 2002

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- CMMI Level 4, ***Quantitatively Managed*** covers both the organizational and project aspects of process stability and capability
- *Stability* and *Capability* are not just noble concepts, they have economic value and are about managing variation

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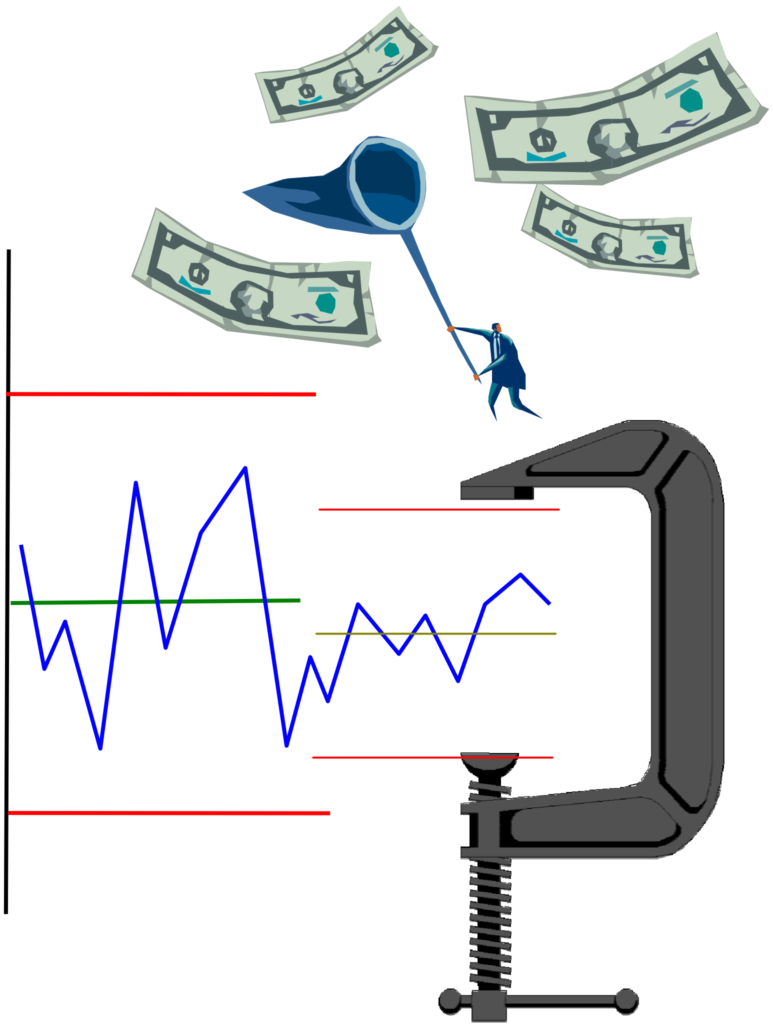
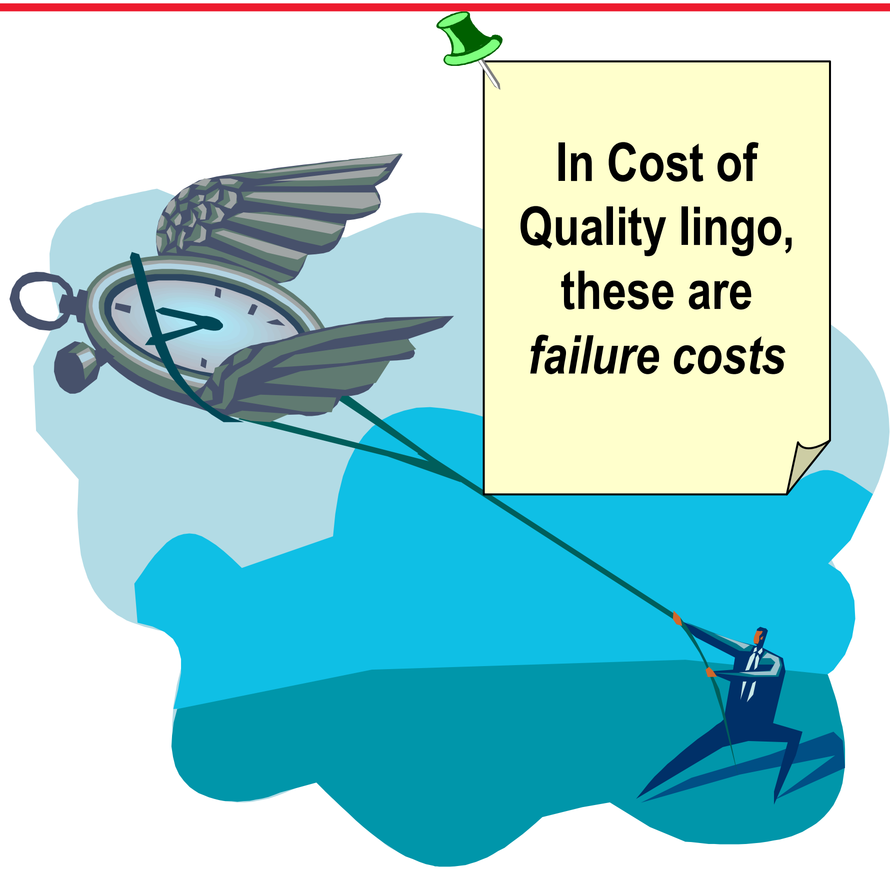
The problem…



- The economic value of rendering processes stable and capable is often incalculable
- And, the return on investment of placing *more* processes under quantitative management likewise is indeterminable
- So, how to quantify the benefit?

Situations where variation manifests as schedule misses is a problem..



Schedule often is a major concern of Customers

- Projects miss committed delivery dates due to systematic underestimates of the effort to perform tasks
- Projects miss committed delivery dates due to poor execution and control of project tasks
- Missed delivery dates often have dire consequences

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The concept of failure costs…

Internal Failure Cost are the costs that result from a failure to…

"Do it right the first time."

- Defect correction
- Budget misses
- Processing discrepancy reports (DR's)
- Retesting
- Unscheduled downtime
- Inventory shrinkage
- Schedule misses
- Invoice errors
- Payroll errors
- Erroneous status reporting
- Lost data

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Example…

- The *Build Scheduling* subprocess was put under Quantitative Management
- Same process used across several projects to determine schedule performance

Data were collected for 30 samples…

Build	±Days Early or Late	Build	± Days Early or Late	Build	± Days Early or Late
Build 1	28	Build 11	23	Build 21	89
Build 2	1	Build 12	20	Build 22	11
Build 3	-1	Build 13	19	Build 23	15
Build 4	10	Build 14	337	Build 24	12
Build 5	19	Build 15	58	Build 25	20
Build 6	5	Build 16	2	Build 26	4
Build 7	90	Build 17	53	Build 27	4
Build 8	2	Build 18	8	Build 28	13
Build 9	87	Build 19	10	Build 29	31
Build 10	11	Build 20	62	Build 30	95

Fairly clear that schedule performance is an issue

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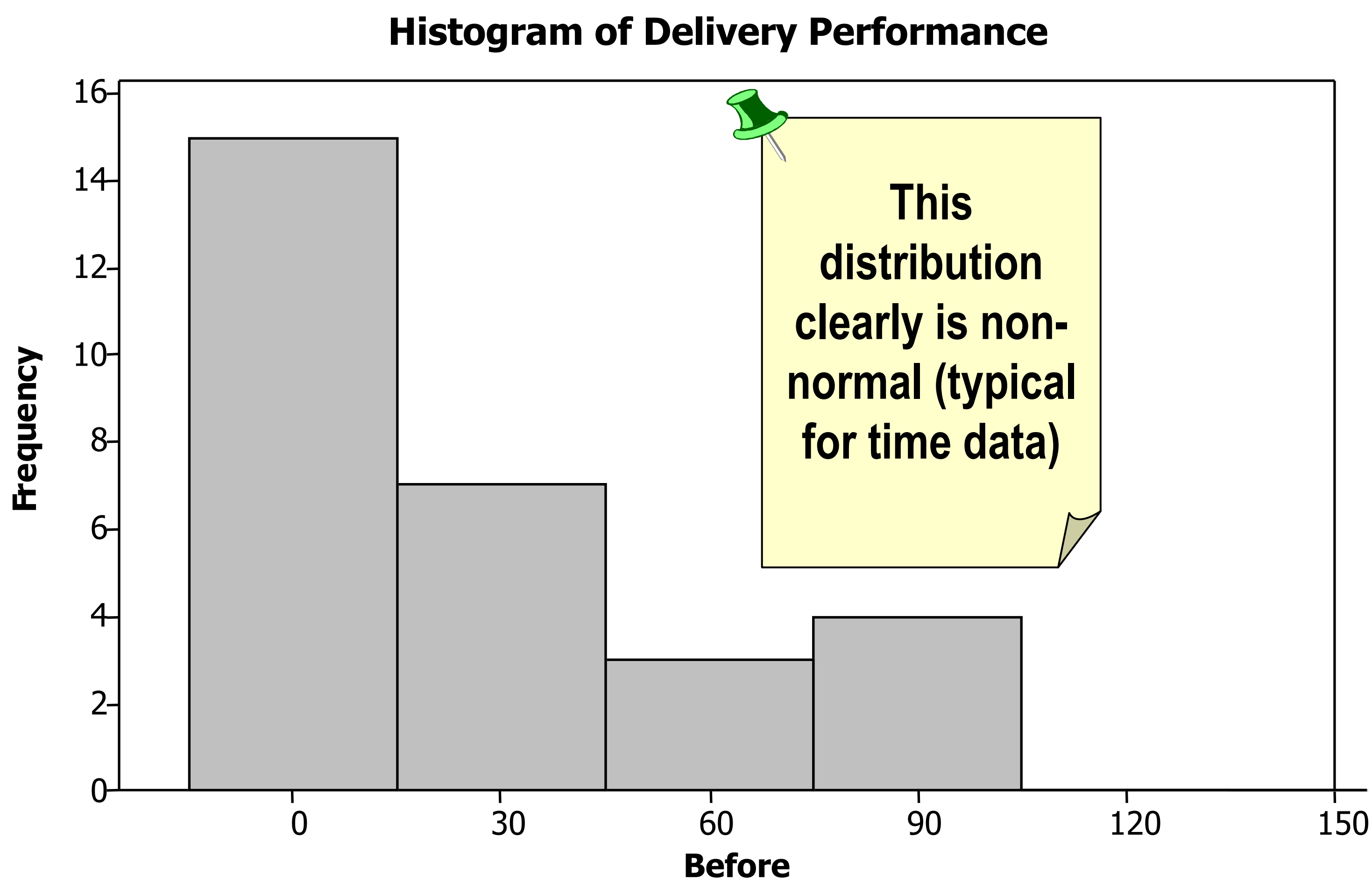
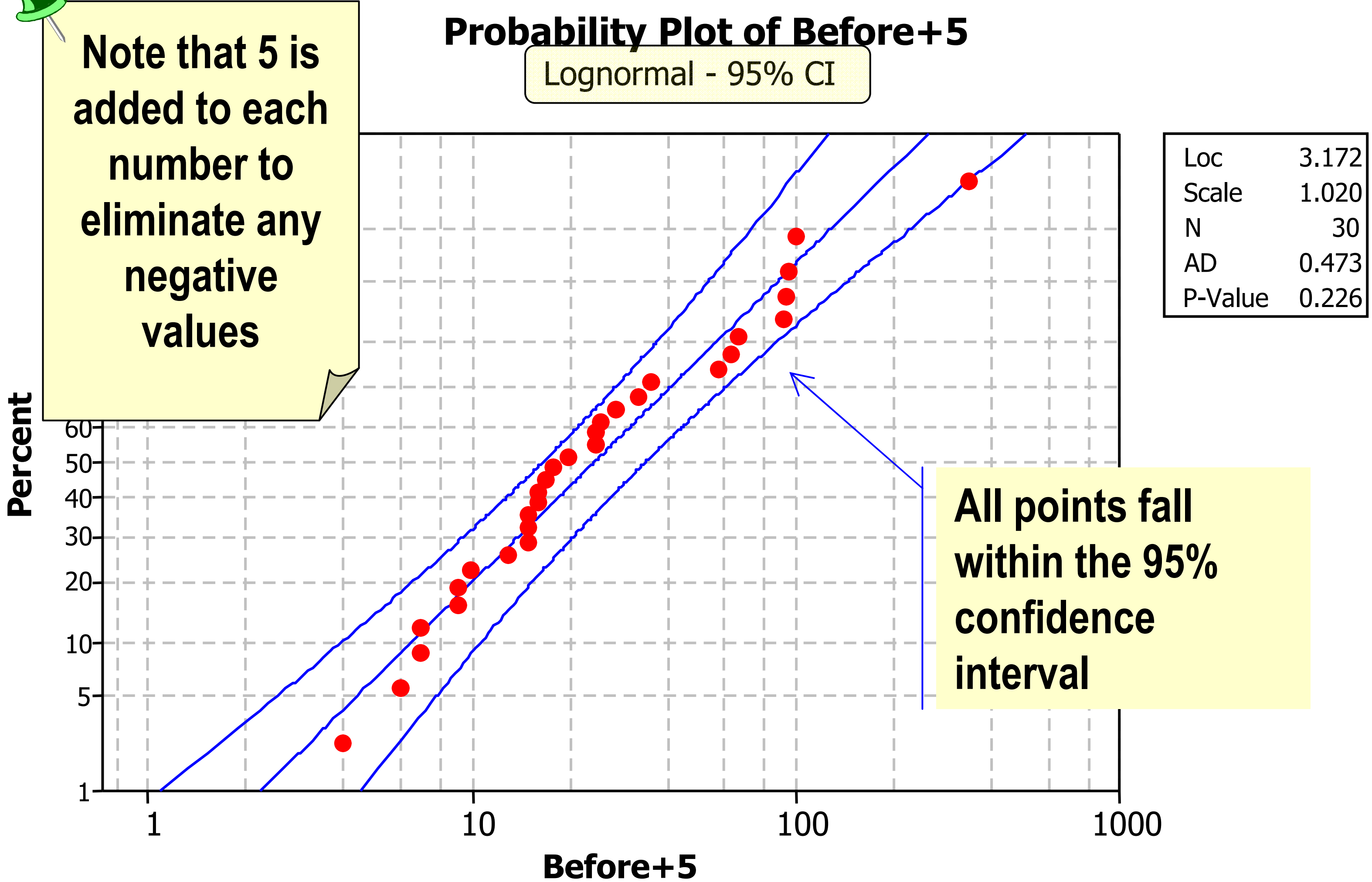
Histogram reveals the shape of the data…



Data that are not normal present analytic challenges

Further analysis shows the data to be a lognormal distribution…

Note that 5 is added to each number to eliminate any negative values



All points fall within the 95% confidence interval

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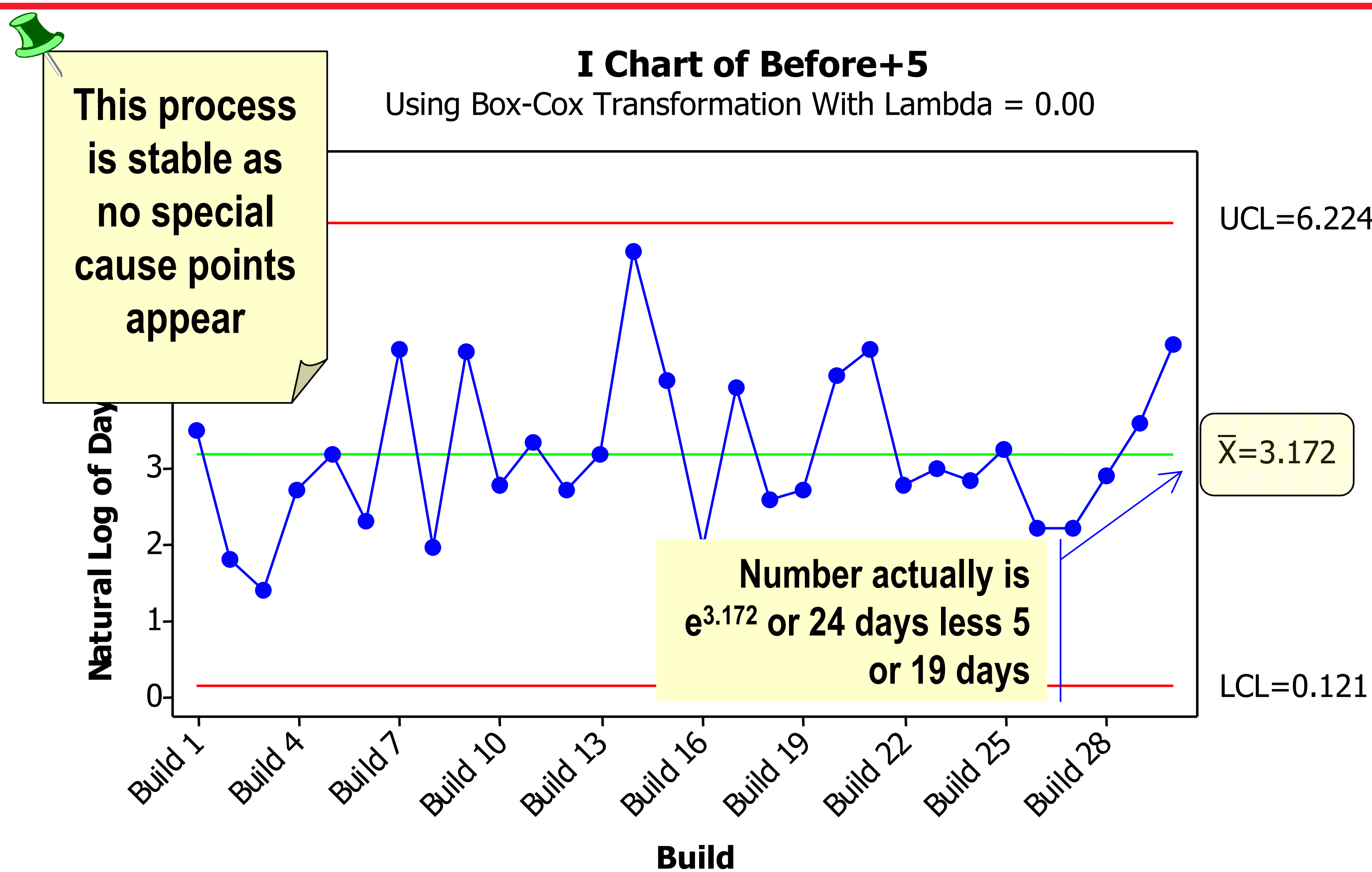
Charting the data shows the process to be stable…



Stable processes lend themselves to improvement

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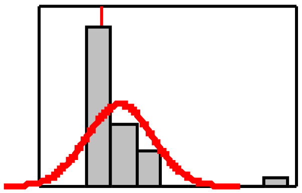
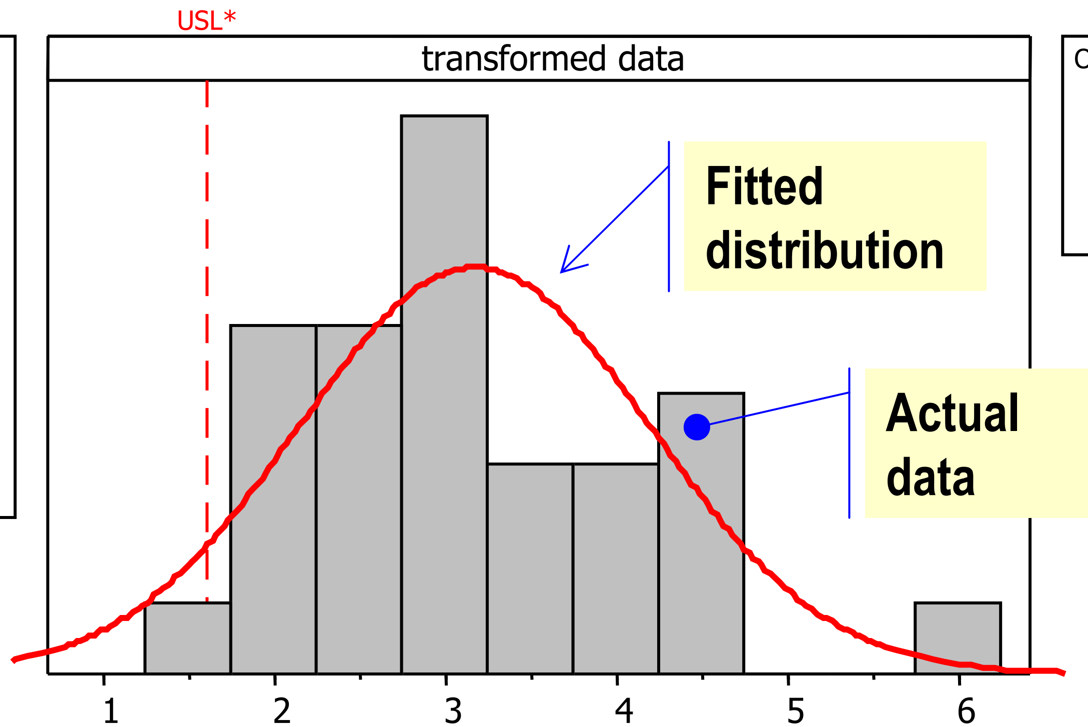
The process is *not* capable...



Process Capability of Before+5

Using Box-Cox Transformation With Lambda = 0

Process Data	
LSL	*
Target	*
USL	5
Sample Mean	42.6
Sample N	30
StDev(Overall)	64.4483
After Transformation	
LSL*	*
Target*	*
USL*	1.60944
Sample Mean*	3.1725
StDev(Overall)*	1.02886



Overall Capability	
Z.Bench	-1.52
Z.LSL	*
Z.USL	-1.52
Ppk	-0.51
Cpm	*

Observed Performance	
% < LSL	*
% > USL	96.67
% Total	96.67

Exp. Overall Performance	
% < LSL*	*
% > USL*	93.56
% Total	93.56

Can expect the process to be late 94% of the time

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An improvement team went to work…

- The team conducted a thorough Causal Analysis and Resolution
- They implemented a new Build Scheduling process

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Data were collected for 30 new samples…

Build	± Days Early or Late	Build	± Days Early or Late	Build	± Days Early or Late
Build 31	-3	Build 41	35	Build 51	88
Build 32	-4	Build 42	177	Build 52	3
Build 33	4	Build 43	11	Build 53	22
Build 34	4	Build 44	7	Build 54	-2
Build 35	24	Build 45	17	Build 55	-2
Build 36	23	Build 46	-2	Build 56	4
Build 37	0	Build 47	9	Build 57	11
Build 38	28	Build 48	15	Build 58	-2
Build 39	-3	Build 49	5	Build 59	-2
Build 40	38	Build 50	3	Build 60	3

The performance looks better. But, by how much, and what dollar benefit?

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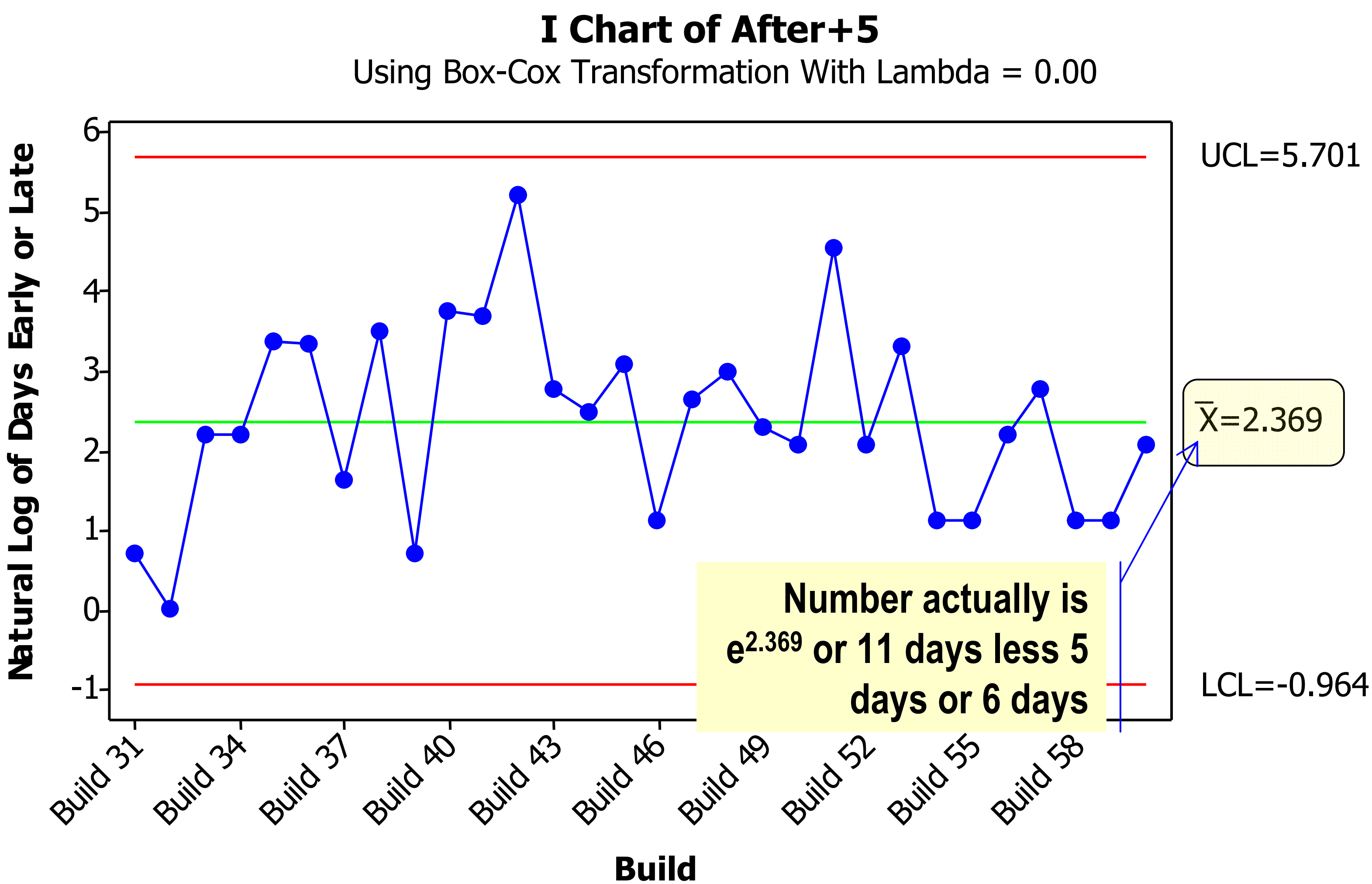
The “After” process is still stable…



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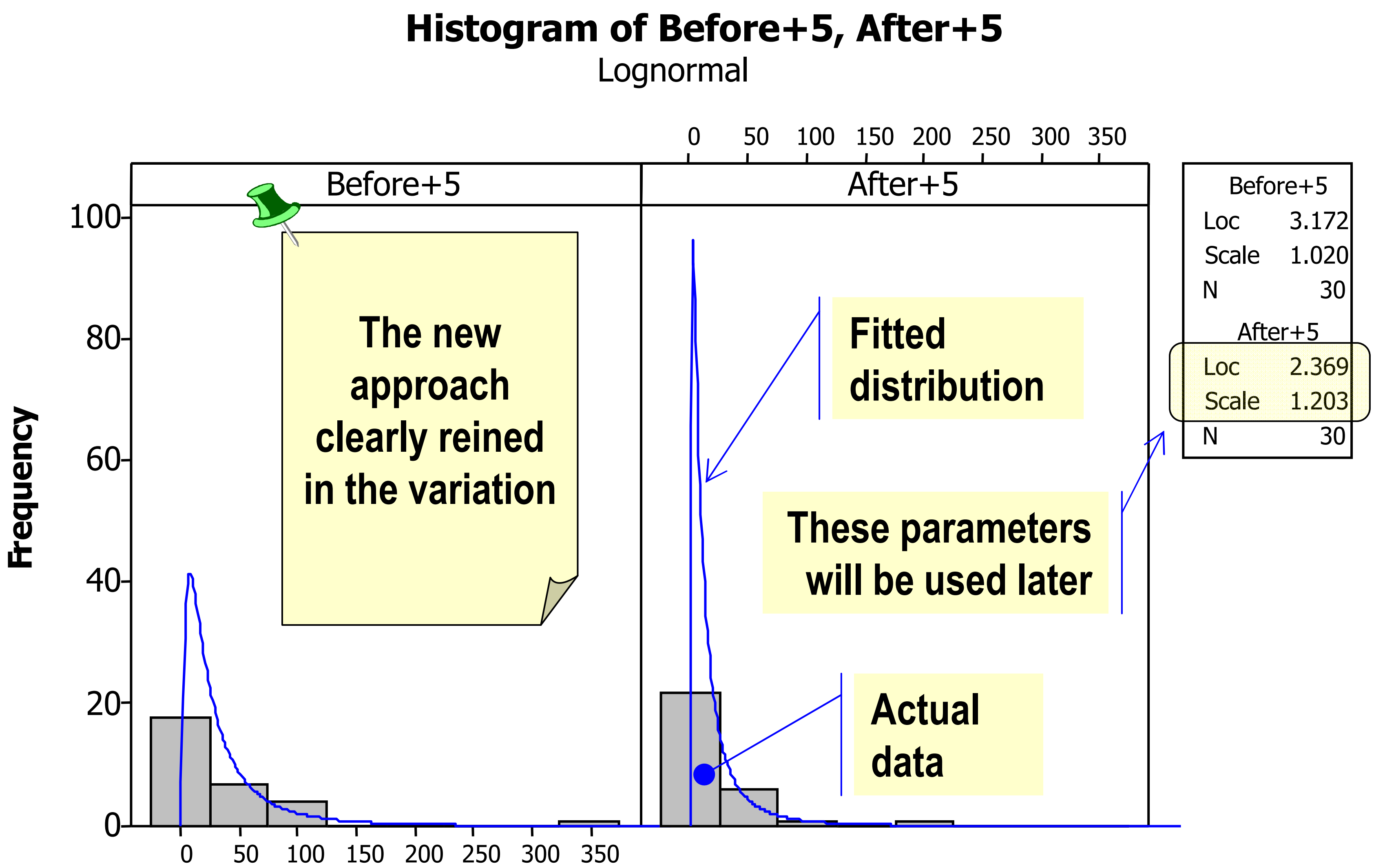
Comparing the "Before" to the "After" shows a change in the data distribution…



And, a hypothesis test shows that difference is indeed real…

A Mann Whitney test is similar to a *t*-test but can be applied to non-normal data

Mann-Whitney Test and CI: Before, After

```
         N   Median
Before  30    14.00
After   30     4.50


Point estimate for ETA1-ETA2 is 8.00
95.2 Percent CI for ETA1-ETA2 is (2.01,17.00)
W = 1082.0
Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0138
The test is significant at 0.0137 (adjusted for ties)
```

95% confidence interval does not contain zero

P-Value > .05; not significant

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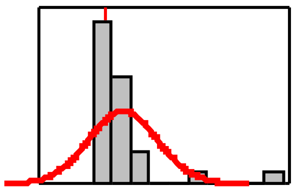
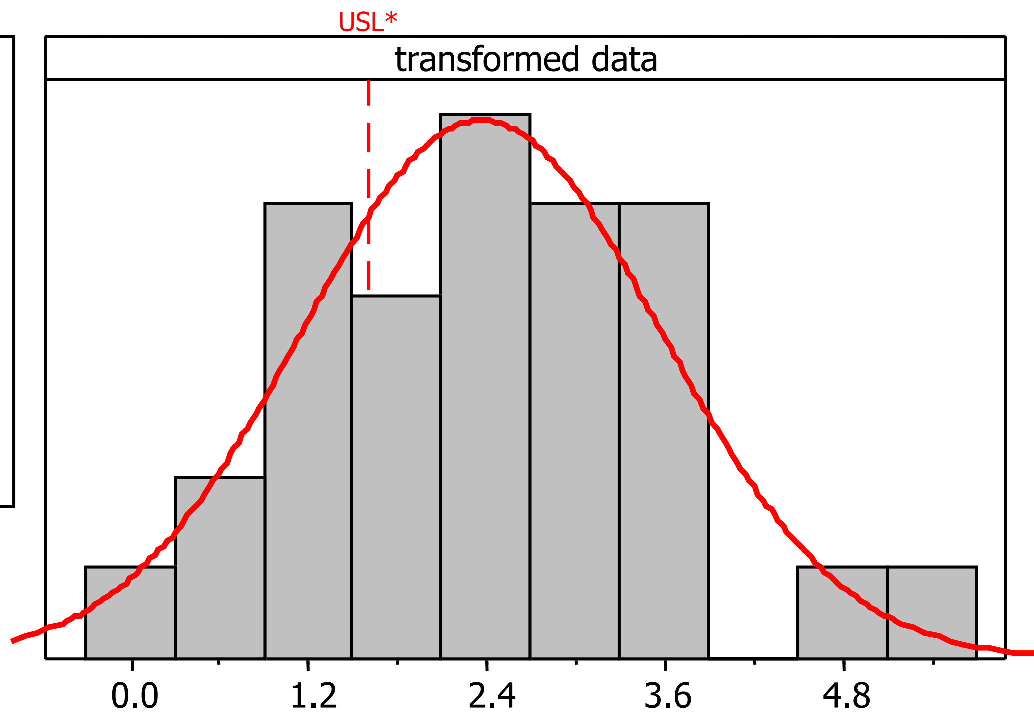
And more the process is more capable…



Process Capability of After+5

Using Box-Cox Transformation With Lambda = 0

Process Data	
LSL	*
Target	*
USL	5
Sample Mean	22.0333
Sample N	30
StDev(Overall)	35.7601
After Transformation	
LSL*	*
Target*	*
USL*	1.60944
Sample Mean*	2.36853
StDev(Overall)*	1.21385



Overall Capability	
Z.Bench	-0.63
Z.LSL	*
Z.USL	-0.63
Ppk	-0.21
Cpm	*

Observed Performance	
% < LSL	*
% > USL	70.00
% Total	70.00

Exp. Overall Performance	
% < LSL*	*
% > USL*	73.41
% Total	73.41

Was 94%, now 73%

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Next, compute the failure costs…

Days Late	Resources per Day	Labor Cost per Hour	probability	Failure Cost (Before)
1	40 hrs.	$50	1.0%	$124
2	40 hrs.	$50	1.7%	$816
:	:	:	:	:
140	40 hrs.	$50	1.8%	$15,523

- Compute the probability of each possible day late using the parameters from the fitted distributions
- Compute the daily failure cost: resource hours × labor rate
- Weight the daily failure costs by the probability
- Sum all the daily failure costs

The revised process cuts failure cost almost in half…

Days Late	Resources per Day	Labor Cost per Hour	p(Before)	Overrun (Before)	p(After)	Overrun (After)
1	40 hrs.	$50	1.0%	$124	4.8%	$1,908
2	40 hrs.	$50	1.7%	$816	6.3%	$5,027
:	:	:	:	:	:	:
20	40 hrs.	$50	1.8%	$15,523	1.4%	$11,581
:	:	:	:	:	:	:
140	40 hrs.	$50	0.1%	$3,473	0.0%	$1,347
Cumulative Failure Cost				$1,226K		$728K

A net benefit of $500K

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Summary…

- The specific benefit from squeezing variation out of a process can be calculated using Cost of Quality principles and Six Sigma techniques
- Knowing the payoff makes further quantitative management compelling

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Paladin Drives Forward To CMMI® Maturity Level 5

The Paladin M109A6 Self-propelled Howitzer

Victor Elias
Artillery Fire Control Systems
Fire Control Systems & Technology Directorate
RDECOM – ARDEC
Picatinny Arsenal, New Jersey

Topics, In Order of Presentation

- U.S. Army RDECOM-ARDEC, FCS&TD, AFCS and the SWE
- The Paladin System Software Development & Maintenance Projects
- A Typical Paladin Project's Business Objective Summary
- Paladin's One Best Way
- The Paladin Process Optimization Life Cycle
- Using CAR to Establish & Optimize A Statistically Managed Process
- Quantitative Methods For CMMI® Maturity Level 5
- Picking Up Where Deming Left Off
- Queuing Systems
- Service Process Capability Measurement Paladin's One Best Way
- Paladin Pilot CAR Study
- Centering and Statistically Managing A Service Process
- Quantitative Methods For CMMI® Maturity Level 5 Paladin's One Best Way
- Paladin Pilot CAR Study: Results & Observations
- Using Quantitative Information as a Basis For Decision Analysis & Resolution
- Artifacts Generated For One Statistically Managed Process Paladin's One Best Way
- Specific Practices Satisfied By One Statistically Managed Process Paladin's One Best Way
- Paladin Drives Forward To CMMI® Maturity Level 5

Armament Research, Development & Engineering Center (ARDEC)
Fire Control Systems & Technology Directorate (FCS&TD)

Vision …

Recognized foremost provider of fire control and related technologies that transform the battlefield and secure the homeland.

Mission …

- ☑ Deliver total life cycle hardware & software engineering solutions for weapon systems control, automated test systems and homeland defense
- ☑ Rapidly incorporate and field emerging hardware and software technologies into sustainable fire control products
- ☑ Provide customers with fire control and related domain expertise
- ☑ Provide sustainment engineering for fielded fire control systems

Artillery Fire Control Systems (AFCS)

Fire Control Systems & Technology Directorate (FCS&TD)
U.S. Army Research, Development & Engineering Command –
Armament Research, Development & Engineering Center (RDECOM-ARDEC)

- The RDECOM-ARDEC Software Enterprise (SWE) consists of the software elements of the FCS&TD, including AFCS, and the Software Quality Groups of the Quality Engineering & System Assurance Directorate (QESA).
- The SWE adopted the Staged Representation of the CMMI® SE/SW/SS Model for Systems Engineering, Software Engineering, and Supplier Sourcing as part of a formal process improvement initiative.
- The SWE achieved a CMMI® maturity level 3 in 2002.
- SWE projects include:
  - Software Development Projects
    - Paladin Software V7, Block 2, Block 3
    - M1A1 Abrams
    - Mortar Fire Control System (MFCS) Heavy
    - Lightweight Handheld Mortar Ballistic Computer
  - Service/Infrastructure Projects
    - Process Engineering Group
    - Process Assurance
    - Organizational Support Environment
    - Configuration Mgmt/Library System Mgmt
  - Acquisition Projects
    - Towed Artillery Digitization (TAD) Block 1A
    - Excalibur XM982
    - CROWS
    - IMS
    - XM29 Rifle (OICW)
    - Virtual Trainers
    - MICAD
    - NSD-A(SPIDER)

The Paladin System Software Development & Maintenance Projects

- **The M109A6 Paladin Self-propelled Howitzer is the U.S. Army's most advanced artillery system.**
- **The Paladin system has advanced navigation capabilities and an on-board capability to determine accurate ballistic firing solutions for a bourgeoning array of special purpose artillery munitions. These capabilities, among others, provide for military commanders a powerful capability to emplace the Paladin system quickly and begin engaging a variety of enemy targets in a matter of seconds.**
- **Currently, the Paladin system is fielded in Iraq where it has made an outstanding contribution to efforts in Operation Iraqi Freedom.**
- **AFCS Paladin projects are system software development and maintenance projects for the Paladin Self-propelled Howitzer. Several Paladin projects are usually in progress simultaneously.**
- **Paladin's Lessons Learned will be helpful to any project seeking attainment of higher maturity levels.**

A Typical Paladin Project's Business Objective Summary

a. Improve Customer Satisfaction

a-1) Provide desired new functionality.

a-2) Maintain and support baseline versions and upgrades.

b. Improve Predictability, Consistency and Quality, of our Services and Products

b-1) Maintain an excellent* outgoing quality level.

c. Maintain and Enhance our Core Competencies

c-1) Perform in accordance with recognized quality standards.**

c-2) Improve performance through staged growth IAW CMMI®.

d. Increase Productivity & Reduce Cycle Time

d-1) Adopt statistical management for key processes (IAW the CAR Plan)

e. Improve our Competitive Advantage

e-1) Achieve progressively improved levels of CMMI® appraisal.

*** An excellent outgoing quality level is one that meets software release standards specified in the Software Test Plan.**
**** Recognized quality standards include practices outlined in the organizationally adopted CMMI® model and SWE policies and procedures.**

Organizational Objectives (a to e)
Project Objectives (a-1 to e-1)

Paladin's One Best Way

For Paladin to drive forward to CMMI® maturity level 5, we needed to formulate a process optimization roadmap.

It was concluded that the basis of this formulation must, of necessity, comprise a strategy that:

- Improves the utilization of model-based quantitative methods;
- Efficiently satisfies multiple Specific Practices (SP's) across multiple projects (when appropriate); and
- Considers behavioral aspects of operating with the people in the system.

For Paladin, it was found that the "One Best Way" of satisfying our strategic intent was an approach called Process Enrichment℠.

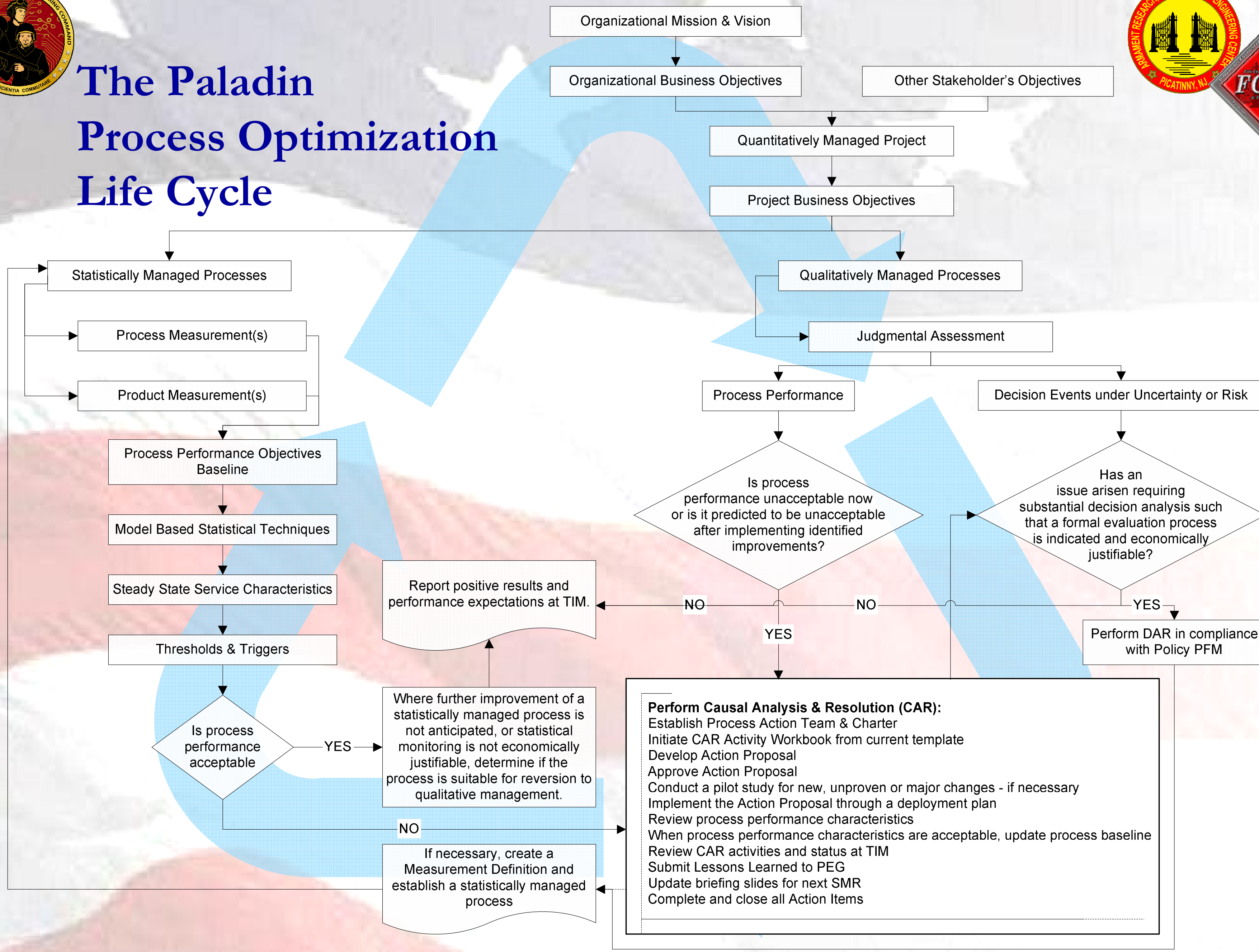
Paladin's One Best Way

Process Enrichment's
Statistical Process Enrichment℠ (SPE) Methodology*

- ☐ Design of experiment
  - Data collection
- ☐ Information generation
  - Task relationships
  - Performance measurements
  - Process Statistics (Capability)
  - Resource utilization/availability
- ☐ Formation of strategic objectives
  - Customer service objectives
  - Process Objectives
  - Economic policy
- ☐ Process Optimization
  - Service Product Specification
  - Process re-engineering
  - Work Simplification
  - Job Enrichment
- ☐ Process Assessment
  - Process Audit
  - Long-term effects of strategy
  - Customer satisfaction evaluation
  - Scheduling critical points for reassessment

** Reprinted courtesy of On QUEST*

The Paladin Process Optimization Life Cycle



Using CAR to Establish & Optimize A Statistically Managed Process

- **Each Paladin project maintains a (CAR) Plan.**

> ***"Causal analysis may also be performed on problems unrelated to defects. For example, causal analysis may be used to improve quality attributes such as cycle time." (CMMI®)***

- **Paladin's Pilot CAR Study**

"Optimize service process efficiency in processing PA Audit questionnaires"

  - **CAR 1 – *Establish A Statistically Managed Process***
    - ***Establish a CAR Activity Workbook***
      - **Serves as a container to document issues, actions and findings of CAR activities**
    - ***Develop a Measurement Definition***
      - **Describes the measurement method, data collection, and decisions supporting achievement of operational results**
  - **CAR 2 – *Optimize Process Centering***

Quantitative Methods For CMMI® Maturity Level 5

- **Some quantitative methods aren't designed for maturity level 5 process improvements.**

"In quality control in manufacturing, the answer, "No, this is not a constant-cause system," leads to a hunt for an assignable cause of variation, and an attempt to remove it, if possible. The answer, "Yes, this is a constant-cause system," leads to leaving the process alone, making no effort to hunt for causes of variation." (Grant & Leavenworth)

"Removing a <u>special cause</u> of process variation does not change the underlying subprocess. It addresses an error in the way the subprocess is being executed." (CMMI®)

"At maturity level 5, processes are concerned with addressing <u>common causes</u> of process variation and changing the process (that is, shifting the mean of the process performance) to improve process performance…" (CMMI®)

Picking Up Where Deming Left Off

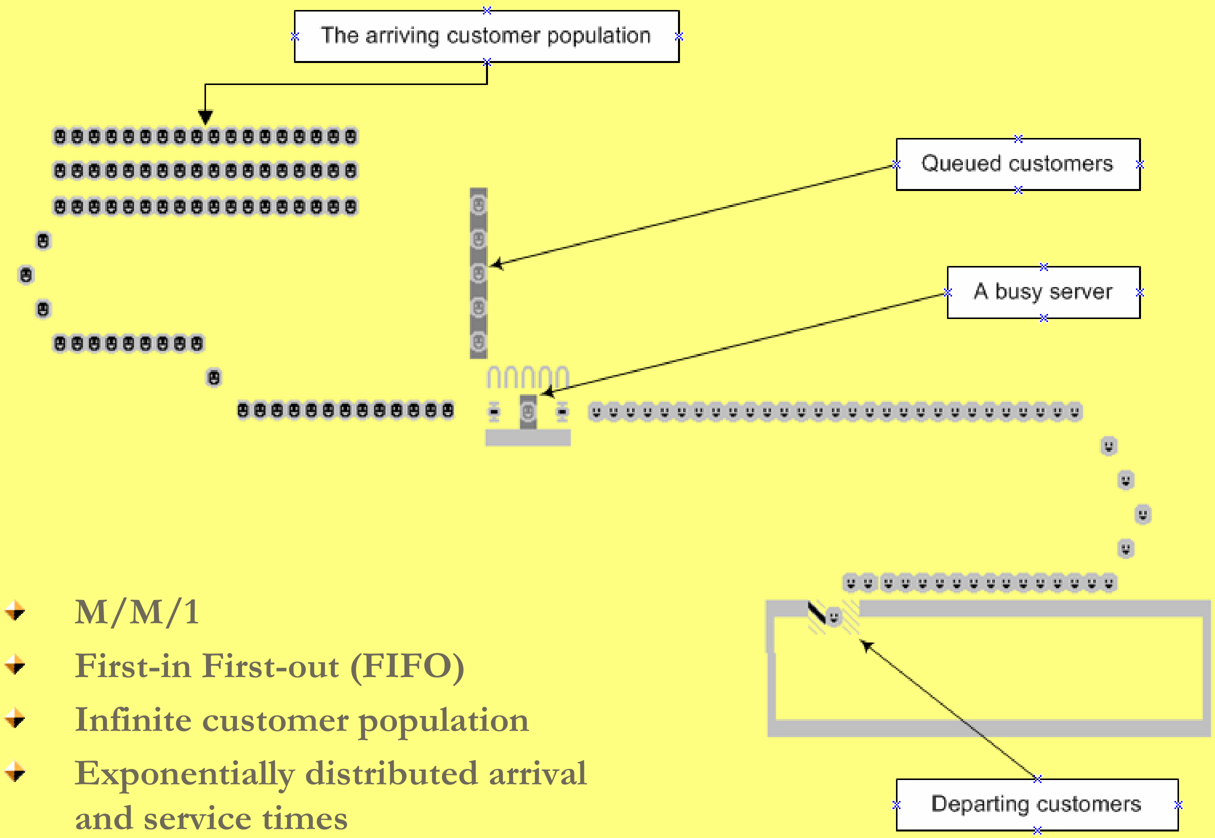
Quantitative Methods For CMMI® Maturity Level 5

"I should estimate that in my experience most troubles and most possibilities for improvement add up to proportions something like this:
94% belong to the system (responsibility of management)
6% special."

(Deming)

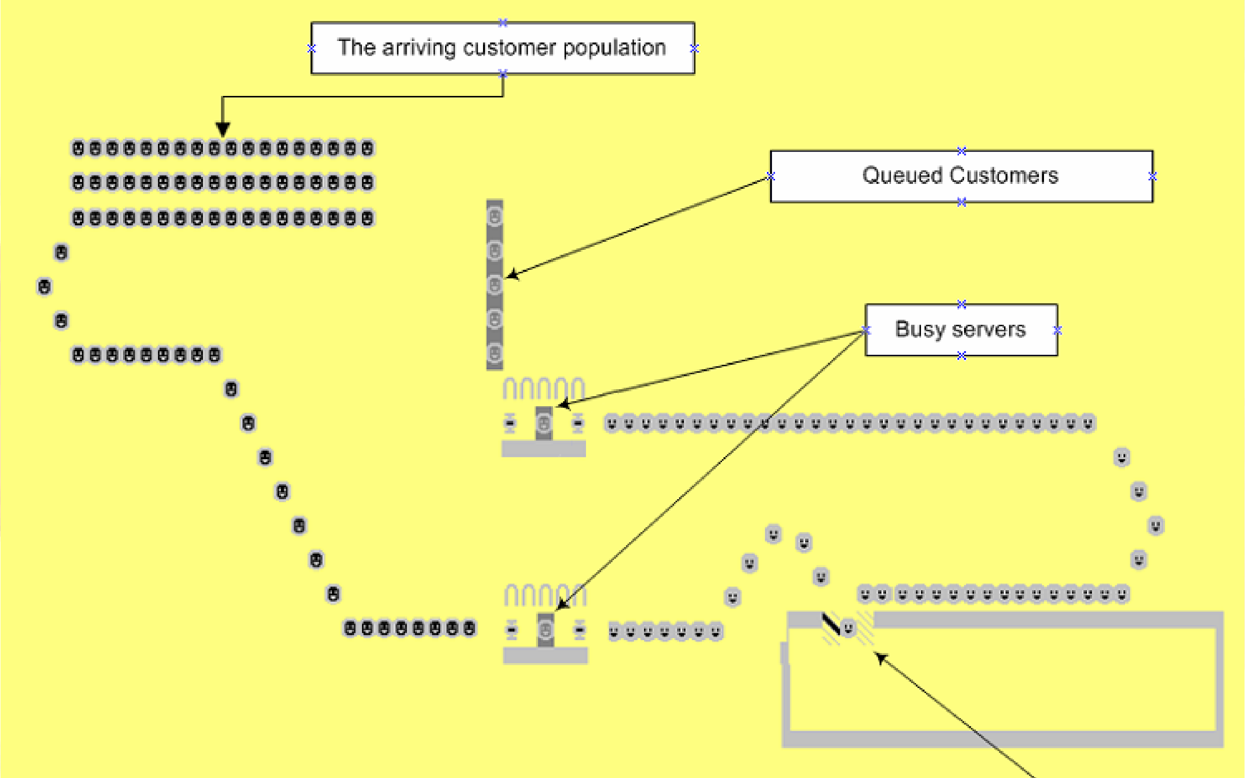
The Process Enrichment philosophy speaks of managing the architecture of a process, as it relates to its capability, in a sustained manner, to meet process objectives, as meeting the need to achieve performance that "assures the longevity of your business."

A Single-Server Single-Stage Queuing System



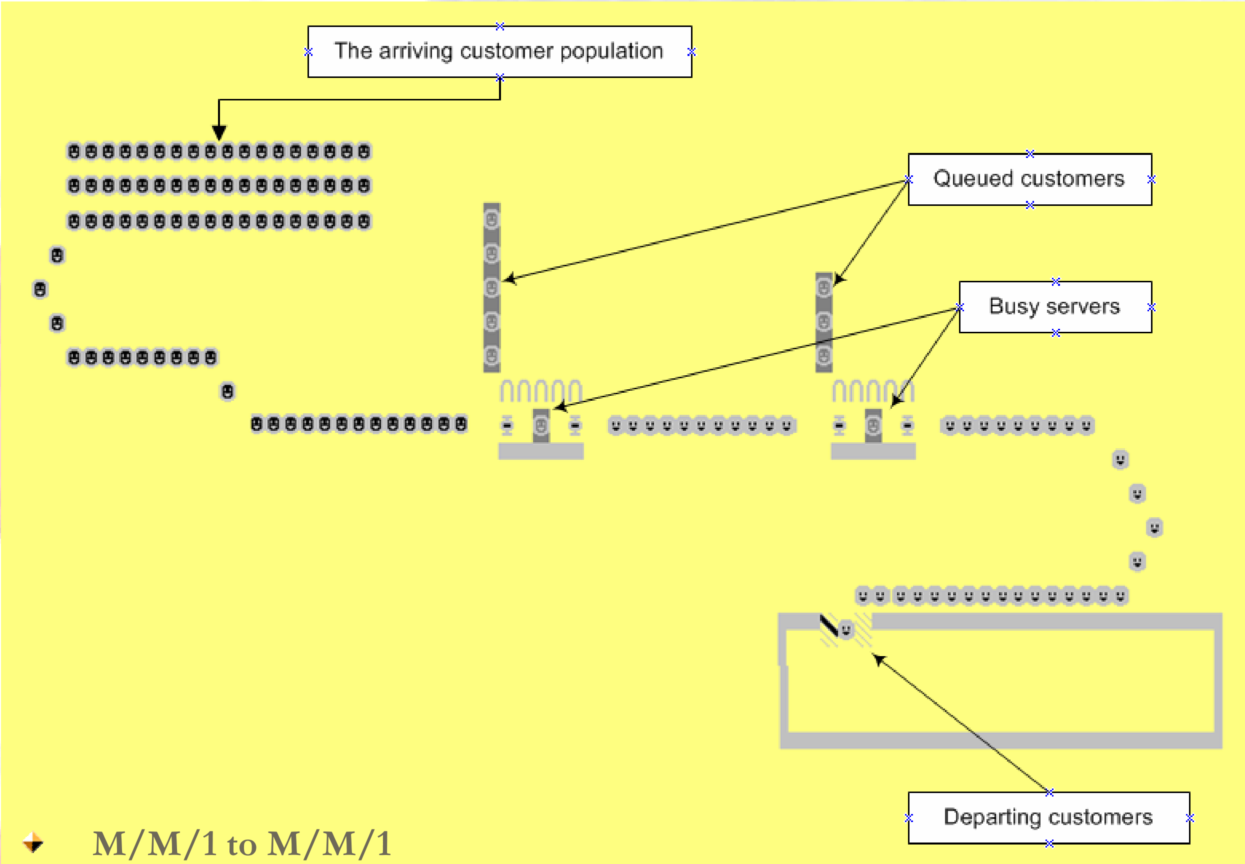
- M/M/1
- First-in First-out (FIFO)
- Infinite customer population
- Exponentially distributed arrival and service times

A Multiple-Server Single-Stage Queuing System



- M/M/2

A Single-Server Multiple-Stage Queuing System



- M/M/1 to M/M/1

Service Process Capability Measurement Paladin's One Best Way

- ***"…statistical control implies monitoring capability as well as stability." (CMMI®)***
- ***An "essential element of quantitative management is understanding the nature and extent of the variation experienced in process performance, and recognizing when the project's actual performance may not be adequate to achieve the project's quality and process-performance objectives." (CMMI®)***

As the preceding slides have shown, service processes are characterized by an interplay of multiple transactions and processes - most notably an arrival process and a service process.

Queuing analysis is a quantitative method that uses arrival rates and service rates to calculate a broad spectrum of process performance characteristics encapsulating service process capability.

As the following slides will demonstrate, this capability of queuing analysis to provide several managerially useful process performance statistics concurrently is unparalleled by any other quantitative method in our experience on Paladin.

Paladin Pilot CAR Study

"Optimize service process efficiency in processing PA Audit questionnaires"

☑ Design of experiment

☑ Information generation

Key service process characteristics:

- Service quality (cycle time)
- Economically optimal number of servers
- Economically optimal service rate
- Server utilization

Model:

- M/M/S Queuing System
- Process capability and variation is described by the steady state values of process performance parameters of the M/M/S model - driven by demand for service, λ , and the service rate, μ, of an average server.
- Threshold limits for process characteristics are established based on the assessed risk of not meeting process objectives. Operation within threshold limits towards the direction of improvement is the objective for each process characteristic.
- Common cause variation is regulated by management decisions regarding process architecture and the service product offering. Special causes of variation are prevented or mitigated by contingency plans driven by threshold values.
- Economic optimization is based on equal waiting costs and service costs

Documentation:

- A Measurement Definition was developed.
- A CAR Activity Workbook was established to record facts, figures, analysis, and conclusions.
- Technical Interchange Meeting (TIM) Read Aheads and Senior Mgmt. Reviews are used to communicate process performance

Implementation Note:

- Since the audit process affects all Paladin projects, one queuing study will provide audit artifacts satisfying Specific Practices for all Paladin projects.

Paladin Pilot CAR Study

"Optimize service process efficiency in processing PA Audit questionnaires"

☑ **Formation of strategic objectives**

Expected Process Performance Characteristics

Characteristic	Actual Value	Threshold	Units
Arrival Rate (λ)	0.023715	>= 00.04	Audits/ Workday
Inter-arrival time ($1/\lambda$)	42.166667	<= 25	Workdays
Service Rate (μ)	0.094340	<= 00.05	Audits/ Workday
Service Time ($1/\mu$)	10.5999999	>= 20.00	Workdays
Server Utilization (ρ)	0.251383 * 100 = 25	>= 35	%
Length in system (L_S)	0.335797	>= 00.60	Audits
Length in queue (L_Q)	0.084414	>= 00.12	Audits
Length in busy queue (L_B)	0.335797	>= 00.60	Audits
Wait in system (Cycle Time) (W_S)	14.159451	>= 25	Workdays /Audit
Wait in queue (W_Q)	3.559451	>= 6	Workdays /Audit
Wait in busy queue (W_B)	14.159451	>= 25	Workdays /Audit
Variance, Std-Dev., of length in system	0.449, 0.66974	>= 00.60, >= 00.90	
Variance, Std-Dev., of wait in system	200, 14.159	>= 275, >= 25	
Probability of no arrivals to system (P_0)	0.748617 * 100 = 75	<= 40	%
Probability of busy system (P_B)	0.251383 * 100 = 25	>= 45	%

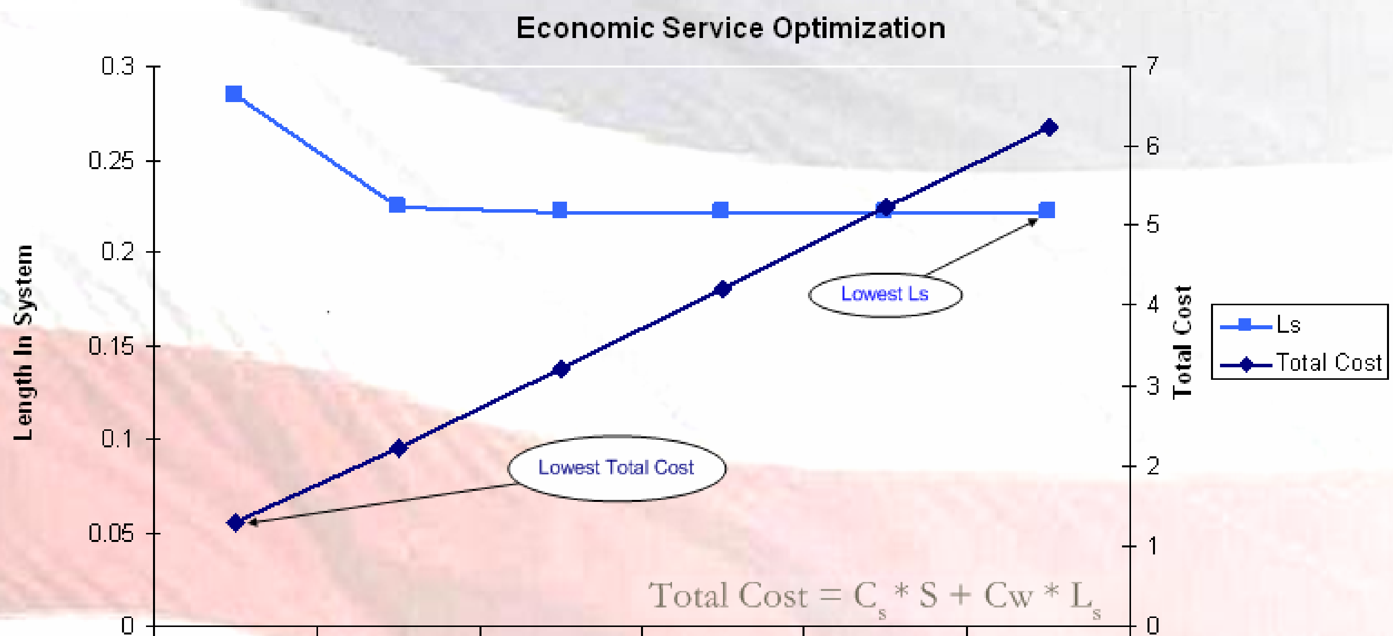
Economically Optimal Process Performance Values

Characteristic	Actual Value	Threshold	Units
Optimal number of servers	1	> 1	Servers
Optimal Service Rate	0.177712	N/A	Audits/ Workday

Analysis: Current staffing of 1 server is economically optimal. All process performance characteristics are well within threshold limits.

Paladin Pilot CAR Study

"Optimize service process efficiency in processing PA Audit questionnaires"

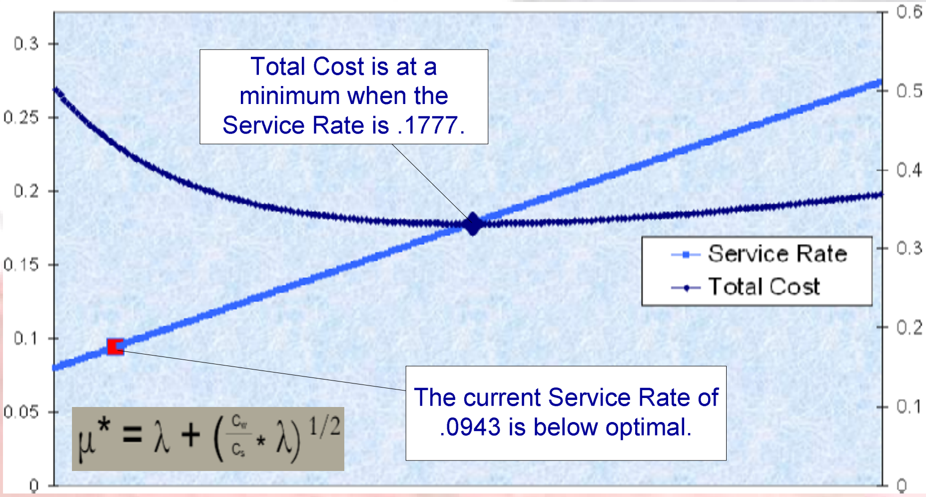


	1	2	3	4	5	6
Ls	0.284825	0.224441	0.221809	0.221689	0.221684	0.221684
Total Cost	1.2848	2.2244	3.2218	4.2217	5.2217	6.2217

Number Of Servers

Analysis: As more servers are added, Total Cost shows an almost linear growth. Length In System (Ls) declines sharply as a second server is added, but shows smaller improvements beyond two servers. The lowest, and therefore optimal, cost is achieved with one server - given the, historically derived, expected process performance characteristics. Staffing of 1 server is economically optimal.

Centering and Statistically Managing A Service Process



☑ Process Optimization

For service processes, the concept of centering involves identifying the best qualitative and quantitative position for the service process to achieve, in the steady state, in order to satisfy process goals – of which several are usually present.

The optimal number of servers cannot usually provide the optimal service rate because the optimal number of servers is an integer value. The optimal service rate is derived as shown in the figure above. This value, shows the direction of improvement for the service rate from the current value.

A quantitative process objective is set to meet this optimal service rate. If necessary, process centering requires re-engineering the process to match the optimal service rate or to satisfy qualitative process needs.

Quantitative Methods For CMMI® Maturity Level 5 Paladin's One Best Way

- **"Critical criteria for selecting statistical management measures include the following:**
  - **Controllable (e.g., can a measure's values be changed by changing how the subprocess is implemented?)**
  - **Adequate performance indicator (e.g., is the measure a good indicator of how well the subprocess is performing relative to the objectives of interest?)" (CMMI®)**
- **The goal of quantitative methods for service processes is for them to support the manageability of the service process. There is a strong correlation between the parameters monitored in a queuing study and the parameters management is interested in controlling. For example, the parameter values monitored will change in a quantifiable manner as the number of servers change, as the duration of service changes and as the demand for service changes.**
- **Assuming that a valid queuing study was performed, a rich variety of managerially-useful process performance characteristic values will have been determined. As has been seen, the model readily facilitates construction of "what if" models that indicate process performance under a variety of scenarios.**

Paladin Pilot CAR Study

"Optimize service process efficiency in processing PA Audit questionnaires"

Results and Observations:

- **Service process efficiency was economically optimized based on demand for service, economic criteria, process capability, and project needs.**
- **Sub-optimal performance can be prevented because mitigation or contingency actions are established.**
- **The queuing model provides a means to quantitatively predict the impact on performance of architectural or service level changes to the service process.**
- **Four organizational level and three project level goals are, to varying extents, satisfied by this measurement system**
- **Queuing analysis constitutes a, model-based, predictive, statistically robust, quantitative method that served well in CMMI® maturity level 5 appraisals.**
- **Process performance data used for this measurement system provides an excellent source of descriptive sampling information which, if found necessary, would provide the foundation for process simulation.**

Using Quantitative Information as a Basis for Decision Analysis and Resolution (DAR)

Dear Project Leader,

Now there are only 8 working days till the audit due date.

The service rate for this process shows a Wait in system (Cycle Time) = 14.159451 workdays.

The planned method of completing this audit, using a single server, is no longer feasible.

There are 3 alternative solutions that should be considered, based on established contingency plans defined in the Measurement Definition…:

1) **Postpone the Audit delivery by 7 days and continue with a single server (audit preparer).**
2) **Add 1 server (a total of two servers) for the following effect:**
   Wait in system . . . . Ws is calculated to be 10.770101*
   and postpone the audit by 3 days.
3) **Add 2 servers (a total of three servers) for the following effect:**
   Wait in system . . . . Ws is calculated to be 10.608624
   and postpone the audit by 3 days.
   Obviously adding additional servers beyond 2 is a fruitless proposition.
4) **Make provisions for an overtime effort.**

Please let me know your view on this at your earliest opportunity.

Regards…

(* Note that the primary message is that the audit can't be done in 8 days.
Use of steady state results to estimate the transient state results is probably a good idea.)

Artifacts Generated For One Statistically Managed Process Paladin's One Best Way

- Measurement Plan (updated only)
  - Describes the Project's measurement commitments including "Statistically Managed Processes"
- Measurement Report
  - A measurement and analysis report on monthly quantitative performance indicators
- CAR Activity Workbook
  - Serves as a container to document issues, actions and findings of CAR activities
- Measurement Definition – Processing PA Audit Questionnaires
  - Describes the measurement method, data collection, and decisions supporting achievement of operational results.
- Technical Interchange Meeting (TIM) Read Ahead
  - A functional area's report containing process performance info. discussed at bi-weekly meetings
- Senior Management Review
  - A quarterly status review meeting
- Upload CAR Activity Workbook to Measurement Repository
  - A Web based repository for sharing measurement information across projects
- RE Request For Audit.msg
  - An e-mail, presenting alternative solutions to the project leader on how to proceed in a circumstance where the proposed schedule for an audit couldn't be met – based on an established threshold.

Specific Practices Satisfied By One Statistically Managed Process Paladin's One Best Way

☑ Process Assessment

1. DAR SP 1.2 Establish Evaluation Criteria
2. DAR SP 1.3 Identify Alternative Solutions
3. DAR SP 1.4 Select Evaluation Methods
4. DAR SP 1.5 Evaluate Alternatives
5. DAR SP 1.6 Select Solutions
6. QPM SP 2.1 Select Measures and Analytic Techniques
7. QPM SP 2.2 Apply Statistical Methods to Understand Variation
8. QPM SP 2.3 Monitor Performance of the Selected Subprocesses
9. QPM SP 2.4 Record Statistical Management Data
10. CAR SP 1.1 Select Defect Data for Analysis
11. CAR SP 1.2 Analyze Causes
12. CAR SP 2.1 Implement the Action Proposals
13. CAR SP 2.2 Evaluate the Effect of Changes
14. CAR SP 2.3 Record Data

Paladin Drives Forward To CMMI® Maturity Level 5

- As Paladin's presentation demonstrates, ARDEC's AFCS is progressing from CMMI® maturity level 3 to maturity level 5.
- Paladin's One Best Way produced results that were useful and succeeded in motivating project members. Optimization is now an accepted and ongoing precept of project planning.
- Paladin's accomplishments in CMMI, and evident process improvements, were recognized and appreciated by customers.
- The Acting Director of ARDEC recognized Paladin's efforts towards CMMI® maturity level 5 as leading the way when he stated:

"Paladin proved it could be done."

Dialog

Notes

For more information about:

- ARDEC visit: http://www.pica.army.mil/PicatinnyPublic/index.asp
- Or contact Victor Elias at the:

Armament Software Engineering Center
Picatinny, New Jersey 07806
victor.elias@us.army.mil
(973) 724-2439

References:

- Capability Maturity Model® Integration (CMMI℠) for Systems Engineering, Software Engineering, and Supplier Sourcing [Picatinny] (CMMI-SE/SW/SS, V1.1 [P]), Staged Representation

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  ℠ Process Enrichment is a service mark of Victor Elias.
- Grant, Eugene L. and Richard S. Leavenworth, © 1988, Statistical Quality Control, 6th edition. New York: McGraw-Hill Book Company.

Carnegie Mellon
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The Effects of CMMI® on Program Performance

Dennis R. Goldenson

Joseph P. Elm

Sponsored by the U.S. Department of Defense

Question

Case studies have shown that CMMI-based process improvement can produce significant returns on investment

And yet, high maturity organizations can still be seen performing poorly on development programs.

WHY ?

Often Heard "Answers"

The high-maturity organizations are not applying high-maturity practices to these unsuccessful programs

Process is just one element of program success. The program failures may arise from weaknesses in the people or the technology applied to the project.

A low-maturity acquirer prevents the organization from performing at a high maturity level.

The programs are unprecedented, and the required technology is not available.

… and many more

The "Real" Answer

We don't know !

We need to collect and analyze evidence from both successful and unsuccessful programs to understand the problem

Finding the Answer 1

The OSD (AT&L) has tasked the NDIA Systems Engineering Division to research and report on the costs and benefits of Systems Engineering practices in the acquisition and / or development of military systems.

The Systems Engineering Effectiveness Committee (SEEC) is addressing this task via a survey of program and project managers across the defense industry.

- **Survey objective** - Identify correlations between the use of specific systems engineering practices and activities on projects, and quantitative measures of project / program performance.

Finding the Answer 2

This survey addresses <u>individual programs</u>

- It assesses key SE practices used on those programs
  - *The assessed practices are derived from the CMMI*
- It collects other characteristics of those programs
  - *Acquirer capabilities, technological difficulty, contractor experience, etc.*
- It collects performance metrics on those programs

Analysis of the survey data will enable us to see correlations between program performance and:

- CMMI practices (individual and ensemble)
- Other program characteristics

Survey Development Plan

1. Define the goal
2. Choose the population
3. Define the means to assess usage of SE practices
4. Define the measured benefits to be studied
5. Develop the survey instrument
6. Execute the survey
7. Analyze the results
8. Report
9. Plan future studies

Step 1:
Define the Goal

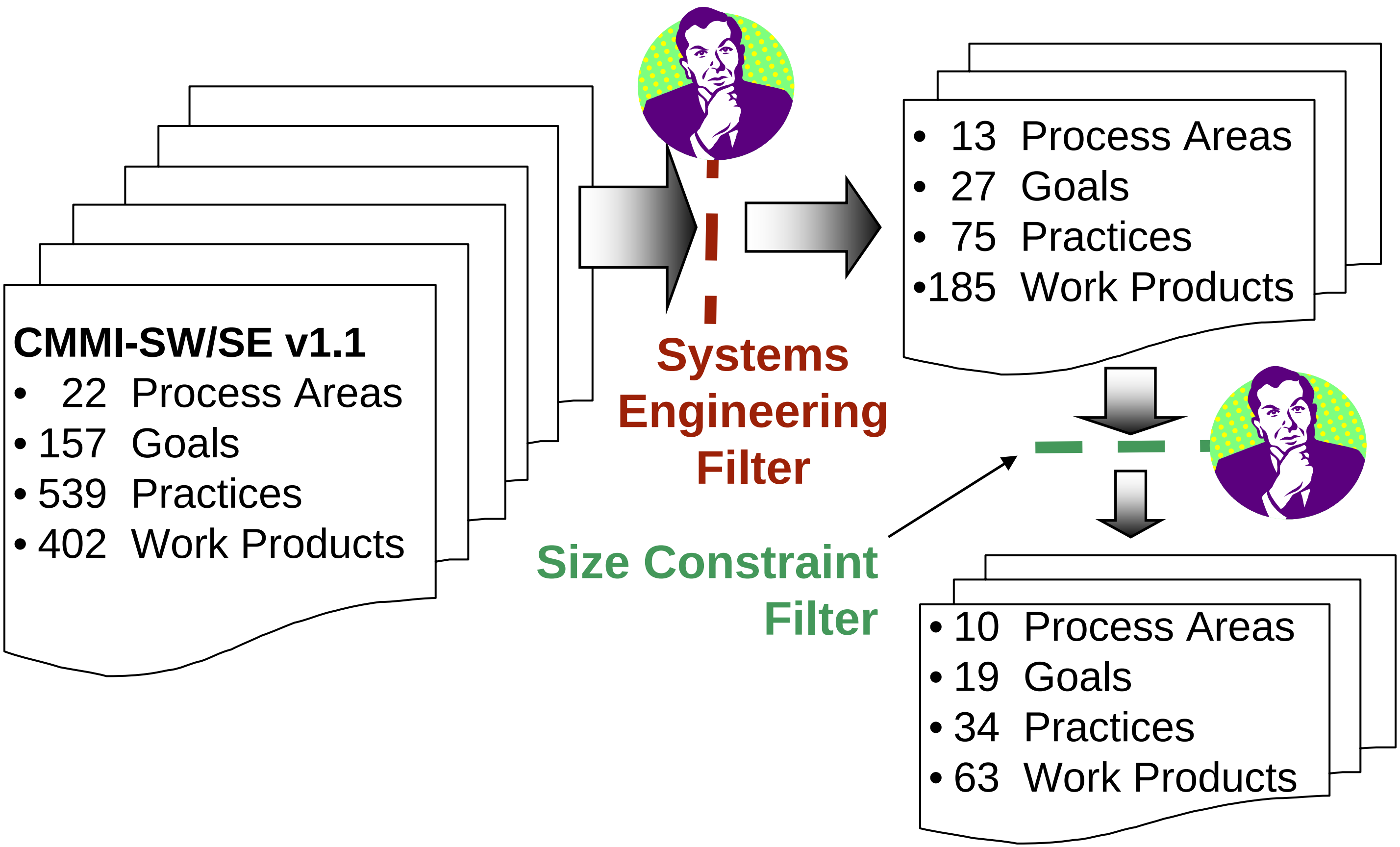
Identify correlations between SE practices and program performance

Step 2:
Choose the population

Chosen population consists of contractors and subcontractors providing products to the DoD

Step 3:

Define assessment of SE practices



Step 4:
Define performance measures

Utilize measures common to many organizations

- Earned Value
- Award Fees
- Technical Requirements Satisfaction
- Milestone Satisfaction
- Problem Reports

Step 5:

Develop the survey instrument

Self-administration

- formatted for web-based deployment

Confidentiality

- No elicitation of identifying data
- Anonymous response collection
- Responses accessible only to authorized SEI staff

Integrity

- Data used only for stated purpose
- No attempt to extract identification data

Self-checking

Section 1
Project Characterization

Section 2
Systems Engineering Evidence

Section 3
Project / Program Performance Metrics

Section 1 - Characterization

Characterization of the project / program under consideration

- **Project / program**
  - Size - Stability
  - Lifecycle phase
  - Subcontracting
  - Application domain
  - Customer / User
  - etc.
- **Organization**
  - Size
  - Organizational capability
  - Related experience
  - etc.

Section 1: Characterization

The objective of this section is to gather information to characterize the project under consideration. This information will assist the survey analysts in categorizing the project, and the executing organization to better understand your responses.

1.1 **Project** – information to characterize the specific project under discussion. Size, stability, lifecycle phase, subcontracting, and application domain are among the parameters used for program characterization.

1.1.1 What phases of the integrated product lifecycle comprise this project (check all that apply), and what phase are you presently executing (check 1)?

Included in project (check all that apply)

Current phase (check 1)

SAMPLE

❒ ❒ Concept Refinement
❒ ❒ Technology Development and Demonstration
❒ ❒ Development
❒ ❒ Manufacturing
❒ ❒ Verification
❒ ❒ Training
❒ ❒ Deployment
❒ ❒ Operation
❒ ❒ Support
❒ ❒ Disposal

1.1.2 What is the current total contract value (US$) of your project? $ ________________

1.1.3 What was the initial contract value (US$) of your project? $ ________________

1.1.4 How many contract change orders have been received? ________________

Section 2: SE Evidence

- Process definition
- Project /program planning
- Risk management
- Requirements development
- Requirements management
- Trade studies
- Interfaces
- Product structure
- Product integration
- Test and verification
- Project / program reviews
- Validation
- Configuration management

Section 2: Systems Engineering Evidence

	Rate your agreement with the following statements		Strongly Disagree	Disagree	Agree	Strongly Agree
2.1	**Process Definition**					
2.1.1	This project utilizes a documented set of systems engineering processes for the planning and execution of the project.		❒	❒	❒	❒
2.2	**Project Planning**					
2.2.1	This project has an accurate and up-to-date Work Breakdown Structure (WBS) that …	a. … includes task descriptions and work package descriptions	❒	❒	❒	❒
		b. … is based upon the product structure	❒	❒	❒	❒
		c. …is developed with the active participation of those who perform the systems engineering activities	❒	❒	❒	❒

Section 3: Performance Metrics

Earned Value

Award fees

Technical requirements satisfaction

Milestone satisfaction

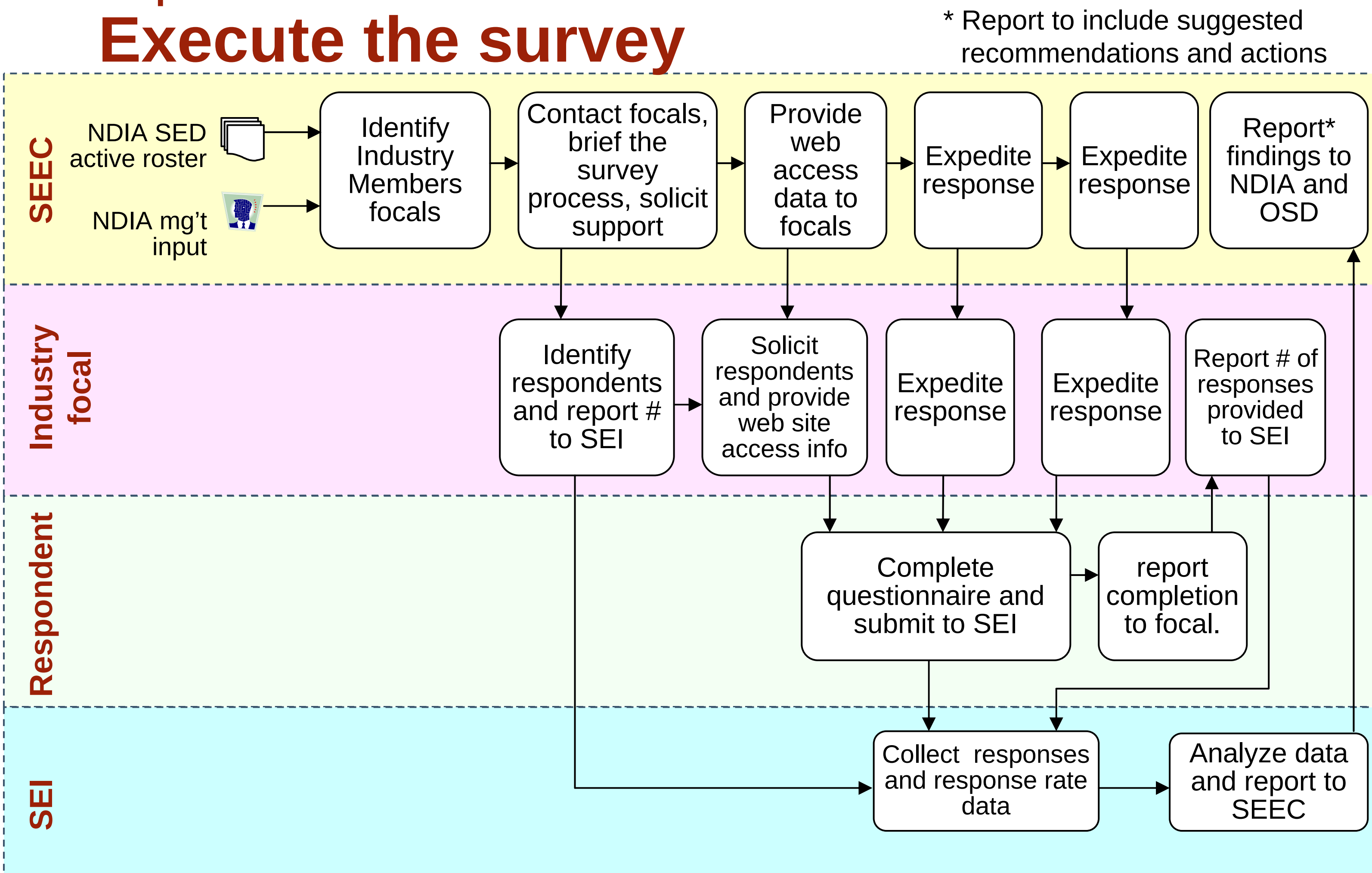
Problem reports

Section 3: Project Performance Metrics

		Strongly Disagree	Disagree	Agree	Strongly Agree
3.1	**Earned Value Management System (EVMS)**				
	Rate your agreement with the following statements				
3.1.1	Your customer requires that you supply EVMS data?	❐	❐	❐	❐
3.1.2	EVMS data is available to decision makers in a timely manner (i.e. current within 2 weeks)?	❐	❐	❐	❐
3.1.3	The requirement to track and report EVMS data is levied upon the project's suppliers.	❐	❐	❐	❐
3.1.4	Variance thresholds for CPI and SPI variance are defined, documented, and used to determine when	❐	❐	❐	❐

SAMPLE

Step 6:
Execute the survey



Step 7:
Analyze the results

Partition responses based on project characterizations

Analyze survey responses to look for correlations between the SE practices and the chosen metrics.

Step 8:
Report

Summarize survey results and analysis in a report.

Step 9:
Plan future studies

Based upon the findings from the survey, the need for additional studies may be defined.

Status

Survey instrument development complete

Web deployment complete

Pilot testing complete

Respondent identification in progress

Response collection through January

Analysis through March and April

Report in May

SE Effectiveness Committee

Dennis Ahearn	Marvin Anthony	Ben Badami
David P. Ball	Al Brown*	Al Bruns
Thomas Christian	Jack Crowley	John Colombi
Greg DiBennedetto	Jim Dietz	Brian Donahue
Terry Doran	Joseph Elm	John P. Gaddie
Donald J. Gantzer	Dennis Goldenson	Dennis E. Hecht
Ellis Hitte	James Holton	George Kailiwai
Ed Kunay	Jeff Loren	John Miller
Gordon F. Neary*	Brad Nelson*	Rick Neupert
Brooks Nolan	Michael Persson*	Bob Rassa
Rusty Rentsch	Paul Robitaille	Garry Roedler
Rex Sallade	Jay R. Schrand	Sarah Sheard
Jack Stockdale	Jason Stripinis	Mike Ucchino*
Ruth Wuenschel	Brenda Zettervall	

* co-chair

Conclusion

Questions ?

Contact information

- Joseph P. Elm jelm@sei.cmu.edu

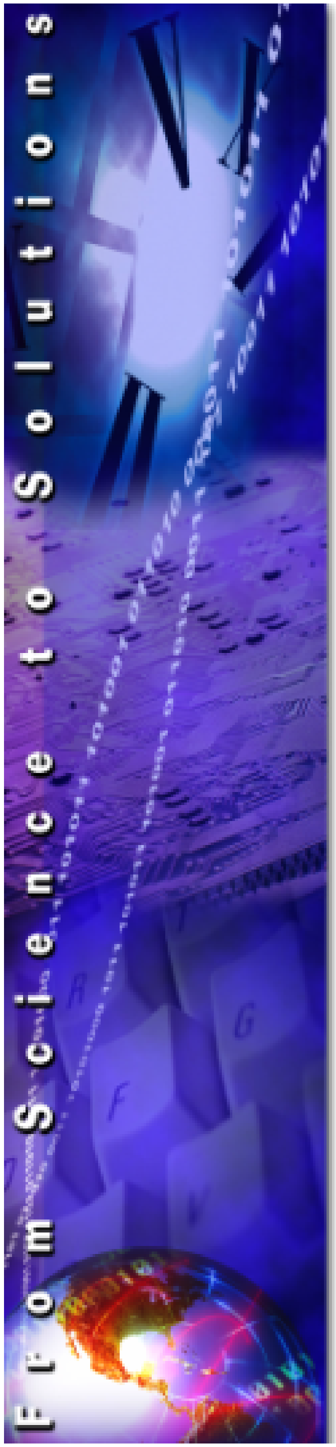
BACK UP

Target Audience

- AAI Corp.
- Alion Science & Technology
- Allied-Signal
- Anteon Corp
- AT&T
- BAE Systems
- BBN Technologies
- Boeing
- Computer Sciences Corp.
- Concurrent Technologies Corp.
- DCS Corp.
- DRS Technologies
- Foster-Miller Inc.
- GE
- General Dynamics
- Gestalt, LLC
- Harris Corp.
- Honeywell
- Hughes Space & Communications
- Impact Technologies LLC
- ITT Industries
- Jacobs Sverdrup
- L-3 Communications
- Lockheed Martin
- Motorola
- Northrop Grumman
- Orbital Sciences Corp.
- Raytheon
- Rockwell Collins
- SAIC
- Scientific Solutions, Inc.
- SI International
- Simulation Strategies Inc.
- Southwest Research Institute
- SRA International
- Support Systems Associates Inc.
- Systems & Electronics, Inc.
- TERADYNE, Inc.
- Titan Systems Co. (AverStar Group)
- Trident Systems, Inc.
- TRW Inc.
- United Defense LP
- United Technologies
- Virtual Technology Corp.
- Vitech Corp.

Selection criteria:
- Active in NDIA SED
- Contractors delivering products to the government

*Need Point-of-Contact (**Focal**) from each company to expedite survey deployment.*



17 November 2005

Business Improvements
Achieving CMMI® Level 5 at SAIC

Who Keeps Moving My Process?

Presented by:

Sharon Cobb Flanagan
Vice President for Quality Assurance

Frank A. Perry, Ph.D.
Senior Vice President
Chief Engineer

System and Network Solutions Group (SNSG)
Science Applications International Corporation (SAIC)

About SAIC

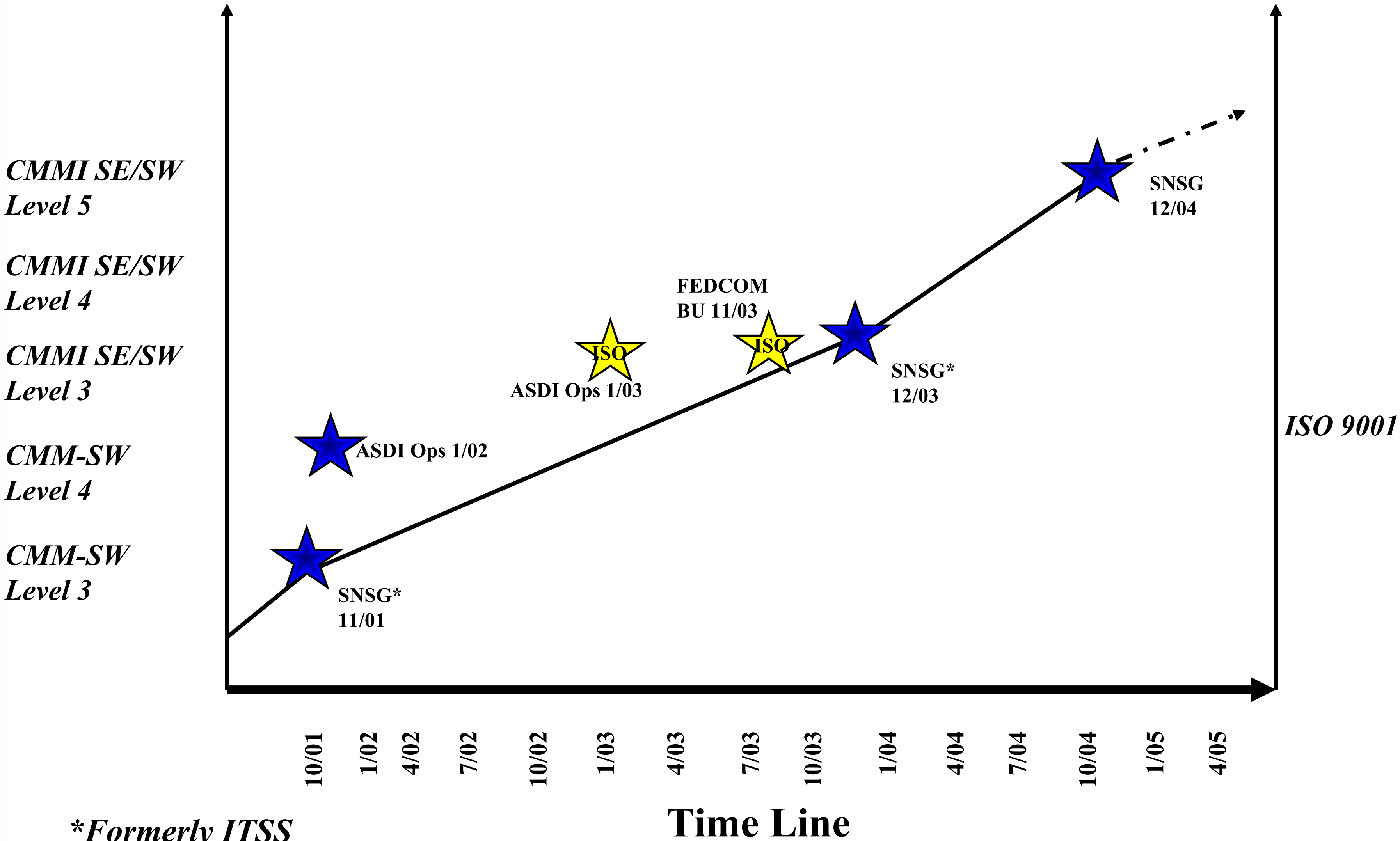
- Science Applications International Corporation (SAIC)
- $7.2 Billion in Revenue
- 42,000+ Employees (Offices in >150 Cities Worldwide)
- Largest Employee-Owned Research & Engineering Company
- Business Areas
  - Criminal Justice
  - Energy – Oil & Gas & Utilities
  - Environment
  - Homeland Security
  - Healthcare
  - National Security
  - Space
  - Telecommunications
  - Logistics

From Science to Solutions

SAIC and Process Improvement

- **SEI CMMI® Partner Program Member**
  - 5 Engineers authorized to teach the SEI Course
  - 8 Engineers authorized to provide SCAMPI(SM) appraisal services
- **Long History of Internal Process Improvement**
  - Organizations at CMMI® Higher Maturity Levels at more than 10 locations
  - Organizations at Software CMM® Higher Maturity Levels at more than 20 locations, including the U.K.
  - More than 20 organizations registered ISO 9001:2000

SNSG Process Improvement Journey: CMMI® and ISO 9001:2000



*Formerly ITSS

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The "Field"

◆ Risks

- Balancing agility, robustness, inflexibility, discipline
- Preventing "process for process sake"
- Complacency in process
- Benefiting one versus many (balancing benefits throughout the organization)

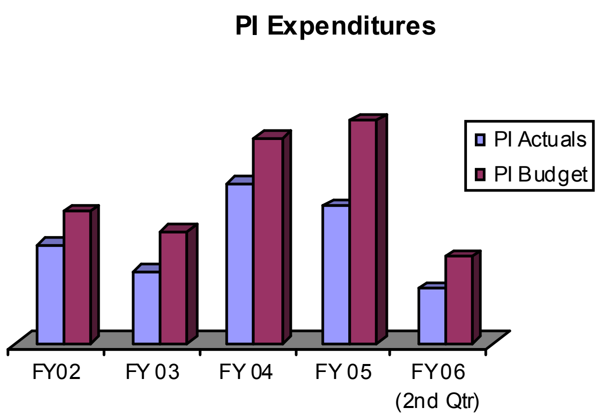
◆ Constraints

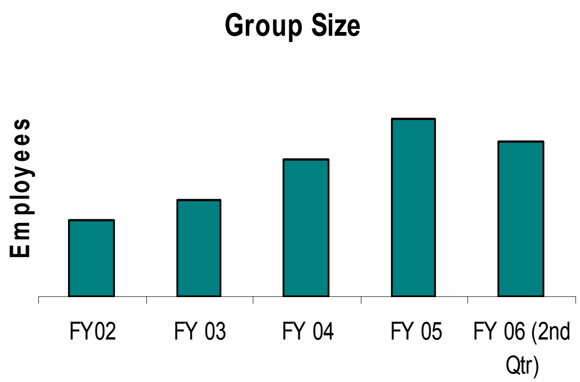
- Cost
- Resources
- Career path
- Size
- Geographically dispersed (multiple locations)
- Diverse business base
- Broad customer base
- Shifts in "team" composition

From Science to Solutions

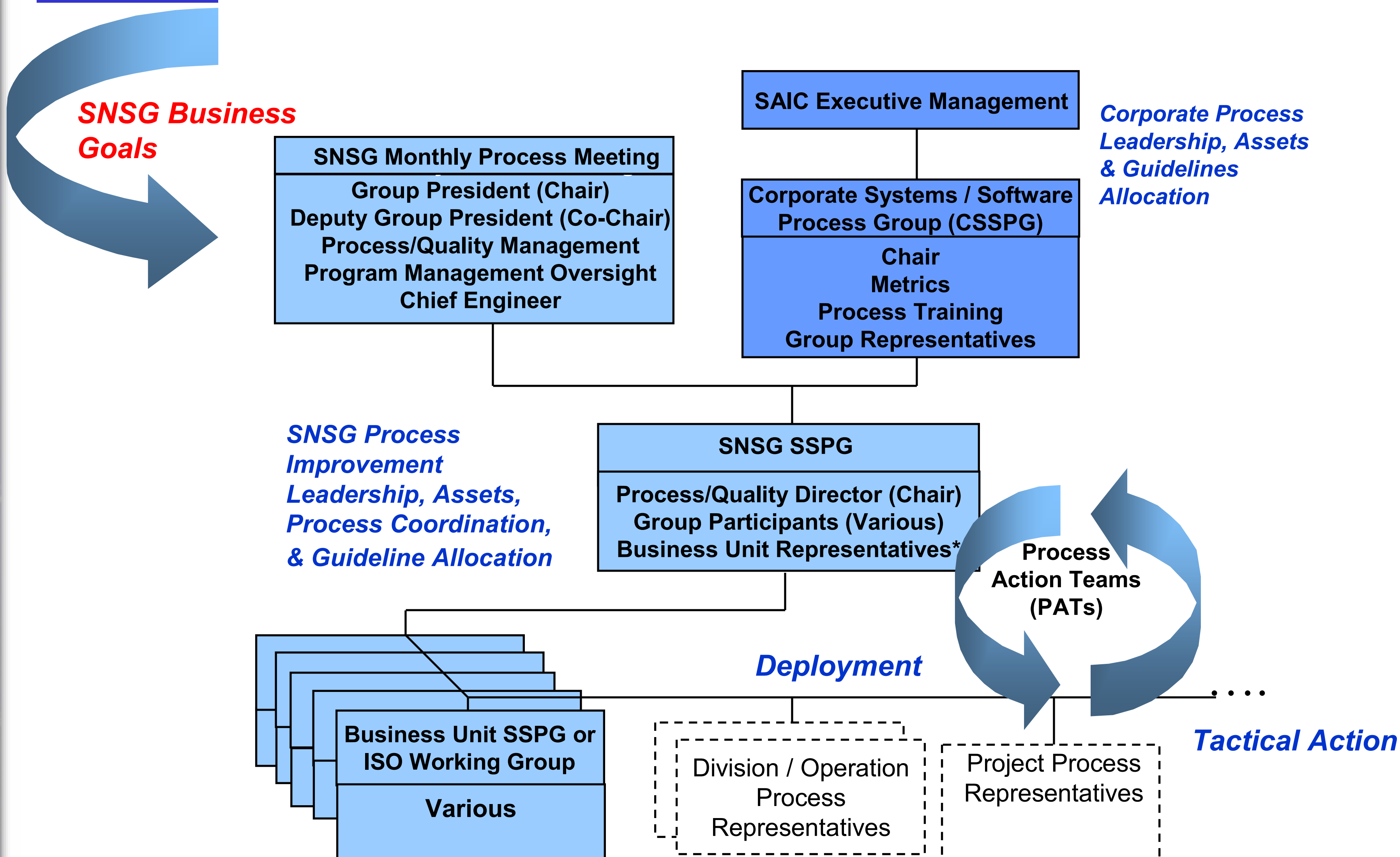
The "Plows"

- **Mechanisms**
  - Monthly Executive Process Reviews (group president, deputy, staff)
  - Monthly SNSG Process Group meetings and metrics meetings
  - Measurement program/reviews; Training program/reviews
  - Web-based tools and repositories; simple Microsoft® Office-based tools
  - Process and tool to manage innovative suggestions
  - Process action teams, Causal analysis teams
  - Change control process
  - Six Sigma®
  - Horizontal and vertical participation





"Growing the Crop"



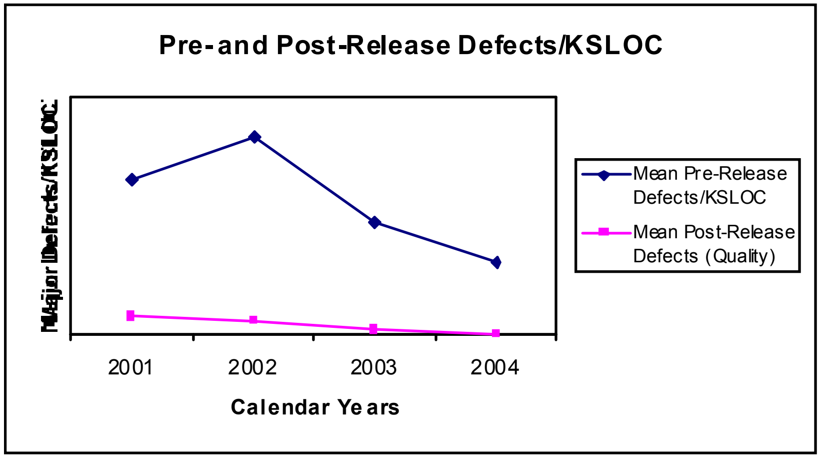
From Science to Solutions

The "Harvest"

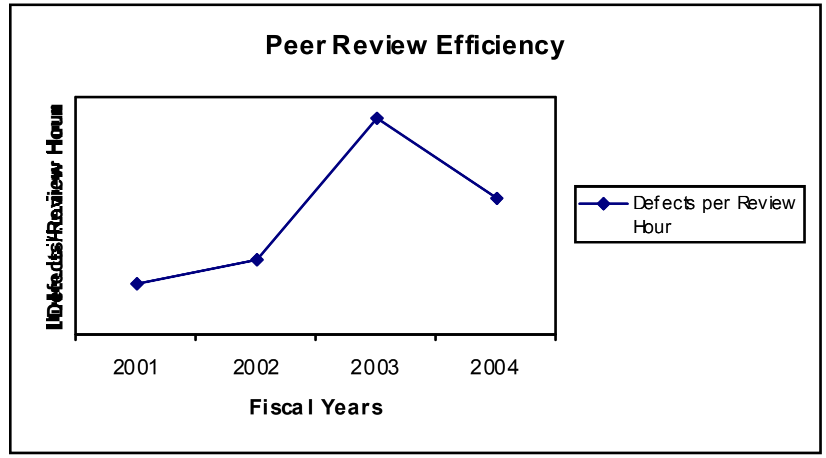
- Noticeable 54% drop in pre-release defects
- Steady increase in overall customer satisfaction
- Peer reviews are approximately 84% more efficient since 2002, even though there are fewer defects to find
  - Reviews are finding defects earlier in the process (costing less) when there are less defects to be found (improved product quality)
  - Reduction in training costs; increase in employee training
- Improved effectiveness of Bid and Proposal process
- On-demand knowledge-sharing (lessons learned process)
- Improved project performance
- Increased business opportunities
- Reduction of 39% in process improvement costs while steadily increasing training, maturity of process assets, and skill sets
- Improvements accomplished while exceeding financial goals

From Science to Solutions

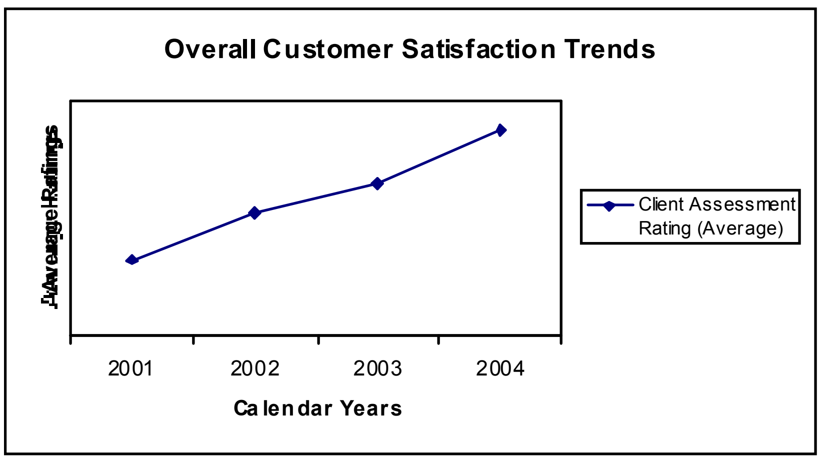
Some Trends Experienced Along the Way



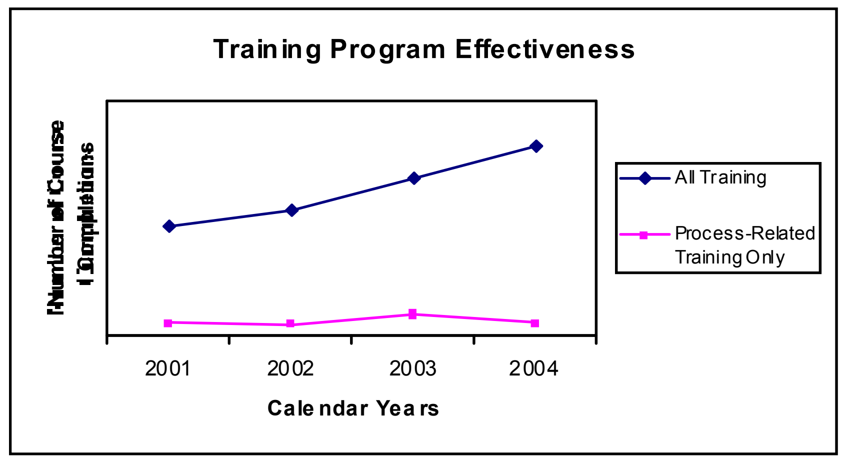
General trend of decreasing defects and increasing product quality over 4 years.



Increase in peer review efficiency despite the fact that there are fewer product defects to find.



Customer satisfaction ratings have steadily increased.



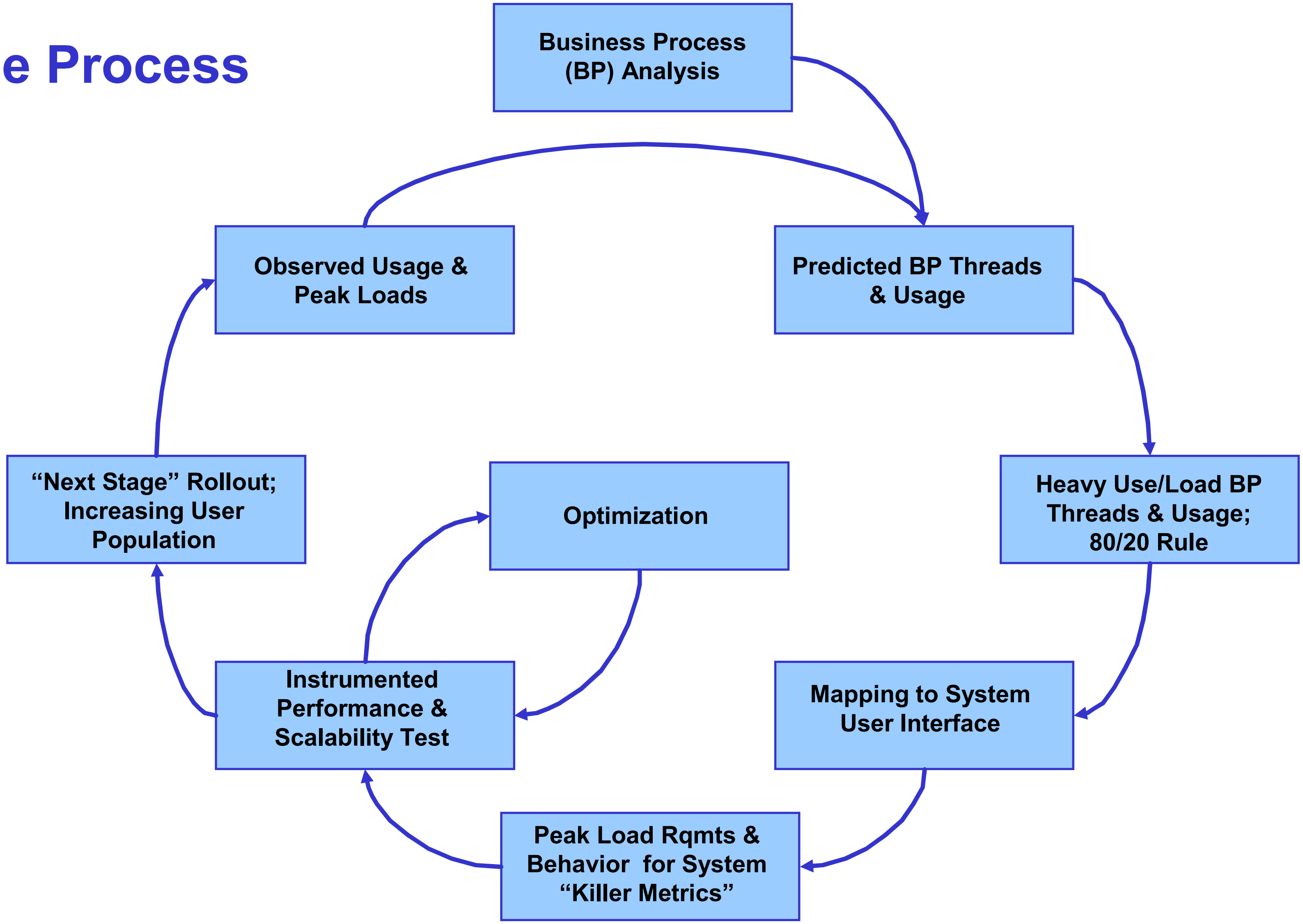
Overall training accomplishments increase while maintaining focus on revenue, PBT, and process improvement investments.

The "Harvest" – a PAT Example

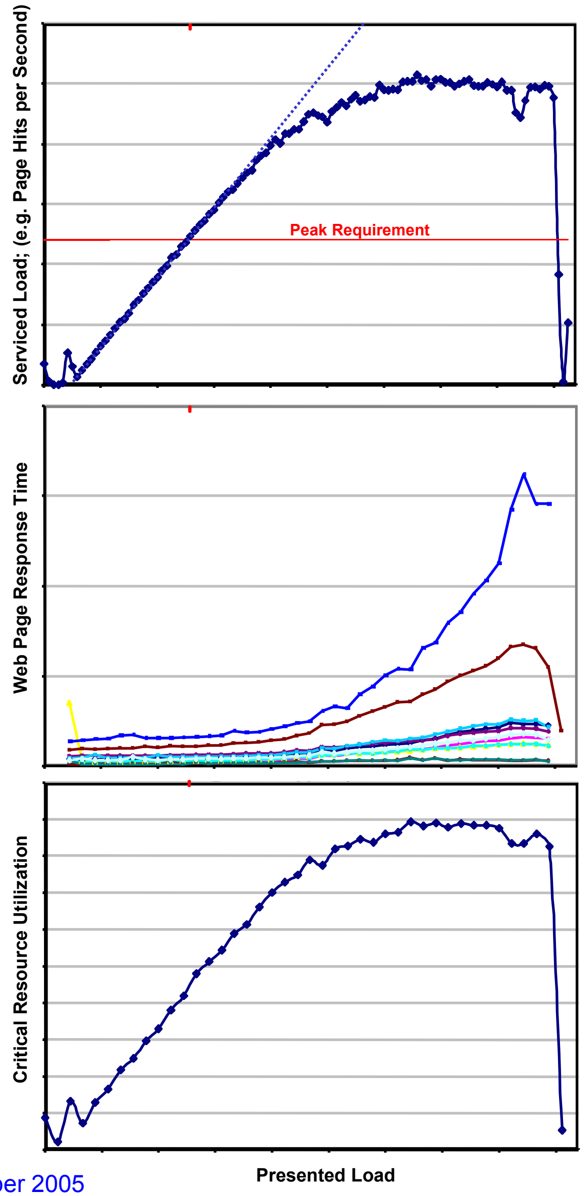
- **Focus On Complex Problems That Must Be Solved Repeatedly**
  - Active program to foster organizational learning
  - Use a PAT as a tool to foster continuous improvement by capturing new best practices
- **Example: Performance & Scalability Testing & Optimization for Large-scale Web-based Systems**
  - Driven by business processes, not technology ⇒ meaningful to business people
  - Rigorous instrumented test and in production representative environments, producing technical metrics that provide real insight into system behavior ⇒ meaningful to engineers and technologists

The "Harvest" – a PAT Example

- The Process



The "Harvest" – a PAT Example

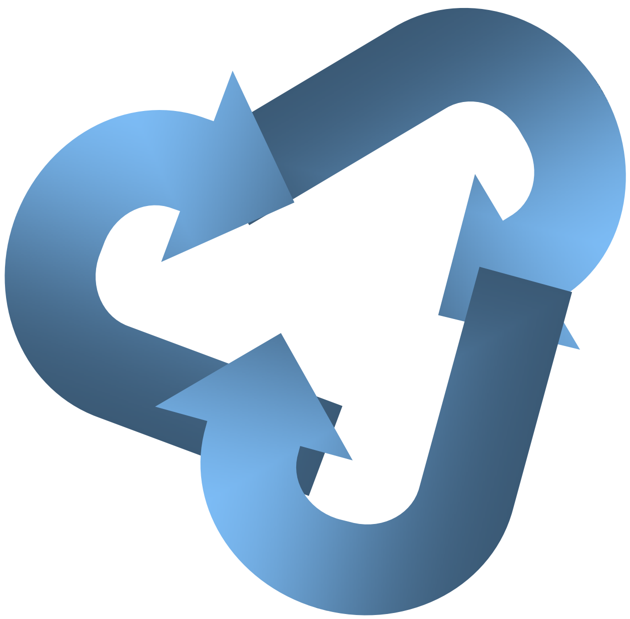


- **General Result: Process Assets Evolved By PATs Over Multiple Projects**
  - Continuous Improvement
- **Specific Result: Repeatable Process to Achieve Scalability, Performance, & Robust System Behavior**
  - Meaningful to Business Users
  - Meaningful to Engineers
  - Achieved Without Reinventing the Wheel on Each Project ⇒ Organizational Learning

Who Keeps Moving My Process?

- Reorganizations
- Mergers and Acquisitions
- Competing resources
- “Immediate needs” versus “time to pilot and deploy”

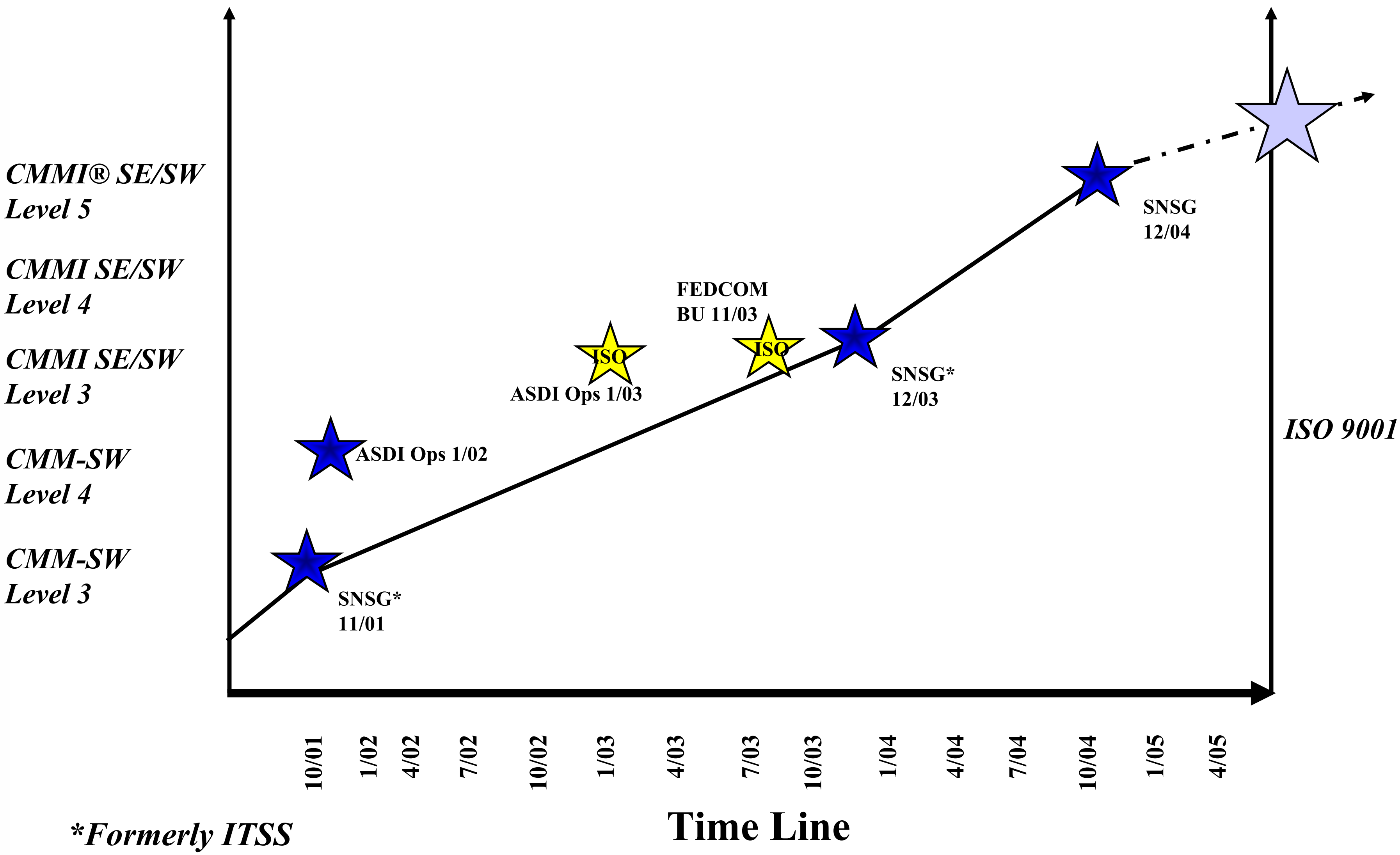
Continuous Adaptation to Change



Working with Change

- **In Place:**
  - Transitioning process
  - Improving process improvement
  - Streamlining processes
  - Integrating processes
  - Web-enabled learning management system
  - Empowerment with accountability (and quality reviews/audits)
  - “On-demand” process training
  - Proposal readiness review process
  - Process performance modeling tool
  - Web-enabled lessons learned database and process
  - Scalable process for large systems development environment
- **In Work:**
  - Document management collaborative review tool
  - Project review improvements/streamlining

SNSG Process Improvement: Looking Ahead



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Techniques for Shortening the Time and Cost of CMMI® Appraisals

Date: 17 November 2005

Presented By: Sam Fogle

Additional Authors: Gene Jorgensen, Sean Cassell

Topics

- Appraisal cost problem, and related cost drivers
- Review of SCAMPI concepts to control appraisal cost
- Proposed appraisal cost and time-saving techniques
- Case Study
- Summary

CMMI Appraisals Problem

- CMMI ® is significantly larger than its legacy source models

	SW-CMM	CMMI SE/SW v1.1 Staged
Model Size Maturity Level 3	Key Process Areas = 13 Goals: 37 Practices: Key = 229	Process Areas = 18 Goals: Specific (40) + Generic (36) = 76 Practices: Specific (136) + Generic (216) = 352
Data Items (for 4 projects)	1,574 items (Factors = 2 data sources)	2,486 items minimum (Factors = 1 direct and 1 indirect evidence minimum)

CMMI Appraisals Problem (cont.)

- Conducting CMMI appraisals is challenging
  - Minimizing use of resources
  - Minimizing the impact on appraisal teams and appraised organization
  - Maintaining a high degree of accuracy for benchmarking
  - Ensuring that all involved have the needed level of understanding of how data will be evaluated

Addressing the Appraisal Cost Concern

- Pilots by Software Engineering Institute sized the time bounds
- Investigated appraisal method changes to meet a target of 100 hrs. or less appraisal on-site time (Maturity Level 3)
- Resulted in SCAMPI^{SM} V1.1 key concepts
  - Verification vs. discovery
  - Focused investigation
  - More rating rules

Key SCAMPI 1.1 Method Concepts

Verification  vs. Discovery 

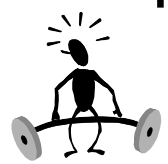
- Organization submits evidence vs. appraisal team asks
- Shifts evidence gathering burden to the organization
- Uses Practice Implementation Indicators (PIIs) (consequences of implementing the practice)
  - Direct artifact – result of doing the practice
  - Indirect artifacts or affirmations – substantiating indicators of doing the practice (corroboration evidence)
- Less observations

Key SCAMPI 1.1 Method Concepts (cont.)

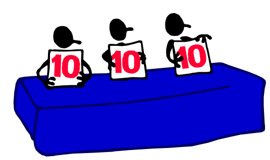
- Focused investigation

  - Continually consolidate data until practices sufficiently covered
  - Promotes more focused interviews

- Data collection, rating, and reporting
  - Weakness focus
  - No gratuitous strengths



  - Mini-teams for related process areas (PAs)
  - Rating rules direct appraisal team judgments where most needed



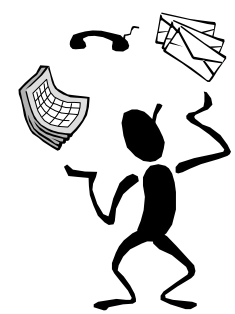
What Appraisal Experiences Tell Us

- PIID identification and collection cost is high
  - Two types of expertise is required
    - What to include – process group knowledge (map processes to model, identify artifact types)
    - Where to find it – project knowledge (which particular project artifact is appropriate)
  - Examples
    - Project effort
      - One project, 16 PAs – 600+ hours
      - Three projects, 20 PAs – 1,600+ hours
    - Almost equal amounts of process group effort

What Appraisal Experiences Tell Us (cont.)

- Appraisal team experience/training is key
  - Introduction to CMMI training
  - SCAMPI appraisal team training
    - SEI materials
    - Training on interpreting controversial and Generic Practices (GPs)

  - Process knowledge experience
    - How site processes relate to one another (integrated)
    - How site processes map easily to CMMI objectives
    - Acknowledgement vs. discovery of Alternative Processes



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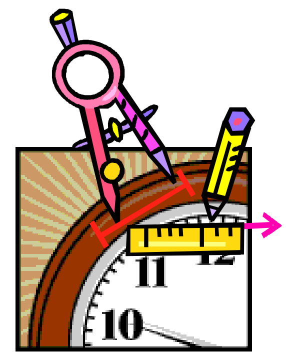
What Appraisal Experiences Tell Us (cont.)

- Too much corroborating evidence
  - High goals are set for indirect artifacts for all practice instantiations
  - SCAMPI requires face-to-face affirmations for a significant % of practices

- Wide range of appraisal times estimated or proposed for appraisals of similar scope
  - Variations due to
    - Risk (Discovery vs. Verification)
    - Knowledge of Customer processes
    - Low-Ball Estimates to ‘Buy Appraisal Business’



Fixed vs. Variable Costs

- Costs are driven by appraisal scope
  - Appraised organization size (number of representative projects)
  - Number of PAs
- Fixed costs
  - Planning, reporting, travel
- Variable
  - Appraisal team training
  - Filling in the PII database (PIIDB)
  - Appraisal team and participants' time
  - Verification vs. discovery (information needs)

Cost of Appraisal

Appraisal Cost = Cost of Planning + Preparation + Execution + Reporting

- Cost of Planning (Fixed)
- Cost of Preparation (Variable)
  - Cost of filling in PIIDB (researching Objective Evidence and entering data)
  - Cost of appraisal team training (CMMI and method)
  - Cost of PIIDB quality reviews
- Cost of Execution (Variable)
  - Cost of team members' and participants' time
- Cost of Reporting (Fixed)

Reducing time = Reducing cost

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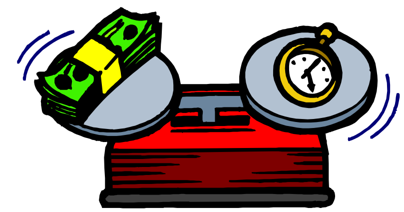
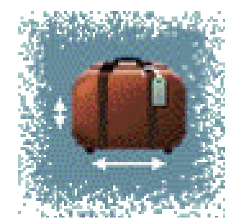
BUILDING BETTER SOLUTIONS TOGETHER

Looking at Possibilities to Reduce Appraisal Costs?

- Investigating the techniques aimed at
  - Reduced preparation cost ⬇
  - Reduced on-site appraisal cost ⬇
  - Tradeoffs between preparation cost and on-site appraisal cost ⬇⬆



- Techniques must stay within the SCAMPI method parameters and limits and not increase appraisal risk



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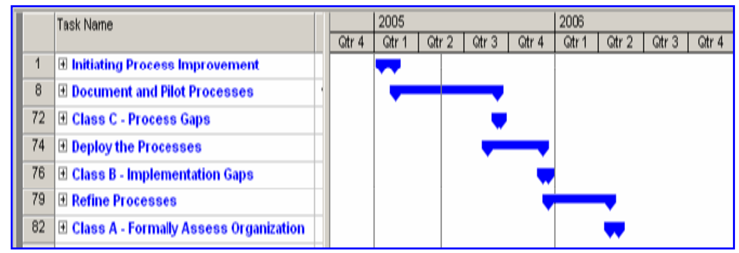
BUILDING BETTER SOLUTIONS TOGETHER

Optimize PI Appraisal Strategy for Cost

- Techniques
  - Use of all appraisals classes defined in the Appraisal Requirements for CMMI
    - Class C – get process right
    - Class B – get implementation right
    - Class A - benchmarking



  - Leverage same projects in multiple appraisal events
  - Use ongoing self assessments

- Cost
  - Preparation: – through reuse and learning
    - Project PIIDB cost
  - Onsite: - less discovery time due to higher PIIDB quality

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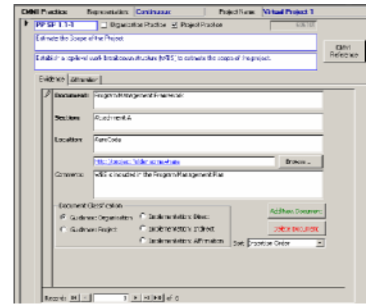
BUILDING BETTER SOLUTIONS TOGETHER

PIID Development – Starting point

- Techniques
  - Process group builds pre-populated PIIDBs based on organization's standard process
    - Projects identify artifact location
    - Projects add project-tailored process artifact information
  - Organizational Process Asset Library or repository directly supports PIIDB evidence collection
  - Projects reuse and modify other projects PIIDBs



- Cost
  - Preparation: Minimized PIIDB cost
    - Less time to identify the standard artifacts types
    - Project PIIDB cost reduced through reuse

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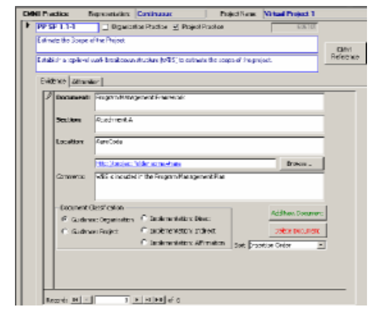
PIID Development - Expertise

- Techniques
  - Coaches knowledgeable in CMMI and SCAMPI work with project personnel to complete PIIDBs
  - Periodic reviews conducted with Lead Appraiser to validate PIIDBs (i.e. valid interpretation of method and model)



- Cost
  - ⬇ Preparation: Minimized PIIDB cost
    - ⬆ Cost of PIIDB reviews
    - ⬇ Improved efficiency by reducing thrashing in identification of appropriate data
    - ⬇ Reduced risk through improved PIIDB quality
    - ⬇ Reduced rework

Appraisal Team Preparation Cost

- Techniques
  - Establish pool of trained candidate appraisal team members
  - Use same appraisal team members in organization's Class C, B, and A appraisals
  - Train appraisal team on interpretation of GPs and controversial practices for consistency

- Cost
  - ⬇ Preparation: Appraisal Team
    - ⬇ Requisite training (e.g. Intro to CMMI and Appraisal Team Training) averaged over ***<u>'n'</u>*** appraisals
    - ⬆ Upfront training on interpretations
  - ⬇ Onsite: Appraisal team objective evidence review and consensus time reduced

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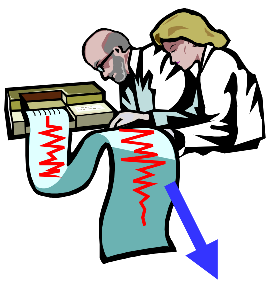
Cost of On-Site Appraisal Team and Participants

- Techniques
  – Expand scope of Readiness Review/Team Training to include extensive review of evidence for content and characterization and identify additional evidence needed.
    - Do advanced readiness checks
    - Train with live data
    - Work through entire appraisal life-cycle



- Cost
  - ⬆ Preparation: Cost of readiness checks
  - ⬇ Onsite:
    - ⬇ On-site schedule accelerated – time reduced

Validate Preliminary Findings Cost

- Techniques
  – More focused to key participants (i.e. project and functional leads)
    - Parameters and Limits: 1 representative from project and any associated staff function
  – Run concurrent preliminary findings feedback sessions

- Cost
  ⬇ Onsite: appraisal team and organization participants' time reduced

Corroborating Evidence Cost

- Techniques
  - Reduce requirements for identification and review of indirect evidence
    - Rely on affirmations for GPs, indirect artifacts for most specific practices
    - Expand project and organizational in-briefs to cover GPs

- Cost
  - ⬇ Preparation: PIID cost reduced
  - ⬆ Preparation: More build time for project and organizational presentations
  - ⬇ Onsite: Appraisal team time reviewing indirect artifacts reduced
  - ⬆ Onsite: Appraisal team and participants' cost for interviews and project presentations may be slightly increased

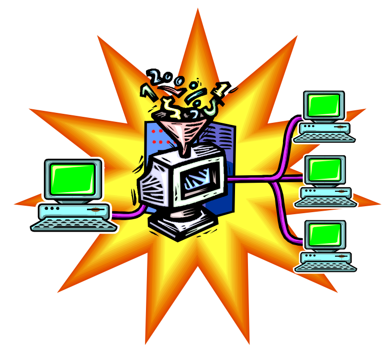
Face-to-Face Affirmation Cost

- Techniques
  - Conduct focused on-call follow-up interviews by mini-teams

- Cost
  - On-site: appraisal team and organization interview participation time reduced

Appraisal Tools

- Techniques
  - For large amounts of objective evidence an integrated online appraisal tool set is paramount to
    - Collecting and documenting objective evidence
    - Checking for sufficiency and updating data collection plans
    - Automating characterizations and ratings
    - Generating preliminary findings and final findings presentations



- Cost
  - ⬇ Preparation:
    - ⬇ PIIDB preparation cost is reduced
    - ⬇ Readiness Review cost is reduced
  - ⬇ On-site: appraisal team time is reduced

Caution on Appraisal Cost Reduction

- The SCAMPI method strove for a balance of evidence types
- In the extreme, cost reduction techniques could be applied so extensively as to cause an unbalance, and appraisal results may be criticized as:
  - Not truly objective
  - Not repeatable
  - Missing critical process failures and inconsistencies because of "speed" or lack of depth

- Recommendation:
  - In evaluating cost reduction techniques ensure that you also address objectivity, repeatability, and quality concerns

Case Study

Most of the techniques described here were piloted with one of the Consortium's member companies.

– Organization: General Dynamics Canada (GDC) – Calgary
– Organizational Coordinator: George Gundesen
– Lead Appraiser: Laura Caldwell, Systems and Software Consortium (SSCI)
– Consultant: Sam Fogle, SSCI
– Engagement Duration: Planning began January 2004, SCAMPI Class A completed July 2005

Case Study (continued)

Techniques piloted:

- A series of three appraisals was planned: a Class C in March 2004, a Class B in November 2004, and a Class A in July 2005.
- A philosophy was adopted to try to reuse as many members of the appraisal team as possible. From the B to the A only one team member changed.
- Members of the Process Group worked with the projects to help complete the PIIDBs, and the Lead Appraiser was periodically brought in to review the PIIDB development and answer questions on interpretation.

Case Study (continued)

More techniques piloted:

- A set of automated tools developed by SSCI was used for both PIIDB development and appraisal conduct.

- The Readiness Review/Team Training was done on live data. The quality of the PIIDBs allowed a large portion of document review to be completed during the time reserved for this effort, thereby shortening the onsite period.

Case Study (continued)

More techniques piloted:

- The project and organizational overviews were conducted using templates that elicited affirmations on how generic practices were addressed across all PAs. This eliminated the need to review indirect evidence for GPs. These sessions were interactive, serving as both overviews and interviews.

- All additional Face-to-Face affirmations were obtained in small sessions with only the applicable Appraisal Team Members (those that had questions for that interviewee - minimum of two).

- Preliminary Findings sessions were planned for two parallel tracks with one member of each mini-team in each.

Case Study (continued)

Case study results:

- The advanced PIIDB checks were very productive and resulted in greatly increased PIIDB quality.

- The Readiness Review/Team Training was conducted over 5 days with no late nights. In addition to completing the training and reviewing the required practices, all of the SPs were characterized and direct artifacts were reviewed for GPs. Also the Organizational Training PA was completed through goal rating.

- The onsite period was shortened to 5 days and some of those ended up being very short days.

Summary

- Reviewed potential cost and time-saving techniques by CMMI appraisal preparation and on-site phases
- Discussed case study of application of techniques
- We welcome additional feedback on your experience and recommendations to the SSCI staff
  - Sam Fogle, fogle@systemsandsoftware.org
  - Gene Jorgensen, jorgensen@systemsandsoftware.org
  - Sean Cassell, cassell@systemsandsoftware.org

Sound Systems Engineering using CMMI®

Michael T. Kutch, Jr.

Director Engineering Operations, Code 09K

Chief Engineer Code 70E

Intelligence & Information Warfare Systems Department

SPAWAR Systems Center Charleston (SSC-C)

Sandee Guidry

SEI Authorized CMMI Lead Appraiser

SEI Authorized CMMI Trainer

Technical Software Services, Inc.

Engineering Process Office

SPAWAR Systems Center Charleston (SSC-C)

NDIA CMMI Technology Conference, November 17, 2005

Systems Center Charleston

Presentation Outline

- Introduction
- Revitalization Effort using CMMI®
- Training
- Summary

SEI Partner TECHSOFT Technical Software Services, Inc.

Introduction to SSC-Charleston

- Where we fit
- What we do
- What we are known for
- Who we are

Where We Fit

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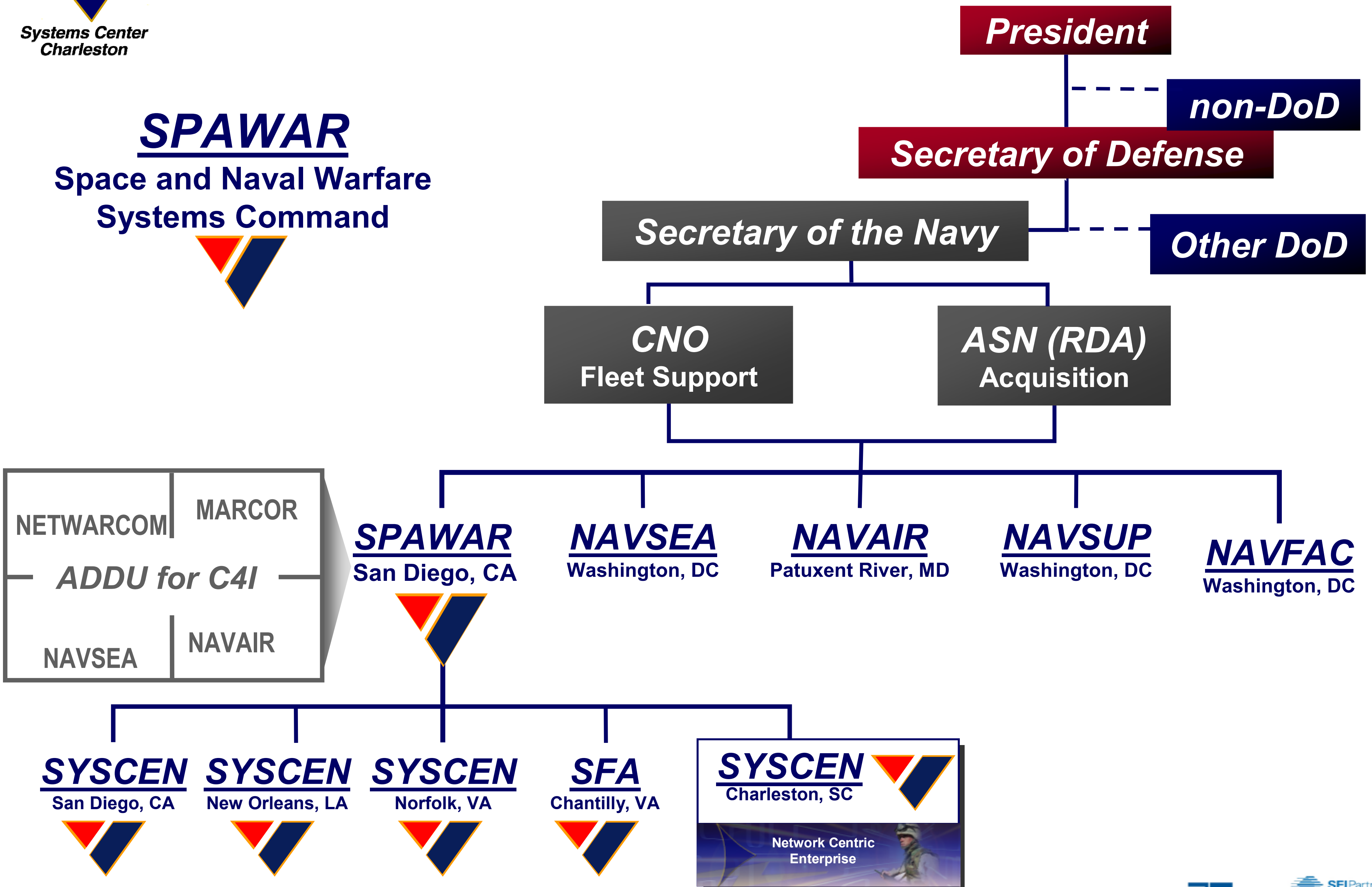
SPAWAR

Space and Naval Warfare Systems Command



What We Do

C^4ISR

Command
Control
Communications
Computers
Intelligence
Surveillance &
Reconnaissance

- ***Modeling & Simulation***
- ***Command & Control***
- ***Navigation***
- ***Physical & Computer Security***
- ***Video Teleconferencing***
- ***Information Assurance***
- ***Sensors***
- ***Communications***
- ***Cryptologic & Intelligence***
- ***Image Processing***
- ***Meteorology***
- ***Air Traffic Control***

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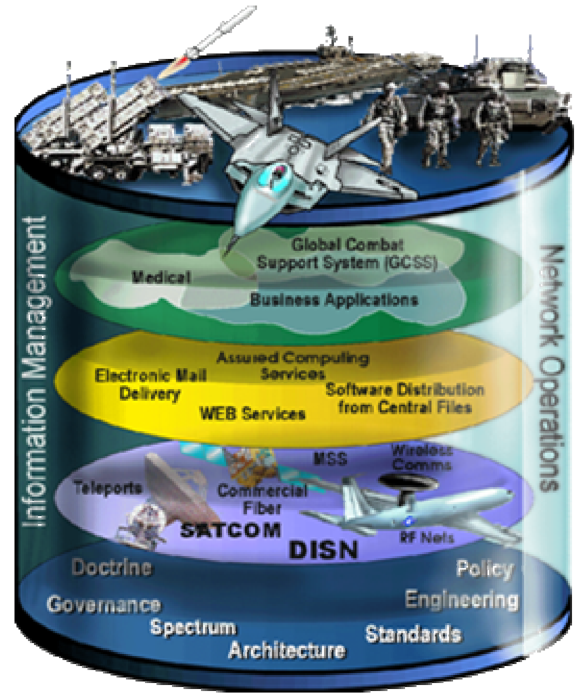
What We're Known For

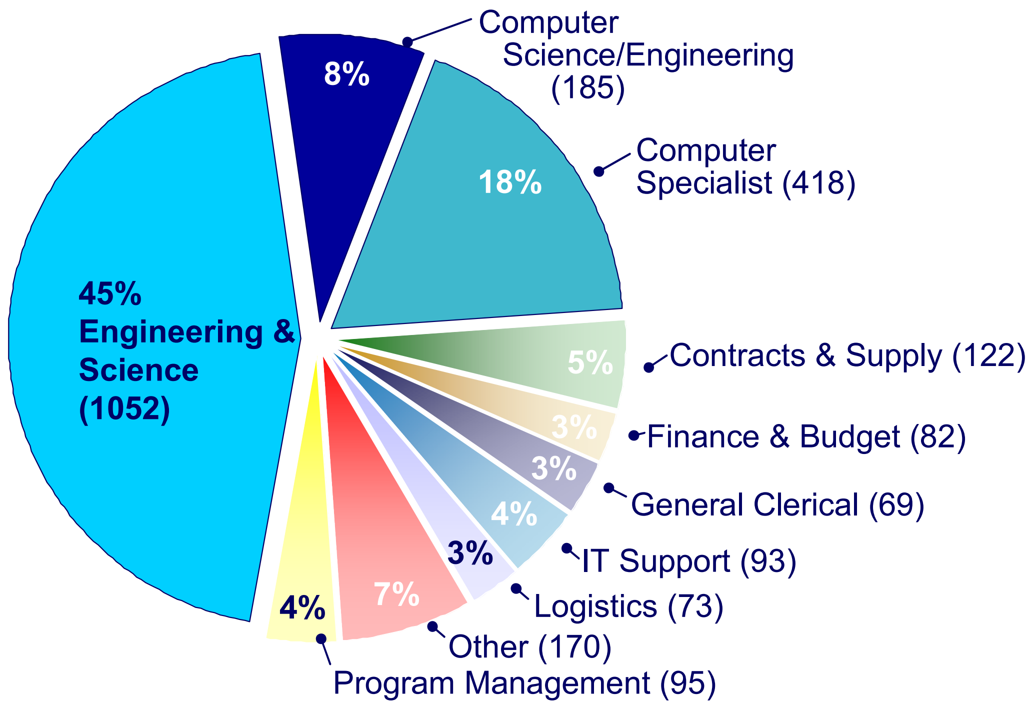


- **Developer of FORCEnet joint collaborative assessment tools** that promote netCentric interoperability and reduce system redundancy
- **Principal SPAWAR provider for Joint and Homeland Security** C4I solutions in a responsive manner.
- **Navy's most efficient provider of critical engineering** and acquisition expertise for Navy/Joint commands and other federal agencies
- **Rapid integrator and deployer of interoperable technologies** to the Navy, Federal Government, and Joint Warfighter
- **Developer and employer of life-cycle logistic support solutions** in a web-enabled portal environment

Systems Center Charleston

A Large Systems & Software Engineering Organization

Over 70% of workforce is in an engineering or computer-related discipline



- **The effective and efficient solutions to the global war on terror developed by SPAWAR result from good systems and software engineering.**
- **Systems engineering is our core competency.**
- **Total workforce of ~ 2300 employees.**

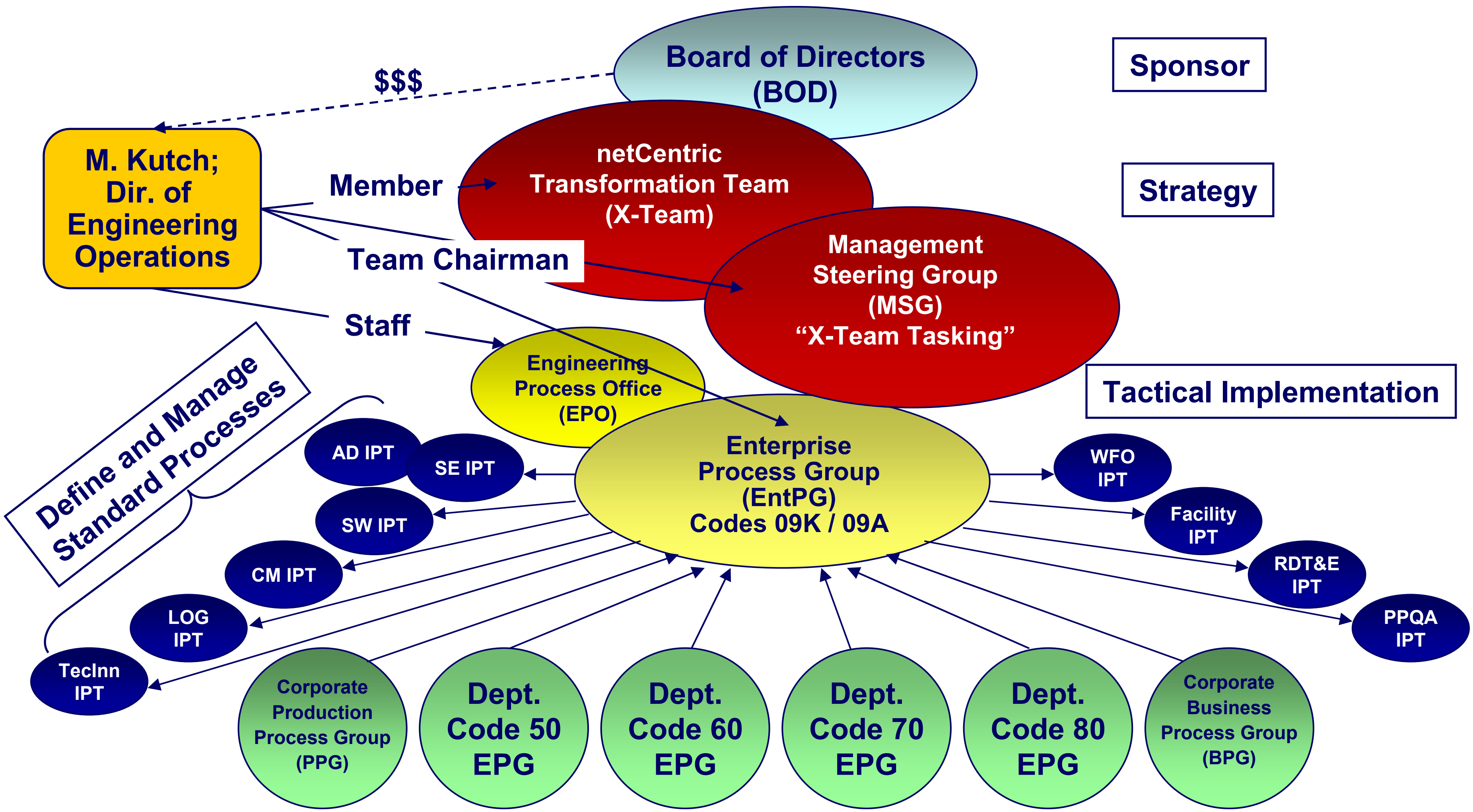
SE Revitalization Effort using CMMI®

- Vision
- Organization
- Plan
- Process
- Tool

Vision

- **Vision**
  - Develop and maintain a World Class Systems Engineering Organization
- **Approach**
  - Achieve Command-wide operational consistency
  - Based on ISO/IEC 15288 – systems engineering
  - Based on ISO/IEC 12207 – software engineering
  - Based on implementing CMMI® "Staged Respresentation"
  - Measure using best practices of CMMI® "Continuous Representation"
- **Benefits**
  - Facilitates sharing of tools, documentation, templates, and other artifacts needed by project engineers
  - Project Engineers will implement projects quicker; with improved monitoring, effectiveness, quality and efficiency

Organization for Implementation



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SSC-C SE Revitalization Plan

Elements of SSC-C SE Revitalization

Policy / Guidance

- DoD SE Guidance & SE Instruction 54xx.1
- SSC-C SE Process Manual
- SSC-C SW Process Manual
- ePlan Builder

Training / Education

- Intro to PI WBT
- SE 101 WBT
- SE Fundamentals
- SW Fundamentals
- Certification Program

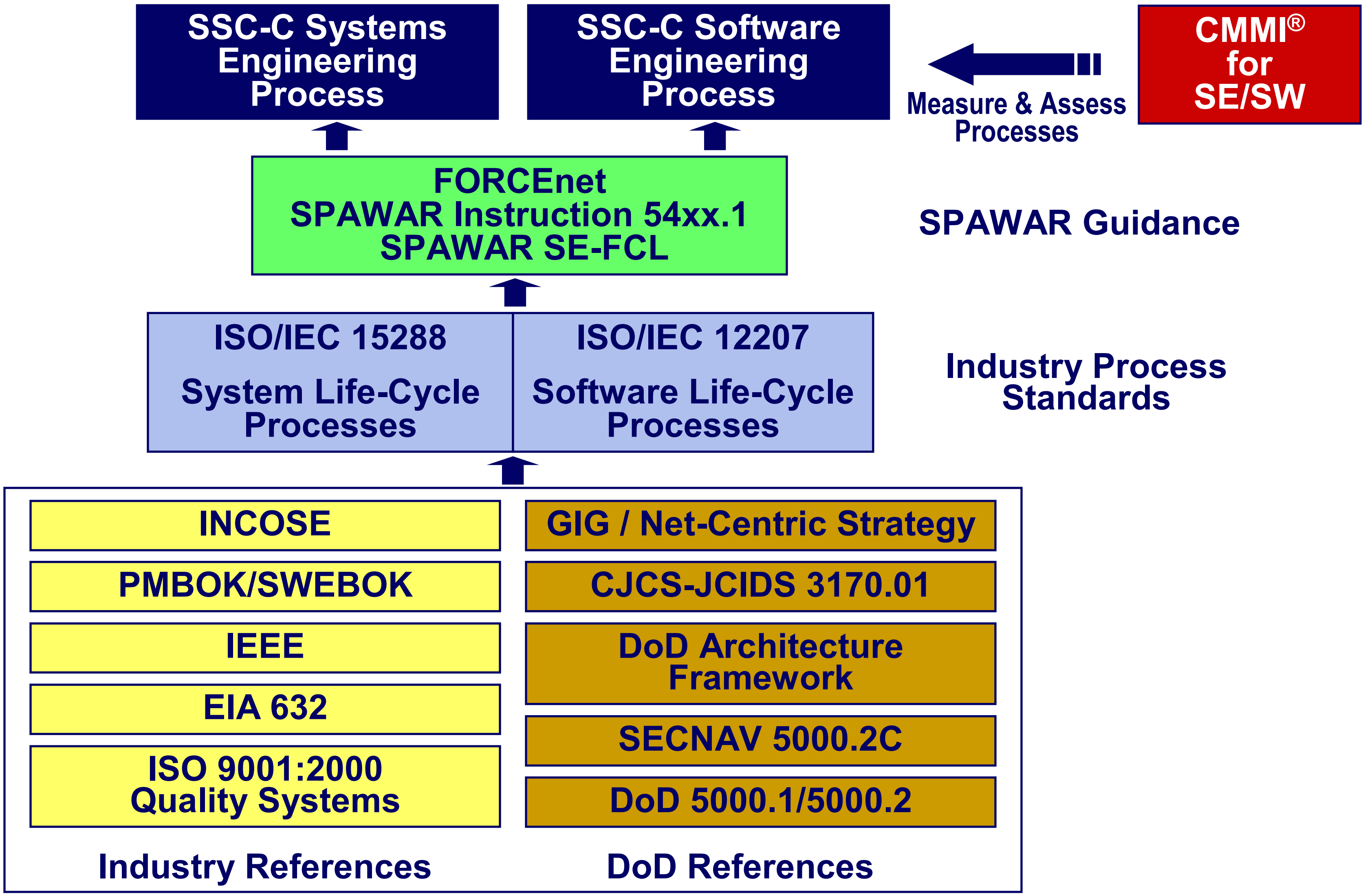
Assessment & Support

- CMMI® Level 2
- CMMI® Level 3
- Integrated Product Teams
- SITC - Tools
- Lean Six Sigma

Underway

Completed/Ongoing

Basis for SSC-C SE Process

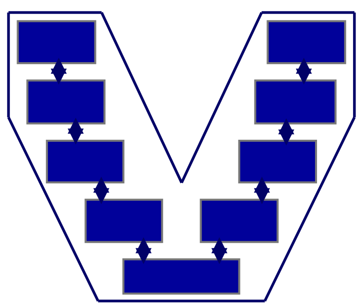


SSC-Charleston SE Process Steps

- Process Implementation
- Stakeholders Requirements Definition
- System Requirements Analysis
- System Architectural Design
- Implementation
- Integration
- Verification
- Transition
- Validation

Key Milestones

- System Requirements Review (SRR)
- System Design Review (SDR)
- Test Readiness Review (TRR)



Follows SE "Vee"

Each process step is defined by required inputs, controls, associated processes, and outputs.

Adapted from "SSC-C Systems Engineering Process Manual"

ePlan Builder Tool

- **ePlan Builder tool**
  - An interactive, web-based application that leads the user through a structured interview process (like TurboTax) to generate a CMMI®-compliant plan
  - Includes standard, consistent text
  - Generates a complete Project Management Plan, Configuration Management Plan, Quality Assurance Plan, and Requirements Management Plan
  - Future versions will build
    - Systems Engineering Plan
    - Measurement and Analysis Plan
    - Supplier Agreement Management Plan

Training

- Process Improvement and CMMI®
- Systems/Software Engineering Classroom
- Web Based Training (WBTs)

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Process Improvement Training

Over 1300 Individuals Trained

Total attendance over 2800 *

- **Intro to Process Improvement**
  - Over 800 people trained
  - Provided via WBT
  - Now Mandatory for all employees
- **CMMI®**
  - SEI's Intro to CMMI® course onsite
  - SSC-C Level 2 Processes
  - 875 people trained
- **Project Management/Project Monitoring & Control**
  - 625 people trained
- **Process-specific Workshops (CM, QA, REQ, M&A)**
  - 375 people trained

**** This accounts for some employees attending more than one course***

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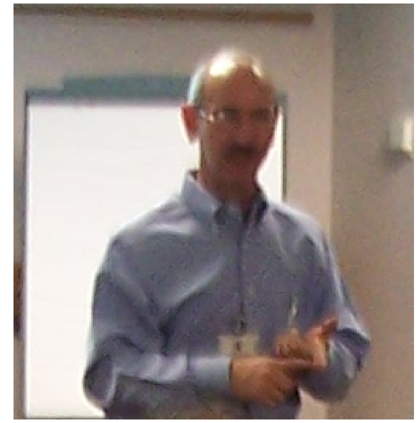
Systems Engineering Fundamentals Classes



- **3-day on-site, classroom course**
  - Based on SMU SE Masters course
  - Customized to incorporate SSC-C SE process
  - 180 SSC-C engineers trained
  - Classes planned every 2 months
- **1-day *SE for Managers* course added**
- ***Intro to Software Engineering* planned**

"The course was very educational. It helped me relate my current project to the overall system it was a part of, and how it fits in with the big picture."

"The course was well presented and accurately covered the Systems Engineering Design Process Fundamentals. Continued/additional training on this subject is critically needed for this command to continue to develop as a professional engineering organization."

Student Feedback

PI Web Based Training

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To offer Process Improvement training to more employees, we developed an on-line web based tutorial (PI-WBT) that allows students to take the course at their own pace and to receive a certificate and education credit upon course completion.

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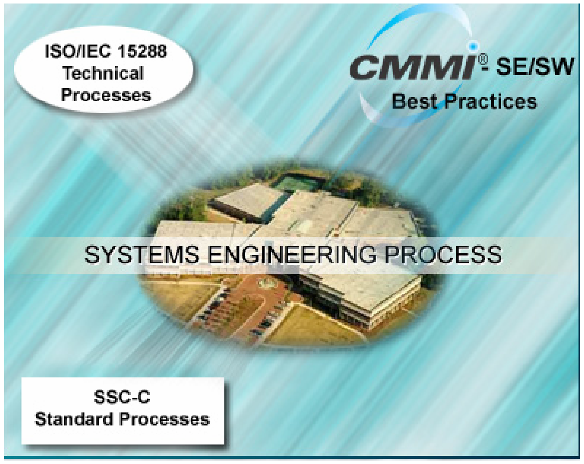
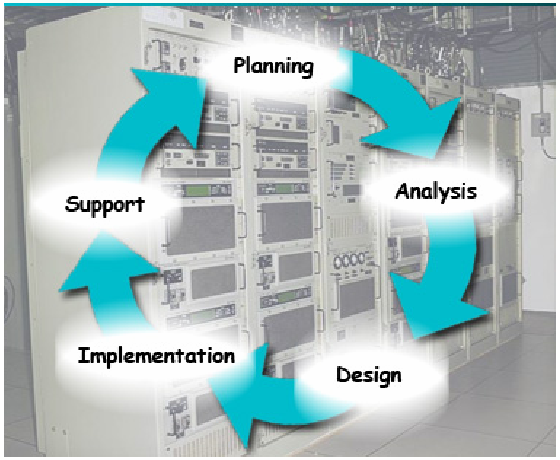
Systems Center Charleston

- **Introduction to Systems Engineering**
  - 10-module web based training
  - Closely aligned to SSC-C SE Process, SE Fundamentals Course, ISO/IEC 15288 and IEEE standards
  - Includes hotlinks to referenced documentation
    - Process manuals, policies, standards





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Summary

- Accomplishments
- Results and Measures
- Lessons Learned
- Going Forward

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What We Have Accomplished

- **Process Focus**
  - Defined Policies and Processes
  - Aligned with DoD and SPAWAR guidance
  - Aligned with industry standards and CMMI® model
  - Built organization structured around processes and process improvement
- **Training is Critical**
  - Providing Fundamentals of Engineering for new and old professionals
  - Developed web-based training for “self-paced” and refresher training
  - Defining a structured technical career development path for engineers
- **Tools for the Engineers**
  - Developed *ePlan Builder* application to generate planning documents
  - Developed templates, checklists, and web-based document repositories to link standards and DoD guidance to day-to-day tasks and processes

Early and persistent Systems and Software Engineering applied to programs and projects

Results and Measures

- **Formal process improvement policy issued in 2003**
  - Use CMMI® to evaluate progress against best practices
- **Selected pilot projects**
  - Training of project teams
- **Informal Appraisals, Process Reviews, and Document Reviews to measure progress and identify gaps**
  - Class B/C appraisals of selected projects
  - Define/review project-specific plans and procedures
  - Ensure the processes and procedures were used
- **Project-level Formal SCAMPI℠ Appraisals (Class A)**
  - Evaluated compliance with CMMI ® Maturity Level 2 requirements
  - 8 projects appraised between June 2004 and February 2005
- **Command-wide appraisal in April, 2005**

Major Milestone – Maturity Level 2

- **The first SPAWAR Systems Center to achieve CMMI® Maturity Level 2 at the command level**

Lessons Learned

- **Senior Management support is critical to success**
- **Training**
  - Everyone needs to be engaged – "train the masses"
  - Specific training for process owners/subject matter experts
- **Utilize Teams (IPTs) as champions of specific processes**
  - Multi-department representation
  - Change agent mentality
  - Process focused charters
- **Resource Properly**
  - Implement with projects that want to improve, can benefit from efforts, and that recognize own weaknesses
  - EPO staff provided skilled coaching, resources, support, and tools
  - Project members learned by doing and maintaining
- **Goals and Publicity**
  - Keep goals to sizable bites (projects)
  - Publicize successes; Share best practices

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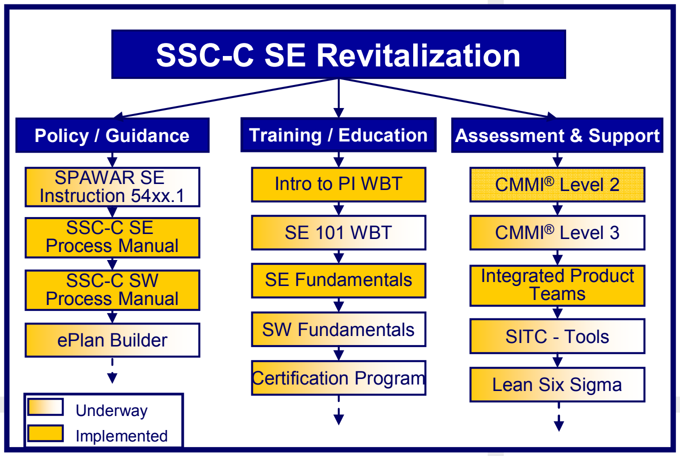
Summary

- Aggressive SE Program
- Industry Standards
  - Systems Engineering (SE)
  - Software Engineering (SW)
- Best Practices
  - CMMI®
  - ISO 9001
  - Lean Six Sigma



- Training – 1,300 people*
- Systems Engineering Fundamentals - 180
- Intro to SSC-C PI
  - CMMI® Level 2 Processes
  - CMMI® Level 3 Processes
  - SE/SW Engineering Workshops
  - Web-Based Training (WBT) for Process Improvement

*includes industry partners

- Successes
  - Command Achieved CMMI® Maturity Level 2 in April 2005
  - 1st SPAWAR Systems Center to Achieve CMMI® Maturity Level 2

Systems Center Charleston 2 MATURITY LEVEL April 28, 2005

- Plans
  - World Class Systems Engineering
  - Support Command Balanced Scorecard
  - April 2007 CMMI® Maturity Level 3

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Going Forward

- **Develop more "how to …" guidance and tools**
  - ePlan Builder, an interactive web application, helps build required plans.
    - Currently builds PMP, QA, Configuration Mgmt, and Requirements Mgmt plan
    - Systems Engineering Plan, Measurement & Analysis Plan, and Supplier Agreement Management Plans under development
  - Institutionalize the SE/SW processes
    - Emphasize Formal Reviews
- **IPTs - expanding beyond CMMI® & Engineering areas**
  - Expecting more integration from teams
- **CMMI®**
  - SSC-Charleston standard process with Tailoring Guidelines for all projects
  - Projects progressing to ML3
  - Process Improvement tracked at department/project level using self assessment tool
  - 2 Balanced Scorecard measures directly related to CMMI®

Systems Center Charleston

Thank you !

Any Questions ?

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Software Engineering Institute
Pittsburgh, PA 15213-3890

The Best Intentions of SCAMPI V1.1

What We Meant and What *Some People* Heard

Sponsored by the U.S. Department of Defense

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SCAMPI Essential Characteristics

Accuracy	Ratings are truly reflective of organization's maturity, reflect the reference model, and can be used for comparisons across organizations Appraisal results reflect the strengths and weaknesses of the appraised organization (i.e., no significant strengths and weaknesses are left undiscovered)
Repeatability	Ratings and findings likely to be consistent with those of another independent appraisal conducted under comparable conditions
Cost/Resource Effectiveness	Efficient in terms of person-hours spent planning, preparing, and executing an appraisal Accounting for organizational investment in obtaining the appraisal results, including resources of the host organization, impact on appraised projects, and the appraisal team
Meaningfulness of Results	Appraisal results are useful to the sponsor in supporting decision-making
ARC Compliance	Compliance with requirements for ARC Class A method

References: SCAMPI v1.1 MDD; GEIA workshop (2000); AMIT team charter

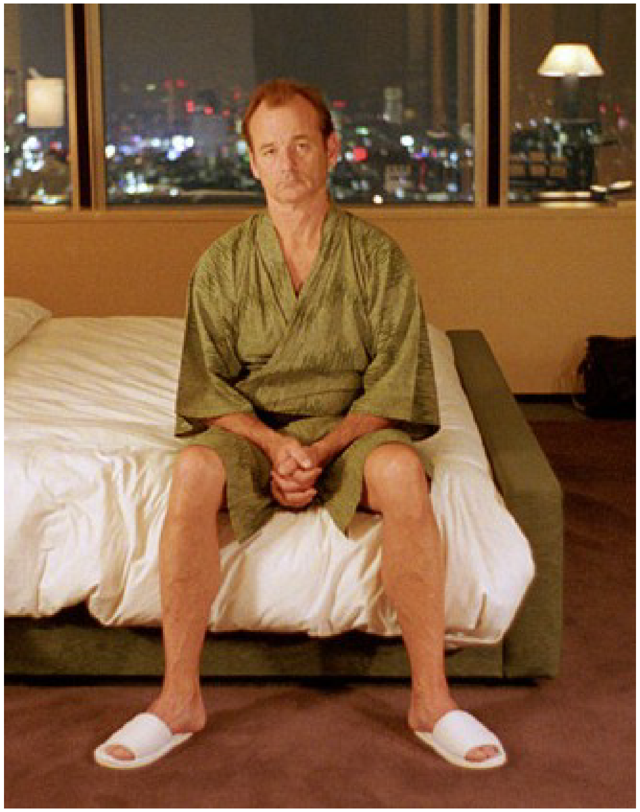
Lost In Translation

The *true intentions* of the SCAMPI v1.1 development team are not always being realized in practice.

Our thesis is that some of these intentions were *lost in translation* during deployment.

CMMI users may not get the *performance intended* from SCAMPI Appraisals.

With apologies to Bill Murray



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Presentation Outline

Design Constraints For SCAMPI

Best Intentions Worth Revisiting

Implications For SCAMPI V1.2

Design Constraints for SCAMPI

New Realities

- Broader Organizational Scope
- Larger (More Robust) Model
- Multiple Uses for the Same Benchmark

Performance Attributes

- Efficiency and Affordability
- Standardization and Reliability
- Accuracy and Validity

Presentation Outline

Design Constraints For SCAMPI

Best Intentions Worth Revisiting

Implications For SCAMPI V1.2

Best Intentions Worth Revisiting?

Shifting from ***discovery*** to ***verification***
- Moving the effort to the "pre-onsite" time frame
- Leveraging existing organizational assets
- Implementation of the "PII" concept
- Intent of the "Readiness Review"

Formalizing the concept of ***objective evidence***
- Direct Artifacts, Indirect Artifacts and Affirmations
- So-called "continuous consolidation"
- Implementation of "Characterization"

Rigorous standards for ***planning*** and ***reporting***
- Appraisal Input and Appraisal Plan
- Appraisal Disclosure Statement

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Shifting Effort to Preparation from Onsite

Additional effort expended in preparing for a SCAMPI has often led to loss of efficiency over all in many situations.

The team never intended to simply move sand from one hour-glass to another.

The innovations in the appraisal method were focused on significant efficiency gains without increasing total effort.

AMIT charter - 100 hr performance goal:
"…This goal should be evaluated in terms of the overall impact on the organization; i.e., don't locally optimize the on-site period at the greater expense of the overall assessment."

Practice Implementation Indicators

"Practice Implementation Indicator DESCRIPTIONS (PIID)" is being interpreted to mean the entire set of Objective Evidence.

Lead Appraisers sometimes imply that an appraisal can be conducted with NO discovery – almost like a checklist-based approach.

Effort spent perfecting PIIDs may not always be worthwhile.

Readiness Review

In some cases, the readiness review is being conducted as a 'pre-appraisal' with a focus on predicting the rating outcome of the SCAMPI.

The intent was to assure that the SCAMPI can be conducted efficiently, by determining the feasibility of the appraisal plan.

Doing the appraisal twice is not the goal.

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Best Intentions Worth Revisiting?

Shifting from ***discovery*** to ***verification***

- Moving the effort to the “pre-onsite” time frame
- Implementation of the “PII” concept
- Intent of the “Readiness Review”

Formalizing the concept of ***objective evidence***

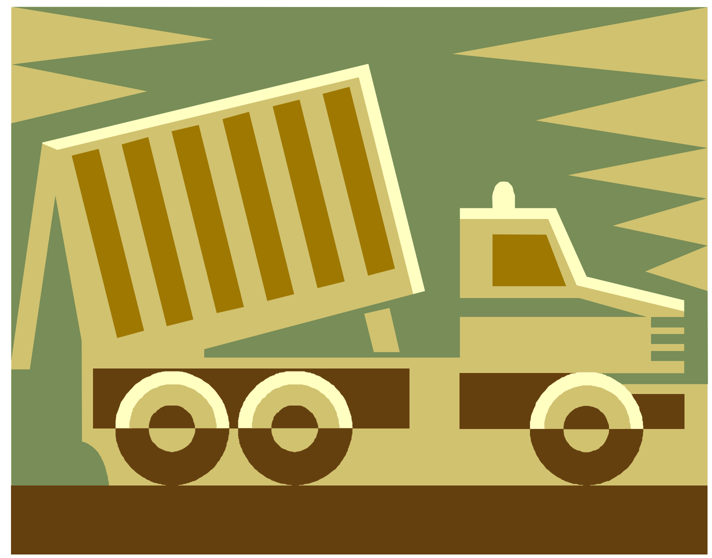
- Direct Artifacts, Indirect Artifacts and Affirmations
- So-called “continuous consolidation”
- Implementation of “Characterization”

Rigorous standards for ***planning*** and ***reporting***

- Appraisal Input and Appraisal Plan
- Appraisal Disclosure Statement

Types of Objective Evidence

Definitions are provided for:
- Direct Artifacts
- Indirect Artifacts
- Affirmations



The intent was to simplify corroboration and data sufficiency criteria – not to over-specify them.

Some Lead Appraisers insist on 100% Indirect Artifacts, and 100% affirmations, when they may not be needed.

Corroboration

SCAMPI MDD requires:

Direct artifacts AND (Indirect artifacts OR Affirmations) for each practice, for each instantiation, with separate coverage requirements for *Face-to-Face* affirmations

Some appraisers ask for up to:

Direct AND Indirect AND Written Affirmations AND *Face-to-Face* Affirmations, for each practice, for each instantiation

- Is there a detectable increase in accuracy that justifies the increased cost of collecting all of this evidence?
- Does this level of detailed “accounting” for evidence help, or hinder, accuracy and repeatability of results?

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Continuous Consolidation – Data Triage

Benefits expected from dynamically inventorying the objective evidence and choosing options for collecting information does not seem to be realized very often.

Parallel interviews, autonomous mini-teams, and revisions to the data collection plan do not appear to be used as frequently as we expected.

It seems to be difficult to give up the old way of doing things.

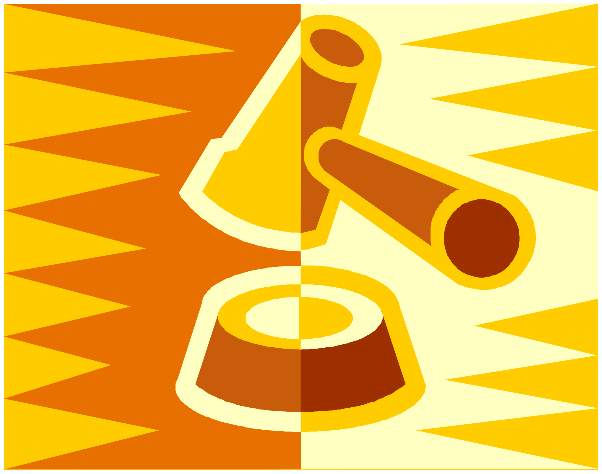
Characterization vs. Rating

A 4-point characterization is used:
- (FI) Fully Implemented
- (LI) Largely Implemented
- (PI) Partially Implemented
- (NI) Not Implemented

Intent was to focus team investigation, judgment, and resources on areas where they were most needed.

These were not intended to serve the same purpose as ratings. The characterizations are applied to ***expected*** content of the model.

Rather than merely steering the team discussion characterizations are being used deterministically in reference to ***required*** content.



Best Intentions Worth Revisiting?

Shifting from ***discovery*** to ***verification***

- Moving the effort to the "pre-onsite" time frame
- Implementation of the "PII" concept
- Intent of the "Readiness Review"

Formalizing the concept of ***objective evidence***

- Direct Artifacts, Indirect Artifacts and Affirmations
- So-called "continuous consolidation"
- Implementation of "Characterization"

Rigorous standards for ***planning*** and ***reporting***

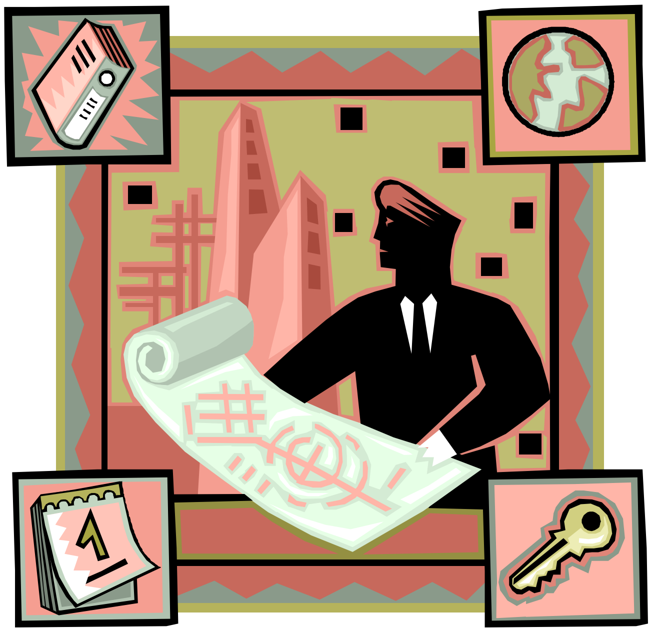
- Appraisal Input and Appraisal Plan
- Appraisal Disclosure Statement

Appraisal Planning Requirements

Separation of ***Appraisal Input*** and ***Appraisal Plan*** was intended to promote a clear differentiation of concerns – and harmonize with ISO 15504.

Most Lead Appraisers saw it as a burden to create & maintain two different forms that have to be filled out "for the SEI."

Differentiating types of planning data and appropriate levels of change control was the intent – not administrative overhead.



Appraisal Disclosure Statement

The intent was to ensure "**truth in advertising**" by creating a standard way of reporting results.

It is not clear that the traditional "**press release strategy**" has been altered significantly.

New and creative ways to be vague are appearing in ADS content that describes the Organizational Unit.

Presentation Outline

Design Constraints For SCAMPI

Best Intentions Worth Revisiting

Implications For SCAMPI V1.2

Implications for SCAMPI V1.2

Need to Clarify
- Organizational Scoping
- Documenting Planning Data
- Definitions of Objective Evidence
- Role of Data Collection Mechanisms
- Characterization and Rating Procedures
- Content of Appraisal Disclosure Statement

Data and lessons learned from the conduct of SCAMPI V1.1 appraisals should contribute to our thinking and act as a baseline for comparison.

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Sponsored by the U.S. Department of Defense

Supplier Management Strategy Considerations with CMMI

CMMI Technology Conference & User Group
14-17 November 2005

Rick Hefner, Ph.D.
Northrop Grumman Corporation

Mary Lynn Penn
LMC Integrated Systems & Solutions

Background

Supplier Agreement Management and Integrated Supplier Management process areas cover only day-to-day tactics

How do you address the broader strategy issues, such as:

- How do you quantify the risk of working with a low maturity supplier?
- Should primes conduct pre-award and in-process appraisals of key suppliers?
- Which teaming approaches are appropriate in various situations?
- Should the supplier be asked to follow the prime's process?
- Should the supplier be allowed to use their own processes?
- When does Integrated Supplier Management apply?
- How should Subcontracts be involved with the CMMI effort?

CMMI: Supplier Management

Supplier Agreement Management	*Integrated Supplier Management*
Used to manage simple supplier arrangements (e.g., COTS)	**Used to manage complex supplier arrangements**
SG 1 Establish Supplier Agreements SP 1.1 Determine Acquisition Type SP 1.2 Select Suppliers SP 1.3 Establish Supplier Agreements **SG 2 Satisfy Supplier Agreements** SP 2.1 Review COTS Products SP 2.2 Execute the Supplier Agreement SP 2.3 Accept the Acquired Product SP 2.4 Transition Products	**SG 1 Analyze and Select Sources of Products** SP 1.1 Analyze Potential Sources of Products SP 1.2 Evaluate and Determine Sources of Products **SG 2 Coordinate Work with Suppliers** SP 2.1 Monitor Selected Supplier Processes SP 2.2 Evaluate Selected Supplier Work Products SP 2.3 Revise the Supplier Agreement or Relationship

Supplier Agreement Management

From the CMMI text

“This process area primarily applies to the acquisition of products and product components that are delivered to the project’s customer. To minimize risks to the project, this process area may also be applied to the acquisition of significant products and product components not delivered to the project’s customer (for example, development tools and test environments).”

“This process area does not directly address arrangements in which the supplier is integrated into the project team (for example, integrated product teams). Typically, these situations are handled by other processes or functions, possibly external to the project, though some of the specific practices of this process area may be useful in managing the formal agreement with such a supplier.”

Supplier Agreement Management

SG 1 Agreements with the suppliers are established and maintained.

SP 1.1 Determine the type of acquisition for each product or product component to be acquired.

SP 1.2 Select suppliers based on an evaluation of their ability to meet the specified requirements and established criteria.

SP 1.3 Establish and maintain formal agreements with the supplier.

SG 2 Agreements with the suppliers are satisfied by both the project and the supplier.

SP 2.1 Review candidate COTS products to ensure they satisfy the specified requirements that are covered under a supplier agreement.

SP 2.2 Perform activities with the supplier as specified in the supplier agreement.

SP 2.3 Ensure that the supplier agreement is satisfied before accepting the acquired product.

SP 2.4 Transition the acquired products from the supplier to the project.

Understanding areas where ability is weak can lead to mitigating the inherent risks

Formal commitments can lead to an appreciation of the commitments, mechanisms for enforcement

Contracts must have the required clauses to allow sufficient visibility into potential problems

Review before acceptance allows the agreement to be enforced

Integrated Supplier Management

From the CMMI text

The Integrated Supplier Management process area builds on the concepts established in the Supplier Agreement Management process area by adding practices that emphasize a cooperative relationship with suppliers.

Integrated Supplier Management is designed for situations in which projects use suppliers to perform functions that are critical to the success of the project.

Integrated Supplier Management

SG 1 Potential sources of products that best fit the needs of the project are identified, analyzed, and selected.

SP 1.1 Identify and analyze potential sources of products that may be used to satisfy the project's requirements.

SP 1.2 Use a formal evaluation process to determine which sources of custom-made and off-the-shelf products to use.

SG 2 Work is coordinated with suppliers to ensure the supplier agreement is executed appropriately.

SP 2.1 Monitor and analyze selected processes used by the supplier.

SP 2.2 For custom-made products, evaluate selected supplier work products.

SP 2.3 Revise the supplier agreement or relationship, as appropriate, to reflect changes in conditions.

Increases awareness of alternative suppliers

May be a more rigorous process

Continuous monitoring

Unexpected performance may require changes in the agreement/contract

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Which to Use?

Each supplier must be evaluated as to:

- **Criticality – How important is the product they provide?**
- **Capability – How likely is the supplier to produce the needed product within schedule and budget?**

If supplier performance is important to project success, it is worth devoting resources to understanding the risks and managing them

Using a Subcontracts Organization

The CMMI refers to the supplier management <u>process</u>, not the project team

- **Some practices many be performed by project personnel, some by members of a Subcontracts functional area**
- **CMMI does not dictate an organizational structure**

It is the responsibility of the project manager to ensure the process is performed, regardless of who performs it

- **May involve collaboration with a Subcontracts functional area (e.g., writing specific terms into a contract, etc.)**
- **Subcontracts personnel must be addressed in the Generic Practices (e.g., policies, planning, training, audits, etc.)**

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Selecting a Teaming Approach

Integrated Team

- **Prime and supplier work on one "badgeless" team**

Supplier Uses Prime's Process

- **Prime trains supplier on the process, assets**
- **Prime may augment the supplier's team**

Prime Audits Supplier Process

- **Prime performs quality assurance role**
- **Prime tests delivered product**

Supplier Uses Own Process

- **Prime monitors against plans, schedules, budgets**
- **Prime reviews supplier test results**

Integrated Team

Prime and supplier work on one "badgeless" team

Pros

- Common process can merge best practices from each organization
- Joint teams encourage best use of individual talents, mentoring
- Common processes may simplify reviews, consolidation of data

Cons

- Must have clearly defined roles and responsibilities
- Each organization most experienced with their own process
- Each organization typically bids work based on their own processes
- May not bid training needed to understand joint process
- Difficulty reaching consensus about style issues (e.g., peer reviews)
- Difficulty sharing proprietary process assets
- Personnel from a low maturity organization may not have the knowledge or experience to execute a high maturity process (either prime or sub)

Best when teammates are equal/close in maturity, co-location possible

Supplier Uses Prime's Process

Prime trains supplier on the process, assets

Pros

- Common processes may simplify reviews, consolidation of data

Cons

- Suppliers not experienced with prime's processes
- Supplier may not know how to bid work based on prime's processes
- May not bid training needed to understand prime's processes
- Difficulty sharing proprietary process assets
- Personnel from a low maturity supplier may not have the knowledge or experience needed to execute a high maturity process
- Supplier may be higher maturity than prime

Best when supplier role is small, maturity close to prime

Prime Audits Supplier Process

Prime performs quality assurance role

Pros

- **Each organization uses processes they are familiar with**
- **Prime has insight into supplier's process issues**

Cons

- **Low maturity processes could effect project performance**
  - Can try to levy additional requirements (e.g., behave as a Level X on this project)
- **QA role may be difficult for outsider**

Best when teammates are equal/close in maturity

Supplier Uses Own Process

Prime monitors against plans, schedules, budgets

Pros

- Each organization uses processes they are familiar with

Cons

- Low maturity processes could effect project performance

Best when supplier maturity equal/better than prime

Assessing a Supplier's Capability

Primes should assess a supplier's process capability

- **Process evaluation (SCAMPI A, B, or C depending on the criticality)**
- **Given process weaknesses, work to <u>mitigate the risks to the project</u>**

Example - Weaknesses in Project Planning

SG 1 Establish Estimates *Estimates of project planning parameters are established and maintained.*	▪ **Construct independent estimates** ▪ **Monitor actuals more closely**
SG 2 Develop a Project Plan *A project plan is established and maintained as the basis for managing the project.*	▪ **Review planning for completeness** ▪ **Monitor against plan more closely anticipating forgotten activities**
SG 3 Obtain Commitment to the Plan *Commitments to the project plan are established and maintained.*	▪ **Ensure awareness of commitments** ▪ **Track more closely**
GG 2 Institutionalize a Managed Process *The process is institutionalized as a managed process.*	▪ **Insist on best possible planning** ▪ **Emphasize planning commitments, abilities, directing, verification**
GG 3 Institutionalize a Defined Process *The process is institutionalized as a defined process.*	▪ **Insist on best possible planning** ▪ **Provide examples, templates, historical data where possible**

Supplier Process Evaluations - Challenges

Timing – Ideally, before teaming

- **Can be used up front to set terms of the subcontract**
- **Can also be used to monitor subcontract performance**

Scope – How many projects? Which process areas?

- **Need similarity to projected role on focus project**
- **Must consider site at which work is to take place**
- **Must evaluate all Level 2 and 3 process areas to determine possible risks of each teaming option**

Style – SCAMPI A, B, or C

- **Often time/cost constraints will encourage SCAMPI C**
- **Important that appraiser understand and reports on project risks, not merely compliance**

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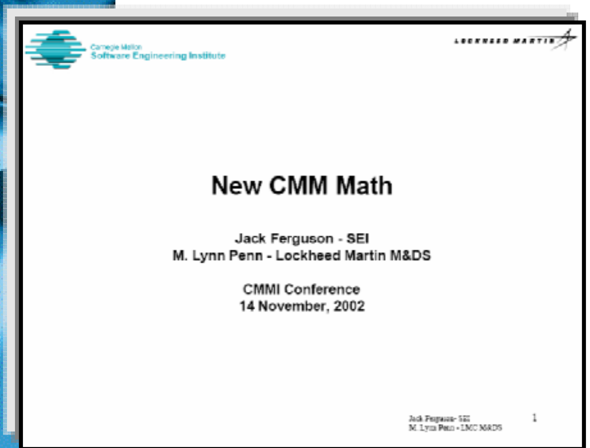
Conclusions


Software Engineering Institute

New CMM Math

Jack Ferguson - SEI
M. Lynn Penn - Lockheed Martin M&DS

CMMI Conference
14 November, 2002

With proper strategies, supplier risks can be mitigated

- **Evaluate the criticality and capability of each supplier**
- **Select Supplier Agreement Management or Integrated Supplier Management, as appropriate**
- **Involve Subcontracts up front and throughout to ensure a strong supplier management process**
- **Select the right team approach based on the situation**
- **Make judicious use of SCAMPI A, B and C's for supplier selection and monitoring**

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How to Become Your Customer's Software Provider of Choice

2005 CMMI Technology Conference

The David Consulting Group
Achieving Software Excellence

www.davidconsultinggroup.com

DISCUSSION POINTS

- **Why are organizations wanting to move IT offshore?**
  - Level 5 service providers promise to deliver high quality software
- **How can internal IT compete with offshore Level 5 providers?**
  - What matters most to your customer?
  - How can you maximize current practices?
- **At what level does your IT organization need to perform in order to be considered a top performer?**
- **How can you become customer's software provider of choice**

WHY DO WE OUTSOURCE

Reasons for Outsourcing	# Respondents
Reduce/control costs	44%
Free up internal resources	20%
Gain access to world-class capabilities	13%
Increase revenue potential	13%
Reduce time to market	11%
Increase process efficiencies	11%
Follow company philosophy of outsourcing non-core activities	11%
Compensate for lack of appropriate skills	8%

Source: Computerworld and Interunity Group, Inc. Concord Mass, April and May 2003

FINDING THE HIDDEN COSTS

- The process of outsourcing incurs cost
- Costs incurred after contract signed
- Travel
- Employee turnover
- Communications

Source: Information Week, "Offshore Outsourcing", Sept. 2004

THE OUTSOURCING MODEL

IT Dept.

Project Management
Process Management
Engineering
- Requirements
- Design
- Build
- Test
- Validation
- Verification

Service Level Management
Contract Management

Business Requirements

Offshore Provider

Project Management
Process Management
Engineering
- Requirements
- Design
- Build
- Test
- Validation
- Verification

Service Level Management

Client Management
Status Reporting
Delivery

Software Deliverables

RISKS ASSOCIATED WITH OUTSOURCING

- **Communication**
  - The greatest barriers or challenges in the IT offshore outsourcing market are cultural and language differences; this often results in communication difficulties between customer and provider

  IMPACT: Requirements Management, Status Reporting, Problem Resolution
- **Staffing**
  - The ability to retain highly skilled developers and/or customer-specific knowledgeable staff is always a problem, particularly in a competitive marketplace such as India

  IMPACT: Engineering
- **Project Management**
  - Project managers are asked to manage both products and services; often their skills are more technically oriented, and they might not have the appropriate skills to manage a client

  IMPACT: Project Management

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KEY AREAS FOR CONSIDERATION

- **The delivery model**. Which attributes of a high maturity provider impact my project deliverables the most?
- **Risk management.** Staffing, communication and project management are risks we all share; what can you do to mitigate those risks?
- **The strategic business drivers**.
  If cost control is a main issue, how can we compete with offshore pricing models?

THE INSOURCING DELIVERY MODEL

Customer

Project Management
Process Management
Engineering
- Requirements
- Design
- Build
- Test
- Verification
- Validation

Service Level Management
Contract Management

Business Requirements

Provider
(Your IT Dept)

Project Management
Process Management
Engineering
- Requirements
- Design
- Build
- Test
- Verification
- Validation

Service Level Management

Client Management
Status Reporting
Delivery

Software Deliverables

OUTSOURCE-PROOF YOUR IT ORGANIZATION

- Compete on process
  - Repeatable development and project management processes
- Develop an enterprise architecture
  - More flexible and productive across different areas of the business
- Sell service levels
  - Focus on quality
- Re-educate your staff
  - Transform into collaborators
- Get transparent
  - Show actual costs to customer

Source: CIO Magazine, "How to Outsource-Proof Your IT Department", 10/15/2004

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LEVEL 2 FOCUSES ON PROJECT MANAGEMENT

- Requirements Management - Creates a common understanding of the customer's requirements and aids in the communication of changes to those requirements
- Project Planning - Creates and communicates plans for managing the software project
- Project Monitoring and Control - Tracks and reports project progress so that interested parties can respond and take action when actuals vary "significantly" from the plan
- Process and Product Quality Assurance - Provides insight into the process being used and the products being built
- Configuration Management - Maintains the integrity of the software products throughout the software life cycle; this practice is of particular significance to the customer if the software is going to be developed and maintained on the customer's platform

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COMMUNICATION

Several of the Level 2 (and 3) practices are very beneficial in terms of promoting better communication on a project-by-project basis.

- This would include Requirements Management, Project Planning and Project Monitoring and Control
- Level 3 includes Organizational Process Focus and Organizational Process Definition, which could be a positive contributor to defined roles and improved communication
- Measurement and Analysis creates an atmosphere that lends itself to the establishment of meaningful, quantitative service level measures

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STAFFING

- Being a Level 3 maturity provider probably ensures a greater level of consistency (roles and responsibilities are well defined) and may have some impact on the long-term effects of staffing variations
- The CMMI® addresses Organizational Training (Level 3) and generally accounts for well-defined procedures and practices
- The CMMI ® emphasizes that adequate resources are applied to all PAs and that personnel must be prepared to perform their assigned tasks

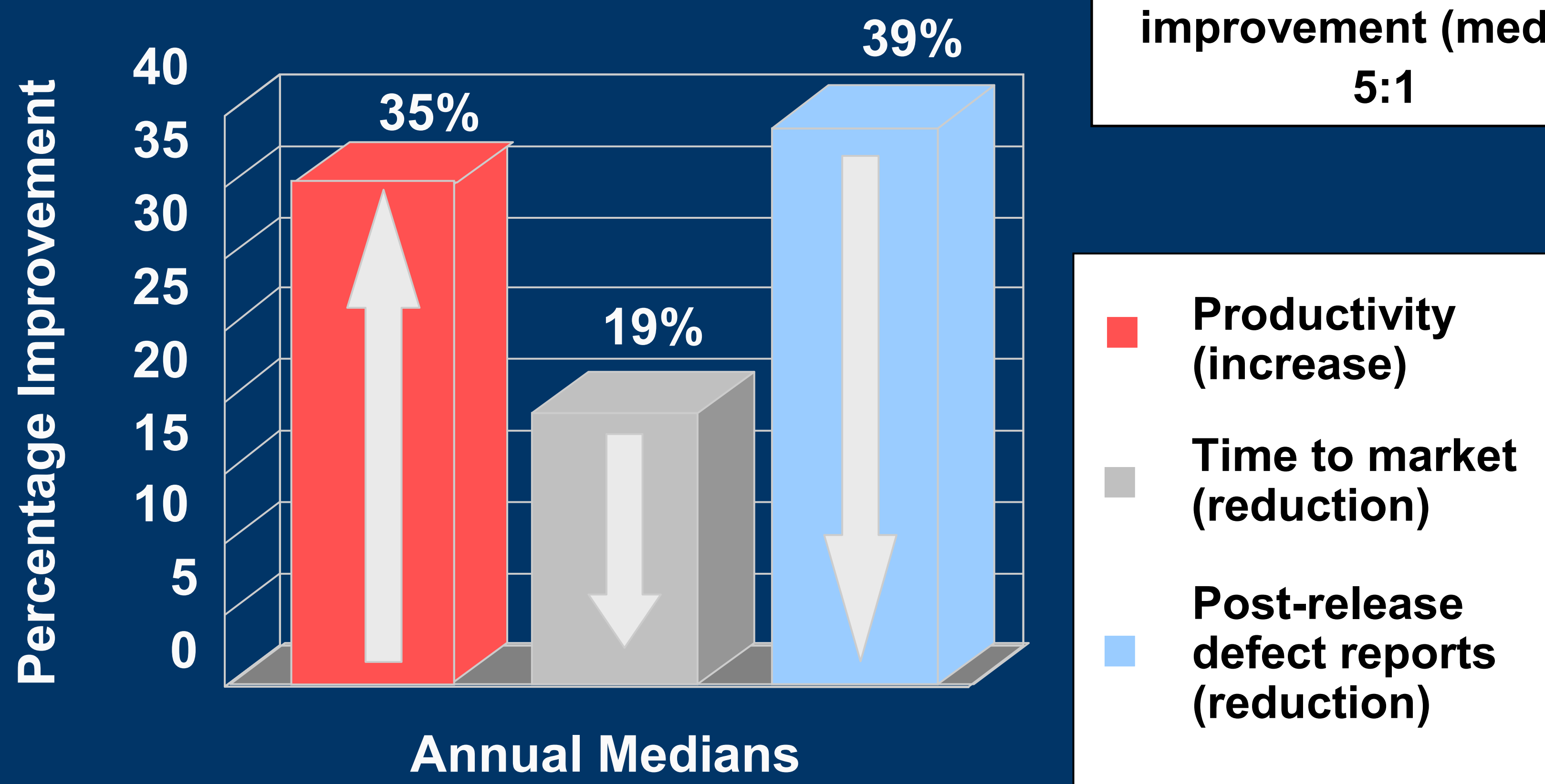
PROJECT MANAGEMENT

There are numerous process areas at Levels 2 and 3 that support effective and efficient project management practices.

- Project Planning, Monitoring and Control, Configuration and Requirements Management and Measurement and Analysis are among them
- At Level 2 the CMMI® focuses on project-specific tasks at the project management level, requires procedural documentation and at the higher maturity levels process performance is measured, stabilized and improved
- All in all, the CMM® Levels 2 and 3 are best suited to address the more critical issues associated with project management

IMPROVEMENTS FROM CMM

Savings vs. cost of software process improvement (median) 5:1



A REVIEW OF THE ESSENTIALS

- Cost is a business driver - know your costs, show your costs
- Effective communication builds good relationships - service providers are in the relationship business
- Understand current capabilities and set reasonable (measurable) expectations
- Adopt the essential Level 2 & 3 practices - project management, requirements management and quality control

ASSESSING CAPABILITIES

- **Internal Assessment**
  - Conduct a self assessment
    - Identify Gaps
    - Develop an Action Plan
  - Focus on key processes that have the highest impact
    - Control, communicate, perform
  - Set expectations
    - Improvement takes time
    - Show measured improvement

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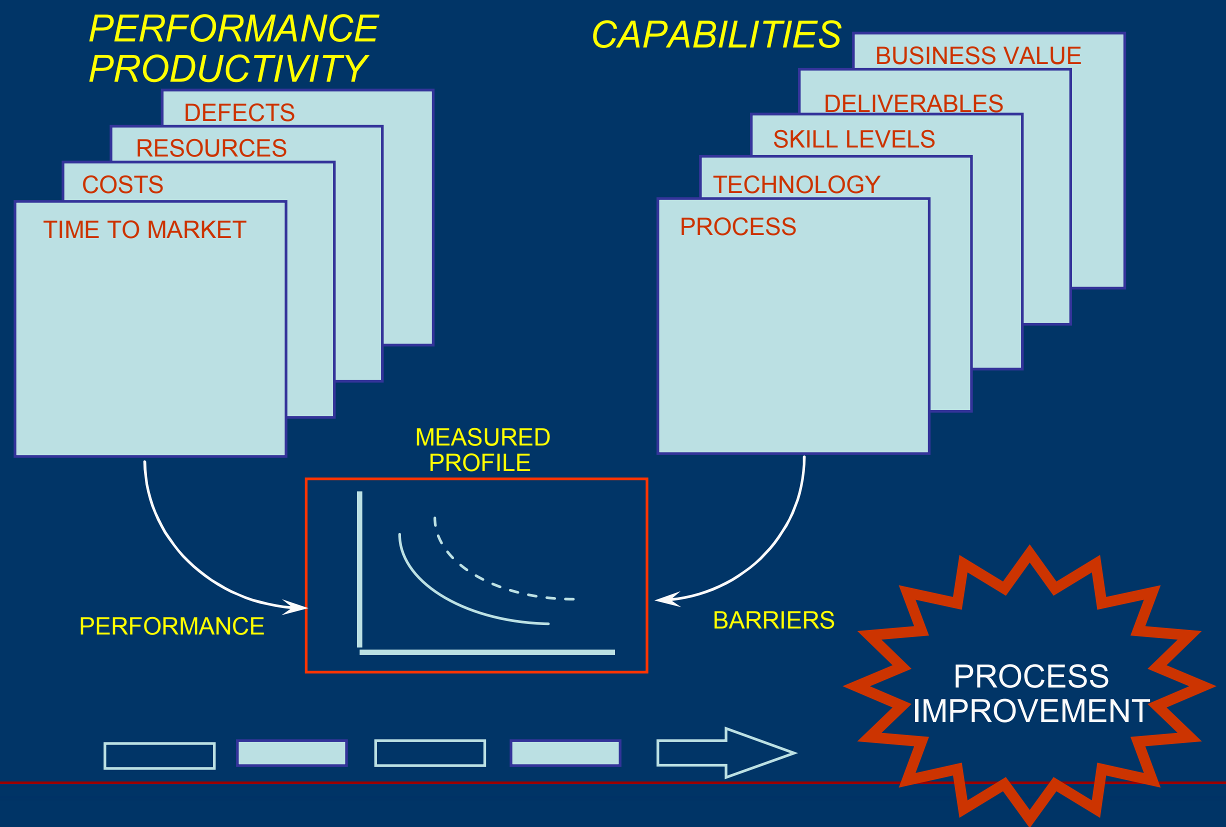
BASELINE PERFORMANCE

- Create a measured profile of key performance indicators
- Use results to properly set SLA targets
- Make comparisons to industry benchmark performance levels



WEIGHING THE PROS AND CONS

The Pros of Using a High Maturity Provider…

Levels 4 and 5 of the CMMI ® emphasize performance measurement. The ability to measure is a key ingredient in evaluating the success of the relationship and the adherence to contractual commitments. However, you don't have to be a high maturity organization in order to effectively measure levels of performance.

A high maturity organization brings to the client a greater exposure to "best practices" software development procedures and stresses the need for continuous process improvement. Process improvement is a mindset that can be ingrained into the current culture.

One con of Using a High Maturity Provider …

There are no guarantees that a high maturity CMMI ® provider will be successful in producing lower cost software or higher quality software, or will reduce the barriers for successful delivery.

ACT LIKE A SERVICE PROVIDER

- Establish good relationship management practices
- Improve your credibility
- Establish service levels
- Reduce your costs – improve productivity
- Practice effective change control
- Accentuate your positives – on site, business
- Outsource smart – what stays vs. what goes

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Adapting CMMI for Acquisition Organizations: A Preliminary Report

5th Annual CMMI Technology Conference & User Group
November 17, 2005

Dr. Hubert F. Hofmann and Deborah K. Yedlin
Information Systems & Services, General Motors Corporation

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- Mike Konrad

General Motors Corporation — Largest Global Automotive Company

BUICK

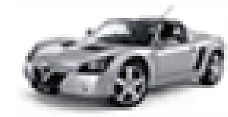
CHEVROLET

Cadillac

GMC

2004 Sales	$193 Billion
Product Sales	In 200 countries
Manufacturing Operations	In 32 countries
2004 Vehicle Production	9.1 million units
Dealers	14,000
Average # Parts / Vehicle	5,000
Supply Chain - Daily	180 M lbs of material from 12,000 sources “Just in Time”
Information Technology	Multi-vendor environment approx. $3 Billion/year

VAUXHALL



Saturn

SAAB

PONTIAC

HOLDEN

HUMMER

Oldsmobile

OPEL

GM Information Technology: Outsourcing Journey

First Generation: Single Source

Second Generation: Multi-Supplier

Third Generation: Standard Enterprise Management

Pre -1984

In-house delivered IT services

1984

GM purchases EDS: all IT employees transferred to EDS business unit

1996

- EDS business unit spin off
- GM IT formed

1997

2002

- Multiple IT Suppliers introduced
- Business Process Outsourcing

2006

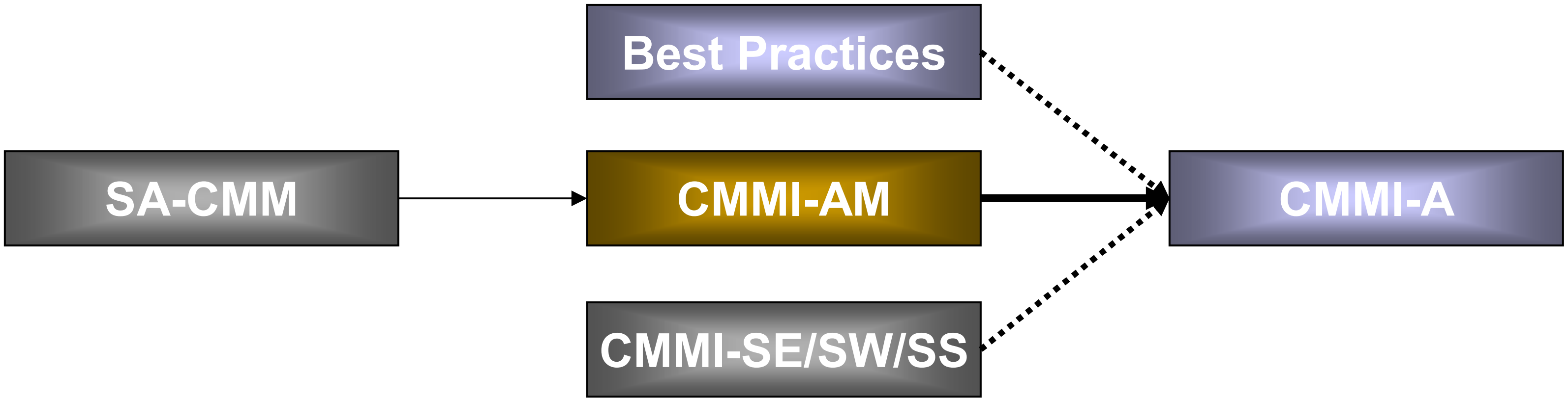
- Multi-Supplier environment

Challenges and Inhibitors of Using Today's CMMI for Acquisition Organizations

- **CMMI does *not effectively* address acquirer needs**
  - Some elements of CMMI are not executed by the acquirer
    - Example: implementing the design
  - Some required elements are not addressed
    - Example: acquisition strategy and contract development

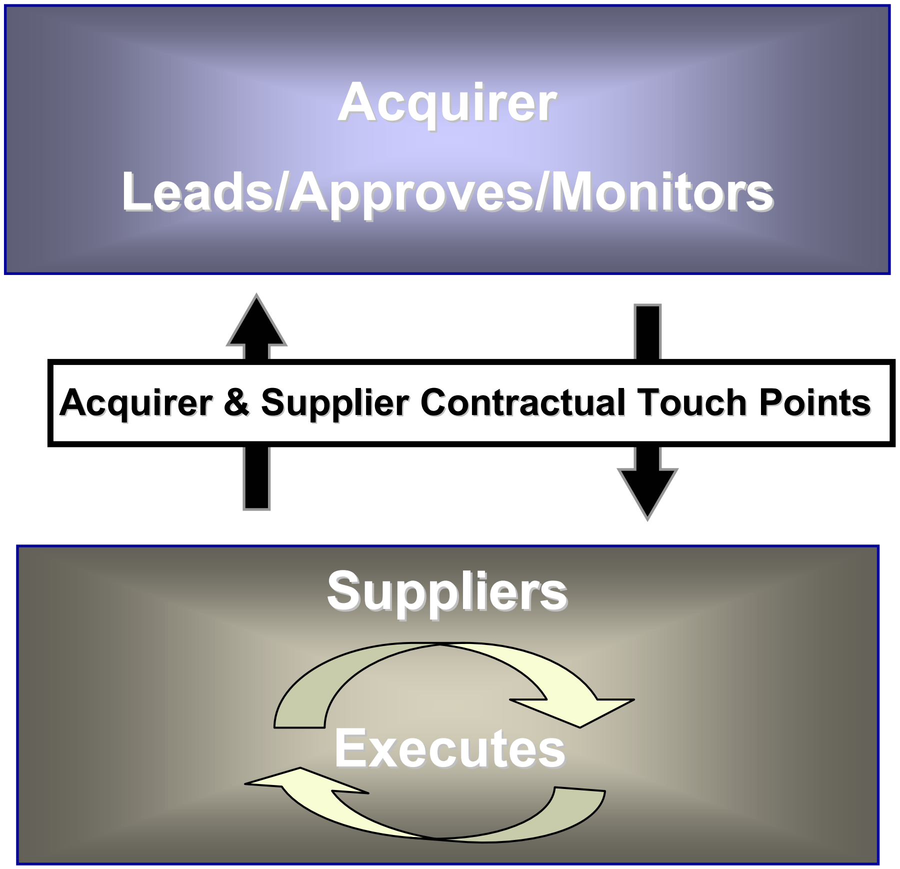
- **CMMI Acquisition Module (CMM-AM) *partially* addresses acquirer needs**
  - Some required elements are not addressed
    - Example: architecture, quantitative management
  - Elements lack precise definition of the acquirer-supplier relationship
    - Example: acquirer sub-practices, typical supplier work products
  - CMMI-AM does not support appraisals using SCAMPI A

Moving Towards a CMMI for Acquisition Organizations: Long Term Goals



- ***Lean*** **CMMI Model for Acquisition (CMMI-A) usable by any acquirer**
  - Clearly delineate the minimum practices that an acquirer must perform to be successful
  - Clarify typical supplier work products in a successful acquirer-supplier relationship
- **Complete model (not a module) with similar structure as CMMI**
- **Staged representation and appraisable using SCAMPI A**
- **Approved by CMMI Steering Group and Industry**

Acquirer vs. Supplier Roles



Key Acquirer Roles*

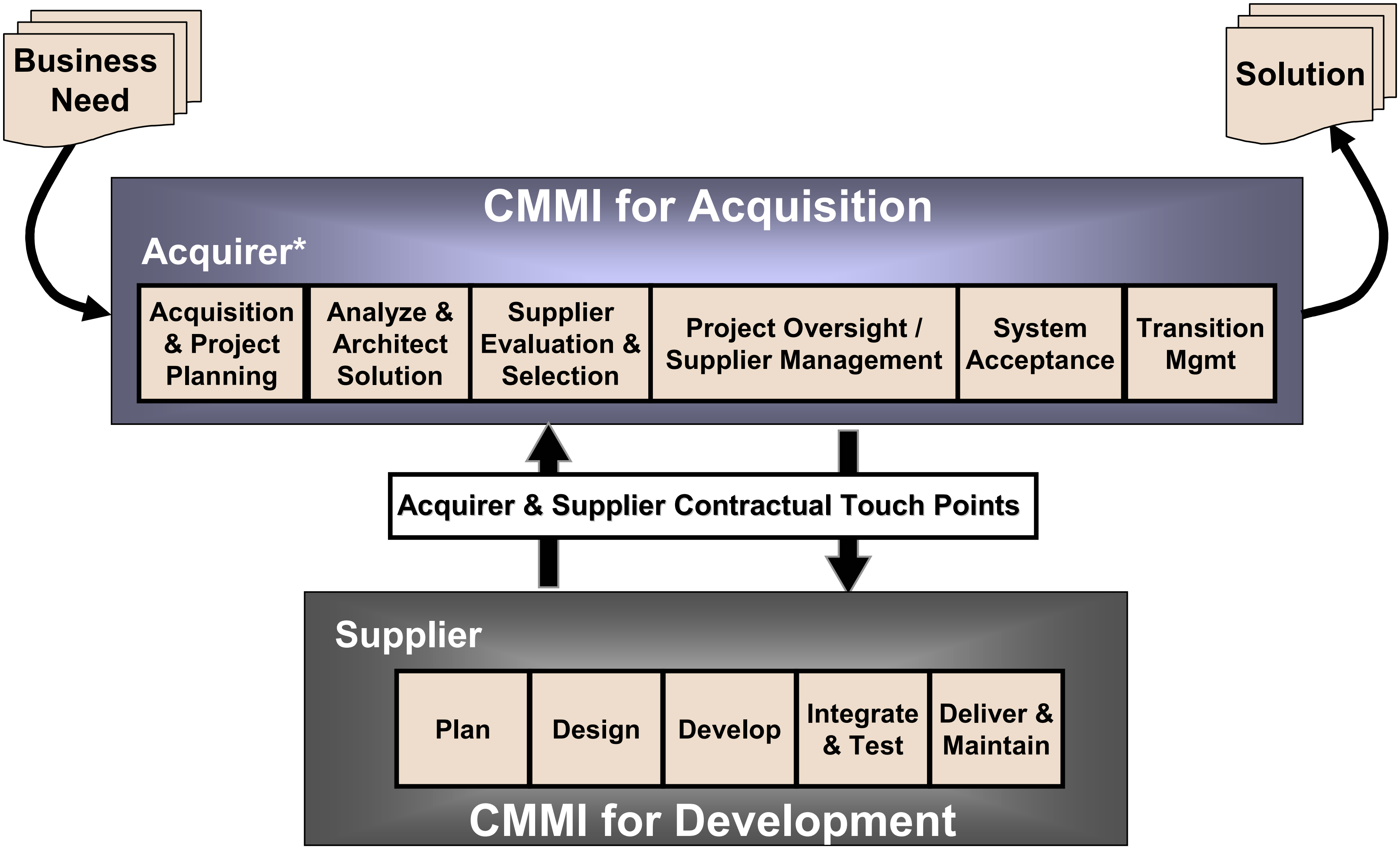
- Business analysis/relationship management (incl. requirements)
- Contract development & supplier management
- Program ownership / project management
- Technical architecture, standards, security

Key Supplier Roles

- Application Design/Development
- System Maintenance
- Desktop / Service / Help Desk
- Hosting
- Data center / mainframe

*** Based on Forrester, “Functions to Retain when Outsourcing” (July 2004)**

Acquisition Life Cycle



* Based on B. Gallagher "Using the CMMI in Acquisition Environments", Software-Intensive Systems Conference (2004) and S. Eslinger "Software Acquisition Best Practices", Acquisition Conference (2003)

Acquisition Life Cycle

Business Need

Solution

CMMI for Acquisition

Acquirer

Acquisition & Project Planning	Analyze & Architect Solution	Supplier Evaluation & Selection	Project Oversight / Supplier Management	System Acceptance	Transition Mgmt

Acquirer & Supplier Contractual Touch Points
Examples of Supplier Work Products

Metrics Data & Analysis Reports reflect progress, product, process compliance:

- Supplier Project Plan
- Detailed Requirements
- Requirements Traceability Matrix
- Product Design
- Executable Code
- Test Plans & Results
- Operations Readiness Report
- Training Plans & Material

Maturity Levels for Acquirers

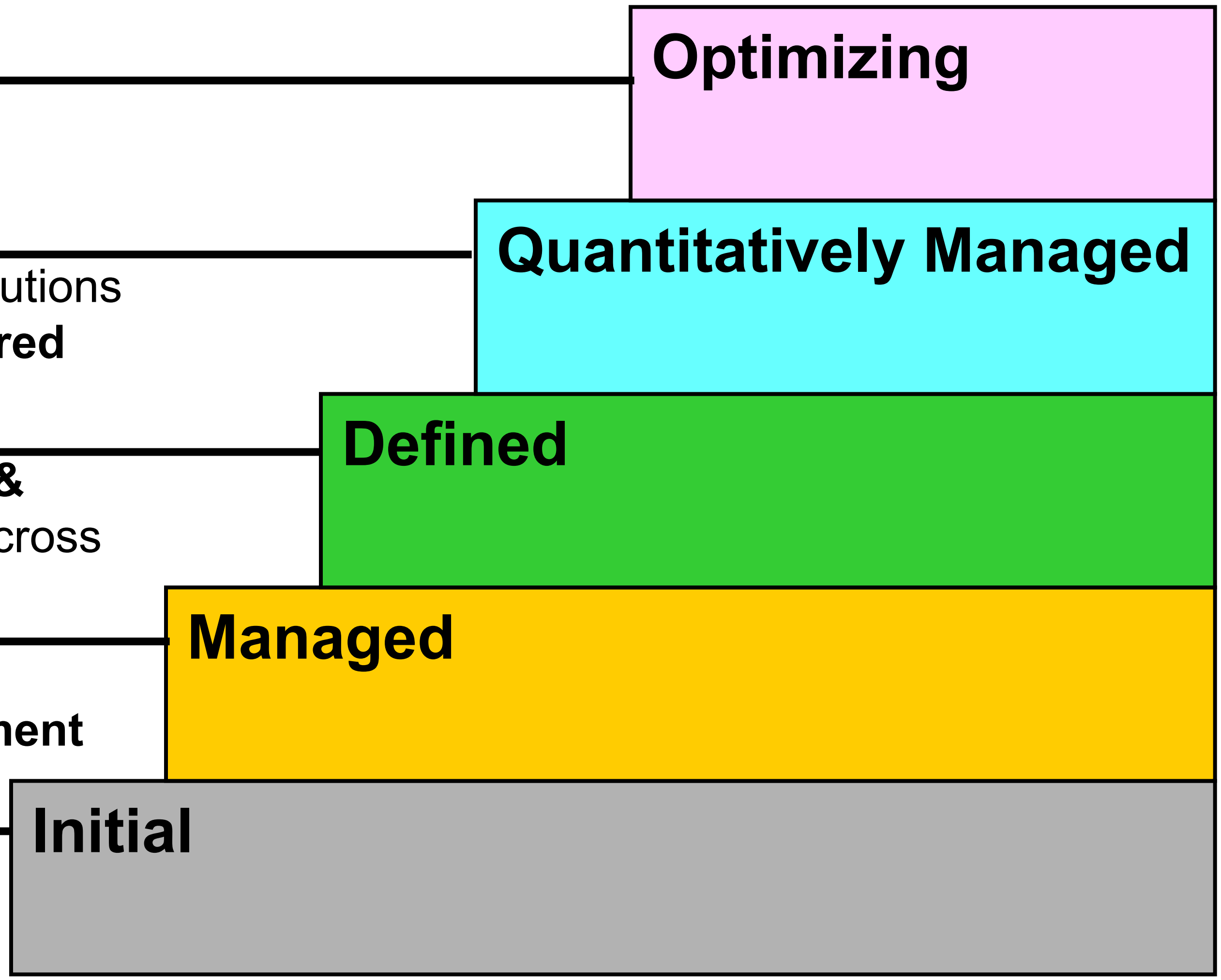
5 Focus on **integrated supply chain**

4 Projects, suppliers, solutions **quantitatively measured and controlled**

3 **Standard processes & standard contracts** across a portfolio of projects

2 **Basic Project and Acquisition Management**

1 **Unpredictable, poor communications, and reactive** project execution



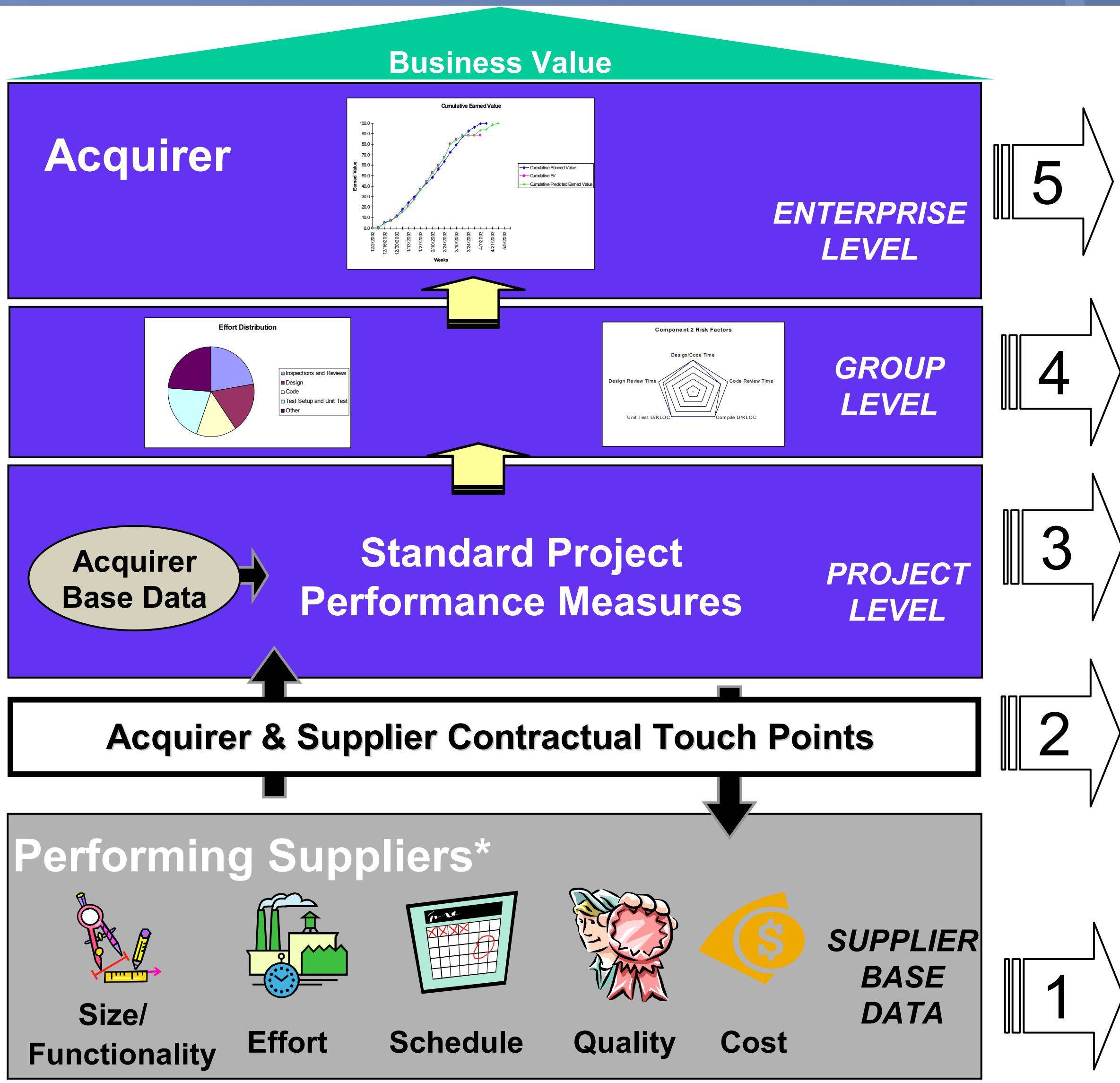
Project Execution: Acquisition Life Cycle and Roles

<table>
<tr><th>Life Cycle / Roles</th><th>Acquisition & Project Planning</th><th>Analyze & Architect Solution</th><th>Supplier Evaluation & Selection</th><th>Project Oversight / Supplier Mgmt</th><th>System Accept-ance</th><th>Transition Mgmt</th></tr>
<tr><td rowspan="3">Supplier Management</td><td rowspan="7">Project Planning</td><td colspan="2" rowspan="3">Solicitation & Contract Development</td><td colspan="3">Supplier Agreement Management</td></tr>
<tr><td colspan="3">Integrated Supplier Management</td></tr>
<tr><td colspan="3">Quantitative Supplier Management</td></tr>
<tr><td rowspan="4">Project Management</td><td colspan="5">Project Monitoring & Control</td></tr>
<tr><td colspan="5">Integrated Project Management</td></tr>
<tr><td colspan="5">Risk Management</td></tr>
<tr><td colspan="5">Quantitative Project Management</td></tr>
<tr><td rowspan="2">Requirements / Validation</td><td colspan="6">Requirements Management</td></tr>
<tr><td colspan="3">Requirements Development</td><td colspan="3">Verification & Validation</td></tr>
<tr><td>Architecture</td><td colspan="4">Technical Solution</td><td colspan="2">Transition to Operations</td></tr>
</table>

Level 2 Level 3 Level 4

* Process management and support processes are also required.

House of Measures – Key Principles



Enterprise Level - Enterprise level measures based on quantitative roll-up and drill-down capability provide business value analysis

Group Level - Group Performance measures to monitor process capability and operational performance at an aggregate level

Project Level - Standard project performance measures derived from supplier and acquirer base data

Touch Points – Suppliers report standard indices of base data to monitor project progress as defined in the contract

Supplier Base Data – Common measures from all suppliers will provide a metric foundation based on industry standards

*** Stronger Management Practices are needed to Improve DoD's Software Intensive Weapons Acquisitions, GAO-04-393 (March 2004)**

Next Steps

- Conduct pilots with General Motors Information Technology and its strategic suppliers
- Join CMMI for Acquisition (CMMI-A) requirements development team
- Publish special report about "Adapting CMMI for Acquisition Organizations: A Preliminary Report"
- Implement the new CMMI for Acquisition Organizations within General Motors
- Pilot GM internal appraisals against the new CMMI for Acquisition Organizations
- Present keynote at the SEPG 2006

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Simplifying Process Tailoring To Enhance Project Execution

NDIA/SEI CMMI® Technology Conference
November 2005

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Falls Church, VA

Customer Success Is Our Mission

Raytheon Falls Church (RFC)

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RFC Projects

- Support multiple product lines and multiple customers
- Range from very small to very large
- IR&D, full product development, partial life cycles, expert services,…

Process Maturity History

- Software CMM Level 3, December 2001
- Systems Engineering EIA-731 Level 3, April 2002
- SW and SE CMMI Level 3, October 2004
- *And now we're looking at CMMI IPPD/SS & Levels 4/5*

RFC Process Architecture (2004)

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Business Needs

Corporate Policies and Procedures

CMMI® Requirements

Organization's Set of Standard Processes (OSSP)

Policies

Procedures

Work Instructions

Enablers

IPDS

Tailoring

Project's Defined Process

Work Instructions and Enablers provide "how-to" guidance

IPDS = Raytheon's Integrated Product Development System

Observations

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What Worked Well

- Large development projects typically used Work Instructions and Enablers with little tailoring needed

What Didn't

- Smaller projects sometimes committed to ”too much process” (doing more work than necessary), or,
- Spent much time "tailoring down" from the full OSSP

Core Process Directives - 1

Pilot Version

Objectives

- Address "tailoring down from a single size-Large OSSP"
- Build on existing OSSP Work Instructions and Enablers
- Articulate process requirements for projects
- Relate process requirements to a project's characteristics
- Relate process implementation detail to a project's characteristics
- Simplify tailoring to enhance execution, particularly for small projects

Core Process Directives - 2

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Goals and Critical Outputs

- Goals and supporting practices for site process requirements – CMMI, Integrated Product Development System (IPDS), Earned Value Management System (EVMS), etc.
- “Critical outputs” needed to satisfy process goals:
  - Minimum required content for each critical output
  - Pointers to templates and other Enablers
  - Process description embedded for some
- Site-standard roles

For Each Process Goal

- Practices supporting the goal and the role(s) responsible for each
- Critical outputs
- Relevant Work Instructions

Core Process Directives - 3

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Project Types Based on Project Characteristics

- Significant Development
- Minor Development
- Significant Support/Services
- Minor Support/Services

Applicability Rules for Each Project Type

- Process goals that must be satisfied
- Process implementation requirements
- Requirements packaged as a “Requirements Set” for each project type

RFC Process Architecture (2005 Pilot)

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Organization's Set of Standard Processes (OSSP)

Core Process Directives

Goals/Practices

Roles

Critical Outputs

Applicability Rules

Policies

Procedures

Work Instructions

Enablers

Requirement Sets by Project Type

Significant Development

Minor Development

Significant Support

Minor Support

Tailoring

Project's Defined Process

Requirement Set - Excerpt

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Process Requirements for Significant Development

The following defines RFC's process goals and the requirements neccessary to meet these goals. Associated with each goal are the practices that must be performed and the Critical Outputs from that must be created.

17. RFC Requirements for Risk Management (RSKM)

RSKM SG 1 Goal: Preparation for risk management is conducted.

The following requirements support this goal:

The Program Manager and Program's Risk Coordinator determine risk sources and categories. (Ref: RSKM SP 1.1)

The Program Manager and Program's Risk Coordinator define the parameters used to analyze and categorize risks, and the parameters used to control the risk management effort. (Ref: RSKM SP 1.2)

The Program Manager and Program's Risk Coordinator establish and maintain the strategy to be used for risk management. (Ref: RSKM SP 1.3)

The following outputs shall be produced:

Risk List or Register

Risk Management Plan

The following work instructions shall be followed:

PM-108 - Risk Management (RISK)

Critical Output Descriptions - Excerpt

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Critical Output Descriptions

Risk List or Register

Risk List or Register is a prioritized list of program risks and assessed likelihood and impact severity with a summary of mitigation plans. Risk List or Register is included in or referenced by the Integrated Program Management Plan (IPMP) and is maintained according to the Risk Management Plan (see Risk Management Plan) as part of the program's Risk Repository (see Risk Repository).

Reference: PM-108, PM-E-011

Risk Management Plan

The Risk Management Plan is included in or referenced by the Integrated Program Management Plan (IPMP) and defines the following items:

(a) The overall strategy for managing risks and opportunities
(b) How often the risk plans and status will be updated
(c) Organization and responsibility of program personnel for risk identification, assessment, handling, and reporting
(d) Tools and methods to be used in risk identification, assessment, handling and reporting

Reference: PM-E-029

Development/Support/Services

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Development Project:

- Delivers a system, product, or component
- Develops concepts, requirements, or designs for a system, product, or component that RFC is likely to deliver in the future

Support Project:

- Integrates/verifies subsequent portions of a system or product developed by RFC and/or maintains a product
  - If significant enhancements required, project type is “development”

Services Project:

- Provides engineering expertise without likelihood of product delivery

Definition of Significant/Minor Project

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Classification Based on:

- $ value and effort
- Contract type
- Designation by senior management as:
  - Strategic opportunity
  - Major program
  - Top risk program
- ***It's not just about <u>large</u> or <u>small</u>***

Applicability Rules

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Significant Development Project:

- Goals for all Level 2 and 3 process areas
- Critical outputs for the applicable goals (formal tailoring)
- Work Instructions for the applicable goals (formal tailoring)

Minor Development Project:

- Goals for all Level 2 and 3 process areas
- Critical outputs for the applicable goals (formal tailoring)

Significant Support/Services Project:

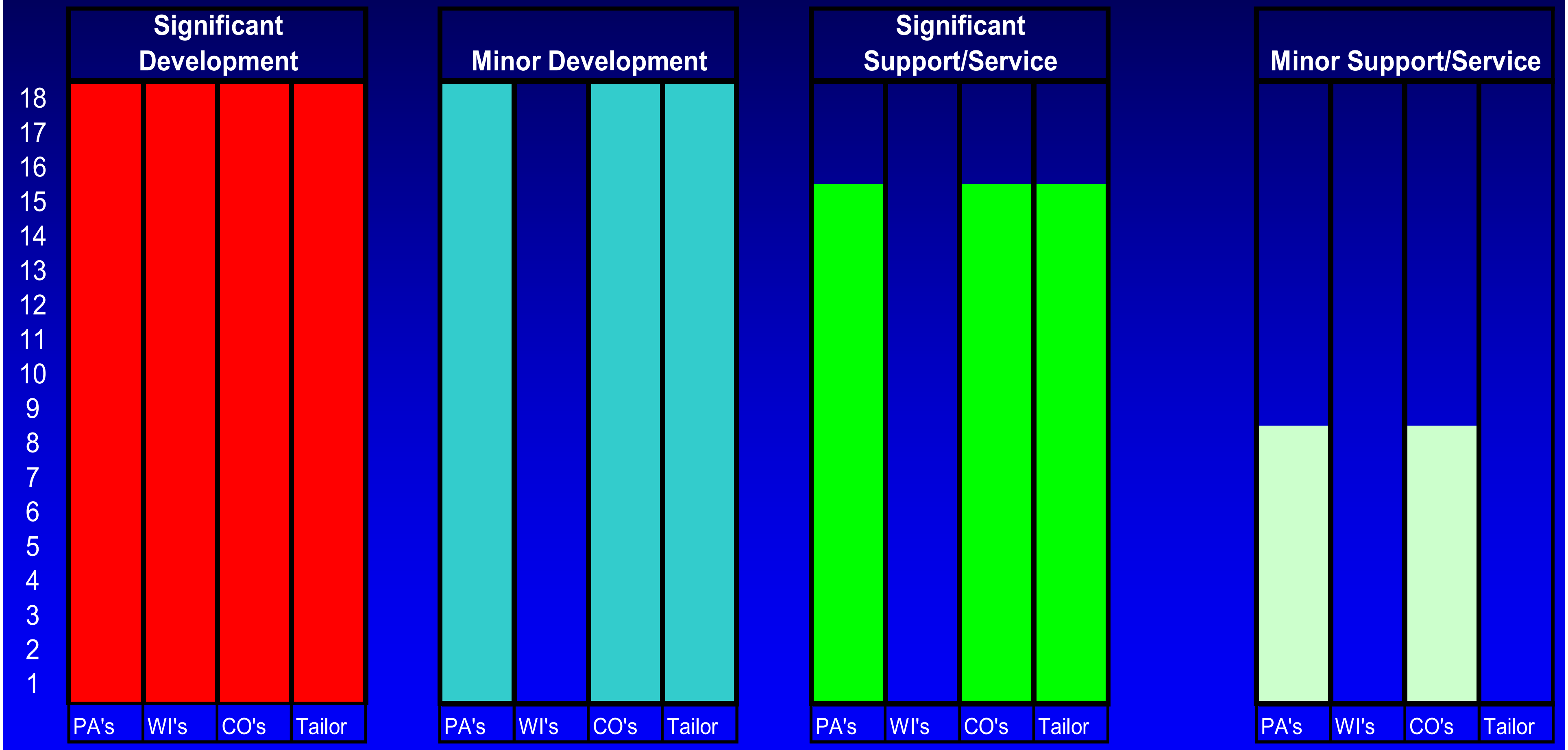
- Goals for all Level 2 and 3 process areas except RD, TS, and PI
- Critical outputs for the applicable goals (formal tailoring)

Minor Support/Services Project:

- Goals for all Level 2 process areas
- Critical outputs for the applicable goals (informal tailoring)

➢ ***All Requirement Sets identify the relevant Work Instructions***
➢ ***Projects may add other elements as appropriate***

Reducing the Amount of Detail



OSSP Tailoring

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Produces the Project's Defined Process (PDP) to govern project execution

- Tailored life-cycle activities and other project characteristics
- Tailored Critical Outputs and Work Instructions (if required)
- Integrated Project Management Plan (IPMP) – Includes or contains references to the project's major planning elements

An important part of project planning

Facilitated by a deployment coach

When Tailoring is Performed

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1 - During Proposal Preparation

- Establish high-level project characteristics and process requirements
- Perform preliminary tailoring and planning
  - Create initial IMP and IMS, e.g.
- ***Early understanding of process requirements helps improve bid estimates (e.g., amount of CM and QA support needed)***

2 - Following Contract Award

- Refine preliminary tailoring/planning outputs based on actual award
- Perform detailed tailoring and planning
  - Create PDP and project plans

What Has Been Simplified/Improved

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Projects tailor from an OSSP subset based on project characteristics

- Less time spent “tailoring down”
- Less chance projects commit to “too much process”

Degree of process implementation detail related to Project characteristics

- High level of detail required for planning Significant Development projects
- Reduced requirements for other types of projects

Project’s Defined Process to guide execution is better fit to project characteristics

- Better alignment with “What” project needs to do and “How” to do it

Some Final Thoughts

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"If you want to try this at home"

- A one-size-fits-all OSSP can be made to work for all projects — ***but it makes sense to have several sizes available to ensure a better fit***
- All projects need process requirements — ***but all projects do not necessarily need the same degree of process detail. This is likely to be true for small projects***
- Multiple levels of process requirements CAN work effectively — ***but there are more considerations than just large versus small. Use a scheme that satisfies business needs***
- ***There must be sufficient guidance so projects know what they need to do***

Questions?

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Being Customer Oriented

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Welcome

WelKom

Huan Yín

Bienvenido

Bienvenue

Wilkommen

ΈΚΑΛΟΣ ΟΡΙΣΑΤΕ

Bienvenuto

Välkommen

Tervetuloa

Witamy

ברוכים הבאים

Topics

- Who Are the Customers?
- Customer Relationship Management
- Process Improvement Means Change
- Culture
- Process Improvement in Different Types of Organizations
- Being a Quality Company

Topics - 2

- Standards, Models, and Concepts Supporting Customer Orientation
  - EFQM
  - Baldridge
  - Six Sigma
  - CMMI
  - ITIL
- End-to-End Quality

Who Are The Customers?

Who Are the Customers?

- Internal
  - Marketing
  - Product Manager
  - Systems
  - Another development unit in a prime contractor role
- External
  - Customer/Purchaser
  - End user
- Often there are multiple "customers"

Customer vs. User

- The customer:
  - Establishes the need for the product
  - Is responsible for ensuring payment for its development and
  - Is responsible for acceptance of its delivery
- The user works with the delivered system:
  - Operational user (e.g., pilot, train controller, accounting personnel)
  - Administrative user (e.g., data entry support)
  - System Management (e.g., computer systems manager)
  - System Maintenance (e.g., aircraft maintenance)

Customer vs. User - 2

- Customers may appear in a variety of roles:
  - Represent end users
  - Be the actual end user
  - Trying to meet the demands of the existing market (Marketing, Product Management)
  - Driving the needs/wants/desires of the future open market (Marketing, Research and Development, Product Management)
- The key is to ensure you:
  - **Meet the needs** of the end users
  - **Fulfill the requirements** of the customer

Customer Relationship Management

Customer Relationship Management

- Customer Relationship Management (CRM) is a philosophy whose principle tenet is that a business should be designed to serve its customers
  - In a CRM initiative, systems, processes, and the organizational structure are all examined and revised if necessary to create a customer-oriented enterprise
- Develop your organization’s definition of CRM – ***there is no universal definition***

Customer Relationship Management - 2

- Rules to ensure that your customer-oriented program is not just the latest fad:
  - Develop business objectives to hold the initiative together over time
  - Ensure that all CRM objectives are understandable, tangible and measurable
- Put the customer on your team
  - Too many organizations think if “the customer” as “the enemy” instead of an integral part of the system being developed
  - Involving the customer can help to set reasonable –customer-oriented goals and, at the very least, create goodwill

Customer Relationship Management - 3

- Organize your customer-orientation around your processes
  - The customer looks at your organization as a black box that receives an order and delivers a high-quality product on-time and within budget out the back end
  - The processes that your organization develops and uses should encapsulate everything you can manipulate to improve a customer output

Customer Relationship Management - 5

- Actively manage change – a successful CRM program not only drives process improvement but also changes:
  - The way the organization works
  - The roles that employees and other stakeholders play
  - The mode, frequency, and goals of interaction among customers, salespeople, customer service representatives, marketing personnel and everyone else involved in the customer relationship

Culture
and Its Influences

What is Culture?

- Culture may be defined as the totality of the mental and physical reactions and activities that characterize the behavior of individuals collectively and individually, in relations to their natural environment, to other groups, to members of the group itself and of each individual to himself
- What really binds people together is their culture, -- the ideas and the standards they have in common

What is Culture? - 2

- Culture has a value dimension and is about:
  - Relationships - between individuals and groups
  - Shared memories, experience and identity
  - Social standards, values and norms
  - What we consider valuable to pass on to future generations."

Culture Examples

- Japanese
- Indian
- French
- German
- Chinese
- African
- Singaporean
- South American
- United States
- United Kingdom

Culture Examples - 2

- Europe and Asia
  - Germany and China
- Siemens (German) – English Speaking Countries
  - Munich – Boston, Birmingham
- East Coast – West Coast
  - Boston and Palo Alto
- China Lake – Point Magoo
  - Suits vs Jeans and Boots
- Texas vs “Rest of the World”

Process Improvement in Different Types of Organizations

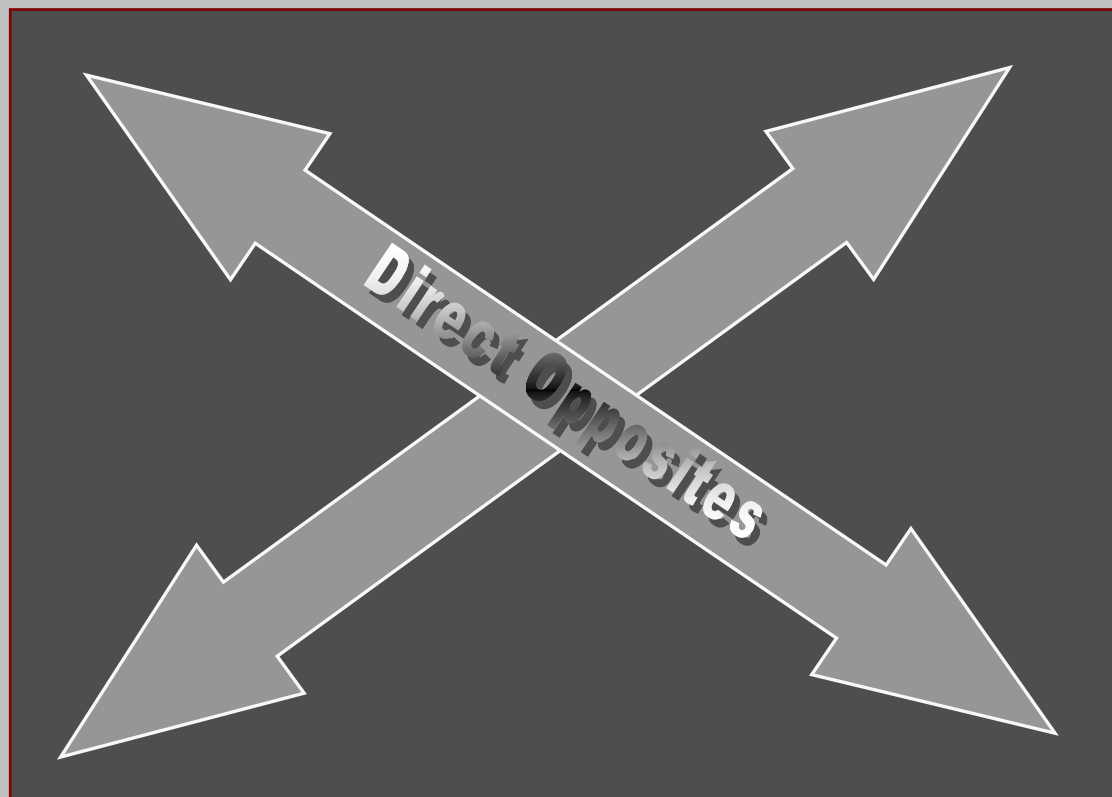
Work Organization Paradigms

- If we are interested in fully understanding the organization and management of projects, then it is reasonable to ask:
  - How is it possible for groups of people to carry out coordinated efforts?
  - What are the various possibilities for doing so?
- Organization paradigms can be understood as variations in how working groups set priorities and deal with certain fundamental, unavoidable issues in all human endeavors

Relationships Among Reference Organizational Paradigms

Random
Innovative
Independence

Open
Adaptive
Collaboration



Harmonious
Alignment
Synchronous

Traditional
Hierarchy
Closed

Using Constantine's Organizational Paradigms

- A framework for understanding the full range of variations in how development projects can be organized and managed
- Four different types of organizational paradigms
  - Closed
  - Random
  - Open
  - Synchronous

Closed Organization

- Strengths
  - Stable
  - Clear lines of authority
  - Traditional hierarchy
  - Responds to incremental change
  - Predictable performance on routine tactical projects
- Weaknesses
  - Weak on innovation
  - Requires strong leadership to change
  - Change and diversity not valued
  - Individuality often thought of as disloyal

Random Organization

- Strengths
  - Able to make creative breakthroughs
  - Independence
  - Free expression and individual freedom
  - Thrives on change
- Weaknesses
  - Requires strong leader (with personality and enthusiasm)
  - Not stable or efficient
  - Weak follow-through
  - Less able to sustain change
  - Difficulty in meeting deadlines

Open Organization

- Strengths
  - Adaptable and flexible
  - Share information freely
  - Changes open to negotiation
  - Excel at solving complex problems
- Weaknesses
  - Waste time in non-results oriented debate
  - Lack of hierarchy may lead to lack of accountability
  - Personnel need to be involved in planning changes and frequently undermine directives from above

Synchronous Organization

- Strengths
  - Harmony
  - Common goals
  - Unified vision—an ideal of cooperation
  - Remarkably efficient in performing established procedures
- Weaknesses
  - Little authentic negotiation or discussion
  - Doesn't respond well to change

Being A Quality Company

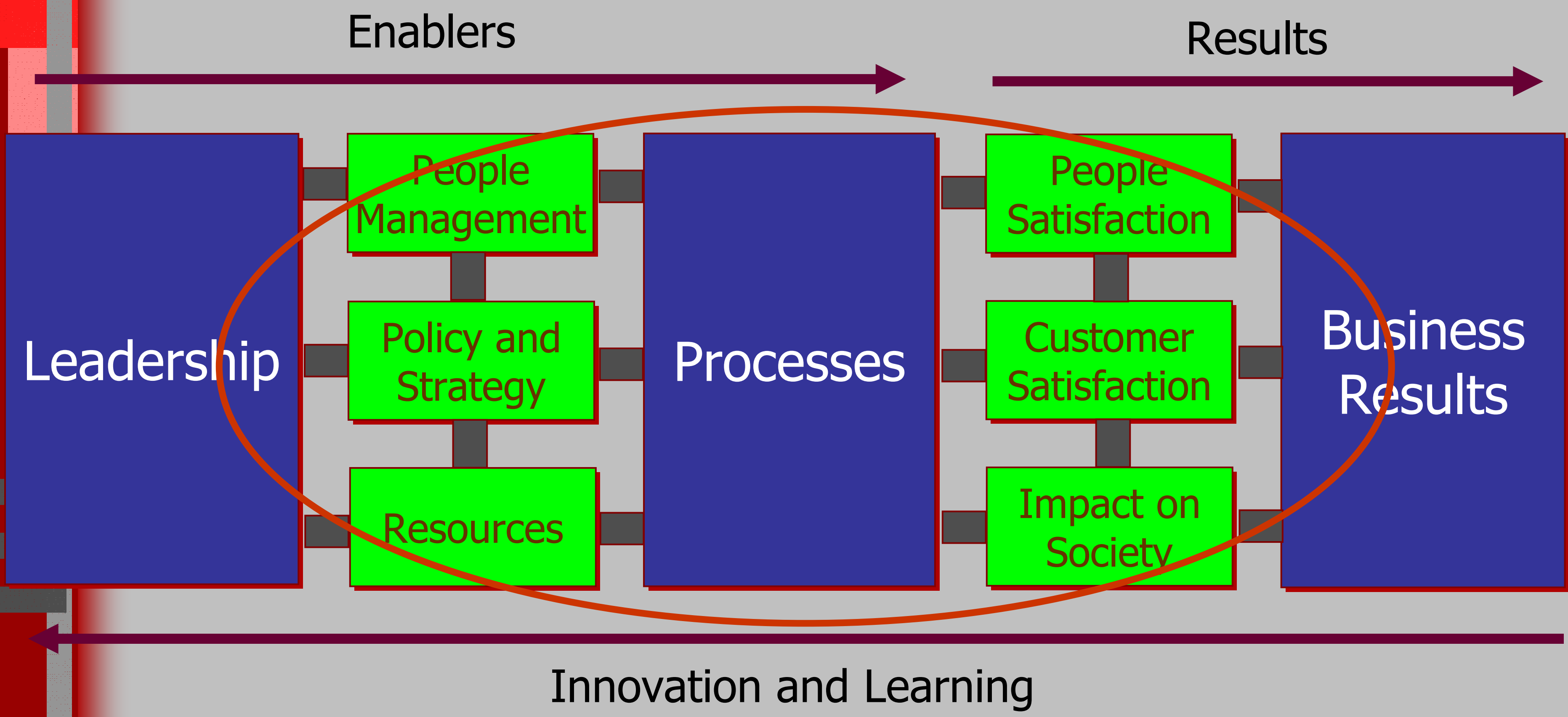
Being A Quality Company

- Being a quality company means going beyond your factory floors, for example to both your suppliers and your customers
- You can't give people a reliable product without having a reliable process to build it with
- Achieving quality involves finding out what the customers need and who are the customers
- Five things you want to go up
  - **Customer satisfaction**
  - Quality
  - People
  - Market Share and Revenue
  - Profit

Standards, Models, and Concepts Supporting Customer Orientation

European Foundation for Quality Management EFQM

EFQM Overview
Equivalent CMMI Coverage



Baldridge Award

The Baldridge Award

- The Baldridge Award is the highest quality prize in the United States and was designed to encourage American companies to improve themselves and continue to improve themselves

The Baldridge Award - 2

- Seven Categories
  - Strategic Quality Planning (60 Points)
  - Information and Analysis (70 Points)
  - Leadership (100 Points)
  - Quality Assurance (140 Points)
  - Human Resource Utilization (150 Points)
  - Quality Results (180 Points)
  - Customer Satisfaction (300 Points)

Six Sigma

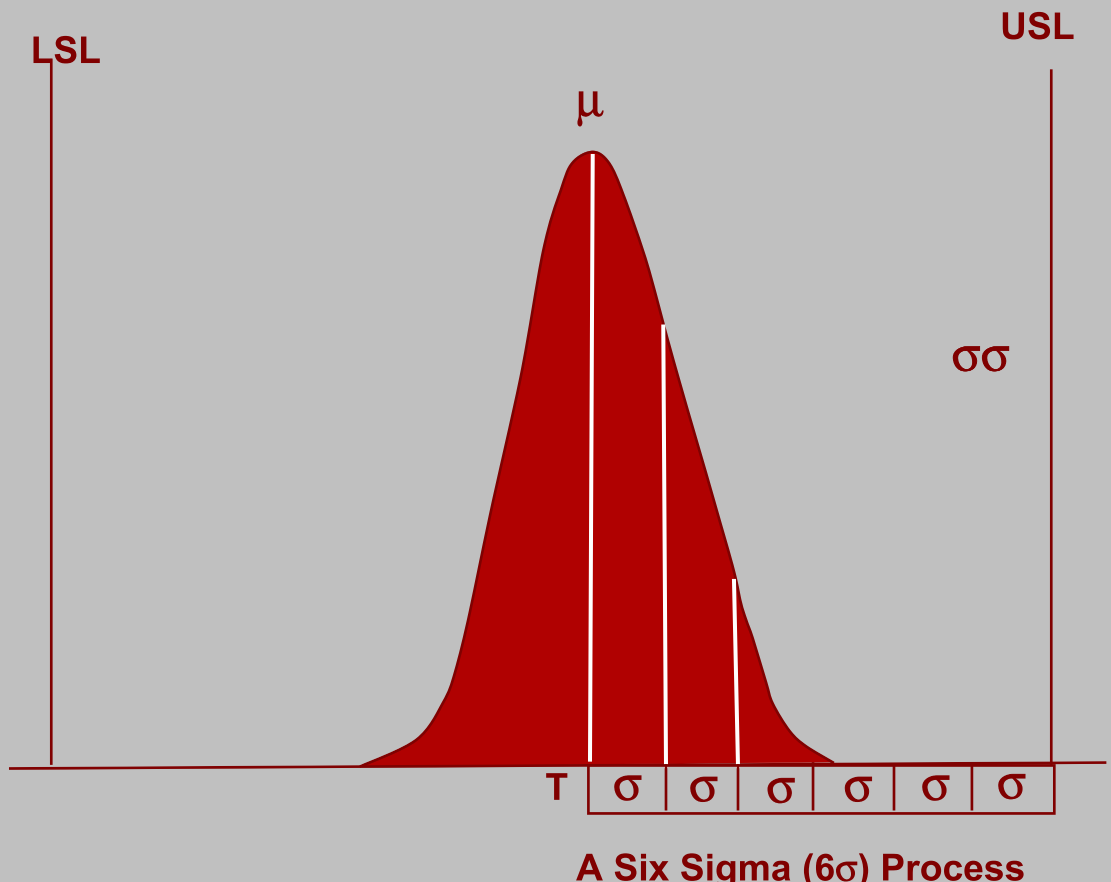
Six Sigma

- Six Sigma has been defined as a smarter way to manage a business or department
- Six Sigma puts the customer first and uses facts and data to drive better solutions
- Six Sigma efforts target three main areas:
  - **Improving customer satisfaction**
  - Reducing cycle time
  - Reducing defects

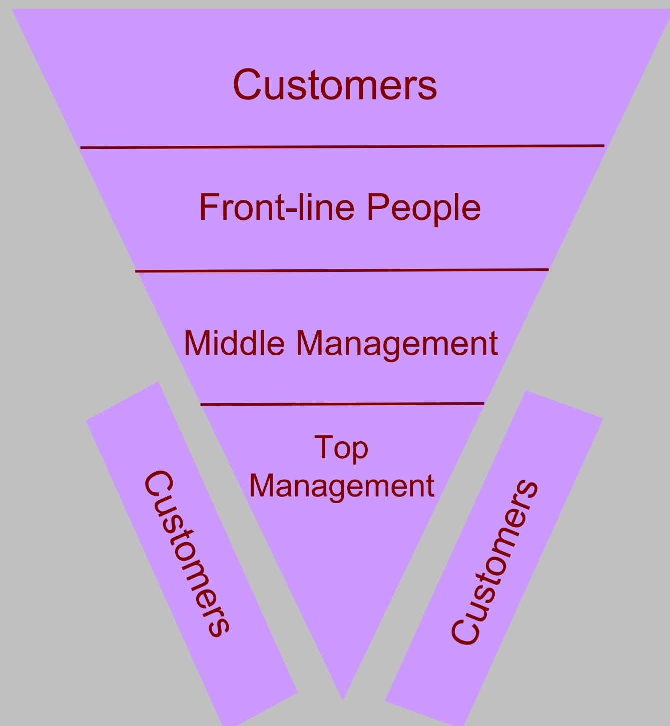
Six Sigma - 2

- Six Sigma driven improvements represent dramatic savings to businesses as well as opportunities to retain customers, capture new markets and build a reputation for top performing products and services
- Six Sigma is a business initiative that embraces the total management commitment and philosophy of excellence, customer focus, process improvement and the rule of measurement – not just gut feel
- Six Sigma advocates describe the customer focus as a required obsession because the external customers buy your business's product and services

A Six Sigma Process



Six Sigma Customer Driven Organizations



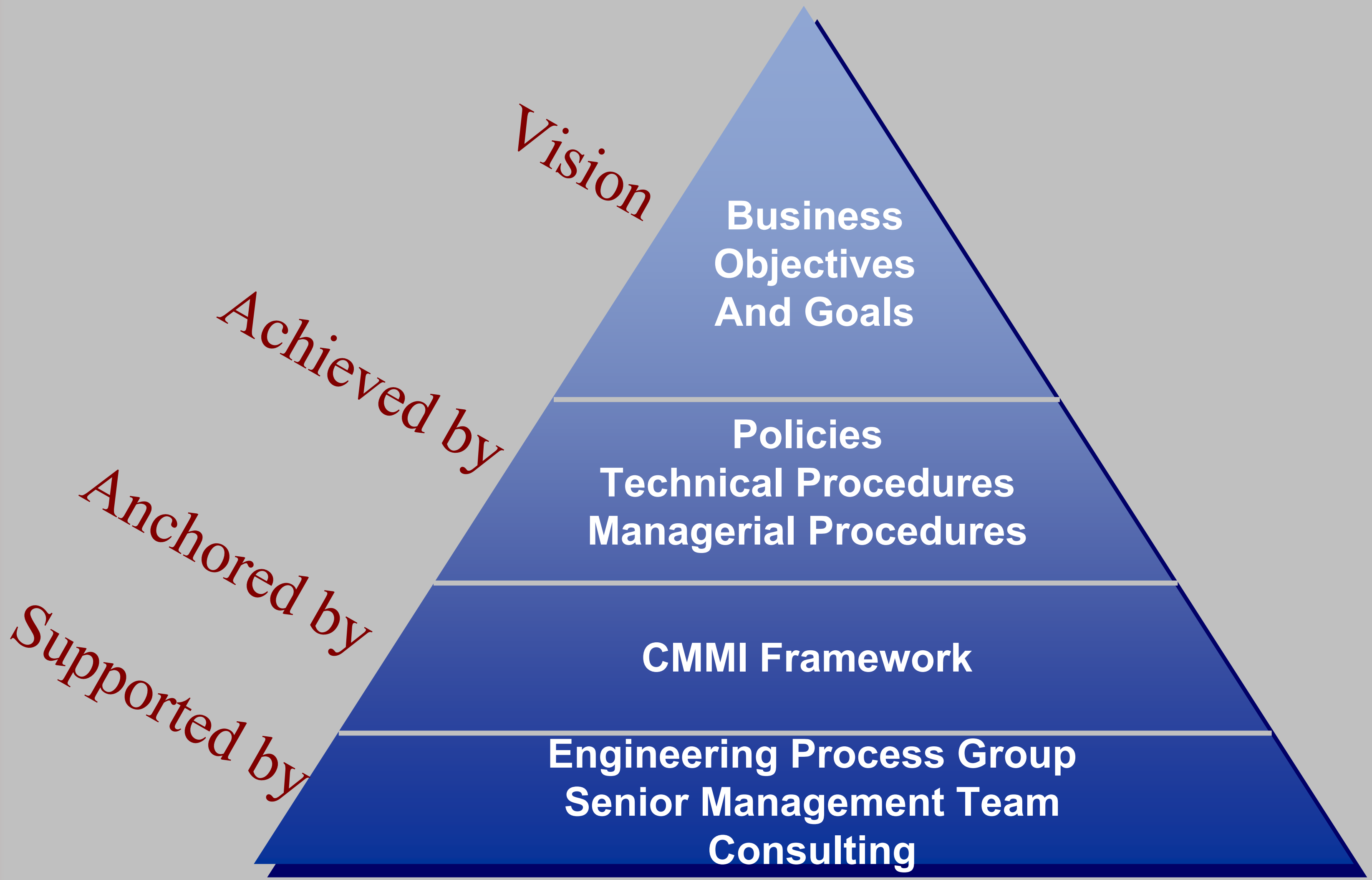
The Correct View of the Customer-Driven Organization Chart
Marketing Management: Analysis, Planning, Implementation and Control
Philip Kotler © Prentice Hall

CMM Integration CMMI®

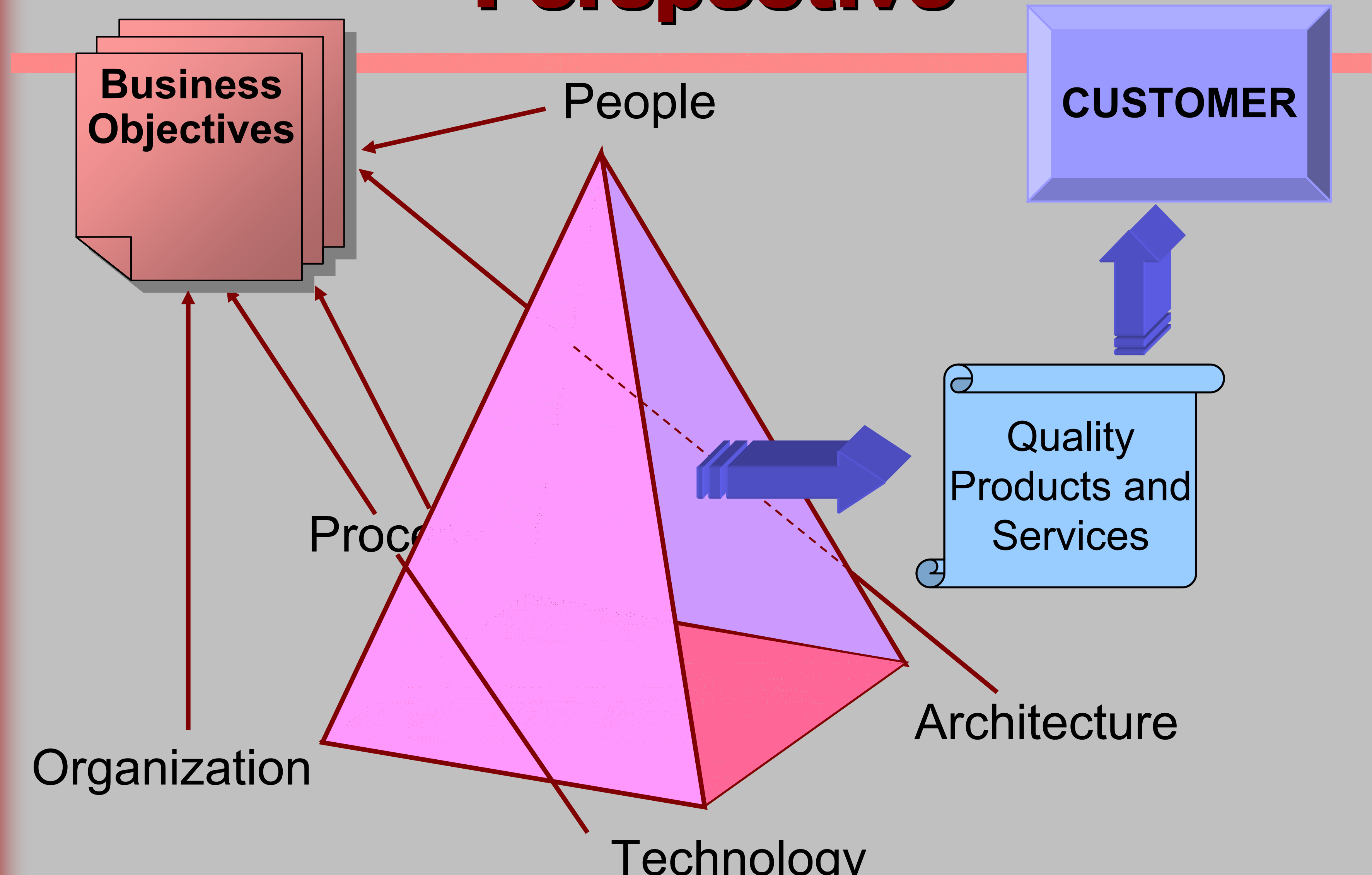
CMMI Overview

Level	Process Characteristics	Process Areas
5 Optimizing	Focus is on quantitative continuous process improvement	Causal Analysis and Resolution Organizational Innovation and Deployment
4 Quantitatively Managed	Process is measured and controlled	Quantitative Project Management Organizational Process Performance
3 Defined	Process is characterized for the organization and is proactive	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organization Process Definition Organizational Training Integrated Project Management Integrated Teaming Organizational Environment For Integration Integrated Supplier Management Risk Management Decision Analysis & Resolution
2 Managed	Process is characterized for projects and is often reactive	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Product and Process Quality Assurance Configuration Management Measurement and Analysis
1 Initial	Process is unpredictable, poorly controlled, and reactive	

The CMMI Framework Contribution



Business Process Perspective



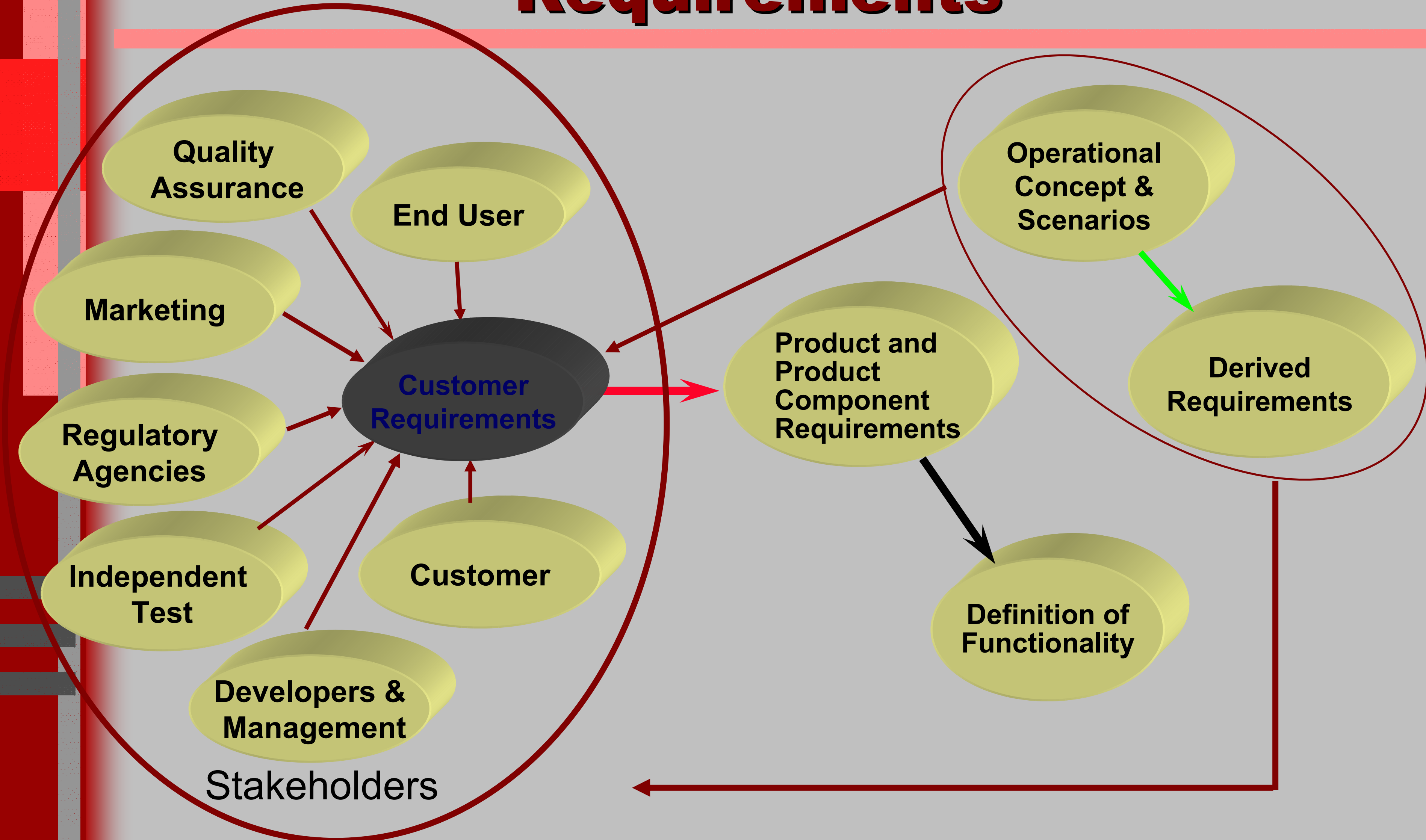
Verification and Validation

Verification & Validation

- **Verification** is used to assure that selected work products meet their specified requirements
  - Verification assures "You built it right"
- **Validation** is used to demonstrate that a product or product component fulfills its intended use when placed in its intended operational environment and utilized by the intended users
  - Validation assures "You built the right thing"

Validating Requirements Throughout the Product Lifecycle

Customer, Product, and Product Component Requirements



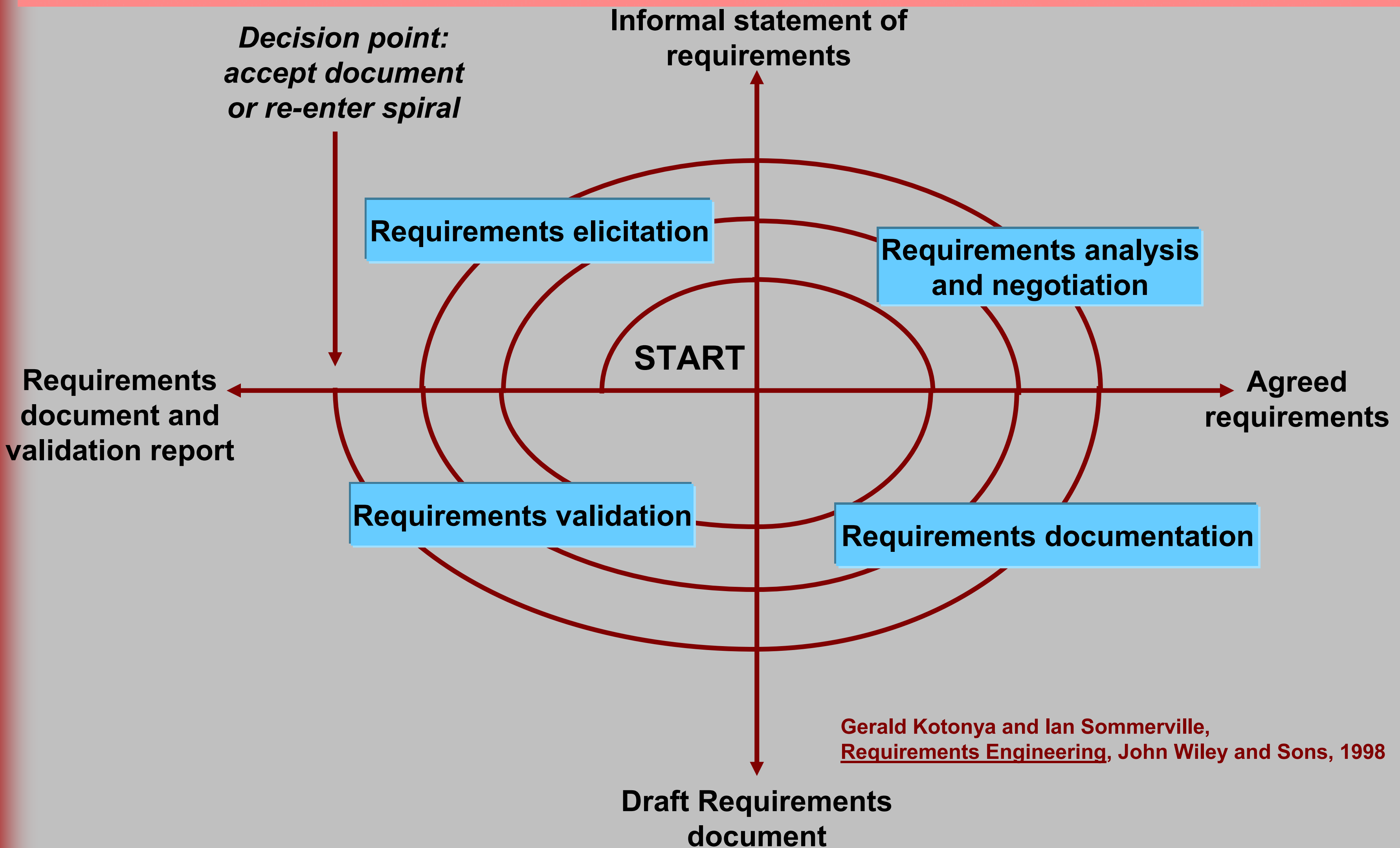
Elicitation Techniques

- Examples of techniques to identify and elicit Stakeholders' needs include:
  - Dialogue
  - Scenario reviews
  - Technology demonstrations
  - Models
  - Simulations
  - Prototypes
  - Brainstorming
  - Observations of existing systems
  - Extractions from sources such as documents, standards, and specifications

Validating Requirements

- Customer requirements should be **validated** early in the development schedule to **gain confidence** that the customer requirements are capable of guiding a development that results in the customer's operational needs being met
  - Simulations
  - Prototypes
  - Analyses
  - Scenarios
  - Storyboards

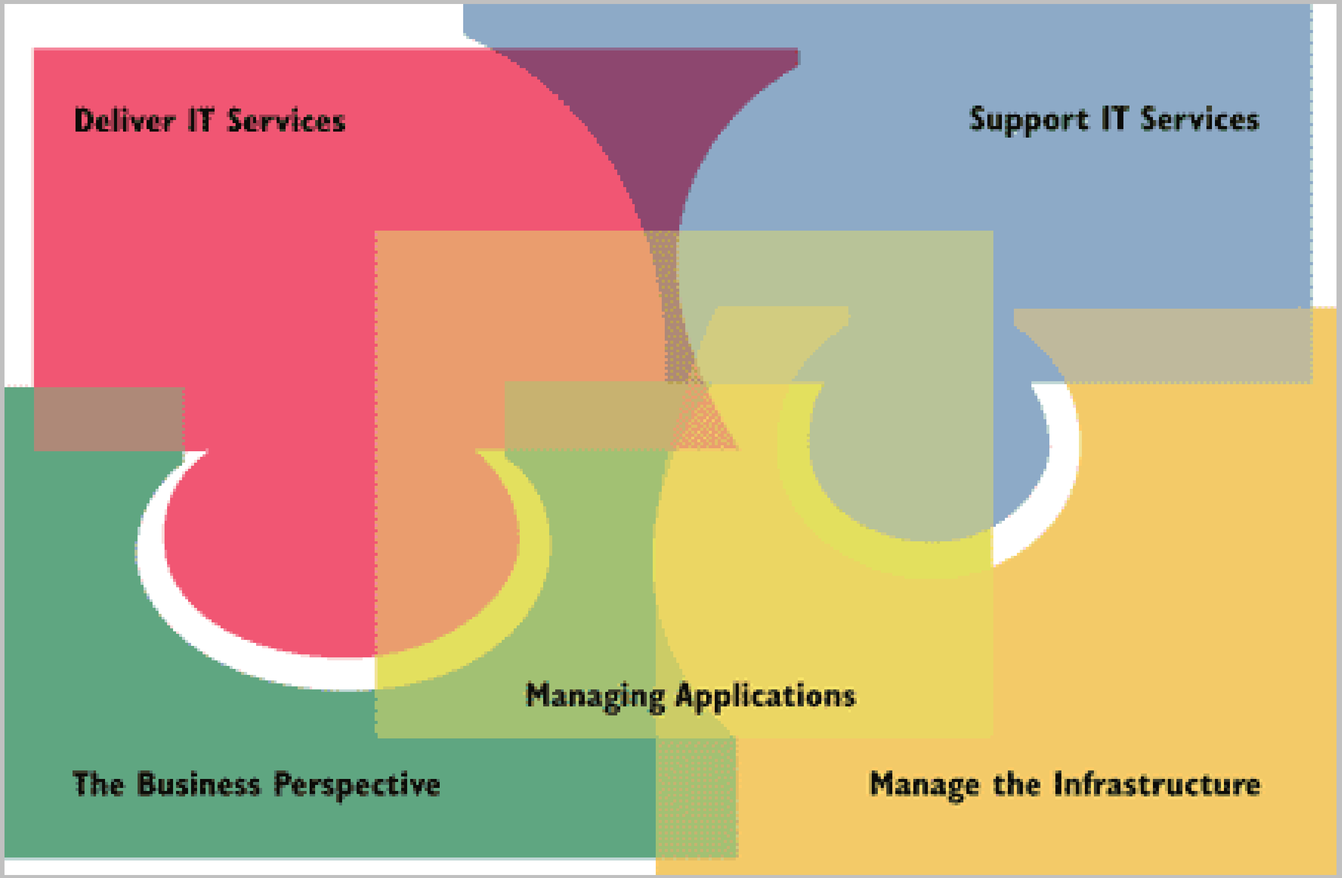
Validating Requirements



Gerald Kotonya and Ian Sommerville, Requirements Engineering, John Wiley and Sons, 1998

IT Infrastructure Library
ITIL

Jigsaw Diagram



Why ITIL?

- Organizations are increasingly dependent upon IT to satisfy their corporate aims and meet their business needs
  - This growing dependency leads to growing needs for quality IT services – **quality that is matched to business needs and user requirements as they emerge**

Why ITIL? - 2

- IT Service Management is concerned with delivering and supporting IT services that are:
  - Appropriate to the business requirements / objectives of the organization
  - Result in higher customer satisfaction

ITIL Background

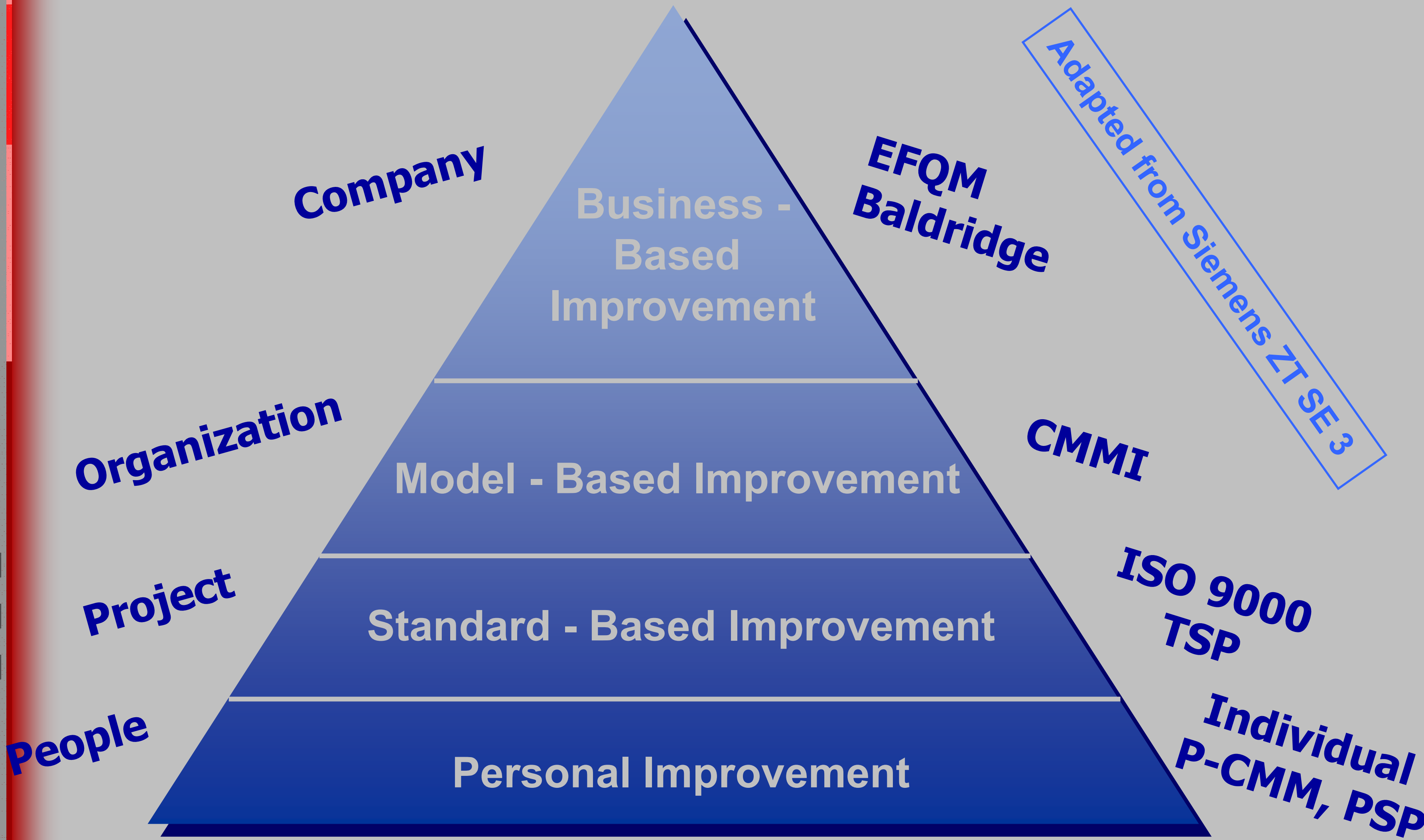
- Developed in the late 1980s, the IT Infrastructure Library (ITIL) has become the world-wide *de facto* standard in Service Management
- Starting as a guide for UK government, the framework has proved to be useful to organizations in all sectors
- ITIL is a framework that describes the goals, general activities, inputs and outputs of the various Service Management processes, which can be incorporated within IT organizations

ITIL Background - 2

- ITIL focuses on both tactical and operational level
  - Tactical processes are centered on the relationships between the IT organisation and their Customers
  - Service Delivery is partially concerned with setting up agreements and monitoring the targets within these agreements.
  - On the operational level, the Service Support processes can be viewed as responding to the changes needed in, and any failures in, the services laid down in these agreements

End-to-End Quality

Business Process Improvement Model



What Business Are You in?

- What Business Are You in?
- How does each department contribute to this business success?
- How do these departments interact with each other to maximize company profit and achieve business goals?
- What business processes exist in each department to optimize its product quality and minimize interface conflicts?

What Business Are You in? - 2

- What standards and models are you using to accomplish daily tasks?
- What personal processes are being used for each person to optimize his/her performance?
- Does each person understand his/her role in supporting the Organization’s business quality goals?

The Deming Quality Chain

Improve Quality → Decrease Costs → Improve Productivity → Decrease Prices → Increase Market → Stay in Business → Provide Jobs and more Jobs → Return on Investment

"Companies ... tend to focus only on the end result – return on investment. This viewpoint is like trying to keep a dog happy by forcibly wagging its tail."

Thank You

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Systems Engineering Influence Throughout the CMMI

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Welcome

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Agenda

- Engineering Systems Think
- What is Systems Engineering?
- Systems Engineering and Systems Management Overview
- Systems Engineering Capability Model EIA – 731
- Processes for Engineering a System
  EIA – 632
- IEEE Standard for Application and Management of the Systems Engineering Process IEEE 1220
- Systems Lifecycle Processes

Engineering Systems Think

Laws of Engineering Systems Thinking

- Systems Thinking is a discipline for seeing the whole
- In all of the project's phases/stages, and along the system's life, the systems engineer has to take into account:
  - The customer's organization vision, goals, and tasks
  - The customer's requirements and preferences
  - The problem to be solved by the system and the customer's needs
- The whole has to be seen as well as the interaction between the system's elements
  - Iterative or recursive thinking must replace the traditional linear thinking

What is
Systems Engineering?

Systems Engineering Definitions

- Systems Engineering is the application of scientific and engineering efforts to transform an operational need into a description of system performance parameters and a system configuration through an iterative process of definition, synthesis, analysis, design, test, and evaluation
- Systems Engineering is an interdisciplinary approach that encompasses the scientific and engineering efforts related to the development, manufacturing, verification, deployment, operations, support, and disposal of systems products and processes

Systems Management

- Systems Management and integration issues are of major importance in determining the effectiveness, efficiency, and overall functionality of systems design
- To achieve a high measure of functionality, it must be possible for a system (product or service) to be efficiently and effectively:
  - Produced
  - Used
  - Maintained
  - Retrofitted
  - Modified

Systems Engineering Capability Model EIA - 731

EIA – 731 Standard Scope

- EIA – 731 was developed to support the development and improvement of systems engineering capability
  - Includes all activities that associate with or enable systems engineering
  - Focuses on an inter-disciplinary approach to enable the realization of a successful system
  - **Not limited to what a Systems Engineering organization or Systems Engineers do**
  - Interaction of many people, processes, and organizations resulting in the accomplishment of the required activities

EIA – 731 Standard Scope - 2

- EIA – 731 applies to programs and organizations doing systems engineering
  - Small or large
  - Simple or complex
  - Software intensive or not
  - Precedented or unprecedented
  - Contains hardware, software, personnel, facilities, data, material, services, or techniques
  - Engineering of a new system or the reengineering of a legacy system

EIA – 731 Standard Scope - 3

- EIA – 731 is intended to provide complete coverage for EIA – 632, Processes for Engineering a System
- EIA – 731 is intended to be consistent with EIA – 632 and IEEE 1220, Standard for Application and Management of the Systems Engineering Process

EIA - 731 Model Architecture

- The components of the model are:
  - **Categories** – A category is a natural grouping of Focus Areas.
    - Technical, Management, and Environment
  - **Focus Areas** – A Focus Area is a set of related unique practices that address some aspect of Systems Engineering
  - **Themes** – A Theme is a subdivision of a Focus Area that defines a related set of Specific Practices
  - **Specific Practices** – An activity that is essential to accomplishing the purpose of a Focus Area or that helps accomplish the purpose of the Focus Area more effectively or efficiently

EIA - 731 Model Architecture - 2

- **Generic Practices** – A Generic Practice is an activity that, when applied to the Specific Practices of a Focus Area, enhances the capability to perform those practices.
  - Generic Practices are applicable to any Focus Area
- **Generic Attributes** – A Generic Attribute is an assessment of the effectiveness of the applied process and of the value of the products of the process.
  - Generic Attributes are applicable to any Focus Area

Levels of Capability

- The EIA - 731 defines six levels of capability which corresponds to the Continuous Representation of the CMMI
- The six capability levels are:
  - Initial – Incomplete (CMMI)
  - Performed – Performed (CMMI)
  - Managed – Managed (CMMI)
  - Defined – Defined (CMMI)
  - Measured - Quantitatively Managed (CMMI)
  - Optimizing – Optimizing (CMMI)

Generic Practices

- The Generic Practices in the SE CMM are consistent with those found in the CMMI but not as extensive:
  - GP 2.1 SE CMM – Follow recorded and approved plans and processes, that were developed to meet program performance goals, in implementing the Focus Area

GP 2.1 EIA - 731

- Plan the performance of the process in accordance with the established program goals (such as profit, customer satisfaction, schedule delivery, and quality goals)
- Document the approach to performing the activities of the Focus Area (FA)
- Use the documented plans, standards, or procedures in implementing the process
- Assign responsibilities for developing the work products, and providing the services
- Allocate adequate resources including people, training, tools, budget and time for performing the activities of the Focus Area
- These activities are consistent with GP 2.2, GP 2.3 and GP 2.4 of the CMMI

GP 3.1 EIA - 731

- Standardize and record a well-defined FA process for the organization that is designed to meet specific business goals, and is based on experiences captured from previous programs
- A well-defined standard process or family of processes is characterized by:
  - Entrance criteria
  - Inputs
  - Standards and procedures
  - Verification mechanisms (Defect reviews)
  - Outputs
  - Completion criteria
  - Metrics
- Corresponds to SP1.1 in Organizational Process Definition of the CMMI

Focus Areas

- Systems Engineering Technical Category
  - Define Stakeholder and System Level Requirements (RD, TS)
  - Define Technical Solution (RD,TS)
  - Define Solution (TS)
  - Assess and Select (TS, DAR)
  - Integrate System (PI)
  - Verify System (VER)
  - Validate System (VAL)

Focus Areas - 2

- Systems Engineering Management Category
  - Plan and Organize (PP)
  - Monitor and Control (PMC, GP 2.8)
  - Integrate Disciplines (IPM)
  - Coordinate with Suppliers (SAM, ISM)
  - Manage Risk (RSKM)
  - Manage Data (PP – Data Management)
  - Manage Configurations (CM, GP 2.6)
  - Ensure Quality (PPQA, GP 2.9)

Focus Areas - 3

- Systems Engineering Environment Category
  - Define and Improve the Systems Engineering Process (OPF, OPD)
  - Manage Competency (OT)
  - Manage Technology (TS, ISM, GP 2.3, OID)
  - Manage Systems Engineering Support Environment (OPF, OPD, OEI)

Theme: Problem Refinement

- Develop a detailed operational concept of the interaction of the system, the user, and the environment, that satisfies the operational, support, maintenance and disposal needs
- Derive, from the system and other requirements, requirements that may be logically inferred and implied
- Identify key stakeholder requirements and constraints that have a strong influence on cost, schedule, functionality, risk or performance
- Identify and manage non-technical requirements concurrently with operational, functional, support, maintenance and disposal requirements
- Capture relationships between requirements for consideration during change management and requirements allocation

Processes for Engineering a System
EIA - 632

Fundamental Processes for Engineering a System

Processes for Engineering A System

Acquisition and Supply
- Supply Process
- Acquisition Process

Technical Management
- Planning Process
- Assessment Process
- Control Process

System Design
- Requirements Definition Process
- Solution Definition Process

Product Realization
- Implementation Process
- Transition to Use Process

Technical Evaluation
- Systems Analysis Process
- Requirements Validation Process
- System Verification Process
- End Products Validation Process

Relationship of Processes for Engineering a System - 2

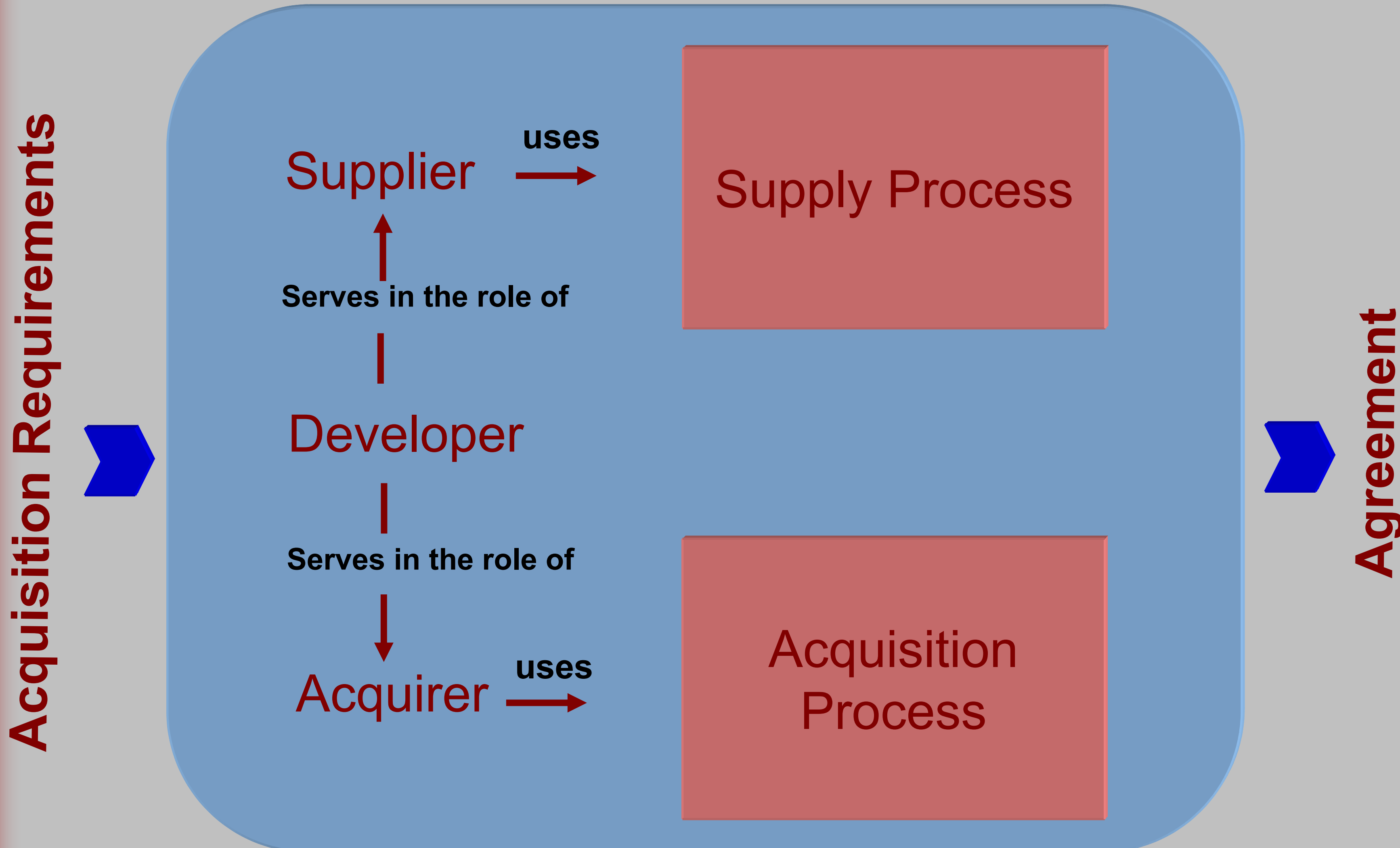
- ***The appropriate processes are applied recursively and iteratively to***:
  - Define the system products of the system hierarchy from the top down
  - Implement and transition the system products from the bottom up to the user or customer
- The requirements that are assigned to the proposed engineering processes are, in practice, implemented **concurrently** and are highly iterative

Acquisition and Supply

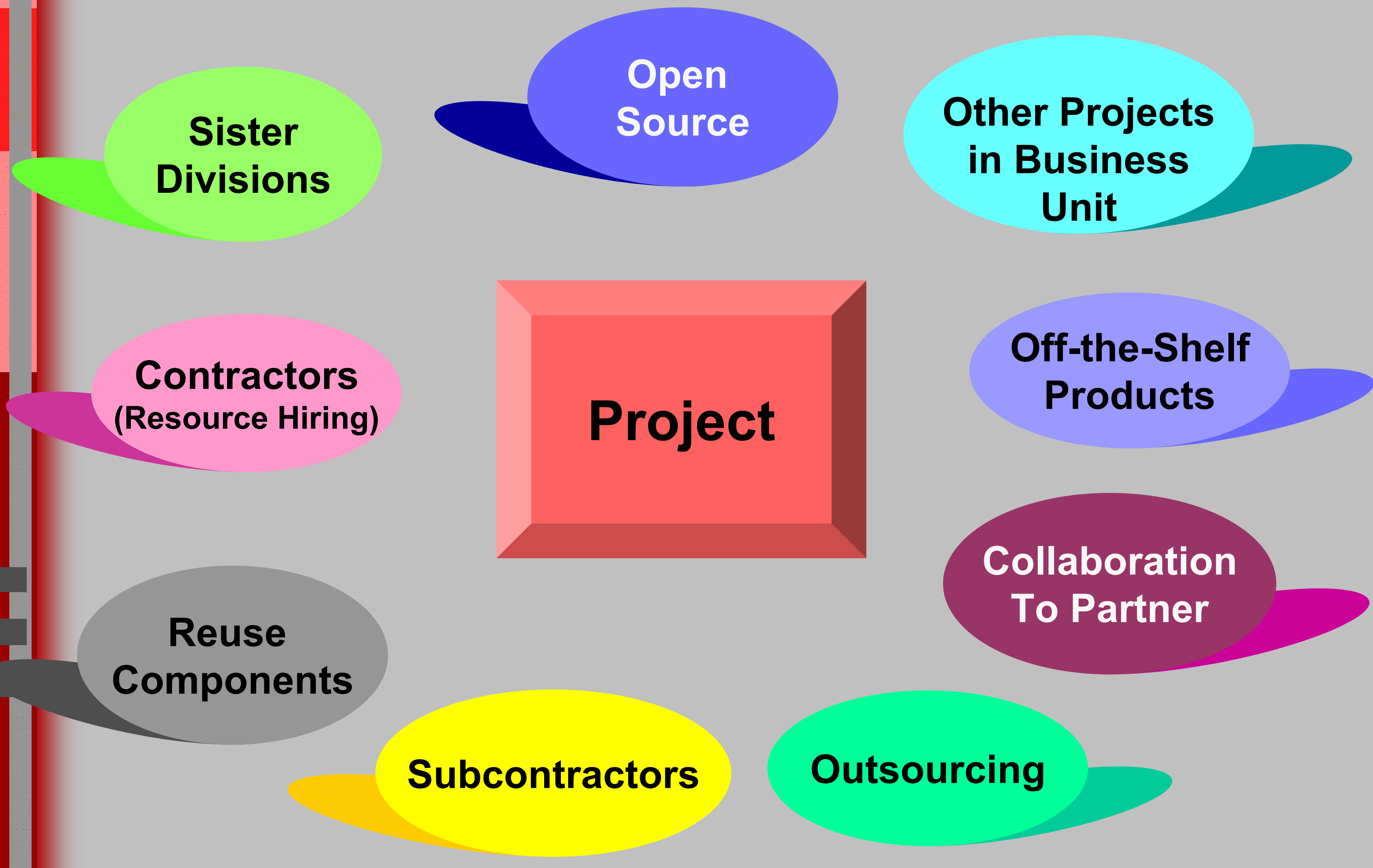
Acquisition and Supply

- The Acquisition and Supply Processes are used by a developer to arrive at an agreement with another party to accomplish specific work and to deliver required products
- The parties can be inside the developer's own enterprise (another project, functional organization, or project team) or can be in a different enterprise

Acquisition and Supply Process



Supplier Management Overview (CMMI)



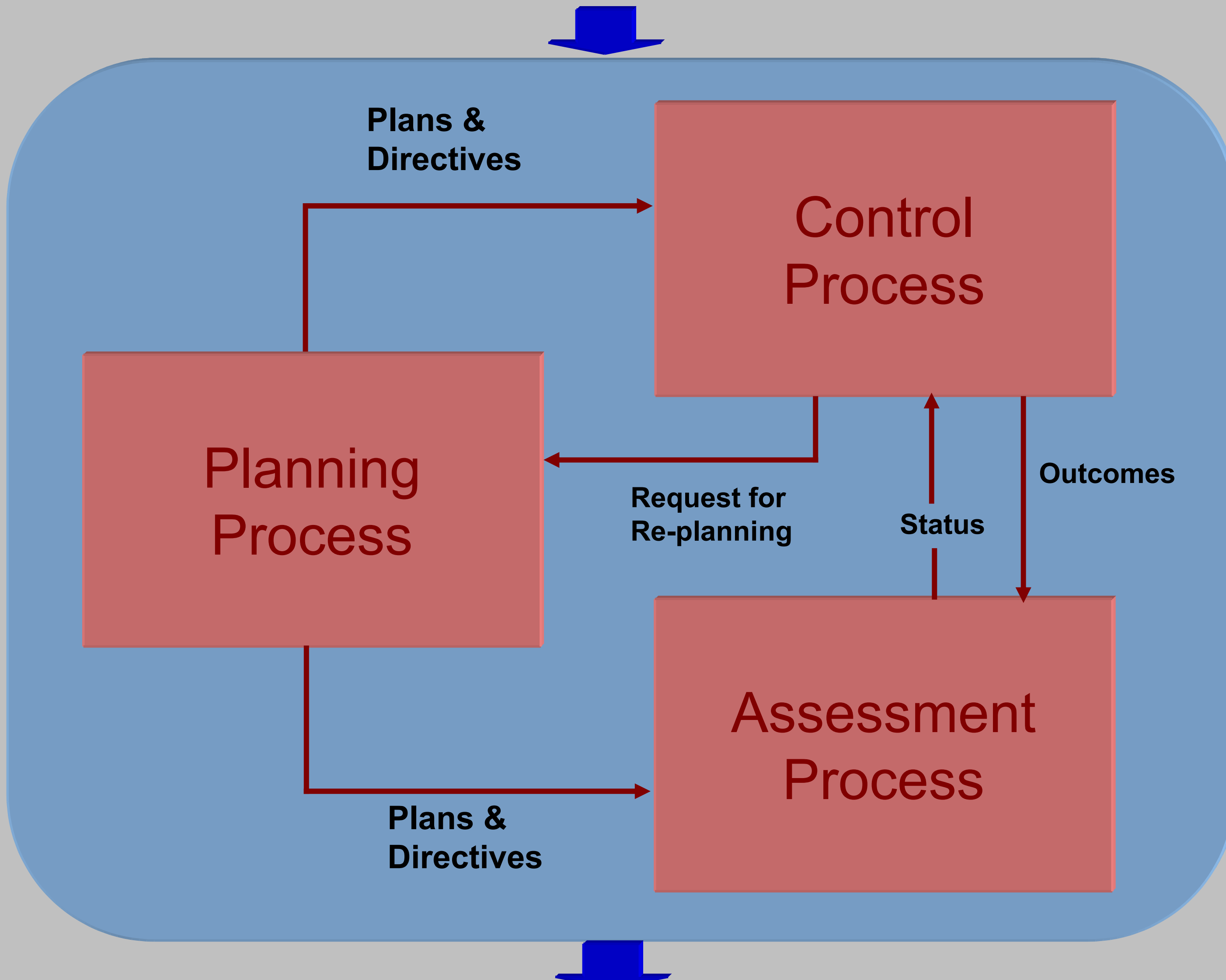
Technical Management

Technical Management

- The Technical Management Processes are to be used to plan, assess, and control the technical work efforts required to satisfy the established agreement.

Technical Management Process

Acquisition, Documents, Agreement, Outcomes, and Feedback



Plans, Directives, Status

Planning Process

- This process is used to support enterprise and project decision making and to prepare all necessary plans that support and complement the project plan
  - Risk Management Plan
  - Technical Review Plan
  - Verification Plans
  - Validation Plans
  - Quality Plan
  - Configuration Management Plan
  - Measurement Plan

Assessment Process

- The Assessment Process is used to:
  - Determine progress of the technical effort against both plans and requirements
  - Review progress during technical reviews
  - Support control of the engineering of a system

Control Process

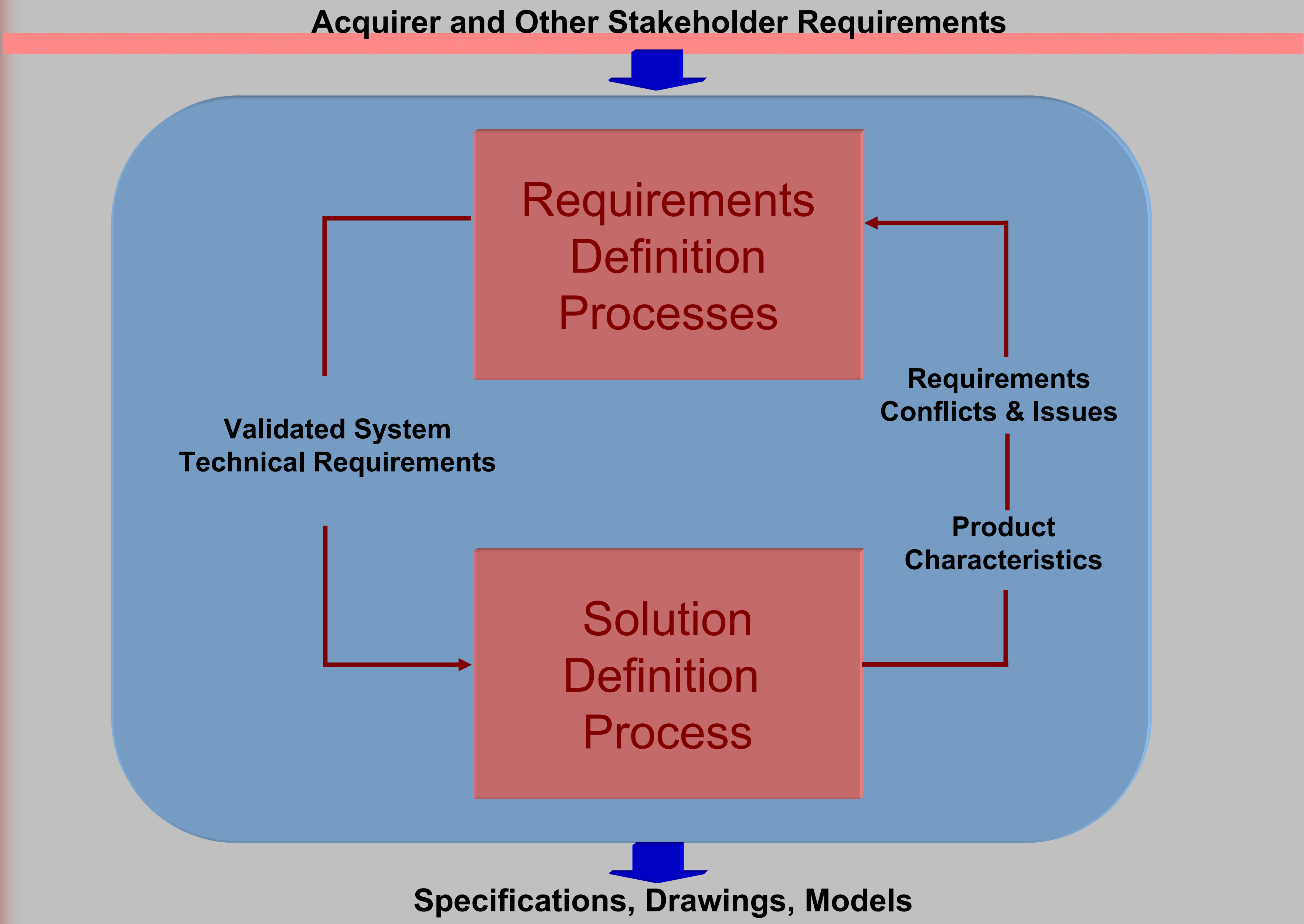
- The Control Process is used to:
  - Manage the conduct and outcomes of the Acquisition and Supply Processes, System Design Processes, Planning and Assessment Processes, Product Realization Processes, and Technical Evaluation Processes
  - Monitor variations from the plan and anomalies relative to the requirements
  - Ensure necessary communications

System Design

System Design Process

- The System Design Processes are used to convert agreed-upon requirements of the buyer into a set of realizable products that satisfy buyer and other stakeholder requirements
- Two processes are linked together
  - Requirements Definition
  - Solution Definition

System Design Process - 2

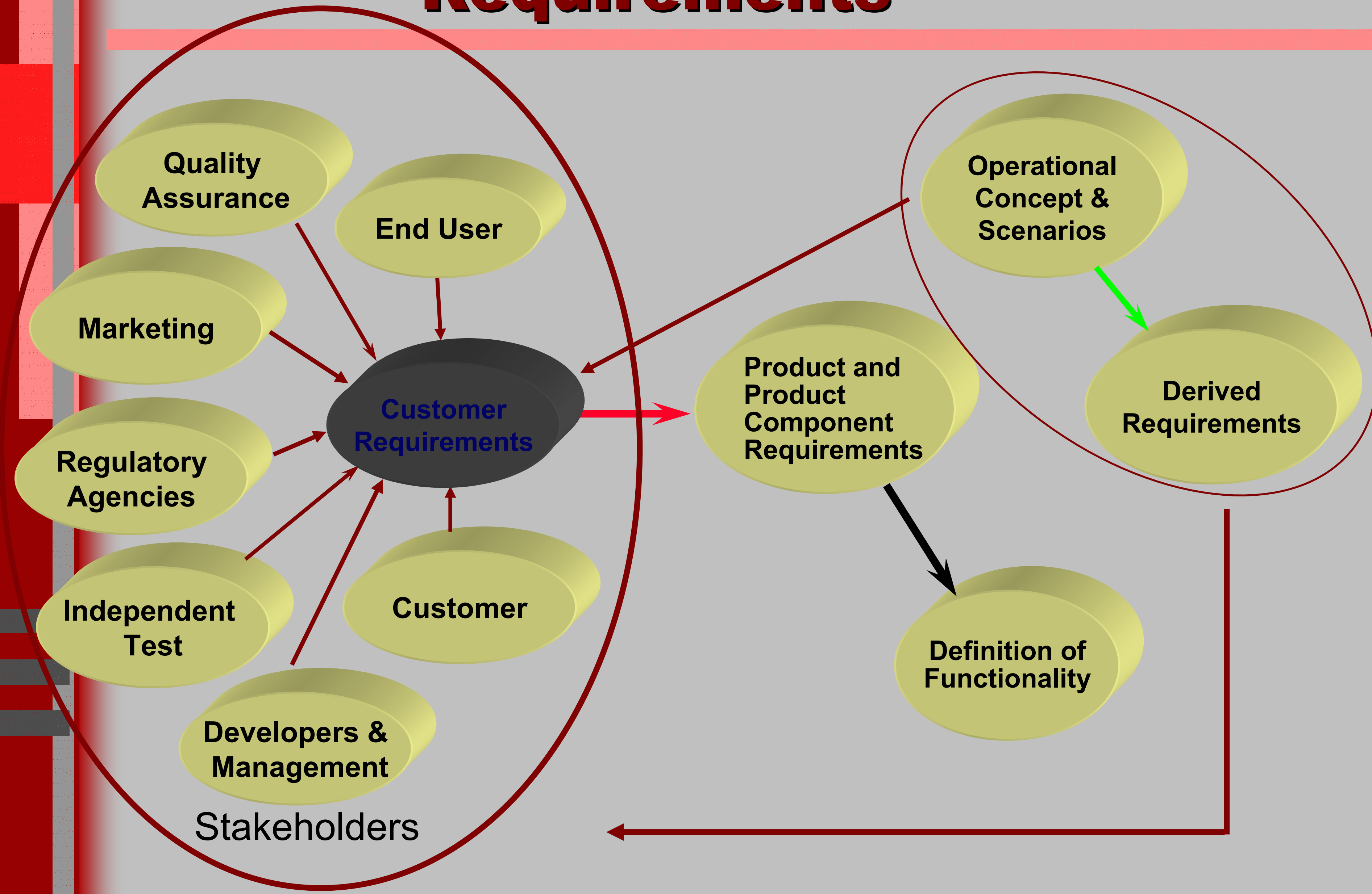


Requirements Definition Process

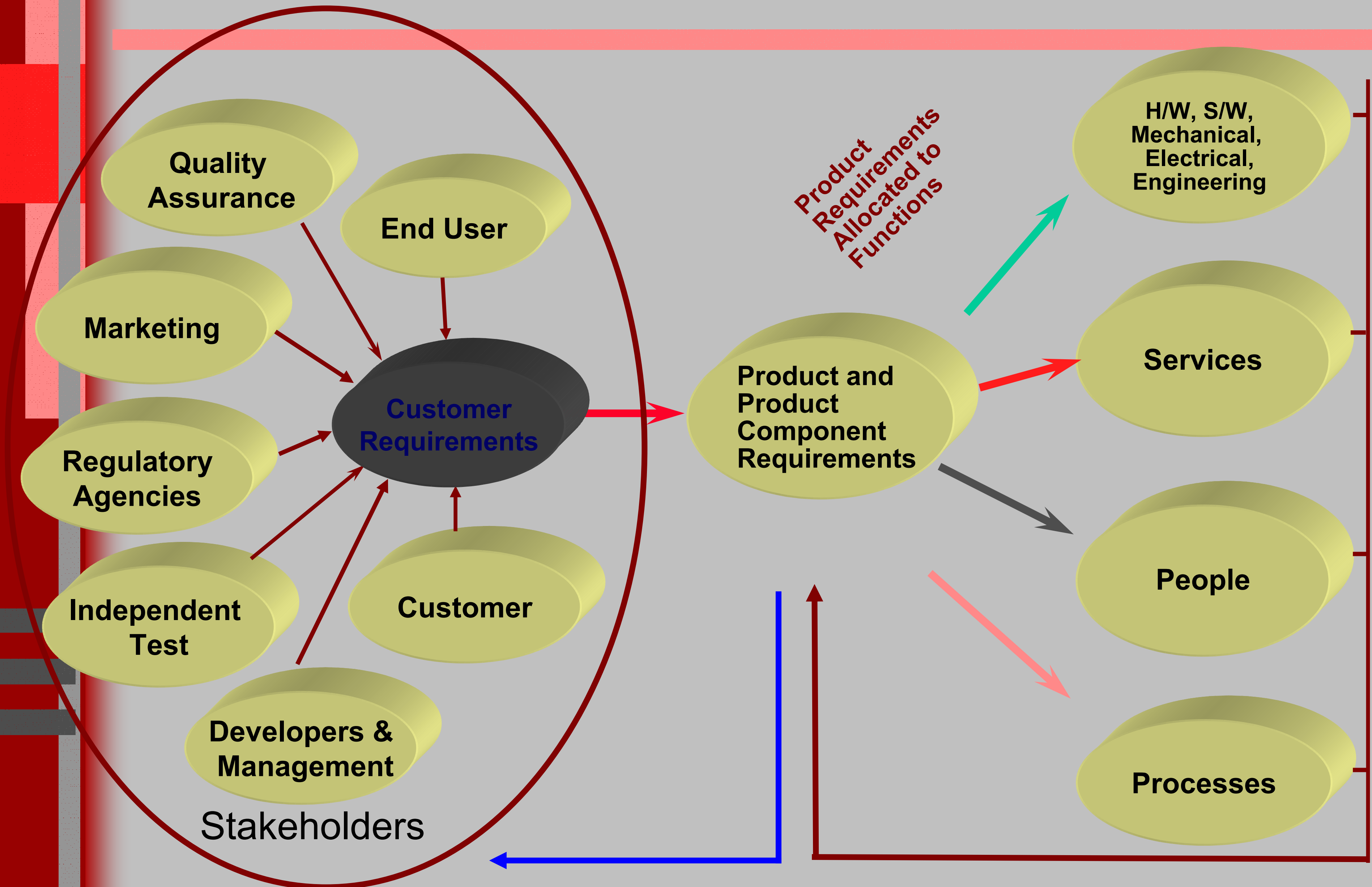
- System Technical Requirements
  - The developer shall define a validated set of system technical requirements. Tasks to consider include:
    - establishing required transformation rules, priorities, inputs, outputs, states, modes, and configurations
    - defining operational requirements and utilization environment
    - defining performance requirements
    - analyzing human factors effects
    - resolving conflicts between sets of buyer requirements and other stakeholders
    - preparing a set of system technical requirements

Requirements Development CMMI®

Customer, Product, and Product Component Requirements



Customer, Product, and Product Component Requirements - 2



Operational Concepts and Scenarios

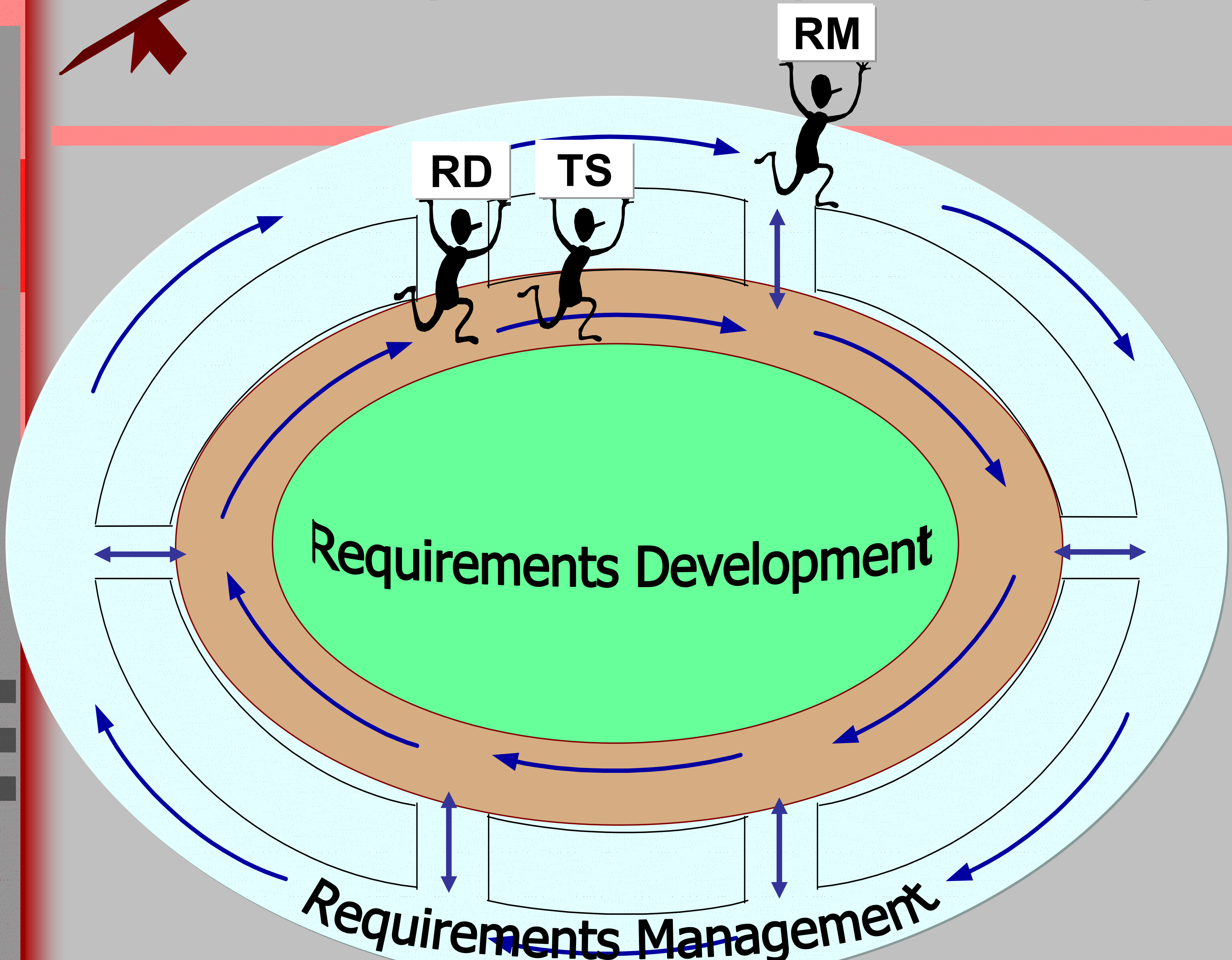
- Scenarios and Operational Concepts are developed, analyzed, and reviewed to refine existing requirements and discover new requirements, needs, and constraints
  - Scenarios are normally sequences of events that might occur in the use of the product
  - Operational concepts depend on both the design solution space and the scenarios
    - define the interaction of the product, the end user and the environment
    - define the operational, maintenance, support, and disposal needs

Product and Product Component Requirements

- Customer requirements are analyzed in conjunction with the development of the operational concept to derive a more detailed and precise set of requirements called "product and product component requirements"

Requirements Management

Requirements Development Partnership



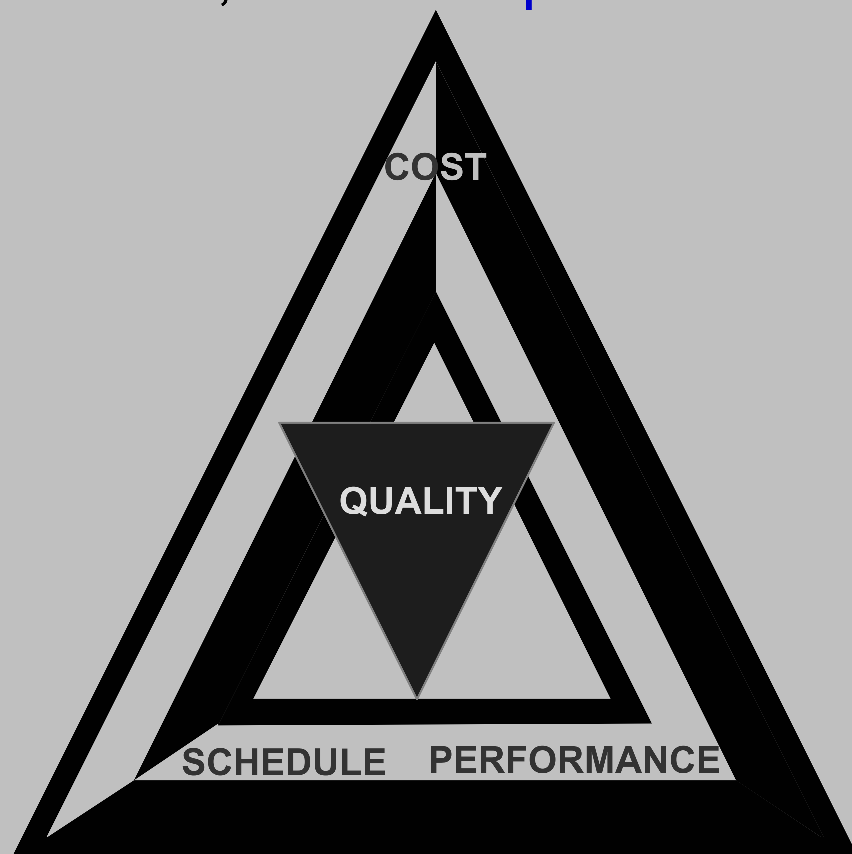
Solution Definition Process

- Logical Solution Representations
  - The developer shall define one or more validated sets of logical solution representations that conform with the technical requirements of the system
  - Tasks to consider include:
    - perform necessary tradeoff analyses
    - identify and define interfaces
    - assign performance requirements and constraints
    - identify and define derived technical requirements statements
    - select and implement one or more appropriate approaches

Alternative Solutions CMMI®

Develop Detailed Alternative Solutions and Selection Criteria

- Problem: Alternative solutions need to be identified and analyzed to enable the selection of a *life-cycle balanced solution* in terms of the quadruple constraint of cost, schedule, technical performance and quality



Develop Detailed Alternative Solutions and Selection Criteria - 2

- Solution: This may be accomplished through the allocation of the requirements to:
  - Software
  - Hardware
  - Electronics
  - Mechanics
  - Optics
  - Hydraulics
  - Manufacturing Processes
  - Services
  - People
- It may be accomplished through:
  - In house development
  - Purchase of Commercial-Off-The-Shelf products
  - Use of Suppliers
  - Use of Re-use components

Develop the Product or Product Component Design

- Product or product component designs must provide the appropriate life-cycle content for:
  - Implementation
  - Modification
  - Reprocurement
  - Maintenance
  - Sustainment
  - Installation
- Design documentation provides a reference point to support the mutual understanding of the design by relevant stakeholders

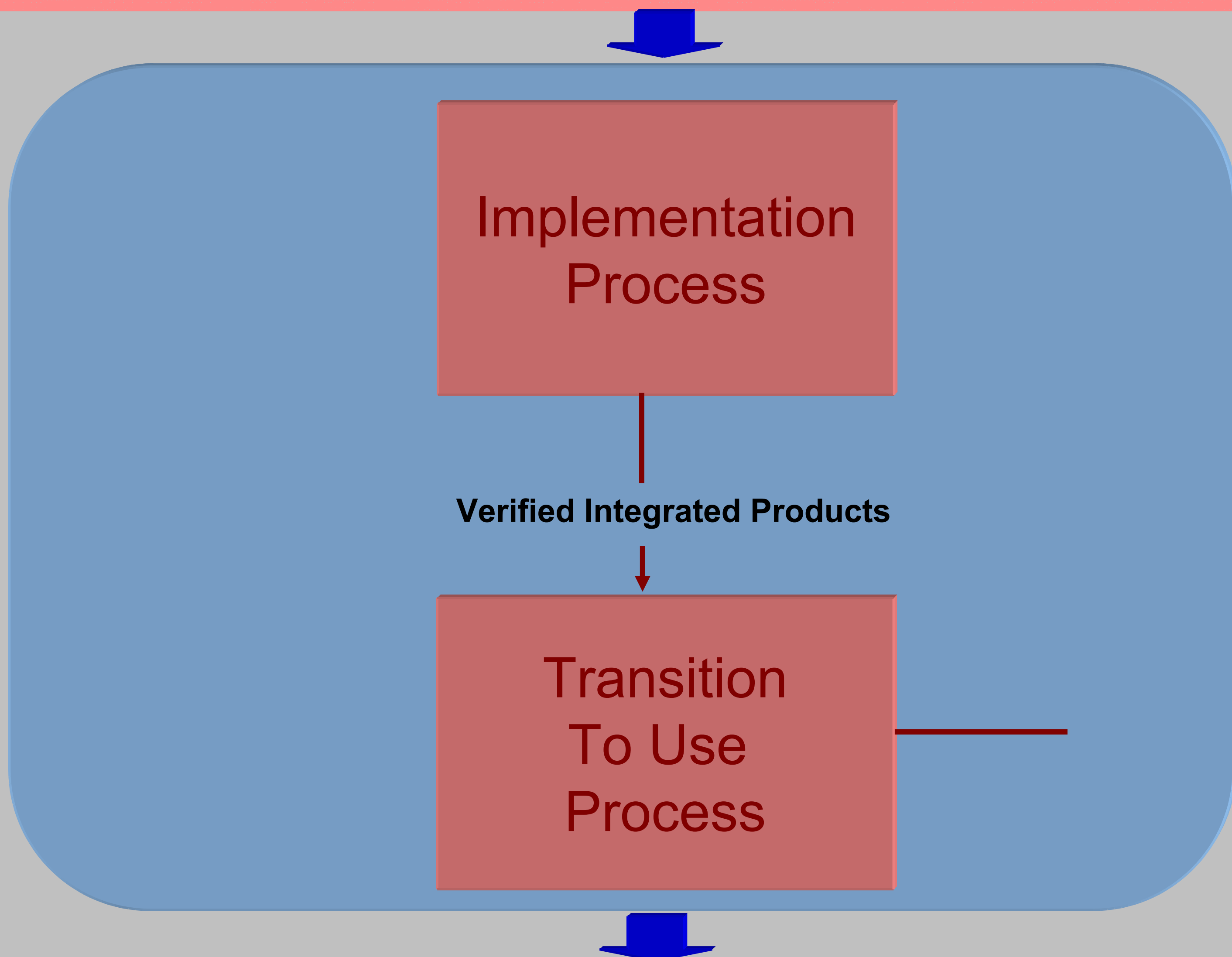
Product Realization

Product Realization Process

- The Product Realization Processes are used to:
  - Convert the specified requirements and other design solution characterizations into either a verified end product or a set of end products in accordance with the agreement and other stakeholder requirements
  - Deliver these to designated operating, customer or storage sites
  - Install these at designated operating sites or into designated platforms
  - Provide interface service support

Product Realization Process - 2

Specified Requirements
Supplier or Buyer-Provided Products



Agreement Satisfaction
Other Stakeholder Satisfaction

Implementation Process

- Implementation
  - Tasks to consider include:
    - **receive the subsystem products** that make up the system's end products
    - validate the subsystem products received
    - assemble the validated subsystem or physically integrate the product components
    - verify each test article against its requirements
    - validate the verified end products

Transition to Use Process

- The Transition to Use Process results in products delivered:
  - To the appropriate destination
  - In the required condition for use by the buyer
  - For the appropriate training of installers, operators, and maintainers

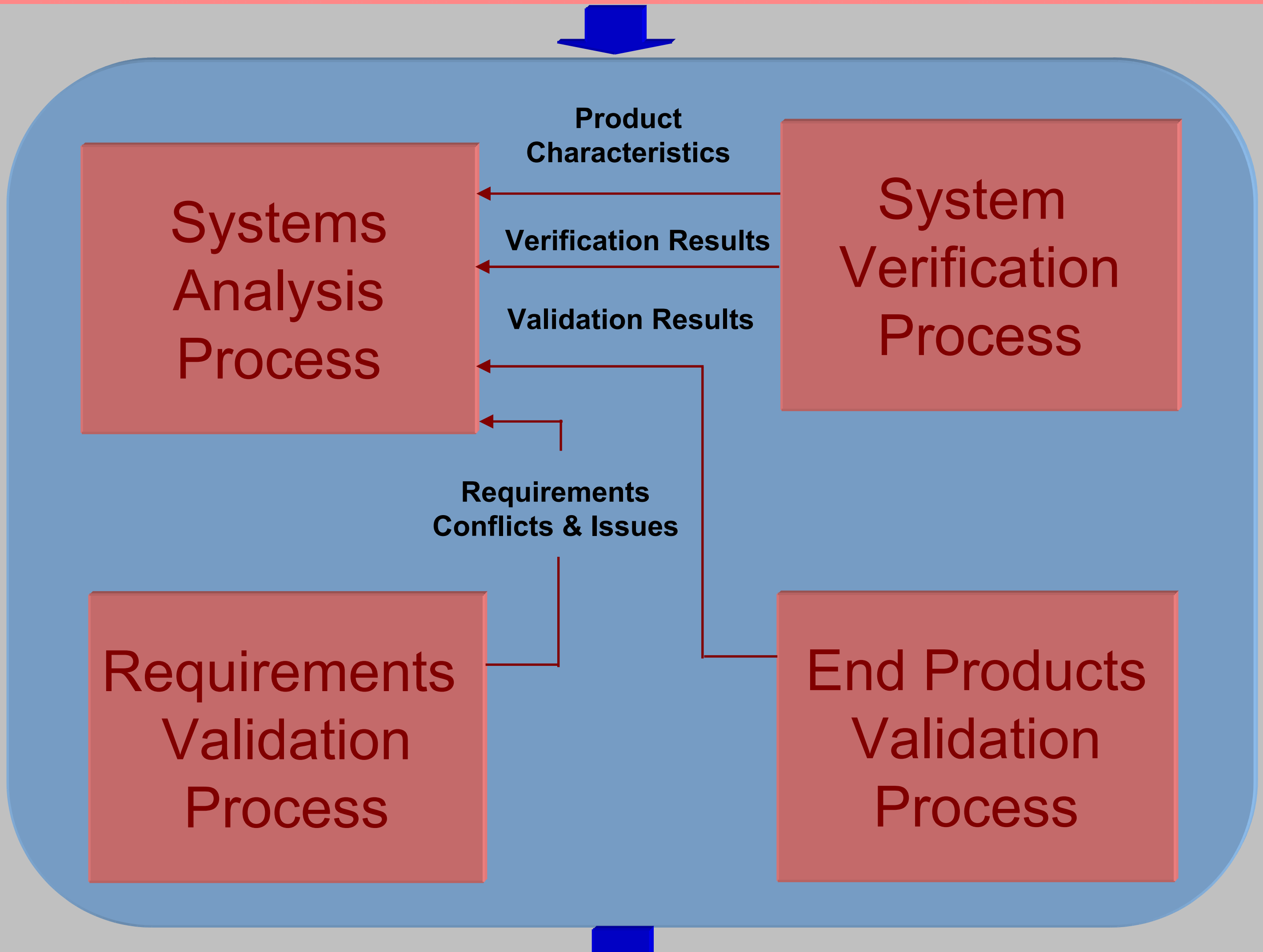
Technical Evaluation

Technical Evaluation

- The Technical Evaluation Processes are intended to be invoked by one of the other processes for engineering a system
  - Systems Analysis
  - Requirements Validation
  - System Validation
  - End Products Validation

Technical Evaluation Process

Analysis Requests, Requirements, Implemented Products



Analytical Models & Assessments, Validated Requirements
Verified System Products, Validated End Products

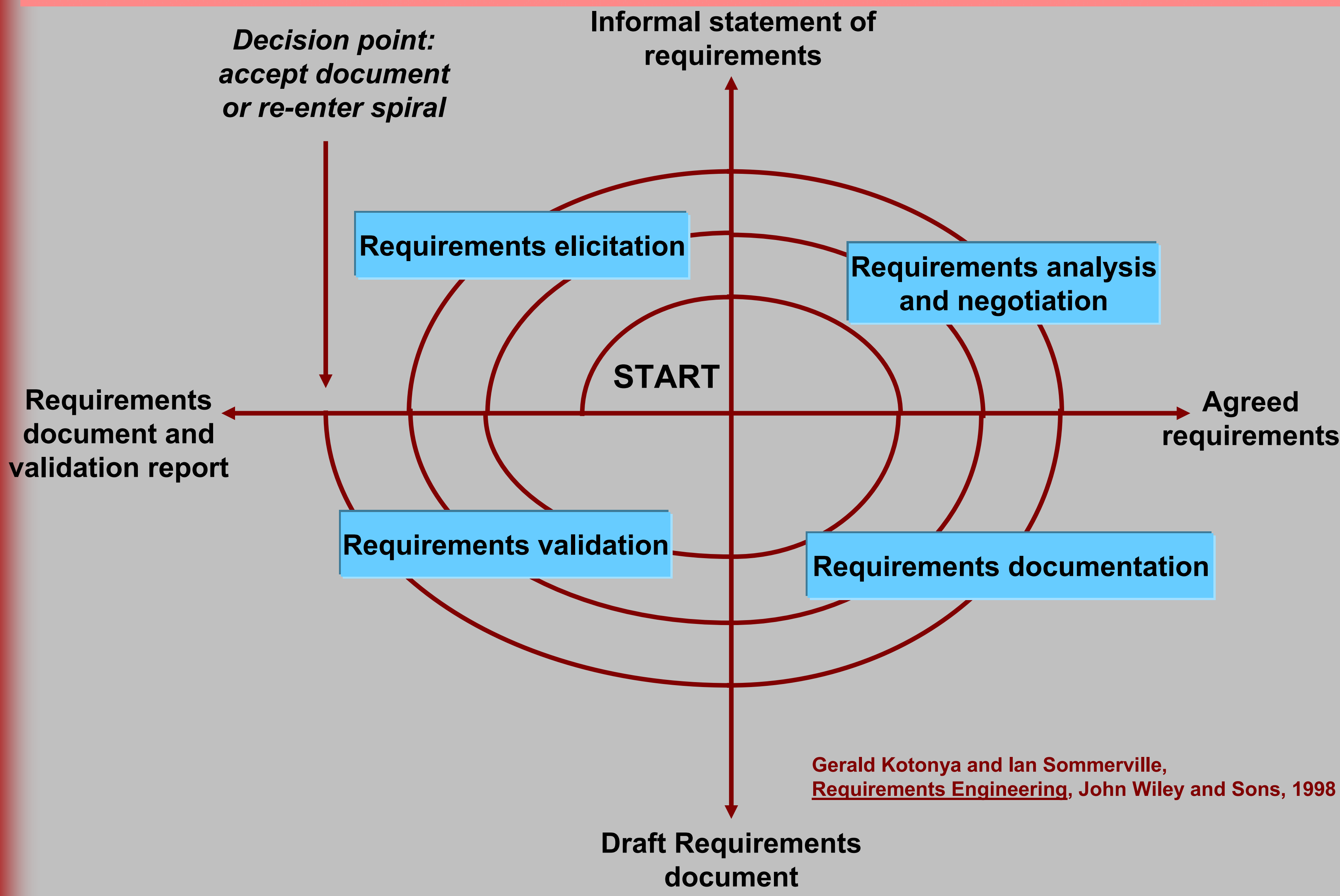
Systems Analysis Process

- The Systems Analysis Process is used to:
  - Provide a rigorous basis for technical decision making, resolution of requirements conflicts, and assessment of alternatives physical solutions
  - Determine progress in satisfying technical and derived technical requirements
  - Support risk management
  - Ensure that decisions are made only after evaluating the cost, schedule, performance, and risk effects on the engineering or reengineering of the system
  - Evaluate the effectiveness of each design solution
  - Define, calculate, and report the cost, schedule, performance, and risk effects of each functional, performance, and design alternative
  - Applicable quality factors such as maintainability, reliability, safety and security must not be degraded

Requirements Validation Process

- System Technical Requirements Validation
  - The developer shall ensure that the set of defined system technical requirements agrees with the validated buyer and other stakeholder requirements

Spiral Model of the Product Requirements Engineering Process (CMMI)



Gerald Kotonya and Ian Sommerville, Requirements Engineering, John Wiley and Sons, 1998

System Verification Process

- End Product Verification
  - The developer shall verify that an end product to be delivered to an acquirer conforms to its specified requirements
  - Tasks to consider include:
    - establishment and checkout of the environment in which the verification method and procedures will be implemented
    - verification of the end product to either show compliance or identify variances (untraceable requirements and constraints)

System Verification Process - 3

- Enabling Product Readiness
  - The developer shall determine readiness of enabling products for development, production test, deployment, installation, training, support / maintenance, and retirement or disposal

Confirm Readiness of Product Components for Integration (CMMI – PI)

- Confirm that each product component is compliant with its interface requirements
  - Ensure that the product components are delivered to the product integration environment in accordance with the planned product integration strategy
  - Verify the receipt of each product component
  - Verify the configuration status of the product component against the expected configuration
  - Verify the configuration status of the accompanying interface documentation against the expected configuration
  - Perform pre-checks of all physical interfaces before connecting product components together

End Products Validation Process

- End Products Validation
  - The developer shall ensure that an end product or an aggregation of end products, conforms to its validated buyer requirements
  - The types of end product validation include:
    - validation against validated buyer requirements in the anticipated usage environment with test conditions that span the expected range of actual operating conditions
    - certification tests against established certification requirements
    - **acceptance tests, using operational processes and personnel in an operational environment**

IEEE Standard for Application and Management of the Systems Engineering Process
IEEE 1220

IEEE 1220 Scope

- Defines the interdisciplinary tasks that are required throughout a system's lifecycle to transform customer needs, requirements, and constraints into a system solution (RD – SP 1.2)
- Specifies the requirements for the systems engineering process (SEP) and its application throughout the product lifecycle

IEEE 1220 Scope - 2

- The standard focuses on the engineering activities necessary to guide product development while ensuring that the product is properly designed to make it affordable to:
  - Produce
  - Own
  - Operate
  - Maintain
  - Dispose of without risk to health or the environment
- The standard describes how to manage a system from initial concept through development, operations and disposal

Basic System Building Blocks

- The basis building blocks of a system are:
  - System itself
  - Related products
  - Life-cycle processes required to support the products
  - Subsystems that make up the products

Basic System Building Blocks - 2

- The life-cycle processes include:
  - Development
  - Manufacturing
  - Test
  - Distribution
  - Operations
  - Support
  - Training
  - Disposal
- Each life-cycle process is itself a process

Basic System Building Blocks - 3

- Manufacturing life-cycle process:
  - Facilities
  - Equipment / tools
  - Procedures
  - Software applications
  - Computer resources
  - Parts inventory
  - Personnel
  - Suppliers / vendors
  - Quality Control

Typical System Lifecycle

System Definition	Subsystem Definition			Production / Customer Support
	Preliminary Design	Detailed Design	Fabrication, Assembly, Integration, and Test (FAIT)	

Systems Lifecycle Processes

System Lifecycle Processes (ISO/IEC 15288)

- 23 Processes grouped four sets:
  - Agreement Processes
    - Acquisition
    - Supply
  - Enterprise Processes
    - Enterprise Management Process
    - Investment Management Process
    - System Life Cycle Process Management Process
    - Resource Management Process

System Lifecycle Processes (ISO/IEC 15288) - 2

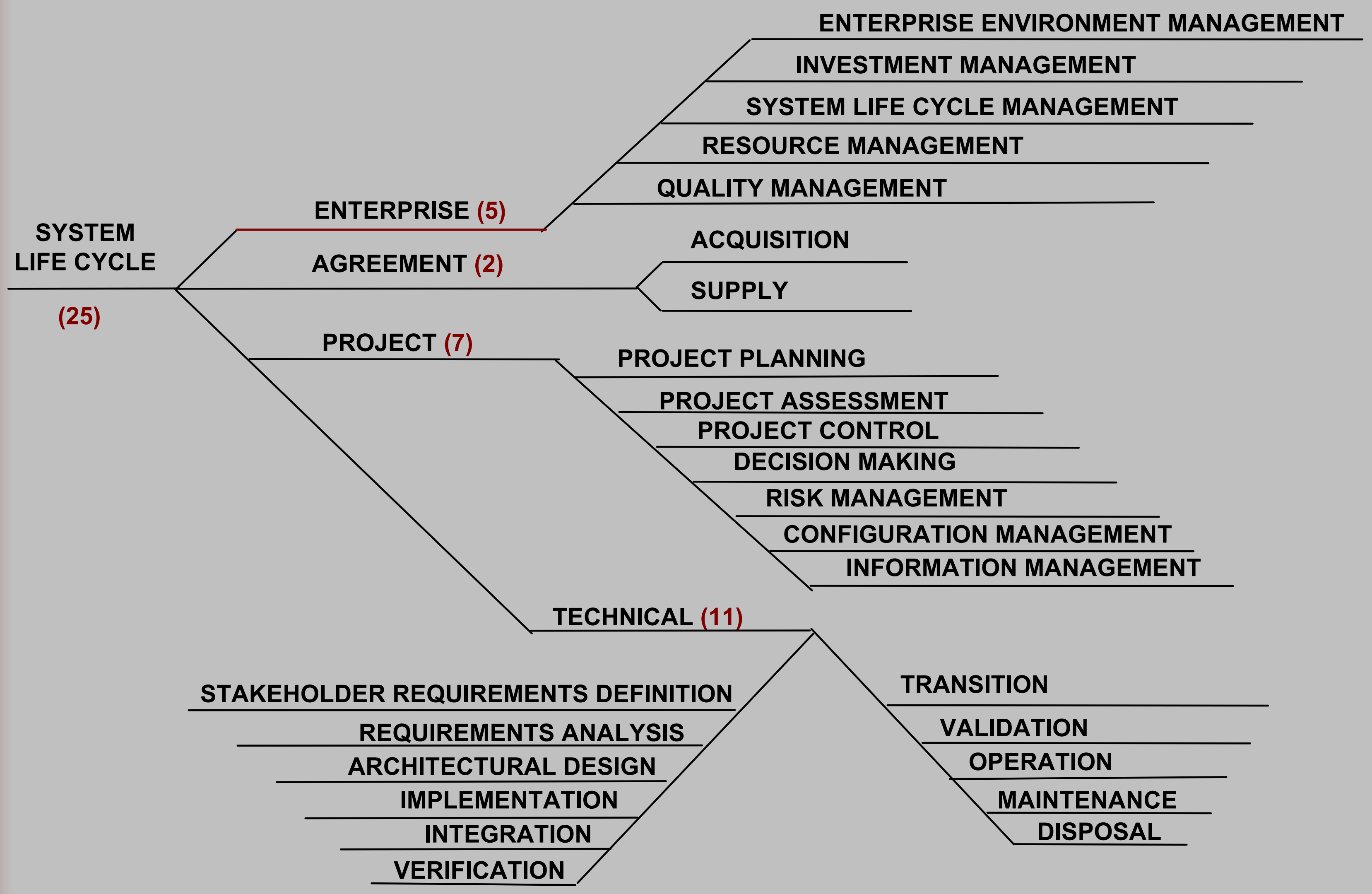
- Project Management Processes
  - Planning Process
  - Assessment Process
  - Control Process
  - Decision Management Process
  - Risk Management Process
  - Configuration Management Process
  - Quality Management Process

System Lifecycle Processes (ISO/IEC 15288) - 3

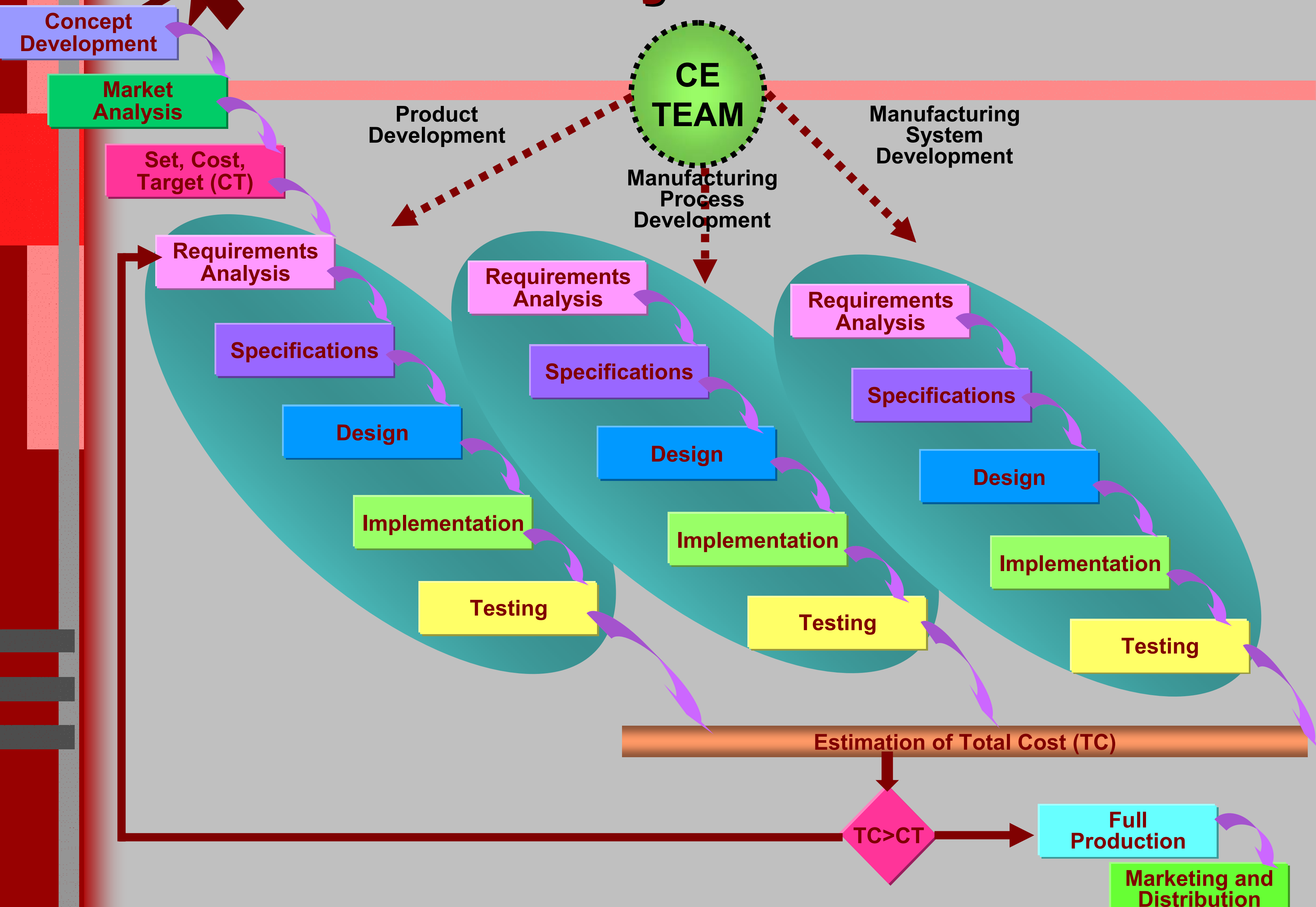
Technical Processes

- Stakeholder Needs Definition Process
- Requirements Analysis Process
- Architectural Design Process
- Implementation Process
- Integration Process
- Verification Process
- Transition Process
- Validation Process
- Operations Process
- Disposal Process

ISO/IEC 15288 Systems Life Cycle Process Framework



A Concurrent Engineering Life-Cycle Model



Summary

- Systems Engineering is deeply integrated into the CMM Integration (CMMI®) and has reintroduced the concepts of “Engineering Systems Think”
  - EIA – 731 - Systems Engineering Capability Model
  - EIA – 632 - Processes for Engineering a System
  - IEEE 1220 - Standard for Application and Management of the Systems Engineering Process
  - ISO 15228 – System Lifecycle Processes
  - Handbook of Systems Engineering and Management – Andrew Sage, Willian Rouse, John Wiley and Sons, 1999

Thank You

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Planning a SCAMPI C Appraisal from a Strategic Perspective

John Kennedy
The Mitre Corporation

Michael West
Natural SPI

Outline

- Introduction
- Strategic Planning
- Case Study
- Lessons Learned

Tactical

- "...relating to small scale actions. ...made or carried out with only a limited or immediate end in view." Webster's Ninth New Collegiate
- "...relating to ...operations that are smaller and of less long-term significance than strategic operations." WHATIS.COM

Strategic

- “...of great importance to an integrated whole or to a planned effect.” Webster’s Ninth New Collegiate
- "method used ... to anticipate and adapt to expected changes. ...sets broad direction and goals ... identifies the major activities to be undertaken to accomplish the desired agency mission and goals” MITRE Definition

Tactical SCAMPIs

- Internal Snapshot/ Status of Process Implementation
- Education, Gap Analysis, Mini-Assessment
- Contract Monitoring
- Evaluation for Award or Incentive Fee

MITRE

NATURAL SPI

Strategic SCAMPI Cs

- Source Selection
- Develop Planning Information for a Long-Range Implementation and/or Improvement Strategy
- Identify program risks and model-based risk management strategies
- Define software and systems delivery weaknesses relevant to the roles of the program's or project's participants
- Discover areas of service or product delivery excellence for cross-pollinating to other areas of the organization or program

Case Study

Space Major Defense Acquisition Program

(Space and Satellite Programs are Different)

- Warfighter Critical
- Schedule-driven
- Many External Stakeholders

Case Study Risk Elements

- It is Large, Complex, Software-Intensive Program
  - Software Programs Are Inherently High Risk
  - Larger Programs are Riskier
  - Significant COTS Implementation
- The Schedule is Very Tight
- The Team is Dispersed and Diverse
  - Different Models and Processes
  - Many Contractors and Vendors

Case Study
Risk Mitigation Activities

- In-House Process Capability Assessment
- No-Fault SCAMPI C Appraisals
  - Prime Contractor
  - Software Developer and System Integrator
- Present Findings & Recommendations to Government and Contractor Teams

Case Study
Buy-In: Why Do This?

Why Do This?

- To Identify Long-Term Risk
- To Address Capability Mismatches
- To Improve Communications Across all Team Components
- To Find Opportunities for Partnering
- To Acquire Planning Information for Strategic Process Improvement

Contractor Concerns

- "It's not in the Contract"
  (Risk Management is.)
- Proprietary Data (Confidentiality)
- Attribution (Non-Attribution)
- Schedule is already Intense (Agree, but it's worth doing anyhow)
- An Appraisal would be disruptive and consume time we can't afford to lose (Our Appraisal Team will do whatever they can to stay out of the way and not waste anyone's time.)

Getting Started

- The First Phase in a SCAMPI Appraisal is

  Plan and Prepare for the Appraisal

- Planning Begins With

  The Appraisal Input

The Appraisal Input - 1

Purpose/Objectives

- Evaluate areas of potential risk that may affect the organization’s ability to deliver
- Provide Detailed Recommendations for Improvements to Meet Strategic Goals

Key Appraisal Participant Information

- Team Members and Organizational Unit Participants with Relevant Knowledge and Experience

The Appraisal Input - 2

Appraisal Scope Specification

- Focus on Critical Process Areas
  - Prime Contractor
    - Processes critical to contract oversight role
  - Software Developer and System Integrator
    - Processes critical to Software Development and System Integration roles

Context

- Different Domains
- Size and Complexity of the Program

The Appraisal Input - 3

Key Appraisal Parameters

- Model to be Used
- Confidentiality and Non-Attribution
  - Sponsor “owns” the SCAMPI Findings
  - Must Respect Contractor Privacy and Data Rights

Planned Tailoring

- Findings Presented to the Sponsor and then to the Appraised Organizations Individually
- Findings and Recommendations then Presented to the Whole Team Simultaneously

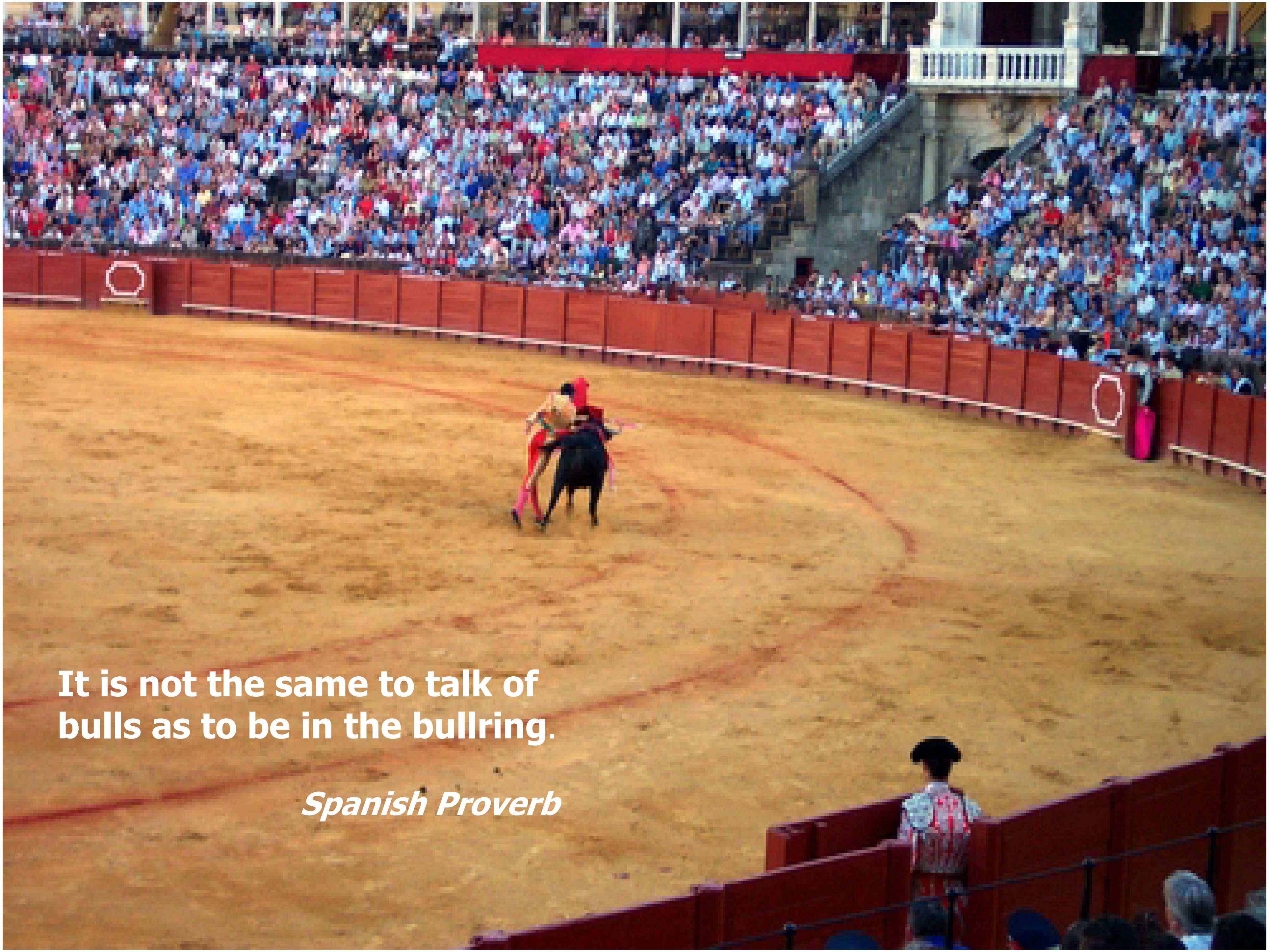
Lessons Learned - 1

- Lead Appraiser is Important – Look for:
  - Qualifications and Experience
  - Flexibility (Schedule)
  - A Good Teacher for the Team and the Sponsor

- Get Direct Access to the Sponsor
  - Senior Management tends to delegate this
  - The delegate won't want to bother the senior manager

Lessons Learned - 2

- Meet Often with the Sponsor
  - Out of sight – out of mind
  - Provide Metrics
- The Sponsor Will Forget the Signed Appraisal Plan if You Allow It
  - It is a contract
  - Be firm
- Respect Contractor Concerns for Privacy, Data, and Non-Attribution


It is not the same to talk of
bulls as to be in the bullring.
Spanish Proverb

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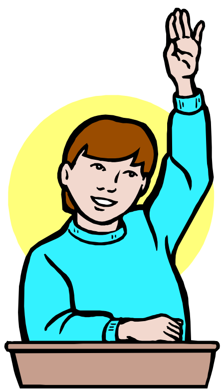
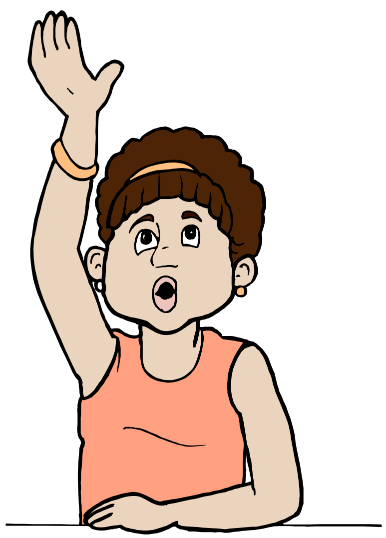
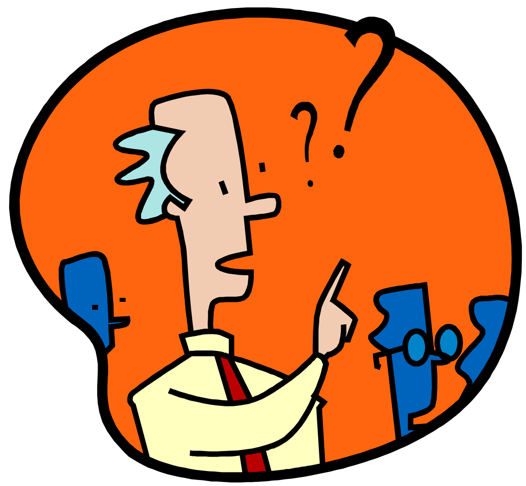
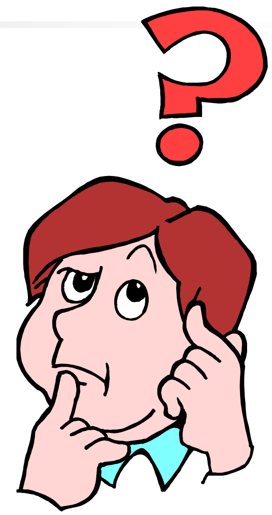
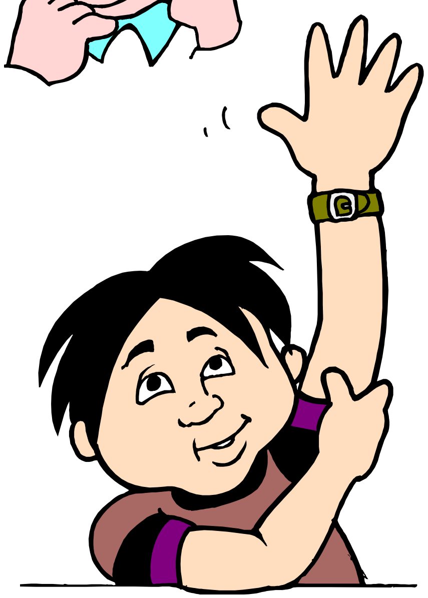
Questions











NORTHROP GRUMMAN

DEFINING THE FUTURE

A Quantitative Comparison of SCAMPI A, B, and C

CMMI Technology Conference & User Group

14-17 November 2005

Dan Luttrell

Rick Hefner, Ph.D.

Northrop Grumman Corporation

Background

- SCAMPI B and C appraisal methods were recently defined to compliment the existing SCAMPI A method
- Selecting the right method involves several factors – cost, schedule, accuracy, efficiency, tailoring, desired results, etc.

What you should consider in selecting a method?

What is the difference in accuracy between an A, B, and C?

How does the selection influence organizational buy-in?

SM SCAMPI, SCAMPI Lead Appraiser, and SEI are service marks of Carnegie Mellon University.
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Characteristics of CMMI Appraisal Classes

The ARC (Appraisal Requirements for CMMI) defines appraisal classes

- A guide to inventors of appraisal methods, and their customers

Key differentiating attributes for appraisal classes include

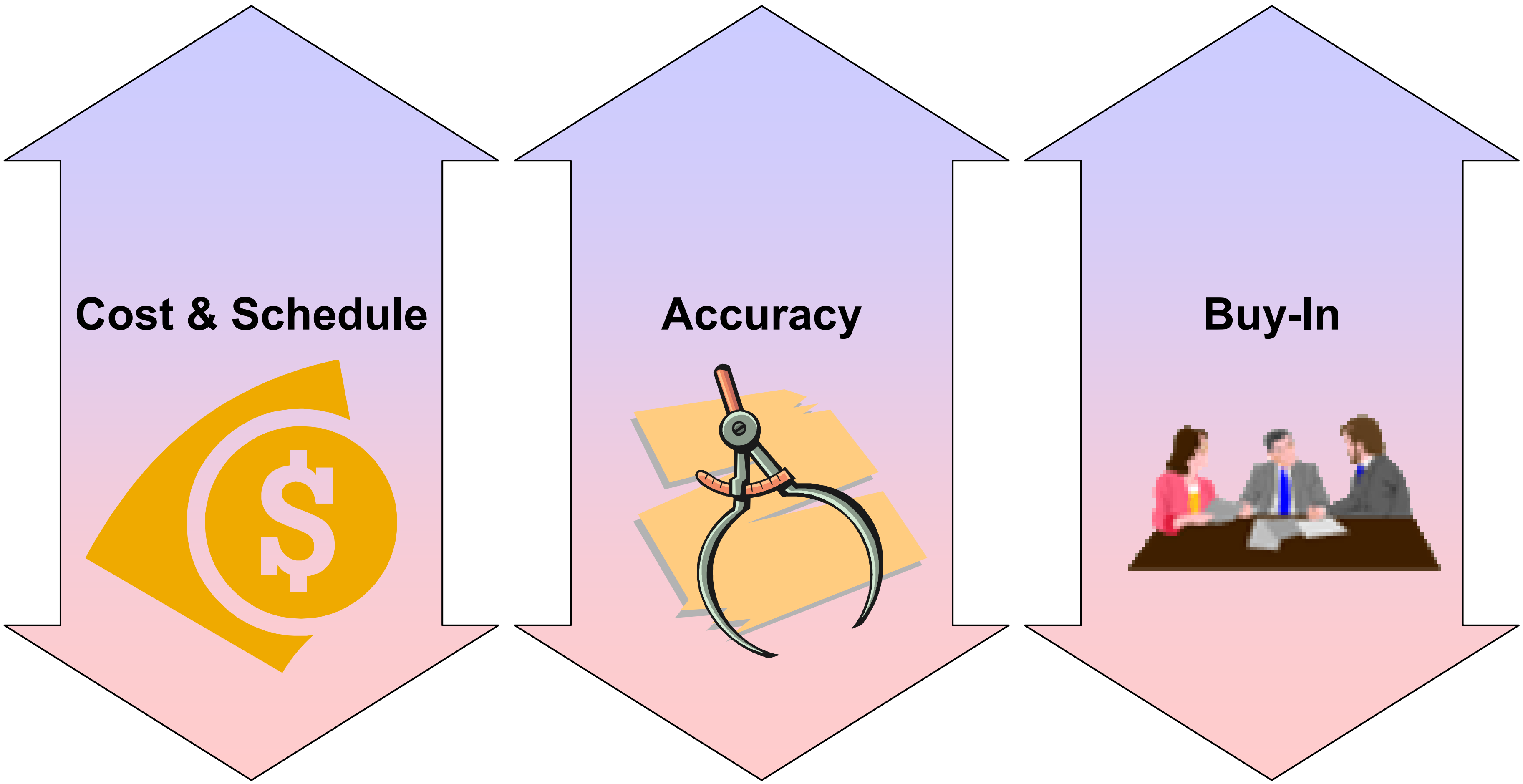
- the degree of confidence in the appraisal outcomes
- the generation of ratings
- appraisal cost and duration

Appraisal Requirements for CMMI, Version 1.1, *CMU/SEI-2001-TR-034*

Characteristics	Class A	Class B	Class C
Amount of Objective Evidence Gathered (relative)	High	Medium	Low
Ratings Generated	Yes	No	No
Resource Needs (relative)	High	Medium	Low
Team Size (relative)	Large	Medium	Small
Appraisal Team Leader Requirements	Lead appraiser	Lead appraiser or person trained and experienced	Person trained and experienced

SCAMPI is simply a family of possible appraisal methods — **SCAMPI-A** | **SCAMPI-B** | **SCAMPI-C**

Impacts Classified



Phase 1 – Plan and Prepare for the Appraisal

Requirement	SCAMPI A	SCAMPI B	SCAMPI C
Led by SEI-authorized Team Lead	Yes	Yes	Yes
Communications between Team Lead and Sponsor	Yes	Yes	Yes
Sponsor approves Appraisal Input and any changes	Yes	Yes	Yes
Sponsor approves Appraisal Plan	Yes	Yes	Yes
Team members complete Intro to CMMI and some form of Team Training	Yes	Yes	Yes
Some form of Readiness Review	Yes	Yes	Yes
Objective Evidence Collection Plan	Yes	Yes	Yes
Criteria for team experience in engineering and management	Yes	Yes	No
Minimum Team Size	4	2	1

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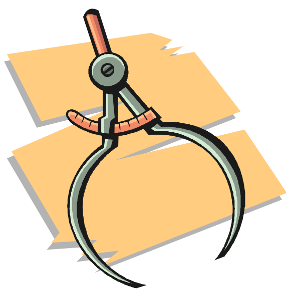
Minimum Team Size

- **Cost is composed of:**
  - Team costs – goes up with team members
  - Organizational costs (interview, presentations) – largely fixed regardless of size

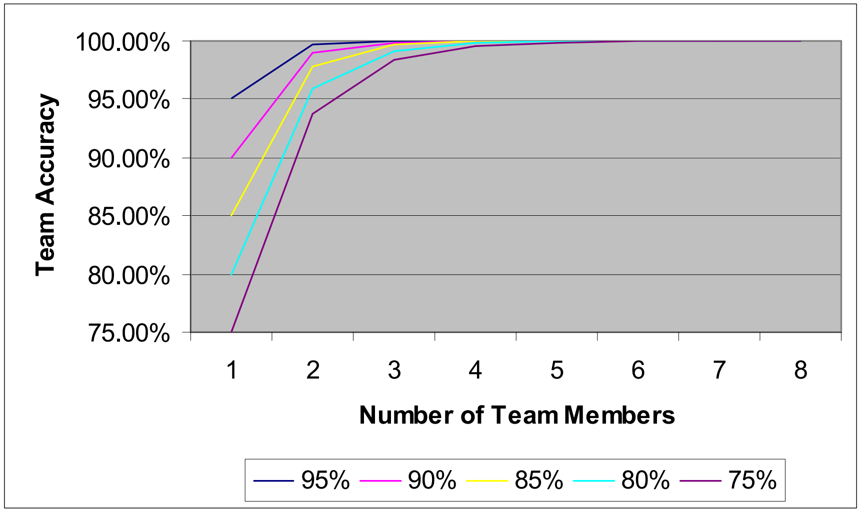


- **Accuracy goes up with as team size increases**

- **Buy-in is driven by the confidence the organization's members has in the appraisal process and appraisal team**
  - Larger teams can increase the likelihood that a respected person is on the team

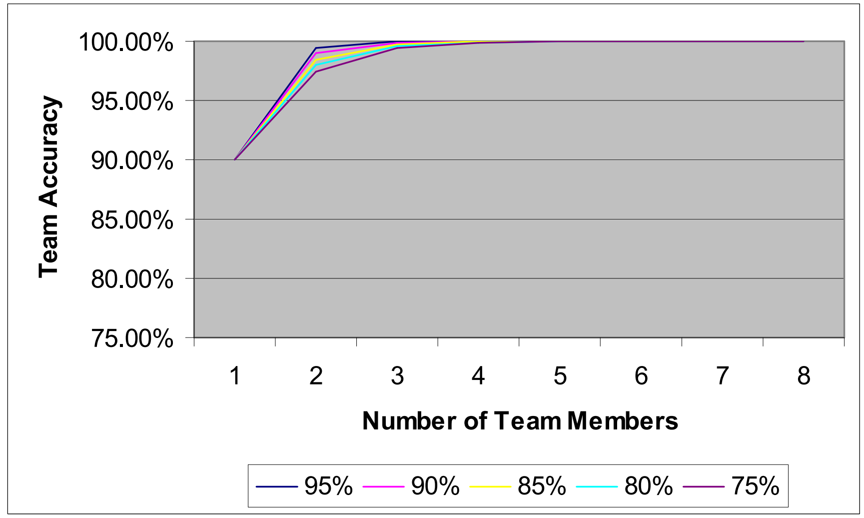
Team Accuracy vs. Team Size

- Team accuracy vs. team size, for given individual accuracies



- As team size goes up, team accuracy rapidly increases (assuming the right answer is obvious once presented)
- Teams of greater than 4 provide little increase in accuracy

- Same, assuming 90% leader accuracy



- If the team leader is 90% accurate, additional team members add little accuracy
- Adding team members does give a chance for them to learn

Appraiser accuracy, not team size, is critical

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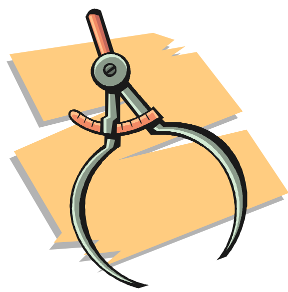
Phase 2 - Conduct Appraisal

Requirement	SCAMPI A	SCAMPI B	SCAMPI C
Data annotated with model and OU information	Yes	Yes	Yes
Direct Artifacts, Indirect Artifacts and Affirmations identified	Yes	Yes	Yes
Gaps in OU implementation with respect to model identified	Yes	Yes	Yes
Final Findings include Strengths and Weaknesses	Yes	Yes	Yes
Direct Artifacts Reviewed	Yes	Yes	No*
Interviews conducted	Yes	Yes	No*
Sources of objective evidence (interviews, documentation, instruments)	2	2	1
Observations corroborated	Yes	Yes	No
Validation of preliminary findings	Yes	Yes	No

* One type of objective evidence collection is required

Sources of Objective Evidence

- **Evidence review takes 1-2 times the length of interviews**
  - If evidence is not reviewed, easy to answer “correctly” in the interviews
  - If interviews are not conducted, evidence may be faked (not really in use) - normally easy to spot



- **Accuracy increases significantly with evidence review**
- **Validation takes little time and often increases accuracy 20-30%**

- **Buy-in is greatly increased by validation**
  - Nothing decreases buy-in faster than a “weakness” that everyone knows is wrong

Phase 3 – Report Results

Requirement	SCAMPI A	SCAMPI B	SCAMPI C
Designated appraisal results provided to stakeholders	Yes	Yes	Yes
Appraisal record delivered to sponsor	Yes	Yes	Yes
Appraisal data package submitted to SEI	Yes	Yes	Yes

* One type of objective evidence collection is required

Conclusions

- **SCAMPI cost, accuracy, and buy-in are driven more by the choice of tailoring options than by the selection of SCAMPI B and C**
- **SCAMPI A's limit the choices, promoting accuracy**
  - This is why SCAMPI A is the only method that results in a maturity or capability level
- **The flexibility permitted by SCAMPA B's and C's can result in inaccurate results and lack of organizational buy-in, especially if conducted by untrained, inexperienced personnel**

Guidance

- **If conducting B's and C's, ensure that team members have sufficient knowledge and experience, and emphasize evidence review**
- **SCAMPI A's can be conducted at similar costs if the method is tailored appropriately**

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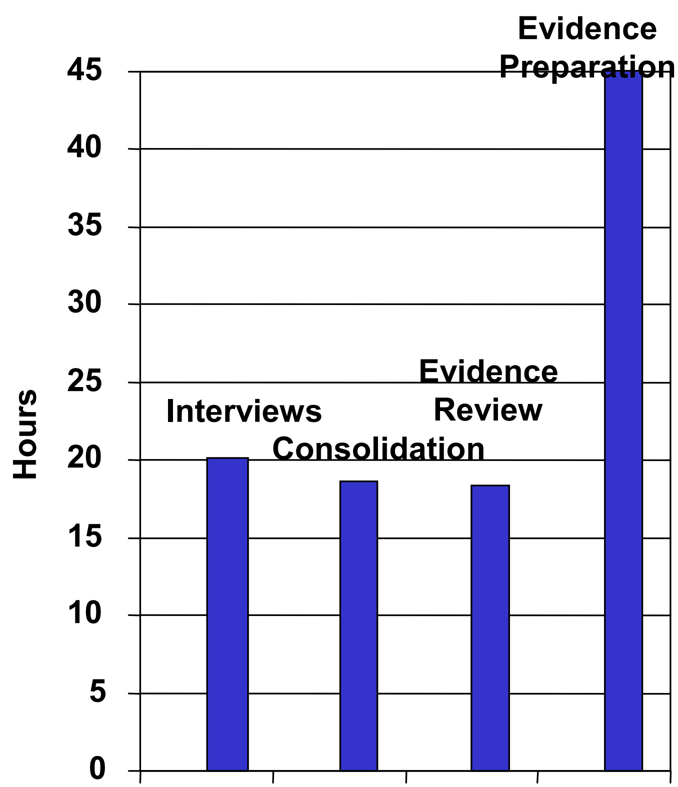
Applying Six Sigma To Appraisals

- Several Six Sigma projects were conducted to optimize the SCAMPI appraisal process



- Collected metrics on time spent on various appraisal activities, defects
- Used Pareto chart to identify bottlenecks, opportunities for improvement
- Used individuals charts to study variation in the appraisal process
- Used fishbone charts and other causal analysis methods to identify potential improvements

“Minimizing SCAMPI Costs via Quantitative Methods, “ R. Hefner and Ron Ulrich, CMMI Technology Conference & User Group, 17-20 November 2003

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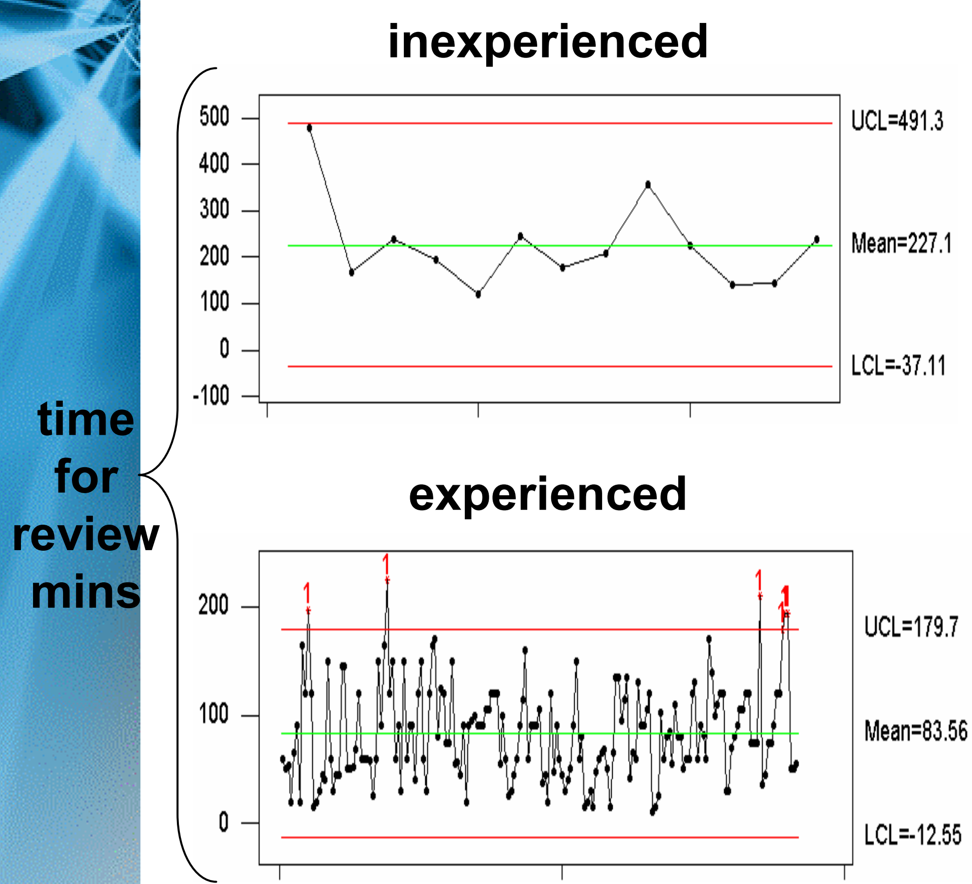
Reducing Variation in Evidence Review



- **The time is takes to review evidence is predictable**
  - Some variation by process area
- **The mean review time and variation is much higher among inexperienced appraisers**
  - At least half of the appraisers on the team should be experienced
- **Review time is driven by the clarity with which evidence is assembled and mapped to the CMMI practices**
  - Ensure thorough evidence scrub prior to on-site period
  - Bad evidence (“defects”) causes unexpected schedule overruns

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Reducing Interview Costs

- **To reduce cost:**
  - Use pre-scripted interview questions
  - Conduct interviews simultaneously in mini-teams (Remember that more than 3-4 people don't increase accuracy much.)
  - Schedule one interview per practice & instantiation (no SCAMPI requirement for multiple interview sources like in CBA IPI)
- **Maintain appraisal accuracy by emphasis on direct evidence**
  - Interviews simply confirm that the evidence is "real"
  - Interviews are <u>not</u> a test of how well someone remembers the practice

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Reducing Consolidation Time

Crafting observations

- **Voice of Customer data indicates organizations and projects simply want to know which practices they do not comply with**
  - Consistent with Verification mode
  - No need to wordsmith charts
- **We created an Appraisal Findings tool to capture the ratings at the instantiation level (every project, every practice)**
  - Simplifies data consolidation, team discussion

Reviewing as a team

- **Most of the time is spent arguing about how to interpret a few CMMI practices**
  - Especially Generic Practices
- **We created "CMMI Interpretation" training which clarifies how ambiguous practices will be evaluated**
  - Driven by areas where disagreement occurred
  - Useful in reaching team (and organizational) consensus

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Measured Success

- **Northrop Grumman Mission Systems is typically conducting Level 5 SCAMPI A appraisals in 5-6 days**
  - Based on over 60 SCAMPI A appraisals
  - 3-4 projects, 6-9 appraisers, 3 mini-teams, 10 hour days
  - Post-appraisal follow-up indicates >95% accuracy rate

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Conclusions

- Regardless of the choice of method (A/B/C), the appraisal process should tailored to yield accuracy, efficiency, and buy-in
- Selection of experienced, knowledgeable appraisers will significantly effect all 3 factors
- The flexibility permitted by SCAMPA B's and C's can result in inaccurate results and lack of organizational buy-in, especially if conducted by untrained, inexperienced personnel

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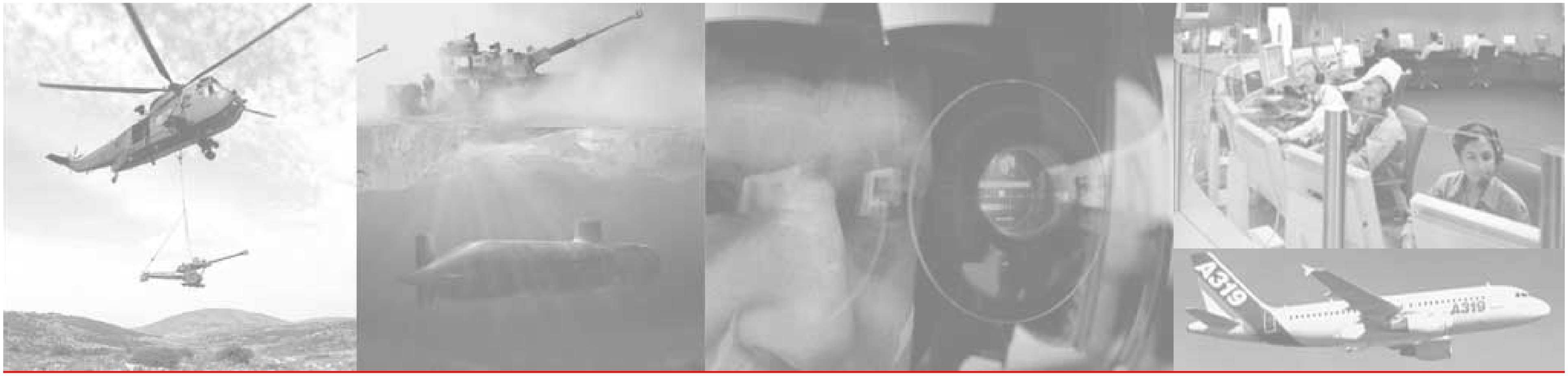
NDIA CMMI Technology conference

How to Incorporate “Lessons Learned” for Sustained Process Improvements

Anil Midha

BAE Systems, CNIR

Wayne, NJ



Presentation Agenda

- Introduction
  - “Lessons Learned” … or were they?
- Issues involved
- Current state of practice
- Opportunities for improvement
- Recommendation – “A Five-Step Approach"
- Conclusion
- Final thoughts

“Lessons Learned” … or were they? - 1

Our experiences, whether “good” or “not so good” teach us important lessons

- ❑ Individually, do we really learn from these lessons?
- ❑ Even if we learn some of the lessons, do we always share our key learnings with others?
- ❑ Even if we share our key lessons with our team members, are they shared with larger entities (projects/organizations)?
- ❑ Even if some of these lessons are shared at larger levels, do most of the projects/organizations really learn from and apply them?

Not always!

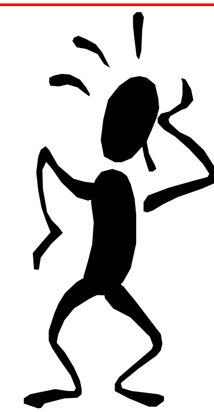
“Lessons Learned” … or were they? - 2

Ideally, if we really learned lessons from various project experiences, then…

- One project's mistakes will usually not be repeated on another project
- Process improvement will be a trivial exercise
- Projects will usually be on time, within budget, and deliver high quality products
- Customer and user satisfaction will be higher
- Organization will function more effectively

“Lessons Learned” … or were they? - 3

We often hear:



- “Didn’t we have the same problem earlier?”
- “I know Joe had encountered this problem on his project!”
- “I thought project XYZ had solved this problem long ago!”
- “I really wish we had learned our lesson from their experience!”

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I haven't got time to share my knowledge/experience

I could have told them it would/wouldn't work - I have tried it

I'll be damned if I am going to change after all this time.

I'd like to share what I know but no one will listen

The problem is other people!

I'm not interested in hearing about mistakes - I want to know about successes

I'll be damned if I am gonna let the world know I made a mistake!

Yes! But my project is different.

I know what's best for me!

It's safer to follow procedures rather than experiment.

There's nothing I can learn from them.

I don't know how to do this but if I ask it'll make me look stupid

I'll send them on a course and then they'll know how to do it

I haven't time to learn, I have a deadline to meet!

I wish I could talk to someone who has done this before

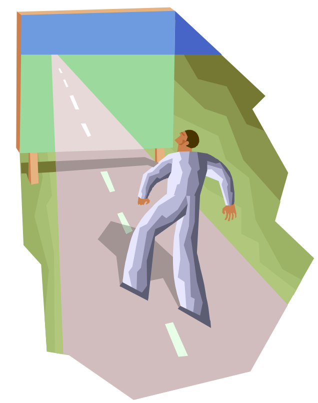
If I tell them what I know, what's to stop them getting rid of me?

Reality is …

- We often reflect on our individual experiences and apply the lessons learned into our own work

- Some cohesive teams share and incorporate project experiences in their future work

- Some organizations facilitate cross-learning through proper organization structure, open culture, and good tools/technology



But these are exceptions!

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Challenges are …

- Today's corporate environment poses several challenges
- Project teams are:
  - Multi-functional
  - Constantly evolving to meet business and resource constraints
  - Matrix structured
  - Culturally diverse
  - Geographically distributed

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The Result is …

- Today's corporate culture is not very conducive for effective communication and cross-team learning

- In spite of organizations' intentions to integrate, several cross-team learning opportunities are missed

- Organizations pay a steep price for repeating similar mistakes and missed opportunities

Lessons are learned, but after missing the boat a few times

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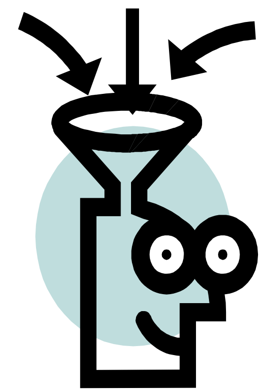
The Issue is …

In today's competitive environment, organizations cannot afford missed opportunities and repeated mistakes

The Resolution is …



Organizations must:

- Constantly and quickly leverage from each other's experiences
- Provide organizational, cultural, and technological infrastructure to facilitate cross-team learning
- Enforce the process discipline

The next best thing to learning from your own lessons is to learn from other's lessons – Gains without much pain!

Current Practices

Some projects:

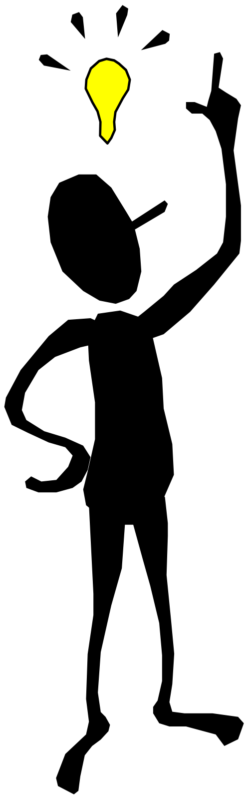
- Perform end-of-phase and/or end-of-project retrospective and collect observations/lessons learned
- Store lessons learned in a searchable database or even in a sophisticated knowledge repository
- Encourage people to use lessons learned
- Periodically review the collected lessons learned and make process improvements for persistent problems

Problems with the Current Practices

Significant variability in practice causes inconsistent results:

- Not all projects conduct end-of-phase and/or end-of-project retrospective and collect lessons learned
- Collected lessons learned lack appropriate categorization, context, problem statement and/or solution
- Repositories lack easy access, good navigation, and/or sophisticated search & retrieve capability
- Overtime, the repositories grows to be big, resulting in stale information, slow searches, and even irrelevant results
- Retrieving relevant information is too time consuming and thus people use the practices they are accustomed to

The Answer is …



"Good ideas are not adopted automatically – they must be driven into practice with courageous patience" - Admiral Hyman Rickover

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Guidance from CMMI

Organizational Process Focus (OPF) Level 3 Process Area – Practice SP 2.4 : Incorporate process-related experiences into organizational process assets:

- Conduct a periodic review of the effectiveness and suitability of the organizational process assets
- Obtain feedback about their use
- Derive lessons learned
- Make lessons learned available
- Appraise the process, methods, and tools in use and make improvement recommendations
- Manage process improvement proposals

Recommendation: Five-Step Approach

Systematically apply the following five-step approach to capture and translate key lessons learned into improved practices for sustained process improvements:

- Step 1: Capture lessons
- Step 2: Catalog and save lessons
- Step 3: Communicate and apply lessons
- Step 4: Incorporate lessons into process assets
- Step 5: Rollout and institutionalize enriched processes

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Step 1: Capture Lessons

Capture lessons from the following three major sources:

- After every major work product inspection, isolate the systemic problems and note key issues/observations

- Project functional teams must conduct a periodic or end-of-phase retrospective to identify key issues

- For all operational high severity/impact problems, perform root cause analysis and isolate key issues

Derive "Lessons" - extrapolated knowledge in terms of Do's and Don'ts from these issues/observations

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Step 1: Capture Lessons (cont.)

- Reflect and capture lessons in terms of both - what particularly worked well and what did not
- For each lesson, record:
  - Project name
  - Project size
  - Project type
  - Project phase
  - Project environment
  - Functional discipline
  - Issue / problem
  - Resolution / Solution
  - Context and key words
  - Scenario, if applicable

Step 2: Catalog and Save Lessons

- ❑ Create a single learning/knowledge repository to catalog and save collected lessons
- ❑ Perform a sanity check on collected information
- ❑ Repository should be
  - Searchable by key project attributes such as name, type, size, phase, functional area, and key words
  - Easily accessible, web-based, and secure

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Step 2: Catalog and Save Lessons (cont.)

Having a single repository for the organization has several benefits:

- Quickly and easily identifies pattern of similar problems
- Easier for practitioners to look and search one common repository as opposed to searching three different ones
- Easier to update and maintain
- Better utilization of resources

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Step 3: Communicate and Apply Lessons

- Disseminate all the recently submitted lessons periodically to project teams (relevant to each functional group)
  - E-mail notifications
  - Organizational meetings
  - Organizational newsletter

- Seek opportunities to apply lessons
  - A successful pilot of a lesson would validate it and pave the way for incorporating it in the process

Step 3: Communicate and Apply Lessons (cont.)

Benefits:

- Brings information to practitioners
- Increases the chance of someone in a project team to apply a relevant lesson
- Encourages everyone to submit to and retrieve lessons from the knowledge pool
- Allows for informal scrutiny of lessons from peers
- Permits further improvisations and innovations of lessons

Step 4: Incorporate Lessons into Process

- Identify lessons that can be incorporated into the process:
  - Exhibit a pattern of belonging to a similar problem or solution
  - Have been successfully piloted in another project
  - Have relatively lower process overhead or lesser risk in changing the process
- Improve the process by incorporating the lessons

Step 4: Incorporate Lessons into Process (cont.)

Improving the process may mean one or more of the following:

- Enhancing planning templates
- Enhancing checklists
- Introducing additional process activities/steps
- Making steps optional or mandatory
- Changing sequence of certain activities
- Suggesting use of new tools/technologies
- Introducing additional inspections or reviews
- Changing focus of certain activities
- Improving tailoring criteria and/or choices
- Collecting additional measurements

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Step 5: Rollout and Institutionalize Process

- Announce and release enhanced processes periodically in various modes, especially highlighting changes in processes:
  - Organizational meetings
  - Organizational newsletter
  - Process release communiqué
- Provide training and/or FAQs for updated processes, as needed
- Maintain knowledge repository:
  - Archive lessons already incorporated in the process assets
  - Keep the repository accurate, concise, and current

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Conclusion

- Each organization has an enormous cumulative intellectual capital of experience:
  - In people's minds
  - In organizational repositories
- These pools of knowledge are not properly utilized for continuous process improvement
- A systematic five-step approach of collecting and translating key lessons into practices would yield sustained and continuous process improvement:
  - Capture lessons from various activities
  - Catalog and save lessons in a structured knowledge repository
  - Communicate and apply lessons
  - Incorporate lessons into process
  - Rollout and institutionalize enhanced lessons

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In closing …

Continuous process improvement is everyone’s responsibility

Truly improving business performance demands more than simply putting more knowledge into organizational repositories

Lessons are really not learned until relevant process assets have been improved and the process has been institutionalized.

Thank You!

Contact Information

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CMMI and agile: a High Tech R&D Success Story

Niels Markert, ARD
Robyn Plouse, INTEL
Gene Miluk, SEI

Sponsored by the U.S. Department of Defense

Advantest America
R & D Center, Inc.

Version #

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Background

INTEL and SEI Collaborating on the development of the SCAMPI B and C Method

ARD Advantest was jointly developing test equipment with INTEL and was offered as a pilot for the new SCAMPI B method

In addition to the opportunity to pilot the SCAMPI B method, this was also an opportunity to test the applicability of the CMMI in a Small High Tech organization exploring the use of AGILE methods

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ARD Background

•ARD is the U.S. R&D arm of Advantest Japan

•It is a small (50 person) high tech R&D operation specializing in the development of leading edge electronic testing and measurement equipment

•ARD requires fast efficient operational processes. It is incorporating agile methods to support rapid development of its latest platform

•ARD acknowledged that CMMI may provide process discipline but was concerned that it would be too large and burdensome

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•ARD Experience

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ARD and CMMI

Improving our process of
on-going improvement

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Introduction of CMMI into ARD

- Obstacles
  - Before CMMI could be taken on, we had to take inventory of what obstacles would prevent or undermine its use/success.
- Constraints
  - We also had to consider what limitations would we be operating under and could we be effective in implementing CMMI.

Obstacles

- Ourselves (Habits and Discipline):
  - History of past success without CMMI
    - ARD has a long history of delivering
  - A “homegrown” improvement program
    - Project Planning had already been iterated with varying degrees of success.
  - “We’re so busy, too busy to do this stuff”
    - An engineering favorite

Constraints

- Product Focus
  - Weighted heavily on early product life-cycle
- Small team size
  - No allocation for a dedicated process “group”
- Project Time
  - Clocks ticking… ARD delivers regardless if we embrace CMMI or not.

Advantest America R & D Center, Inc.

Key Drivers for Implementation

- CMMI audit
  - Progression of –C, -B, -A audits
- Mapping of the Model
  - Model concepts -> Our data
  - Our data -> Model concepts

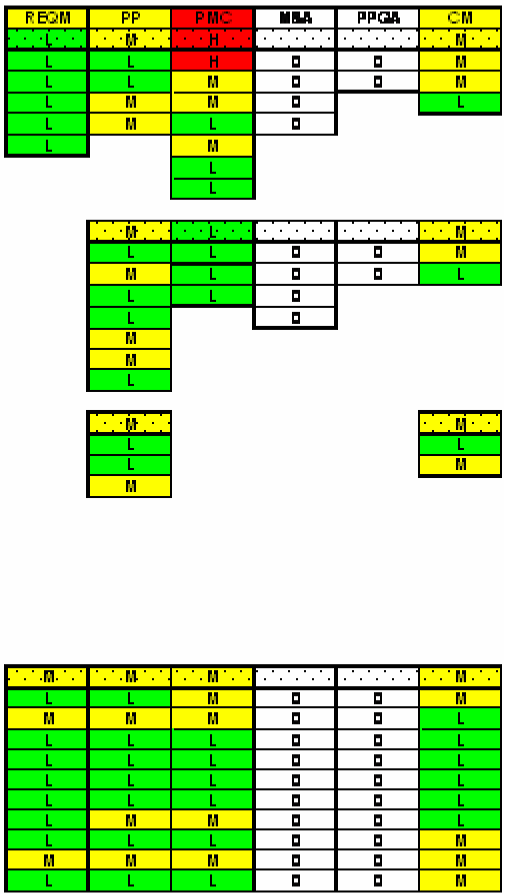
CMMI audit and Artifacts

- Artifacts are tangible items that individuals in the organization can easily relate to, enabling institutionalization of process,
  – CMMI helped reinforce that “artifacts” are what really matter.
- CMMI audit methodology enabled hooks into Artifacts, helping to shape process capture

Mapping the Model

- ARD focused on translating the model into our own terminology.
  - Helping to prevent “hanging ourselves” with the model’s terms.
- Building our process capture
  - Using the model’s “questions and recommendations” to our artifacts and linking them to a process

Progression time line



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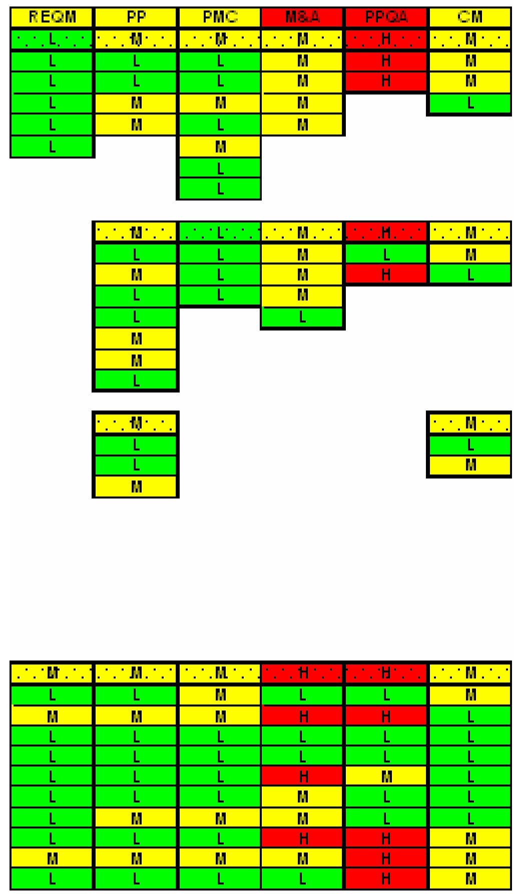

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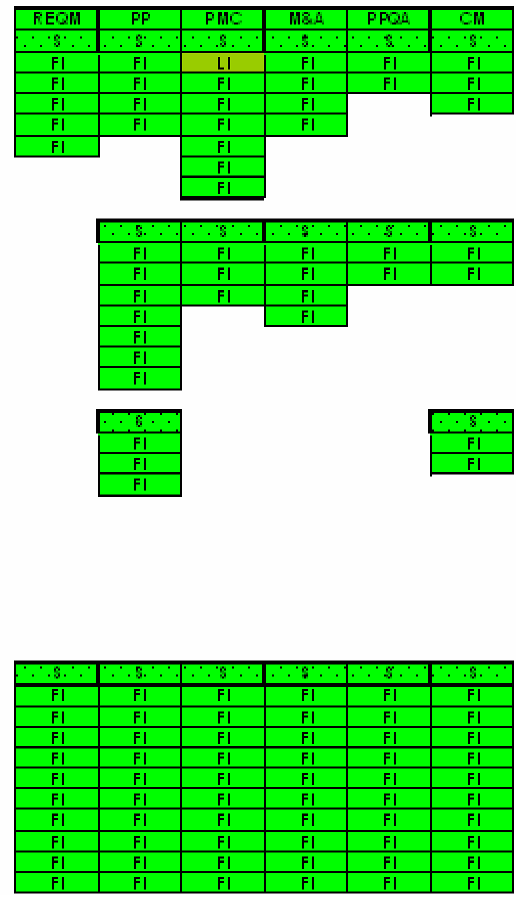

-A
November

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CMMI, A Roadmap for ARD

- Context
  - CMMI model provided the context in which to view our artifacts
  - This provided us a direction on how to make an artifact “concrete” and “measurable”
    - Value as an “official organization artifact”…
    - not just a data pile of interesting stuff

CMMI, A Roadmap for ARD

- Validation
  - As a reference, CMMI provided the framework to validate our artifacts, processes, policies
    - Identifying
      - Do we have the right artifact, process, policy ?
    - Simplifying
      - Is this efficient ?
    - Standardizing
      - Is this a template for the future ?

ARD, value in CMMI

- The biggest value to ARD of CMMI is the “accounting” like audit process.
  - What is this ?
  - Where is it ?
  - How does it link ?
  - What is it supporting ? (a process -> policy)
- Together this is a “concrete”, “real method” to help us achieve results.

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Software Outsourcing with CMMI

CMMI Technology Conference
November 2005

SEI Acquisition Support Program

Brian Gallagher
Joseph P. Elm
Dr. John W. Mishler

Sponsored by the U.S. Department of Defense

Agenda

SEI Acquisition Support Program (ASP)
Brian Gallagher

- Program Description
- Update on CMMI-AM and CMMI-A

Software Acquisition Survival Skills
Joe Elm & John Mishler

- Examples of practical training approach for Acquirers
- Process Areas and Key Issues for Acquirers
- Symptoms of Problems
- Prevention Strategies
- Suggested Actions
  (depending on where you are in the acquisition process)

Wrap-up
Brian Gallagher

What does the SEI Acquisition Support Program (ASP) do?

The Acquisition Support Program (ASP) helps Department of Defense (DoD) and other government acquirers make evolutionary and revolutionary improvements in the acquisition of software-intensive systems, and provides opportunities for SEI programs to create, apply, and amplify new technologies.

Acquisition Business Questions ?

"How can I …

… identify and manage the risks that beset my project?"

… develop and manage requirements?"

… create an acquisition strategy best suited for my program?"

… ensure that my software acquisition is integrated with the whole system"?

… create a software architecture that meets the needs of my project?"

… effectively monitor the progress of my acquisition?"

… continuously improve my software acquisition efforts?"

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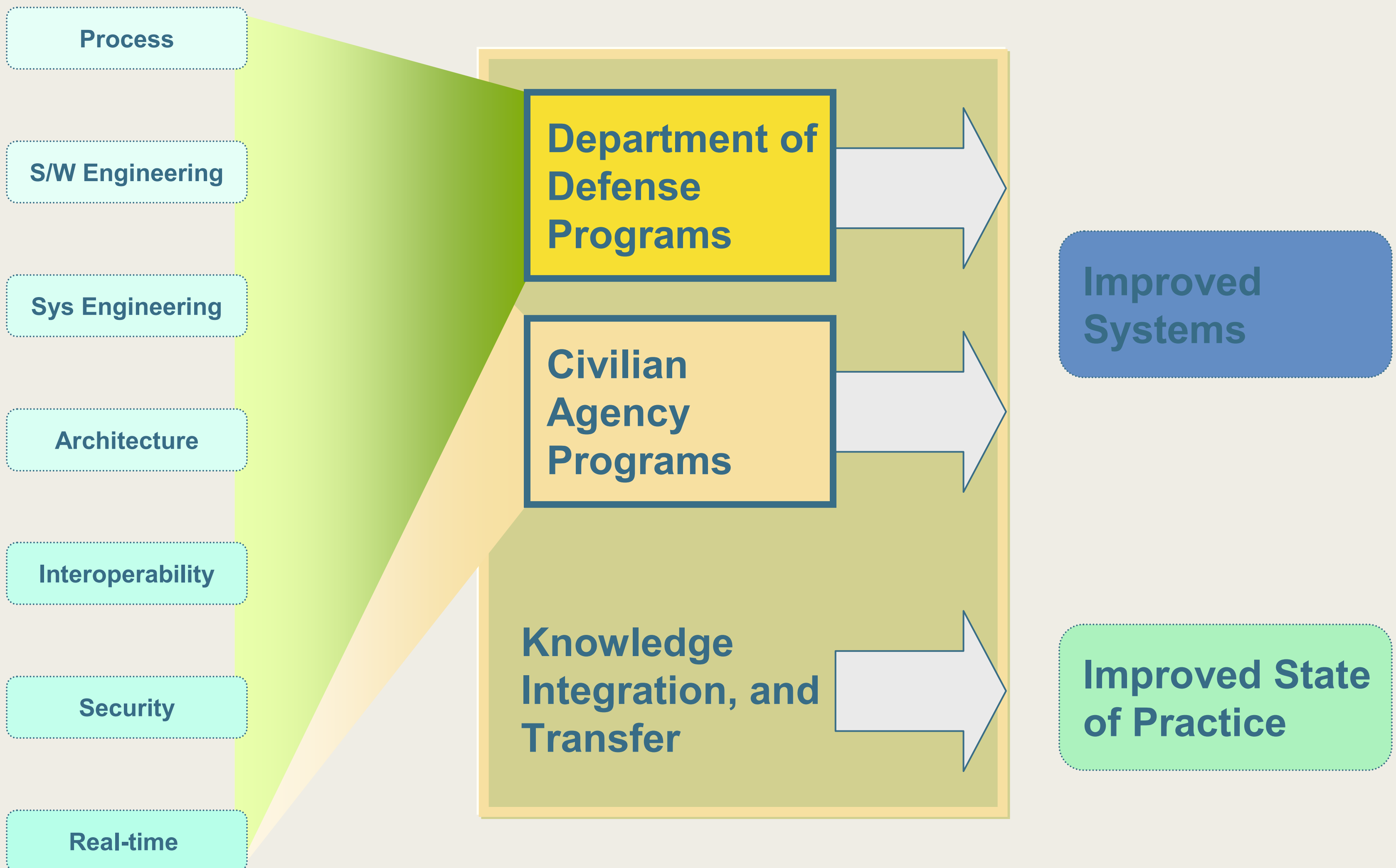
SEI Acquisition Support Program



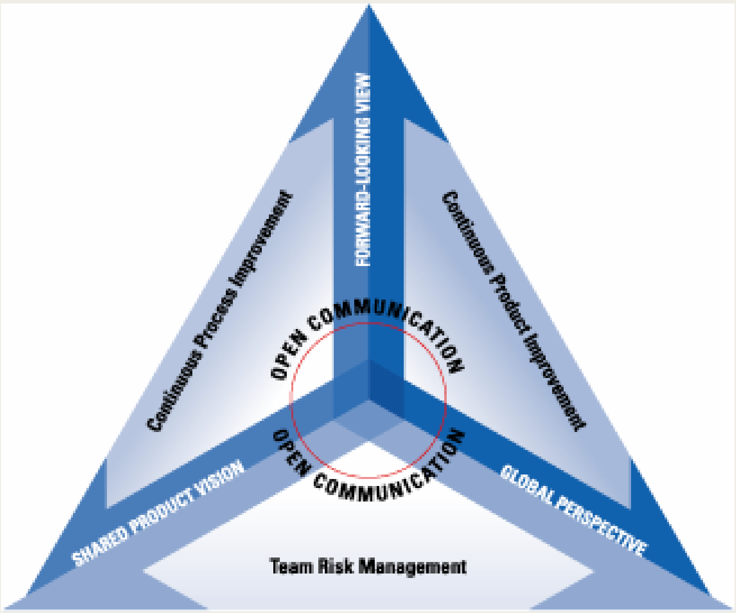
Acquisition Support Program

Purpose

- Accelerate adoption of improved practices for acquiring, deploying, and sustaining software-intensive systems

Tasks

- Enable key acquisition programs to achieve their objectives
- Capture and integrate knowledge from engagements with acquisition organizations



ASP Program Goals

Drawing on our expertise in software engineering, help DoD and other government acquirers improve their ability to acquire, deploy, and sustain systems and capabilities.

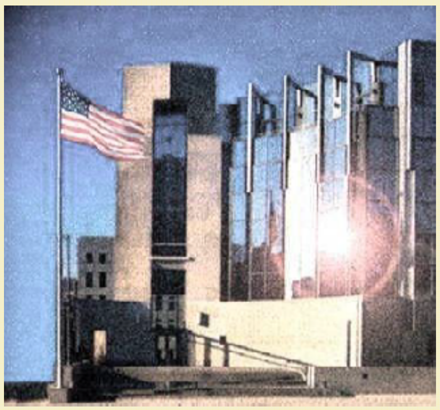
Identify opportunities for the Software Engineering Institute (SEI) to create, apply and amplify technologies that respond to customer needs.

Disseminate lessons learned and best practices through courses, workshops, conferences, publications, and participation in acquisition communities of practice.

ASP Program Strategies

- Understand and characterize the acquisition environment (*Needs Analysis*).
- Work directly with key acquisition programs to help them achieve their objectives (*Acquisition Improvement*).
- Disseminate lessons learned and best practices through courses, workshops, conferences, publications, and participation in acquisition communities of practice (*Knowledge Integration and Transfer*).

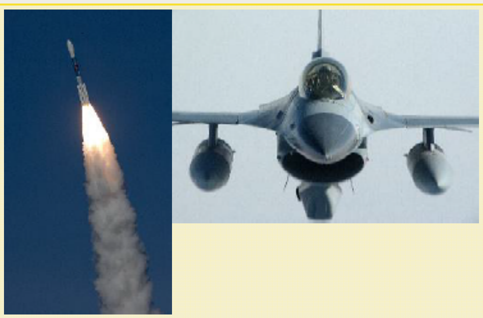
ASP Operational Approach



Acquisition Support Program *applies*

Software and Systems Technologies

Feedback from direct support and community learning improves ASP practices & SEI technologies



Direct Benefit *to Acquisition Programs*

Indirect Benefit *to Similar Programs*

- *Workshops, Classes, Seminars*
- *Tailored learning via Acquisition Communities of Practice*
  - Army, Navy, Air Force, Defense Agencies
  - Software Collaborator's Network
  - STSC
  - MITRE, Aerospace, APL
  - DAU
  - OSD Best Practices
  - Civil Agencies
  - Universities
  - US-UK-AUS SISAIG

CMMI and Acquisition

- **CMMI Acquisition Module (CMMI-AM)**
  - Example of Create, Amplify, Apply
  - Piloted with multiple DoD program offices
    - Large and small size
    - Various life cycle stages
  - Version 1.1 released in May 2005
  - CMMI-AM course now in curriculum
- **CMMI Acquisition Constellation or CMMI-A**
  - In requirements development phase

CMMI Module for Acquisition ver 1.1 Process Areas

Project Management

- Project Planning
- Project Monitoring and Control
- **Solicitation & Contract Monitoring***
- Integrated Project Management
- Risk Management

Engineering

- Requirements Management
- Requirements Development
- Verification
- Validation

Support

- Decision Analysis and Resolution
- Measurement and Analysis
- **Transition to Operations & Support***

- Note 2 new CMMI-AM process areas are in **Bold Type**

CMMI Module for Acquisition ver 1.1 Generic Goals and Practices

Generic Goals	Generic Practices
Institutionalize a Managed Process	Establish an Organizational Policy Plan the Process Provide Resources Assign Responsibility Train People Manage Configurations Identify and Involve Relevant Stakeholders Monitor and Control the Process Objectively Evaluate Adherence Review Status with Higher Level Management
Institutionalize a Defined Process	Establish a Defined Process Collect Improvement Information

CMMI Acquisition Constellation (CMMI-A)

- To be built on common CMMI ver1.2 architecture framework and will include:
  - the primitive or base CMMI model (ver.1.2)
  - groups of amplifications for acquisition
  - groups of elaborations for acquisition
  - groups of additions for acquisition
- Development will be in parallel with CMMI ver.1.2
- Deployment will be after CMMI ver.1.2 is released
  - CMMI ver.1.2 scheduled for release in Q3 or Q4 CY 2006
  - CMMI-A forecast for release sometime in CY 2007

CMMI-A Current Status

- Currently in requirements development phase
- SEI coordinating effort, building upon
  - Existing CMMI Acquisition Module (CMMI-AM)
  - General Motors IT Sourcing expansion
  - Will add government perspectives from both DoD and civil agencies

Software Acquisition Survival Skills

Course developed to integrate key issues identified in government acquisitions. Issues identified via:

- Independent Technical Assessments (ITAs) performed by the SEI
- Informal survey of acquisition professionals
- Literature review

Target audience is acquisition project office staff

Topics include:

- Risk Management
- Systems Engineering
- Architecture
- Process Management
- Pre-Award Activities
- Technical Evaluation
- Metrics
- Requirements Management

SW Survival Skills Modules

Based on

- Review of CMMI process areas and specific practices
- Presentation of acquisition amplifying information
- Identification of symptoms
- Suggesting prevention approaches
- Giving practical tips on what to do next (tailored to where you are in the process)

Today: Two Representative Process Areas

Requirements Management & Risk Management

For each:

- Specific practices
- Sample work products
- Sample key issues
- Symptoms of problems
- Prevention strategies
- What to do now (depending on where you are)

Requirements Management Purpose

The purpose of requirements management is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

For Acquisition, requirements management is applied to the requirements that are received from the requirements development process.

Acquisition Requirements Management

During acquisition, requirements management includes

- the direct management of acquirer-controlled requirements
- oversight of supplier requirements management

Requirements are managed and maintained with discipline so that changes are not executed without recognizing the impact to the project.

Requirements management does not end with the selection of a supplier and an award.

- the acquisition project continues to manage high-level requirements, including changes
- the selected supplier manages the lower level requirements

Requirements Management Goal and Practices

Specific Goal	Specific Practice
Manage Requirements	• Obtain an Understanding of Requirements • Obtain Commitment to Requirements • Manage Requirement Changes • Maintain Bidirectional Traceability of Requirements • Identify Inconsistencies Between Project Work and Requirements

Obtain an Understanding of Reqts.

- Establish criteria for distinguishing appropriate requirements
- Establish objective criteria for the acceptance of requirements
- Analyze requirements to ensure that the criteria are met
- Reach an understanding of the requirements with the stakeholders

Typical Work Products

- Lists of criteria for distinguishing appropriate requirement providers
- Criteria for evaluation and acceptance of requirements
- Results of analyses against criteria
- Agreed to set of requirements

Sample Key Issues

Missing stakeholders

Lack of appropriate requirements results in inadequate verification, rework or system rejection

Failure to have a common understanding of requirements

Insufficient analysis techniques

Obtain Commitment to Requirements

- Assess the impact of requirements on existing commitments
- Negotiate and record commitments

Typical Work Products

- Requirement impact assessments
- Documented commitments to requirements and requirement changes

Sample Key Issues

Inadequate assessments
Existing commitments are not well known or defined
Failure to negotiate with balance in mind
Failure to obtain written commitment

Manage Requirements Changes

- Capture all requirements and requirements changes
- Maintain the requirements change history with the rationale for the changes
- Evaluate the impact of the requirement changes from the standpoint of the stakeholders
- Make the requirements and change data available

Typical Work Products

- Requirement impact assessments
- Documented commitments to requirements and requirement changes

Sample Key Issues

- Lagging documentation
- Failure to plan for and manage the change process
- Incomplete impact assessments
- Lack of backup plans

Maintain Bidirectional Traceability

- Ensure the source of lower level requirements is documented
- Maintain traceability from a base to derived requirements
- Maintain traceability from a requirement to its allocation
- Maintain horizontal traceability from function to function and across interfaces
- Generate a requirements traceability matrix

Typical Work Products

- Requirements traceability matrix
- Requirements tracking system

Sample Key Issues

- Lagging documentation
- Missing or ineffective requirements tracking system
- Forgetting to verify unwanted features have not been added to the system
- Forgetting to verify all required features exist

Identify Inconsistencies

- Review the project's plans, activities and work products for consistency with the requirements and changes
- Identify the source of the inconsistency and the rationale
- Identify and initiate corrective actions

Typical Work Products

- Documentation of inconsistencies including sources, conditions and rationale
- Corrective actions

Sample Key Issues

Waiting too long to identify inconsistencies

Failure to verify that corrective action was completed

Assuming contractor or someone else is handling this

Incomplete documentation

Poor Requirements Management …

Symptoms

- High levels of re-work throughout the project
- Requirements are accepted by staff from any unauthorized sources
- "Galloping" requirements creep
- Requirements are vague and subject to multiple interpretations
- Missed requirements or extraneous (not-needed) requirements
- Inability to prove that the product meets the approved requirements
- Lack of Non-Functional requirements
- Inadequate or missing requirements baselines

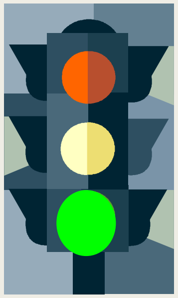
Why should we care?

- Solutions that don't match user needs or may have to be replaced or retired early
- Inability to hold contractor to commitments
- Excessive budget consumption
- Requirements errors are the most common error & most expensive to fix
  - Requirements error are likely to consume 25% - 40% of the total project budget when not caught early

Recovery

- Assess the situation
- Don’t perpetuate the problems
- Select which program elements to continue during assessment and repair

- Use the CMMI Requirements Management Process Area to:
  - –Diagnose problem areas
  - –Develop corrective action plans



- Baseline the current state, and track changes from there

Prevention Strategies

- Take ownership—
  *THEY ARE **YOUR** REQUIREMENTS!*
- Develop and manage requirements in a process context
- Ensure your process
  - Avoids key issues
  - Addresses survival tips
- Involve all stakeholders
- Dedicate sufficient resources

What Do I Do Now? 1

If you are in an early program phase:

- Establish a Configuration Control Board
- Ensure that user/operator groups participate in requirements process
- Provide training on “good” requirements and the requirements management process

If you haven’t released your RFP:

- Ensure RFP requires documentation of change management and requirements management processes
- Ensure the RFP specifies that the PMO approves a requirements baseline
- Ensure system interface requirements are documented in the RFP
- Ensure RFP addresses the ‘ilities’ as well as functional requirements

What Do I Do Now? 2

If you are still negotiating the contract:

- Discuss requirements management with the contractor
- Clearly delineate customer/contractor roles regarding requirements development and management
- Potentially modify incentive plan to encourage some of the ‘ilities’

If you are already executing the program:

- Can you trace requirements top-down and bottom-up?
- Are software requirements effectively documented and decomposed in order to capture all derived and interface requirements?
- Consider any requirements changes on a case by case basis and consider deferring new requirements
- Are the users/operators still involved as the system is being developed?

Risk Management Purpose

The purpose of risk management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

Acquisition Risk Management

For Acquisition, risk identification and estimation of probability of occurrence and impact, particularly for those risks involved in meeting performance requirements, schedules, and cost targets, largely determines the acquisition strategy.

The acquirer has a dual role, first in assessing and managing overall project risks for the duration of the project, and second, in assessing and managing risks associated with the performance of the supplier.

As the acquisition progresses to the selection of a supplier, the risk specific to the supplier's technical and management approach becomes important to the success of the acquisition.

Risk Management Goals and Practices

Specific Goal	Specific Practice
Prepare for Risk Management	• Determine Risk Sources and Categories • Define Risk Parameters • Establish a Risk Management Strategy
Identify and Analyze Risks	• Identify Risks • Evaluate, Categorize, and Prioritize Risks
Mitigate Risks	• Develop Risk Mitigation Plans • Implement Risk Mitigation Plans

Determine Risk Sources & Categories

- Determine risk sources and categories

Typical Work Products

- **Risk sources lists (Internal & External)**
- **Risk categories lists**

Sample Key Issues

Including acquiring office risks as well as vendor risks

Not including all stakeholder viewpoints

Skipping ahead to risk identification

Define Risk Parameters

- Define the parameters used to analyze and categorize risks.
- Define the parameters used to control the risk management effort.

Typical Work Products

- **Risk evaluation, categorization, and prioritization criteria**
- **Risk management requirements (control & approval levels, reassessment intervals, etc.)**

Sample Key Issues

Not tailoring risk categories to specific project

Inability to get agreement on risk category thresholds

Skipping ahead to risk identification

Establish a Risk Management Strategy

- Establish and maintain the strategy to be used for risk management.

Typical Work Products

- **Project risk management strategy**

Sample Key Issues

Lack of established process to sustain continuous risk management over time
Failure to evaluate the supplier's risk management approach for the potential of a shared risk data base
Failure to document the strategy

Identify Risks

- Identify and document the risks.

Typical Work Products

- List of identified risks, including the context, conditions, and consequences of risk occurrence

Sample Key Issues

Failure to include internal project risks as well as technical risks related to the development

Relying on only one source of risk identification

Failure to distinguish between project risks and project issues

Incomplete risk statements (source, condition, context)

Evaluate, Categorize, & Prioritize Risks

- Evaluate and categorize each identified risk using the defined risk categories and parameters
- Determine the relative priority of each risk

Typical Work Products

- **List of risks, with a priority assigned to each risk**

Sample Key Issues

Inability to achieve consensus on risk categorization

Unclear understanding of categories

Uneven application of risk categories

Develop Risk Mitigation Plans

- Develop a risk mitigation plan for the most important risks to the project, as defined by the risk management strategy

Typical Work Products

- Documented handling options for each identified risk
- Risk mitigation & contingency plans
- List of those responsible for tracking and addressing each risk

Sample Key Issues

- Risks without accountability
- Unclear understanding of mitigation approaches
- Mitigation triggers not communicated

Implement Risk Mitigation Plans

- Monitor the status of each risk periodically and implement the risk mitigation plan as appropriate

Typical Work Products

- Updated lists of risk status
- Updated assessments of risk likelihood, consequence, and thresholds
- Updated lists of risk-handling options
- Risk mitigation plans

Sample Key Issues

Lagging documentation

Plans don't match overall strategy set forth for the project

Incentivize risk communication

Poor Risk Management …

Symptoms

- Risks are being ignored
- No activity on documented risk items, static risk database
- Known risks to project staff are a surprise to management
- No risk ownership
- Every time a new problem manifests, a new management technique is tried

Why should we care?

- The project may escape some of the “bullets,” but not all of them
- No lessons learned for future projects means making the same mistakes on multiple projects
- Repeated project failures due to unforeseen (but predictable) risks costs you and your organization

Recovery

- Hold a focused working session to
  - Identity, classify, and prioritize all current risks
  - Revise the risk communication and documentation plan
- Consider an independent assessment of program risk
- Develop a distributed risk repository
  - Local risk management at contractor sites and sub-contractor sites
  - Escalate risks according to acquirer approved criteria
- Train project office personnel in risk management
- Hold a risk management review to include a review of mitigation plans

Prevention Strategies$_1$

- Start a risk management program on **Day 1** of the program
- Ensure that acquiring office staff has had appropriate risk management training
- Use multiple methods to identify risk sources:
  - periodic risk reporting
  - voluntary risk reporting
  - taxonomy-based questionnaire (TBQ)
  - brainstorming
  - risk report forms
  - TBQ interviews

Prevention Strategies $_2$

- Add language to RFPs and contracts that specify how risks are to be reported to the PMO
- Encourage decentralization of risk identification and analysis following an organizationally defined process
- Establish and maintain a schedule of joint risk reviews with all
- contractors throughout the program, including joint prioritization of the most important risks to the program
- Find ways to reward contractors for early identification of issues and risks
- Define a process and criteria for escalating risks to the next higher level

What Do I Do Now? 1

If you are in an early program phase:

- Establish a PMO risk management process
- Review the acquisition strategy for programmatic risks
- Put PMO risk mitigation plans in place

If you haven't released your RFP:

- Ensure RFP requires explanation/evidence of risk management and mitigation processes and strategies
- Ensure RFP addresses programmatic risks previously identified
- Ensure RFP requires bidders to document risks associated with the program
- Establish a method for evaluating the risk of each proposal

What Do I Do Now? 2

If you are still negotiating the contract:

- Include a risk management program in the contract
- Ensure risk management tasks/strategy are properly aligned with development and acquisition strategies

If you are already executing the program:

- Communicate regularly with the contractor about program risks and status
- Ensure PMO staff has the knowledge to identify both technical and non-technical risk items
- Consider revising the incentive or award fee to include the risk management program as an incentive area
- Consider conducting independent risk assessments

Summary of Survival Skills Approach

- Review process areas, specific practices, typical work products
- Include Acquisition amplifying information including sample key issues
- Identify symptoms
- List prevention approaches
- Give practical tips on what to do next (tailored to where you are in the process)

Wrap up and Q & A

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Future of System and Software Engineering Project Management and the CMMI

SYSTEMS AND SOFTWARE CONSORTIUM

BUILDING BETTER SOLUTIONS TOGETHER

Date: November 17, 2005

Presented By: Dr. Kenneth E. Nidiffer

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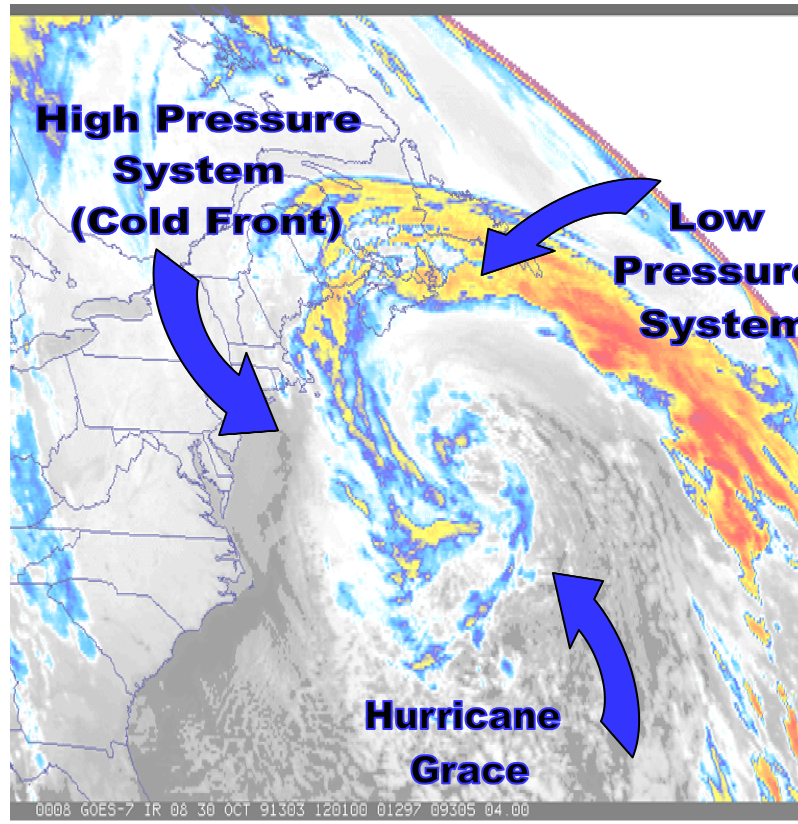
(703) 742-7110

Agenda

- Storms of the 80s
  The software crisis and birth of the Consortium (1985)
- Storms of change today in
  - Customer
  - Industry
  - Technology
  - Society
- Future of Systems and Software Engineering Project Management and the CMMI
  - Top Six Predictions



"Perfect Storm" Event, October 1991
National Oceanic & Atmospheric Administration

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MISTAKES

Successful programs are achieved because problems were overcome.

Market Dynamics

Platform → **Enterprise**
Customer Emphasis

Requirements → **Objectives**
Acquisition Model

Dominant Prime → **Strategic Teaming**
Program Execution

"Boxes" → **"Layers & Stacks"**
Integration Challenge

Proprietary → **Plug & Play**
Architectures and Standards

The emerging dynamic is to address both sides, and do so with compressed delivery schedules

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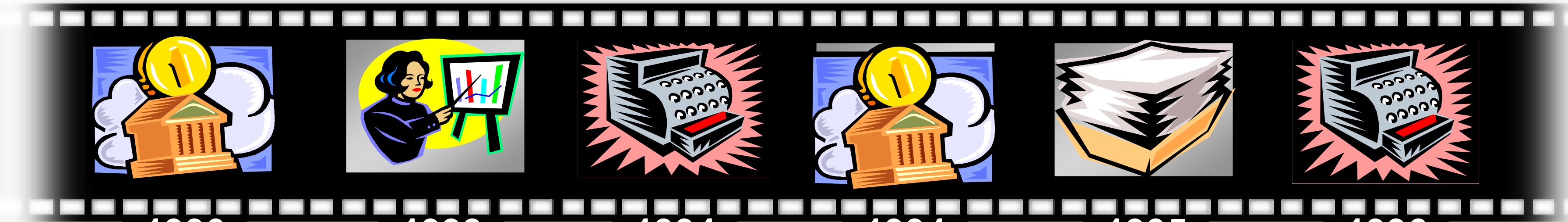
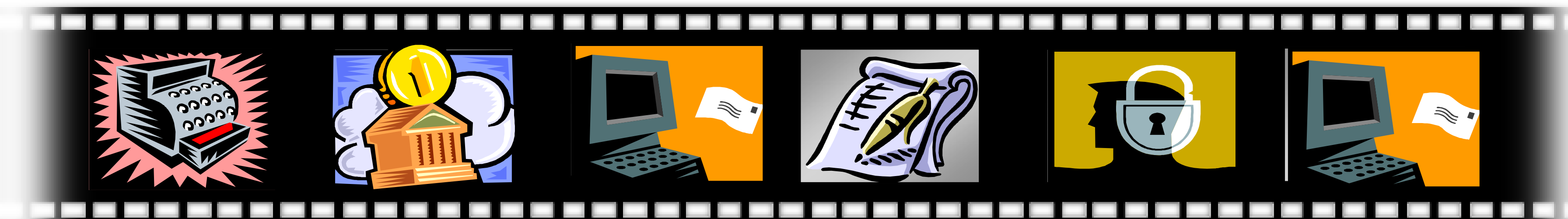
Federal Procurement Legislation



1990	1993	1994	1994	1995	1996
Chief Financial Officers (CFO) Act	Government Performance and Results Act (GPRA)	Federal Acquisition Streamlining Act (FASA)	Government Management Reform Act	Paperwork Reduction Act	Federal Acquisition Reform Act (FARA)



1996	1996	1998	1998	2002	2002
Clinger-Cohen/ Information Technology Mgmt Reform Act (ITMRA)	Federal Financial Management Improvement Act (FMFIA)	Government Paperwork Elimination Act (GPEA)	Federal Activities Inventory Reform Act (FAIR)	Homeland Security Act	E-Government Act (Includes FISMA)

Legislation changed not merely the law, but also has changed the customer's mindset

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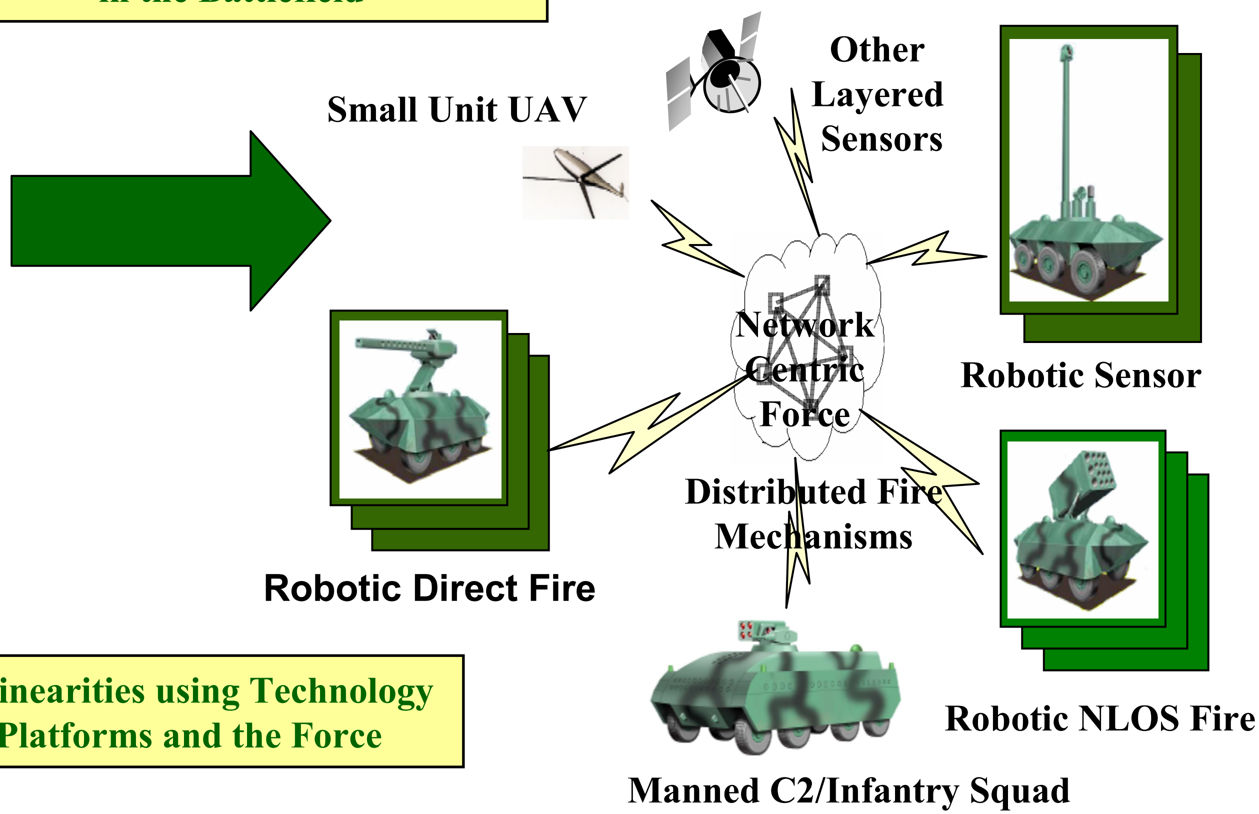
Army FCS: Network Centric Warfare

From This...

Hundreds of Systems Interoperating in the Battlefield

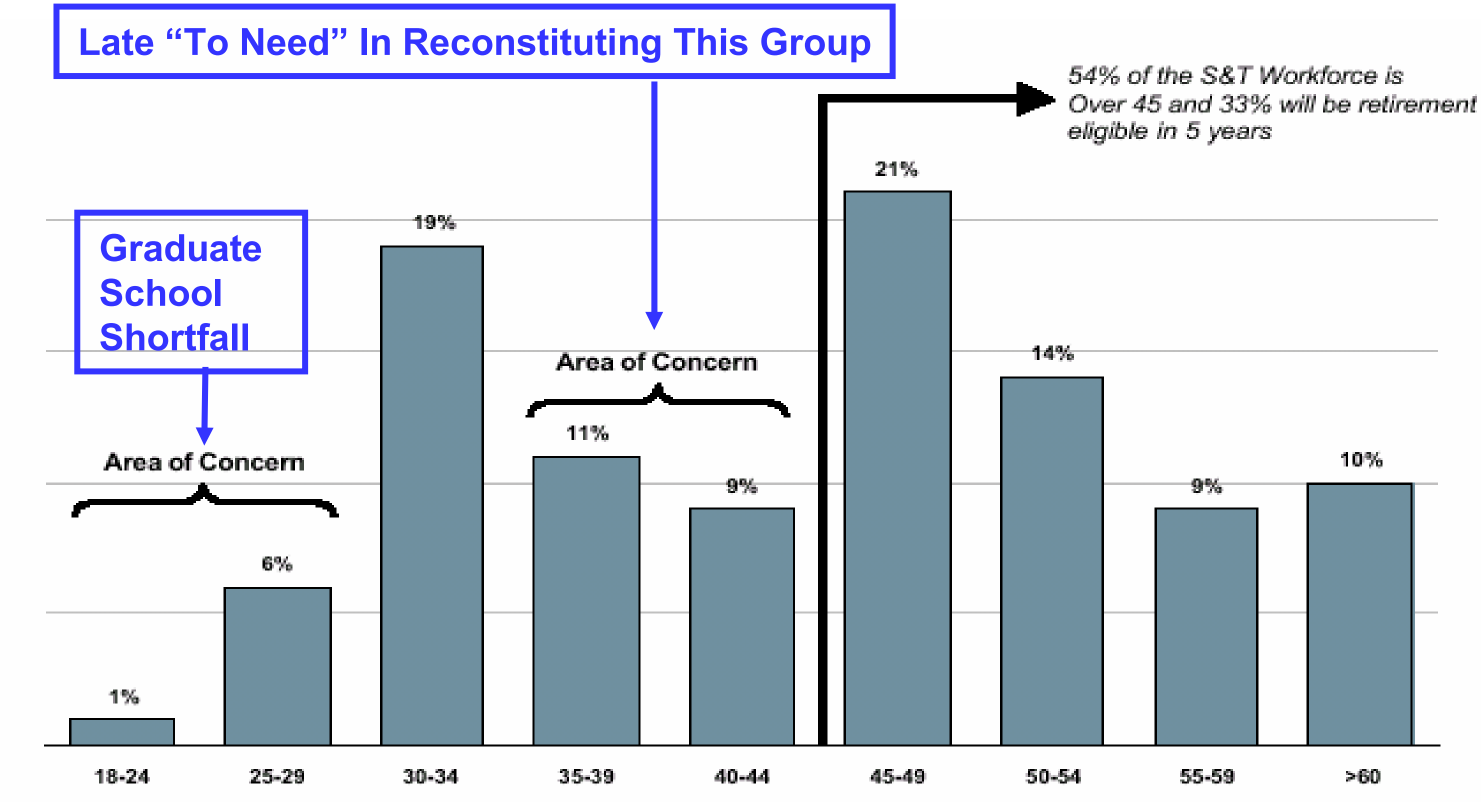
To This...

Network Centric Distributed Platforms



Exploit Battlefield Non-Linearities using Technology to Reduce the Size of Platforms and the Force

Society Drivers: Bimodal Demographics
(Space Industry)

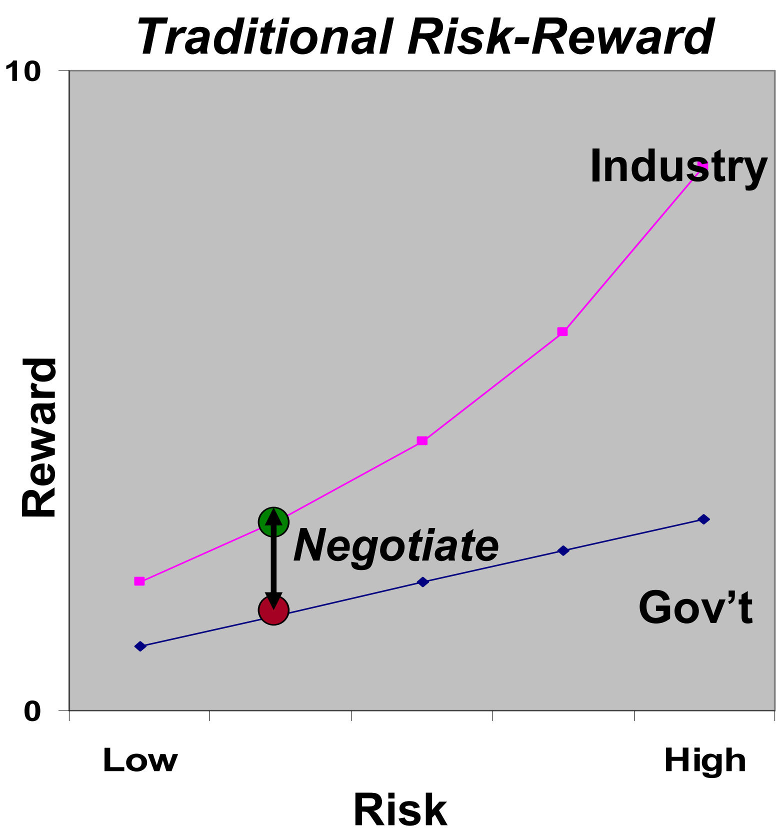


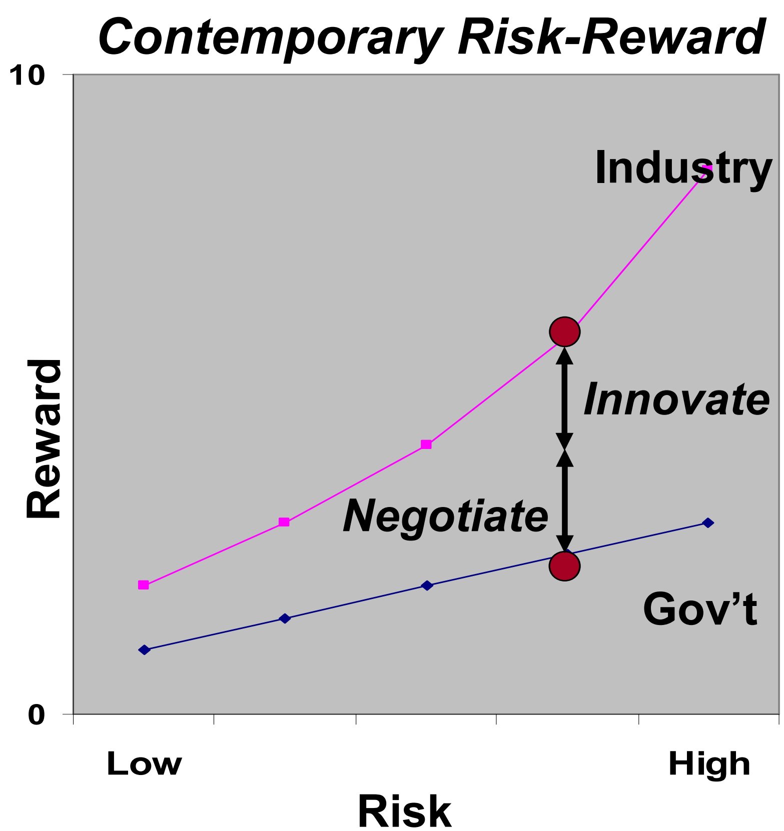
Average Space Industry S&E Workforce Age Distribution

Fewer New Starts and Program Uncertainty Make It Difficult to Both Attract and Retain Essential Talent

Source: Lockheed Martin (0004305-001: AIAA SE Workforce Data. Frank Cappuccio VP & GM Skunk Works)

Innovation Complements Negotiation





Innovation is the key to manage risk-reward in the government market

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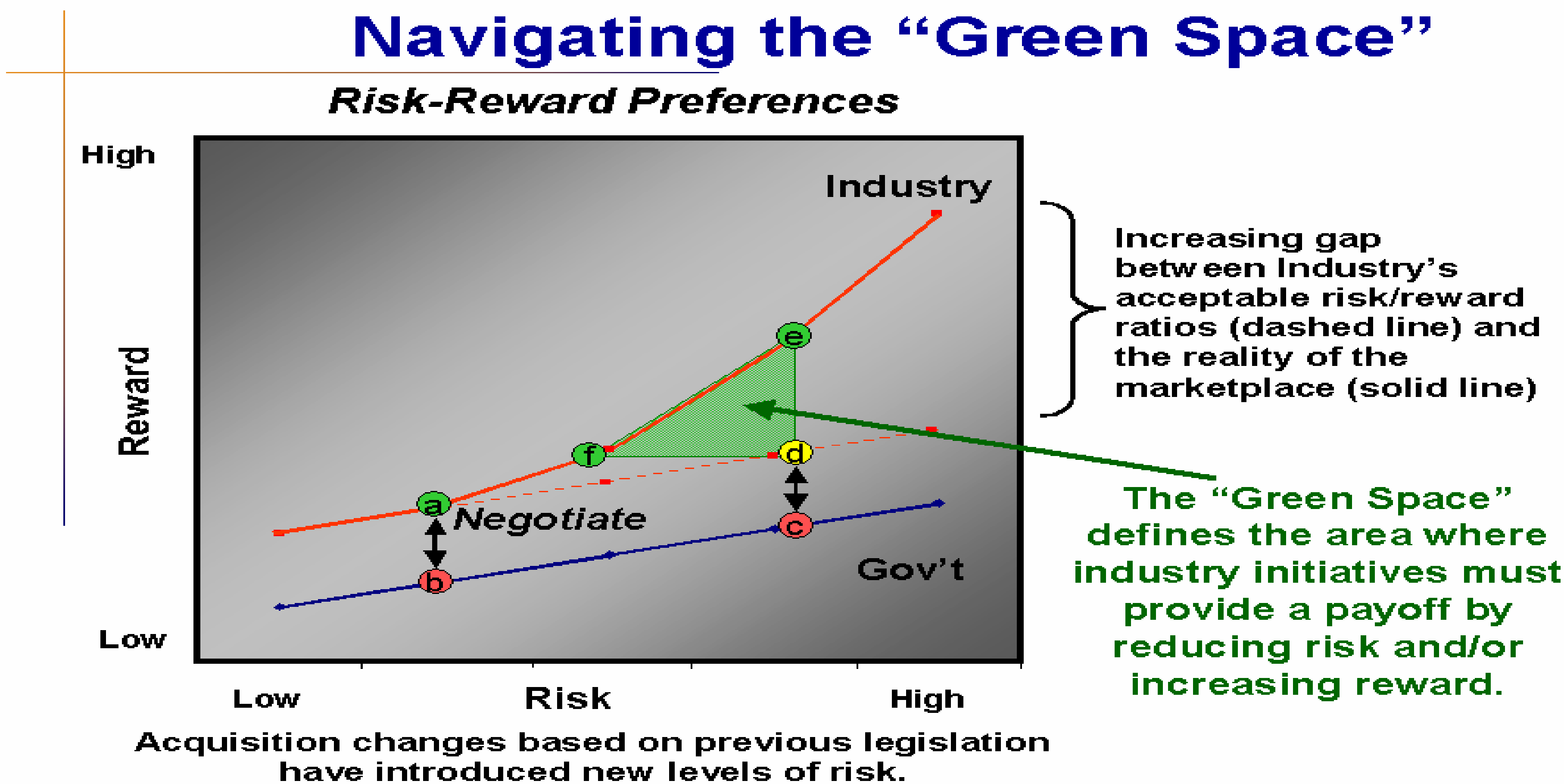
The Future Project Management Challenge



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Source: Nidiffer and Doland, IEEE Software,Sept/Oct 2005

Go Get It!

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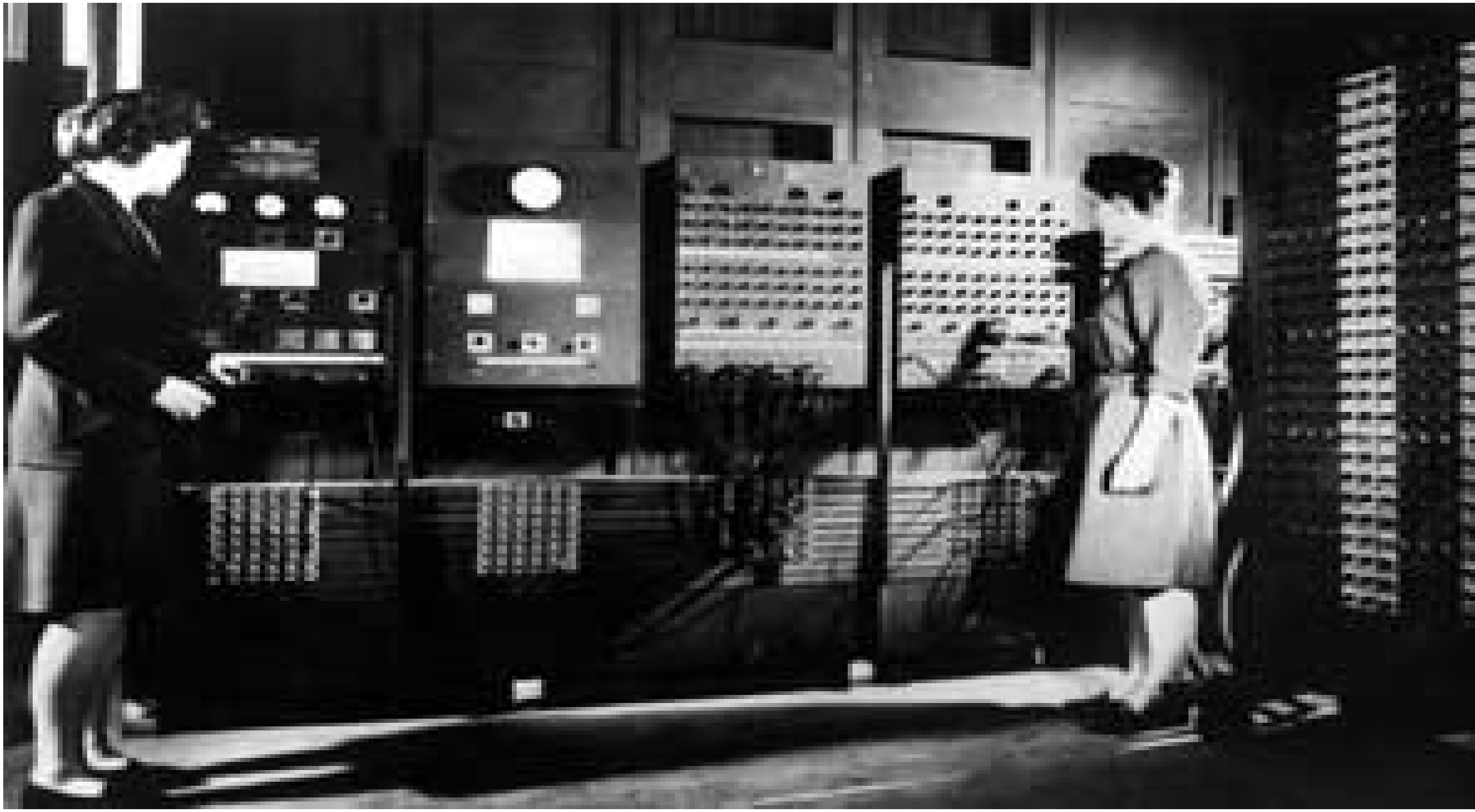
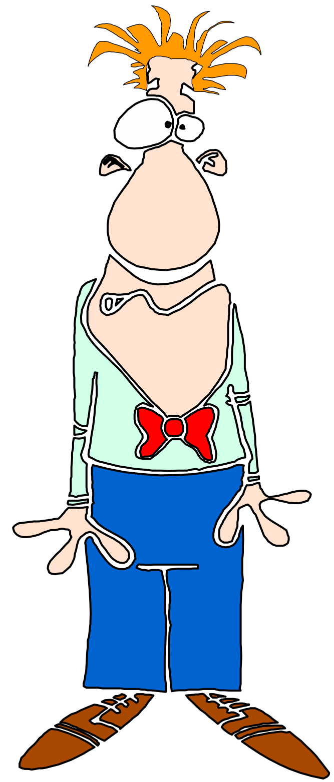


What Got us Where We Are
Won't Necessarily Get us Where We Need to Be

Things Are Going to Change – Get Use To It

1. We’re different!
2. Our customer doesn’t care
3. We didn’t bid the extra activities
4. Our project is too small
5. We have to follow our Prime’s (or customer’s) policies
6. Doesn’t apply to our kind of work
7. We already have a set of processes and it’s too hard to change
8. It doesn’t help me do my job better
9. What is the ROI?



10. Change is good – you go first!

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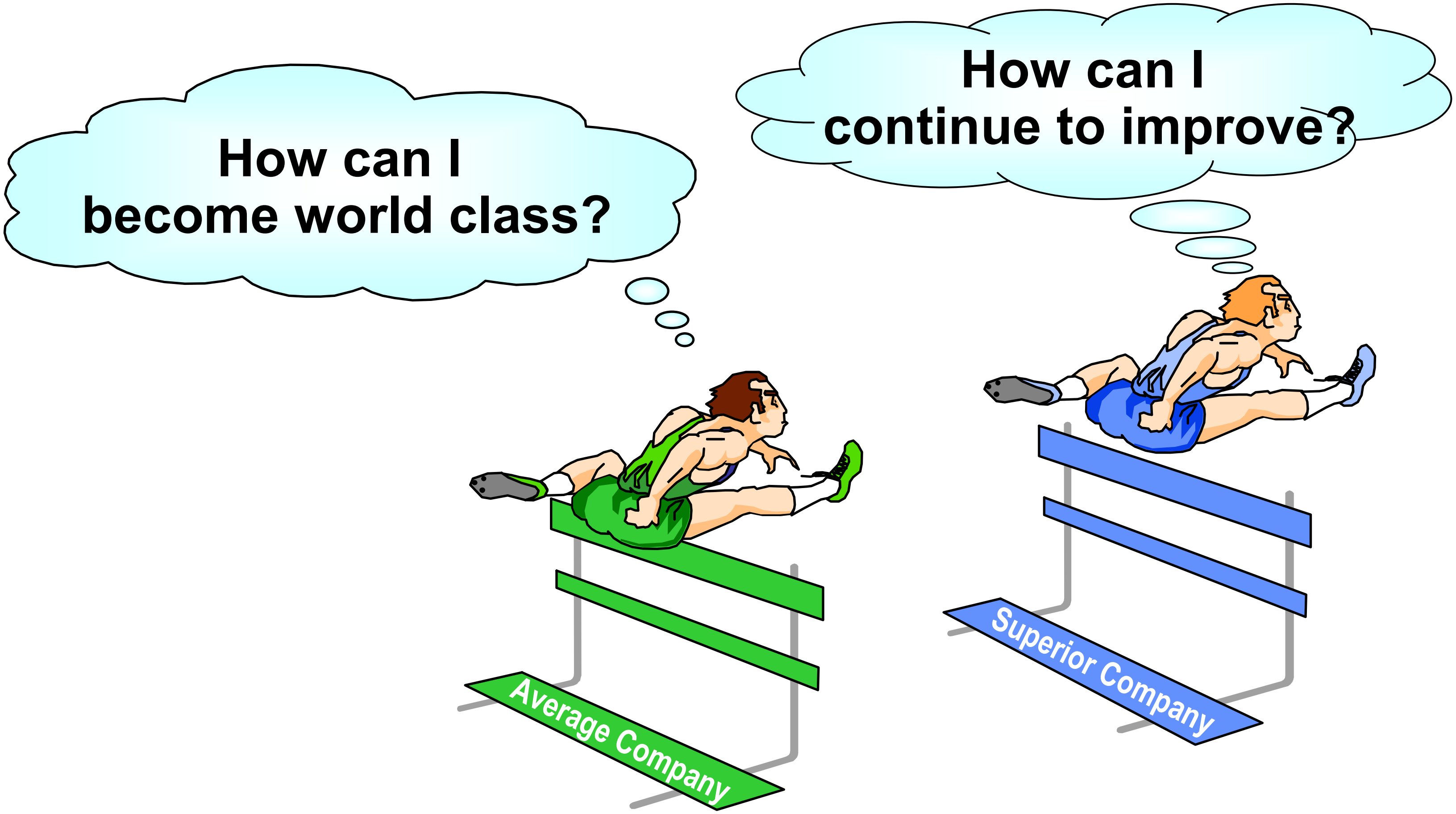
Source: Linda A. Mills, Sector Vice President, Northrop Grumman, 2004,SSCI Member Forum

Maximizing Enterprise Potential



A race, a journey, a way of thinking, never a destination!

The Bottom Line

Process improvement should be done to help the business—not for its own sake.

"In God we trust, all others bring data."

- W. Edwards Deming

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Future of Systems and Software Engineering Project Management and the CMMI – Top Six Predictions

- Evidence exists that some organizations with high maturity ratings have not perform to that maturity on major programs*
  - Staged representation is the predominate CCMI representation (4 to 1) and is often the initial choice due to its binary visibility
  - Continuous representation offers an organization an opportunity to improve several process areas that are closely aligned to the organizational business objectives
- Over time, the Continuous representation will gain both customer and supplier predominance due to its more direct relevance to project performance
  - An emphasis will be placed on providing training/guidance material to program managers on how to achieve CMMI benefits
  - RFP Language in Sections L and M will be crafted to better support the use of CMMI

*Source: NDIA Web Site, Summit on CCMI Use in DoD Programs, Aug, 2005

Future of Systems and Software Engineering Project Management and the CMMI – Top Six Predictions

- While software is the critical infrastructure within infrastructures, we live in a systems of systems world
  - We need to manage our project from a systems perspective.
    - CMMI created from a variety of prior discipline-specific "maturity models" (software, systems engineering, etc)
- A key focus of CMMI will continue to be refine to focus on program management from a systems perspective
- Needs, which are being addressed, exist to extend CMMI for acquisition and for diverse environments.
  - CMMI, in general, is focused on development
- CMMI extensions (acquisition, service environments, etc) will provide updates to the Project Management process areas among others

Future of Systems and Software Engineering Project Management and the CMMI – Top Six Predictions

- We will continue to see good growth in demand for CMMI--in the US and abroad.
  - Release CMMI v1.2 scheduled for 2006
  - Increased references in journals and trade magazines on the merit of the CMMI approach
- The approval to develop a full acquisition model to upgrade the current, very limited acquisition model will receive good support from the community
  - Upgrade to be directed at improving government acquisition offices as well as corporate management offices where tasks have been outsourced.
  - Subcontractor management will become a more important component of this upgrade and other parts of the CMMI constellation

Future of Systems and Software Engineering Project Management and the CMMI – Top Six Predictions

- Organizations typically do not initiate improvement efforts for the sake of process improvement – there is usually a underlying business driver
  - Other process improvement frameworks exist besides CMMI
  - Each process frameworks have their own strengths and weaknesses
- Program managers will demand a value-driven process improvement framework relative to their business
  - CMMI will be updated to accommodate this demand
- Program managers will demand a reduction in assessment costs
  - CMMI appraisals will be refined to accelerate the achievement of business goals, focusing on those areas that provide the greatest return, without compromising the quality or intent of the compliance frameworks

Recommended Reading

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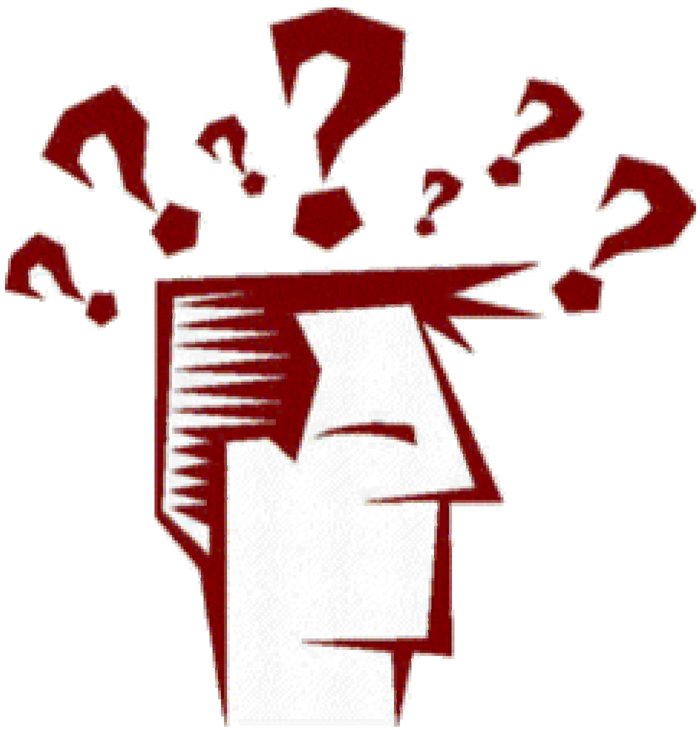
BUILDING BETTER SOLUTIONS TOGETHER

Any Questions?



Learning from Lessons Observed

Know the Earth…Show the Way

Mitigating Resistance to SE Process Change

5th Annual CMMI Technology Conference

Robert Norris
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InnoVision Directorate

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NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

Dedication

Dedicated to the memory of William R. "Bill" Allder, Jr. (1950-2005) of the National Geospatial-Intelligence Agency.

Without is exemplary support to process improvement, none of these lessons would have ever been learned.

Topics

- Recognizing the need for change
- Lessons Observed-Lessons Learned
- Epilogue
- Summary

Recognizing the Need for Change

- If it's broke; don't fix it- Call a hero
- Ultimately, change is a business imperative
- Improve product quality & reduce risk

"Documented repeatable SE processes to produce predictable positive results"

Recognizing the Need for Change$_2$

- Process change requires "organization culture" changes
- Change brings resistance

Overcoming resistance is HARD
But ACHIEVABLE

Dealing with Resistance

- Be prepared
- Face the facts
- Anticipate, plan for, and mitigate change barriers UP FRONT

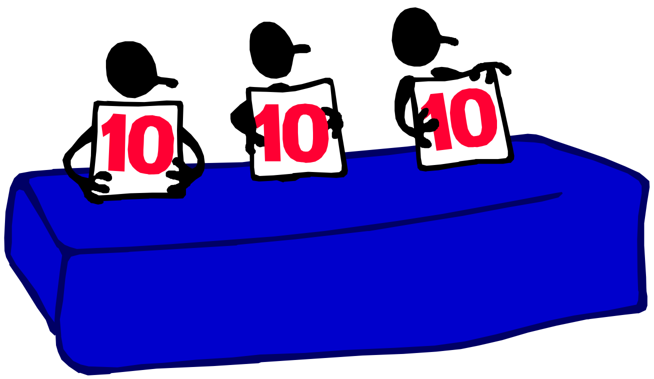
Lessons Observed – Lessons Learned

A lesson is not actually *learned*, it's only *observed* and admired, unless the previous mistake is not repeated due to a deliberate corrective action

- Change team must look at mistakes from previous initiatives
  - Learn by implementing mitigations (lessons)
- Make lessons part of "The Plan" up front

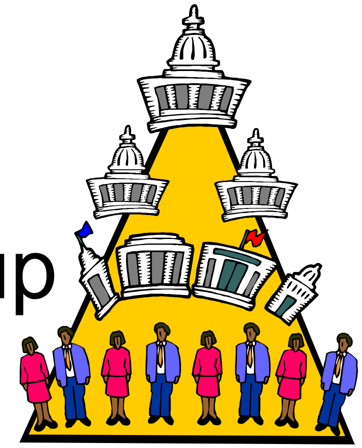
Case Study- NGA Process Improvement Initiative

- Initiated Jan 2000
- Goal: 10 Process Areas to Level 2 (FAA-iCMM*)
- External appraisal conducted Oct 2003
  - 8 Process Areas at Level 3
  - 1 Process Area at Level 2
  - 1 Process Area at Level 1



* Federal Aviation Administration Integrated Capability Maturity Model, Version 1

Case Study$_2$



- Systems Engineering Process Group (SEPG)
  - Led the initiative
  - Observed and learned the lessons
  - 14 government and contractor stakeholders
  - Guided by Senior Steering Group and Sponsor
  - Relied on Process Action Teams (PAT) for process engineering and implementation

The SEPG, PATs and <u>practitioners</u> enabled change to happen!!!

Lessons Observed (LO)- Lessons Learned (LL)

Change Support

– Strong senior sponsorship
– Early constituent buy-in
– Leverage converted doubters
– Incentivize and recognize

Change Planning

– Manage change as a program
– Have a schedule; manage to it
– Personnel Resource Plan
– Pick and stick with a process model
– Progress in small steps

Change Execution

– Pick and stick with a process model
– Appraisal planning
– Conduct a Mock Appraisal
– Use process practitioners
– Help from those who have learned
– Promote change and goals

Senior Sponsorship Is Essential

- LO: Without senior sponsorship, people will resist providing support
- LL: Having a strong supportive sponsor from the beginning is ABSOLUTELY ESSENTIAL!!!!!!*
  - People look for senior leadership endorsement before cooperating
  - Leverage their buy-in and accountability

* Sheard, Sarah A., *What is Senior Management Commitment?*, Proceedings of INCOSE, 2001

Constituent Buy-in Early

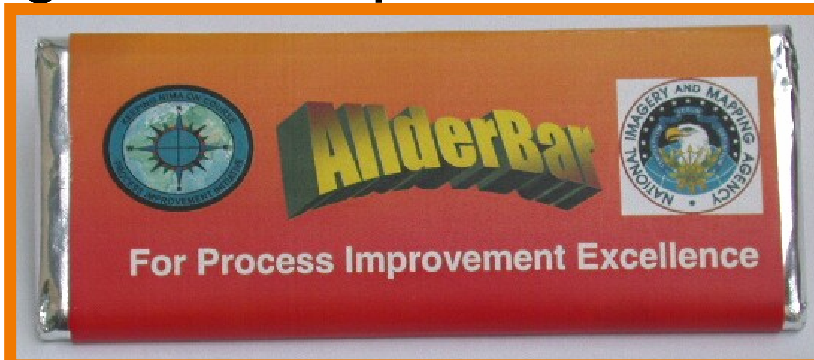
- LO: Many SE practitioners will not be supportive
  - Do not recognize the value of change
- LL: Answer "What's in it for me?" at the start
  - State added-value in clear identifiable outcomes
  - Group forums, one-on-one discussions, written communication
  - Leadership must see and convey the benefits

The Best Change Agents are Doubters Who Become Believers

- LO: Skepticism is infectious
  - Those who doubt value and success hurt progress
- LL: Converted skeptics help breakdown resistance and win others over
  - Buy-in seeing value-added change
  - Removing skepticism takes time, patience and persistence
  - Increased converts – decreased resistance overall

Incentivize and Recognize Those Leading the Charge

- LO: Getting people to change is difficult, frustrating and demoralizing
- LL: Recognizing change agents and practitioners is a strong motivator
  - Ad hoc parties
  - Public awards ceremonies
  - Employee performance plan item



Food is an excellent motivator

Manage Change as a Program

- LO: There is resistance to an activity that seemingly lacks purpose and structure
  - Managers resisted supporting an informal program
  - SEPG was not operating efficiently or effectively
- LL: Develop and use a Work Plan
  - Established ‘real program’ and stabilized activities
  - Used new Program Management Process
  - Full cost, schedule, and resource aspects
  - SEPG held accountable to the plan

Have a Schedule…Manage to it

- LO: Without a detailed (resource-loaded) schedule:
  - Procrastination to meet milestones
  - Cannot measure or manage progress
  - Cannot establish realistic resource needs

- LL: A detailed resource-loaded schedule improves program execution
  - All activities through formal appraisal
  - Defined dates improve schedule management
  - Additional structure increases program legitimacy

Clear progress reporting increased senior management support

Have a Personnel Resource Plan

- LO: Resource managers will not allocate personnel without a resource plan
- LL: Maintain a realistic resource plan
  - Derive from schedule
  - Identify diverse skills needed
  - Identify turnover/overlap periods
  - Include all training requirements

Resistance decreases…buy-in increases for an adequately resourced program

Seek Success in Small Steps

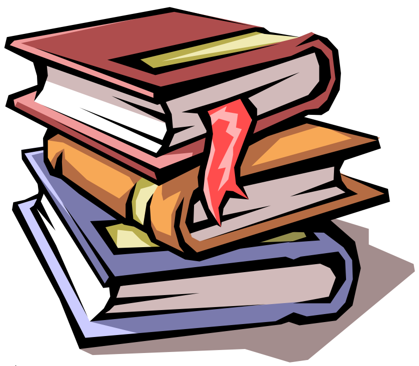
- LO: Pursuing too optimistic goals on an aggressive schedule creates resistance
  - 21 processes to Level 3 across the agency in 3 years
  - Over ambition put initiative at risk

- LL: Scale back – focus on short-term, achievable and manageable goals
  - 10 critical processes to Level 2 in 3 years
  - Implement in one part of organization

Small successes reinforced progress

Pick a Process Model and Stick With it

- LO: There is resistance to change when the specific changes/goals are not clear



- LL: Identify a process model based on a clear objective selection criteria*
  - Define change strategy and goals
  - Develop criteria with process model experts
  - NGA selected the FAA-iCMM
    - Integrates core processes: systems engineering, software engineering and software acquisition
    - Written from acquisition agent point of view
  - Constant reference for continuous improvement

* Adapted from Andary, James F., et al., *NASA Systems Engineering Capability Pre-Assessment Plan*, Proceedings of INCOSE 2004

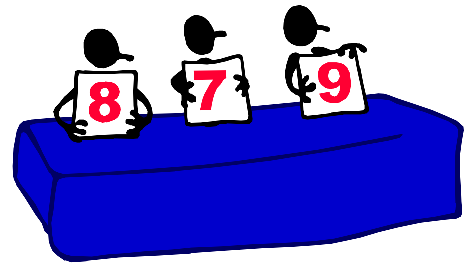
Apply A Lot of Attention to Appraisal Planning

- LO: Appraisals take more effort than imaginable
  - Practitioners resisted extent of help required
  - Appraisers needed a lot of process artifacts
  - Considerable diverse support was essential

- LL: Dedicate sufficient resources
  - Develop and execute detailed plan
  - 6 full-time staff for 6 months covering10 processes
  - 1 full-time person for 6 weeks - collect, catalogue, and organize process artifacts

Being organized reduced resistance!!!

Conduct a Mock Appraisal



- LO: Practitioners doubting success resist appraisal preparations
- LL: Conduct a mock appraisal to assess readiness and gain support
  - 6-months before formal appraisal
  - Validates likelihood of success
  - Being prepared paid off!!!

Publicizing results built credibility and support

Effectively Use of Process Practitioners

- LO: Practitioners who do not buy-into change resist change and process ownership

- LL: Involve practitioners in everything
  - Most knowledgeable for defining, documenting, and facilitating change
  - SEPG and PATs included process owners, practitioners, and change experts
  - Invaluable during artifact collection

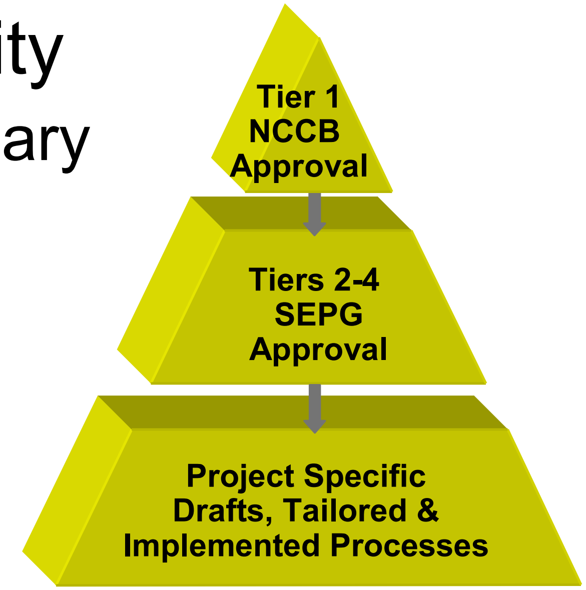
Participation established buy-in; buy-in established credibility for change

Get Help from Those Who Have Learned Lessons

- LO: Changing processes cannot be learned from books
- LL: Rely on process change experts and veterans
  - Imperative and invaluable
  - Strengthens team's competencies
  - Provides critical direction and moral support

Use Hierarchical Process Documents

- LO: People who do not understand the changes resist the changes
  - Different people need different levels of detail
- LL: Write process documentation to meet multi-user needs and ensure utility
  - Tier 1: Policy and Executive Summary
  - Tier 2: Process Practices
  - Tier 3: Templates and checklists
  - Tier 4: Training materials
  - Project specific tailoring



Continually Promote the Change Process and Goals

- LO: Resistance overcomes progress, until a ‘critical mass’ of supporters is achieved

- LL: Communicate-Communicate-Communicate!!!

  – Comprehensive Communication Plan
  – Senior Sponsor messages
  – News articles and e-mails
  – Posters / Banners
  – Rewards for paying attention

Maintain focus and buy-in

Epilogue

- October 2003 achievement was just a milestone
- Agency leadership commitment remains
- Current Steps
  - Continuing institutionalization
  - Developing and institutionalizing new processes
    - Agency strategic planning, budgeting and architecting
    - Acquisition management processes

New lessons are being observed
Lessons learned are still being applied

Summary

Patience

Commitment

Dedication

- Improvements require change
- Resistance accompanies change
- Overcoming resistance is hard but ACHIEVABLE

-Learn from Lessons Observed-

--Benefit from Lessons Learned--

Questions???

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Using SCAMPI C for Collective Improvement Across a Multi-Business Program

Appraisal Team & Authors:

John Fredin
Larry McCarthy (Team Leader)
Oktawian Nowak (Presenter)
Don Olexa
Marek Rydzy

5th Annual CMMI Technology Conference & User Group

The Landscape - Motorola

- **A global leader in providing integrated communications solutions and embedded electronic solutions**
- **Conducts business on six continents**
- **Creates integrated customer solutions such as:**
  - Software-enhanced wireless telephone, two-way radio, messaging and satellite communications products and systems
  - Networking and Internet-access products
  - Embedded electronic products
- **More than 66,000 total employees worldwide**
- **Employees in more than 320 locations in 73 countries**
- **23 manufacturing facilities in: USA, Mexico, Brazil, Great Britain, Germany, France, Israel, China, Korea, Taiwan, Malaysia, Singapore**

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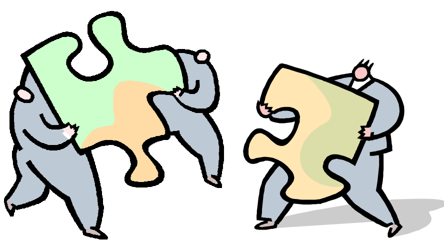
The Situation - BTS

- **Base Transceiver Station (BTS) – Key element of Cellular Infrastructure**
- **Serving 24/7 support to operators such as KDDI, Sprint, Verizon, Alltel, TATA, and China Unicom**

Locations:
Arlington Heights, IL
Chandler, AZ
Kraków, Poland

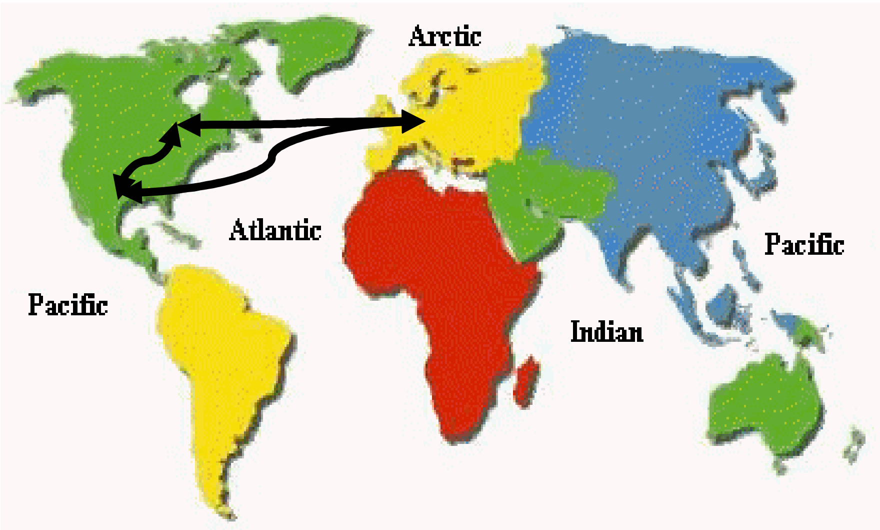


Source Code:
2500 KLOC
C, C++, Assembler

The Situation - GSG

The Global Software Group (GSG) provides cost-effective software and system focused products and services of the highest quality that are responsive to the needs of our customers

The Challenge – “Collective Improvement”



- **The senior manager of BTS calls for “collective improvement” across the program**
- **Senior managers from BTS and GSG align their goals and objectives**
- **Participating in a “combined assessment” is discussed as a possible improvement mechanism**

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The Solution - CMMI Product Suite

- **CMMI provides a wider scope and integrated approach for process improvement**

  (both organizations have been using SW-CMM for several years)

- **Provides focus on integrated activities with IPPD**

  (new integrated program / organizational elements to cover)

- **Provides powerful, flexible appraisal tool with SCAMPI**

  (focus on business needs)

The Solution – IPPD

Organization

OEI – Organization Environment for Integration

- Provides organization-level vision
- Provides support infrastructure
- Manages for integration and collaborative behavior

OPD
OPF
CM
OT
PPQA

Project

IPM – Integrated Project Management for IPPD

- Provides project-level vision
- Provides project structure

Resources, WBS — PP – Project Planning

PMC – Project Monitoring & Control

Measures — MA – Measurement & Analysis

Evaluate risks — RSKM – Risk Management

SAM & ISM – Supplier Management

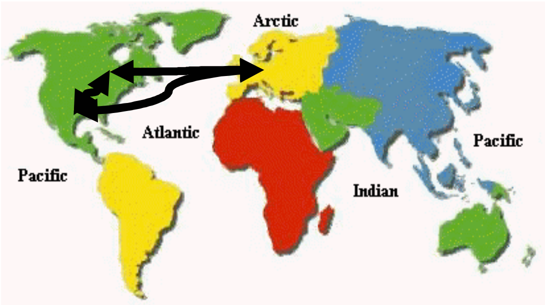
Product architecture, Verification, etc. — Engineering and Other Support PAs

Team

IT – Integrated Teaming

- Provides team-level vision
- Provides team structure

The Solution – SCAMPI C (1)



- **SCAMPI provides tailoring of the appraisal method**
  - Focuses on business needs
  - Structures activities to provide required outputs - FINDINGS
    - **Program-specific**
    - **Site or local organization-specific**
  - Can scale to a sample of participating organization, extend to all
    - **Focus on 2 Cellular Networks sites and 1 Global Software Group site**

- **IPPD-focused SCAMPI C proposed to Senior Management**
  - Three 3-day engagements at each selected site in US and Poland
  - Target IPPD practices AND related / linked practices from other PAs
  - Site-specific findings communicated at each site, then consolidated at the end of the appraisal activities

The Solution – SCAMPI C (2)

- **Senior Management supports IPPD SCAMPI C**
  – Co-Sponsors from the two businesses
  – Team members from across the businesses
  – Authorized and experienced SCAMPI B&C Team Leader
- **Site Managers and BTS project teams participate**
  – Preparation not required, minimum effort to participate
  – Short overview of IPPD at kick-off meeting
  – One interview session for each IPPD-specific PA (OEI, IT, IPM)
- **Focus is on opportunities and actions across the program**
  – Consolidated final findings briefing for Sponsors
  – Post-appraisal action planning
  – Results

The Findings – Overview

- ***29 Findings Resulted in***
- ***38 Specific Actions Distributed Between***

Category	# Findings	# Actions
Shared Vision	3	3
Scorecard Communication	1	4
Project Execution	6	9
Feature Team Definition & Risk Mitigation	7	7
Meeting Effectiveness	2	3
Lessons Learned	3	3
Participation in Process Improvement	4	5
Team Performance	3	4

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The Findings – Example

The Feature Team concepts are new and not clearly defined and communicated …

- **No formal mechanisms for balancing "home" organization (e.g., Functional Area) and Feature Team responsibilities (OEI SP2.3-1)**
- **There is no common definition of a "project" used across BTS (IPM SP1.1-1)**
- **There is confusion about the responsibilities and authority of the Feature Team Manager (IT SP2.3-1)**
- **Inconsistent identification of risks that have been captured to mitigate the unclear Feature Team definitions and impacts on integrated teams (RSKM SP2.1-1)**

Actions & Results

An action:

- **Fully define and deploy process assets to support Feature Teams as Integrated Product Teams (IPT)**
  - Full-time resource dedicated to develop detailed process and guidance for Feature Teams
  - All impacted Process Area Teams are making modifications for their areas

- ***Examples of specific detailed actions***
  - Identify skills required for development activities including Feature Team roles
  - Create guidelines for balancing of Functional Area and Feature Team responsibilities
  - Ensure that the Feature Team procedures for conflict resolution are unique, clear and effective
  - Investigate a more flexible approach to how the M-gates framework can be applied to individual Feature Teams
  - Provide Feature Manager ownership of schedule
  - Develop supporting process assets

Lessons Learned

- **IPPD is useful at the front-end of process improvement activities not just as something to add at the end (after other process areas are completed)**
  - e.g., GSG includes the tailored "IPPD-focused SCAMPI C" method for establishing GSG-Customer Integrated Process
- **IPPD is a platform for integrating all business functions and operations**
- **The SCAMPI "family" of appraisals can be tailored to meet specific business needs**
  - SCAMPI B & C are not just "little As"

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Feedback (1)

Some quotes from senior managers

- ***"This will have an impact on our effectiveness, how we work together across the locations"***

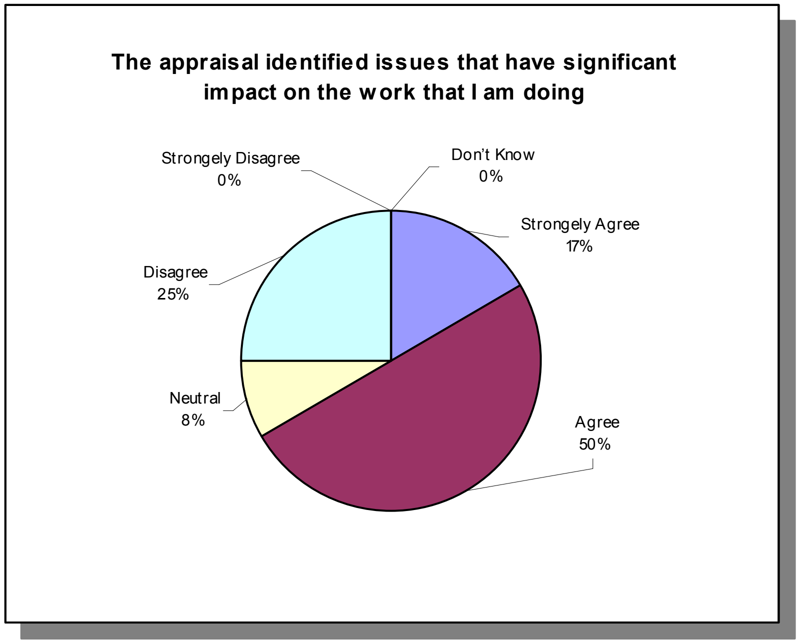
  BTS Program Director

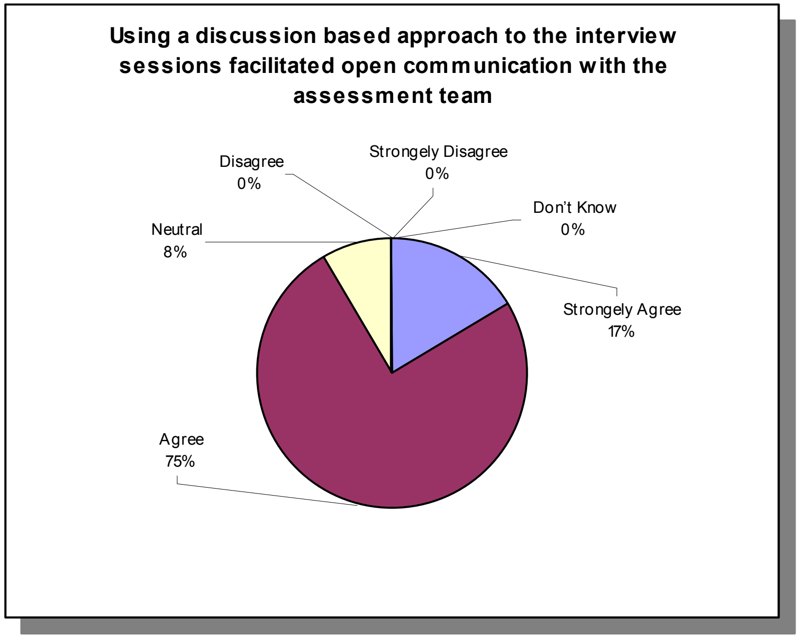
- ***"I am very happy with the results…but we are not yet through all of the actions"***

  GSG BTS Operations Manager

Feedback (2)

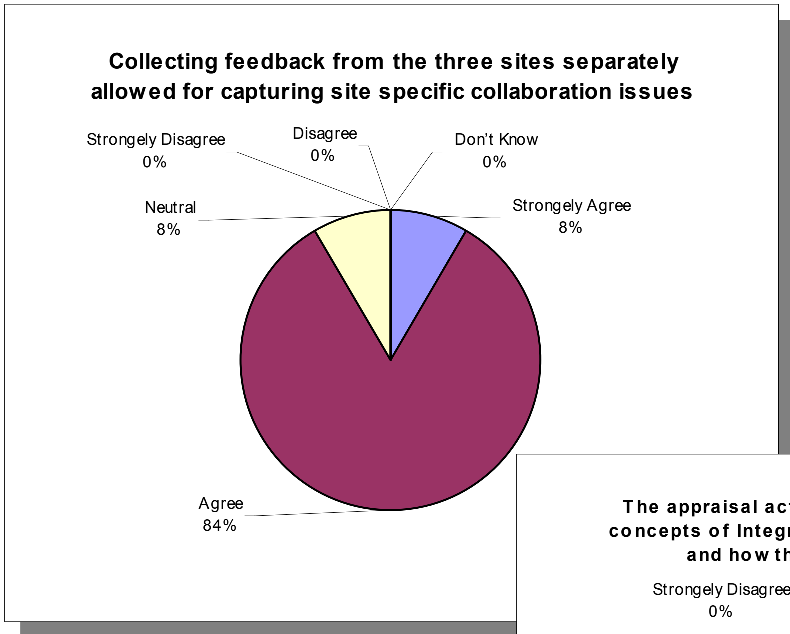
- **Feedback collected from the participants (via web survey)**

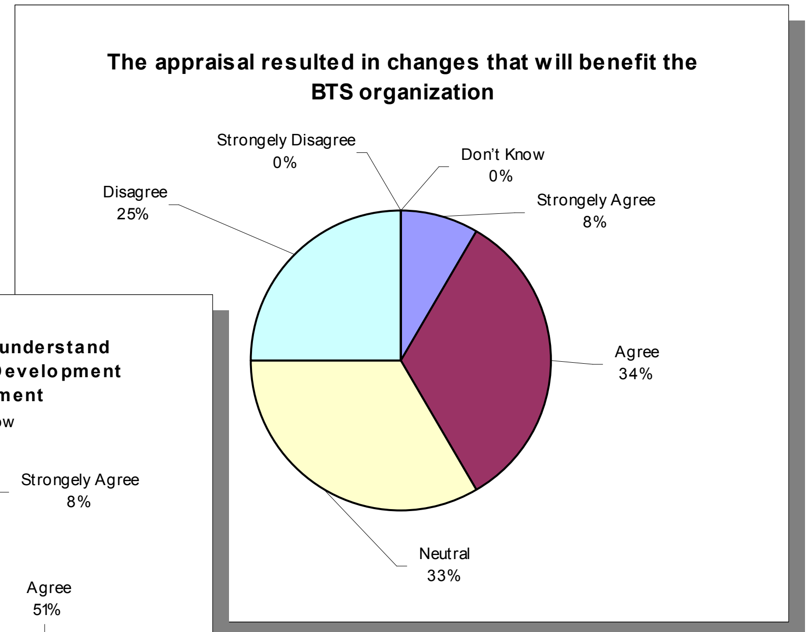


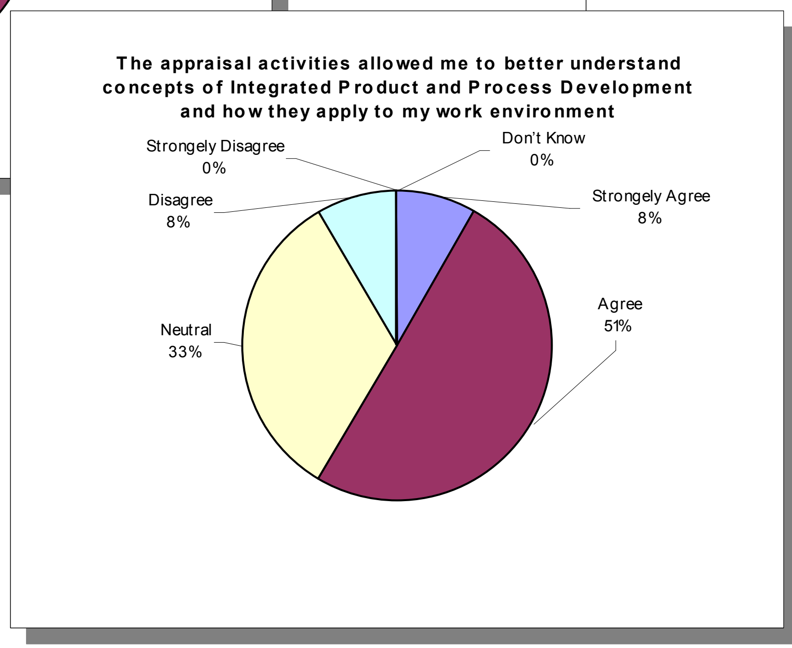


Feedback (3)


Arctic
Atlantic
Pacific
Pacific
Indian


Collecting feedback from the three sites separately allowed for capturing site specific collaboration issues
Strongly Disagree 0%
Disagree 0%
Don't Know 0%
Neutral 8%
Strongly Agree 8%
Agree 84%


The appraisal resulted in changes that will benefit the BTS organization
Strongly Disagree 0%
Don't Know 0%
Disagree 25%
Strongly Agree 8%
Agree 34%
Neutral 33%


The appraisal activities allowed me to better understand concepts of Integrated Product and Process Development and how they apply to my work environment
Strongly Disagree 0%
Don't Know 0%
Disagree 8%
Strongly Agree 8%
Agree 51%
Neutral 33%

Summary

We found that:

- **the CMMI product suite is useful to respond to a business issue (not just appraising for a number but focusing on improvement areas)**
- **IPPD discipline proved to bring value within the overall business or improvement context**
- **the tailored version of SCAMPI appraisal method used allowed the organization to identify ‘weak’ areas and produce a set of actions to improve the operations of a multi-business program in global environment**

Q & A

The Key to a High Maturity Rating is - ORGANIZATION

Karen M. Pelletier
Deputy Project Manager
DD(X) - Smart Product Model Project

November 17, 2005

Track - 4B5

5th Annual CMMI Technology Conference & User Group

DD(X) SPM Pre-Assessment Findings

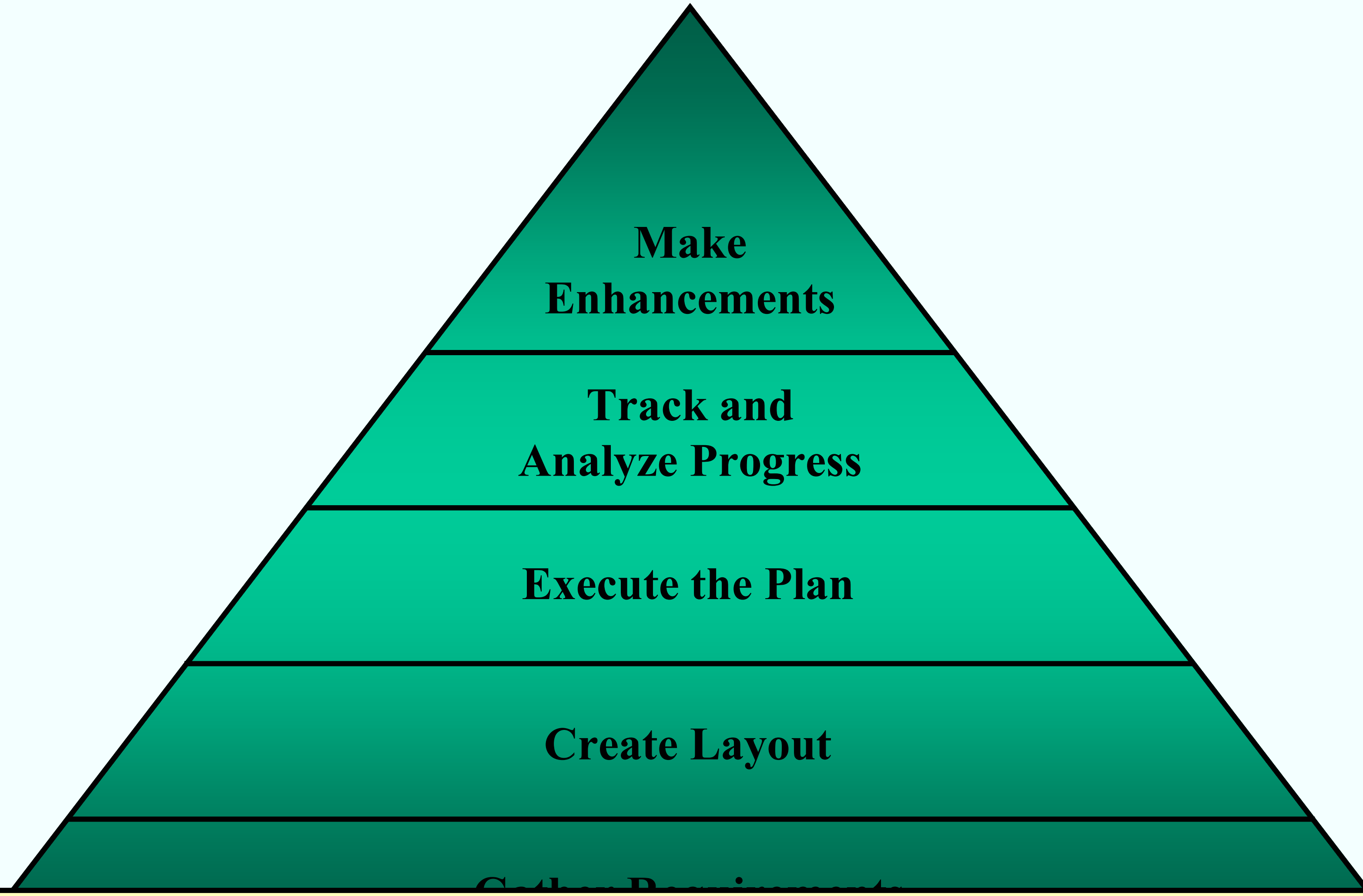
PA	SP # 1	SP # 2	SP # 3	SP # 4	SP # 5	SP # 6	SP # 7	SP # 8	SP # 9	SP # 10	SP # 11	SP # 12	SP # 13	SP # 14	GP2.1	GP2.2	GP2.3	GP2.4	GP2.5	GP2.6	GP2.7	GP2.8	GP2.9	GP2.10	GP3.1	GP3.2
REQM	1.1	1.2	1.3	1.4	1.5										2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
PP	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.3	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
PMC	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3					2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
SAM	1.1	1.2	1.3	2.1	2.2	2.3	2.4								2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
M&A	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4							2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
PPQA	1.1	1.2	2.1	2.2											2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
CM	1.1	1.2	1.3	2.1	2.2	3.1	3.2								2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
RD	1.1	1.2	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5					2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
TS	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2						2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
PI	1.1	1.2	1.3	2.1	2.2	3.1	3.2	3.3	3.4						2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
VER	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2							2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
VAL	1.1	1.2	1.3	2.1	2.2										2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
IPM	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3							2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
RSKM	1.1	1.2	1.3	2.1	2.2	3.1	3.2								2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
DAR	1.1	1.2	1.3	1.4	1.5	1.6									2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
QPM	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4							2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2
CAR	1.1	1.2	2.1	2.2	2.3										2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10	3.1	3.2

Organization is the best policy, staying organized is the challenge

Objectives

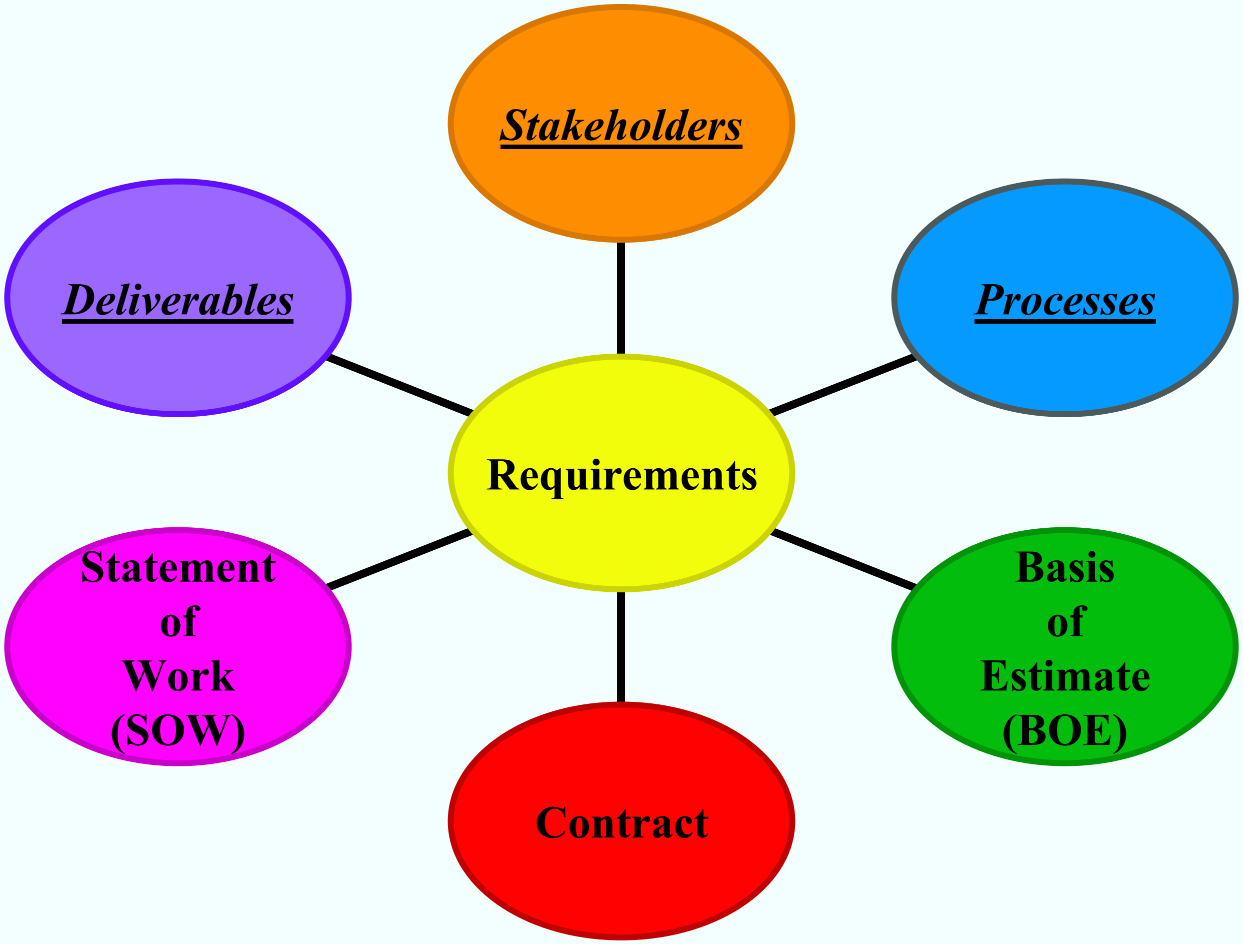
- **To convey the necessity for organization**
- **To share the SPM project's organizational model**
- **To describe how organization provided the foundation to monitor and control the project*; and***
- **To indicate keys to the SPM project's organizational success**

Organizational Thought Process



Construct an organizational model that makes sense for you

Gather Requirements



Know why you are doing what you are doing

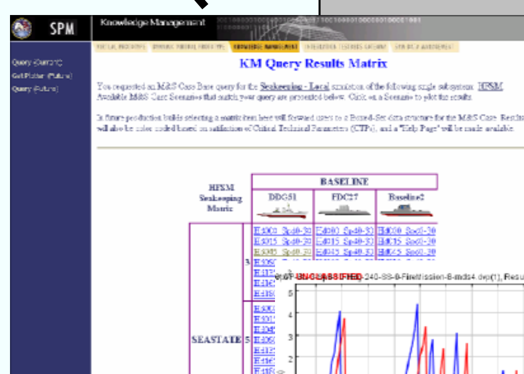
SPM Functions Drive Organization Requirements

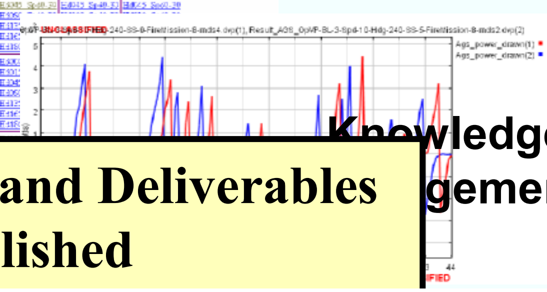
- SPM is an environment that enables interaction with virtual representations of the DD(X) system, its attributes, and behaviors
- SPM provides the capability to access, view, and compare performance analysis results from a central, configuration-managed environment via the web

Smart Product Model

Virtual Prototype

Dynamic Virtual Prototypes





SPM Data Mgt

Integration Testbeds

Knowledge Management

SOW, BOE, Contract, Processes, Stakeholders, and Deliverables provide the roadmap for the work to be accomplished

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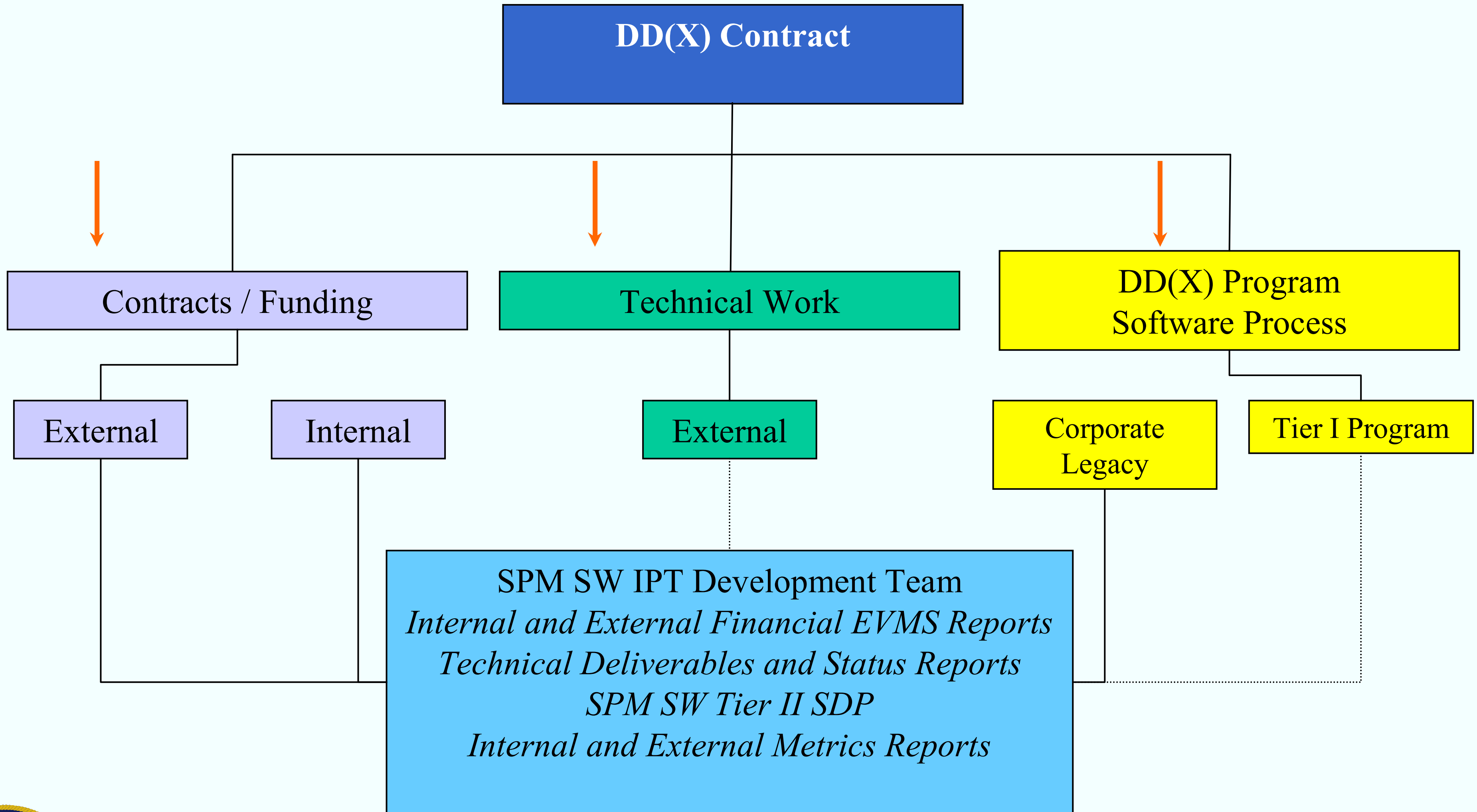
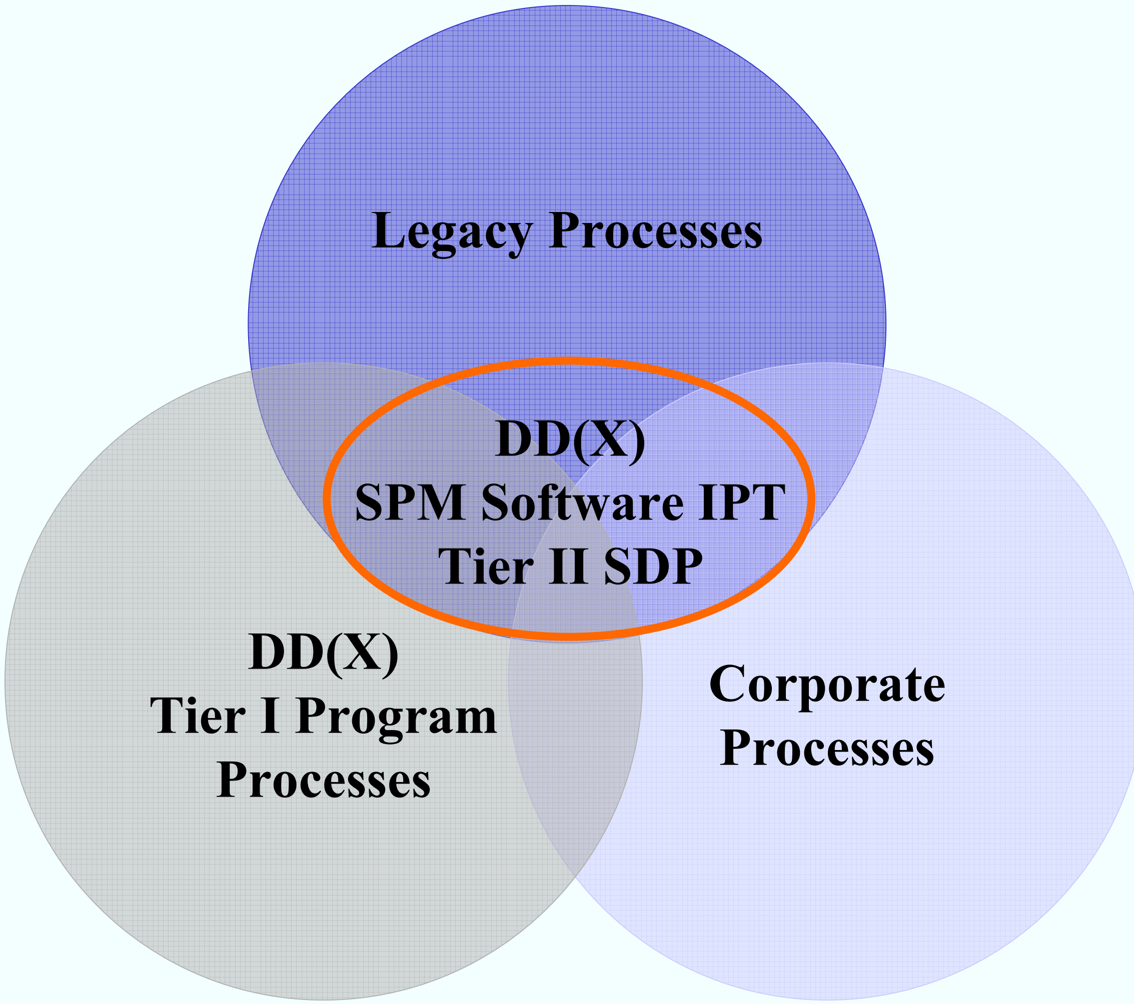
SPM DD(X) Program Stakeholders



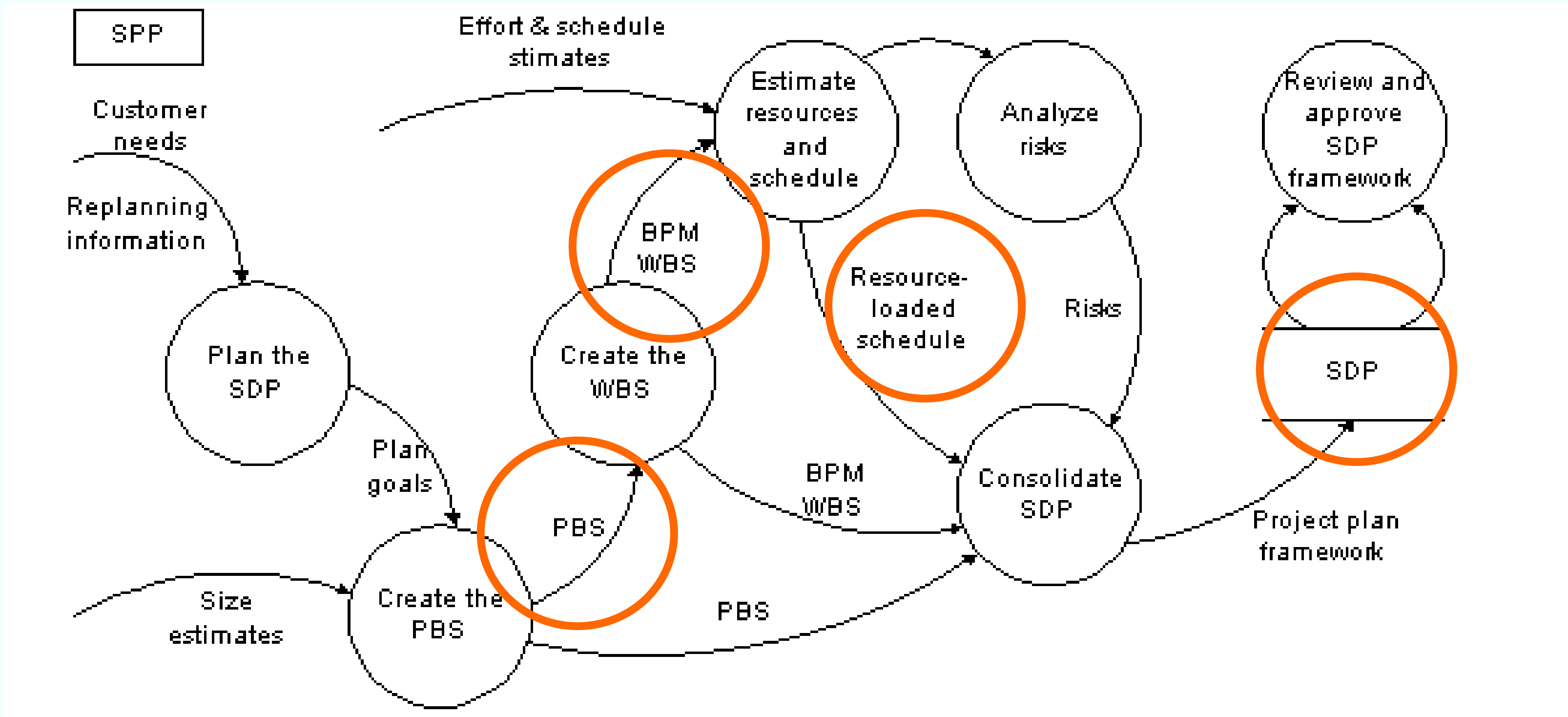
Understand your customer

Understanding the Processes to Satisfy



The complexity of situation in itself necessitates organization

Create the Layout – Project Planning Model



Organization facilitates effective communication by establishing a common ground

Why do we need a Build Process Model?

To ***develop*** software,

… you first need a ***design*** of the software

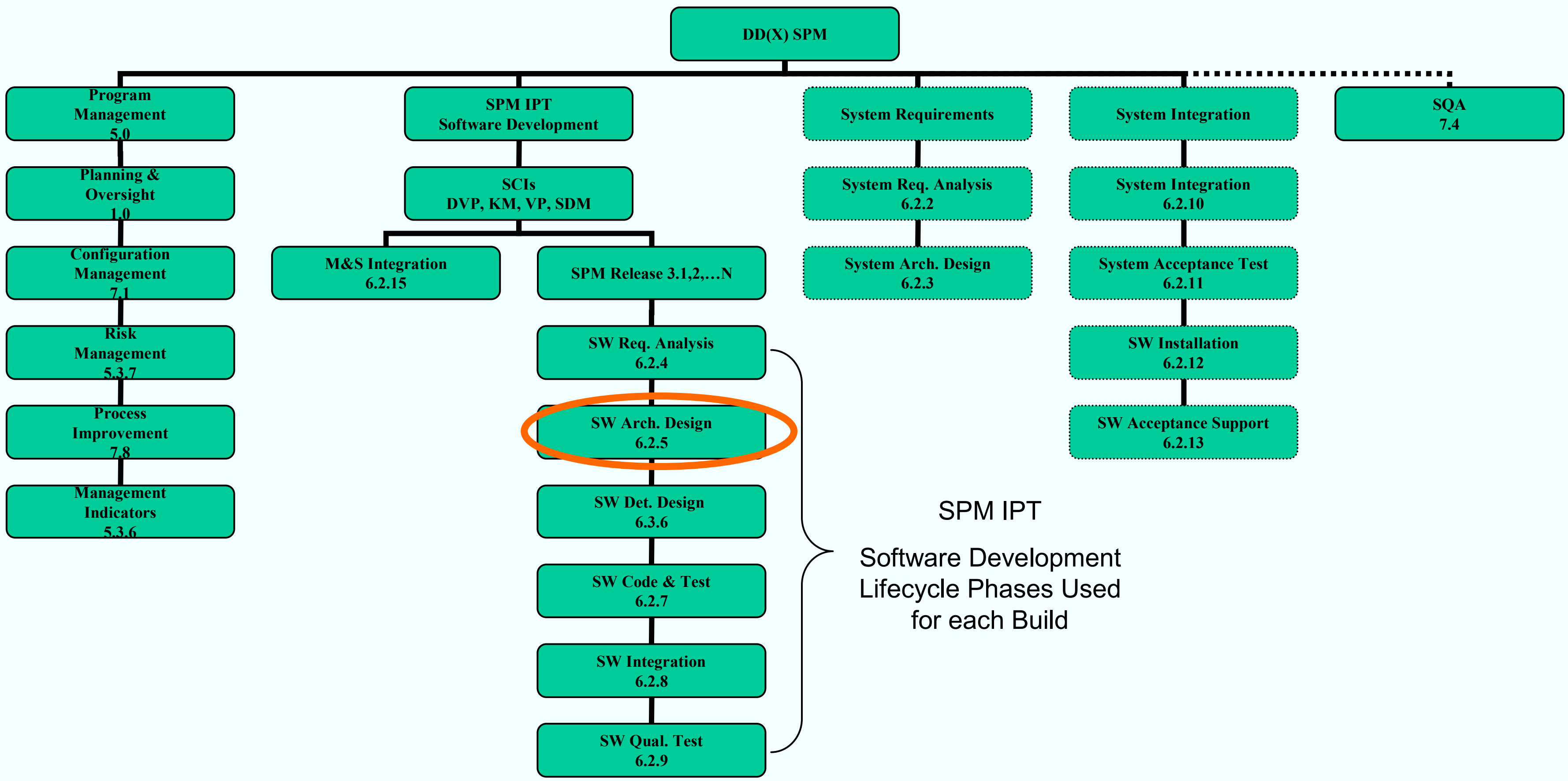
In a similar way,

… a **BPM** is necessary to design the software ***plan***

BPM

Software Development Plan = **WBS** Work to be defined **IMS** Work to be scheduled **PBS** Products to be built + … (other Stuff)

BPM - Build Process Model



Use a visual representation to define your purpose - what you are going to do

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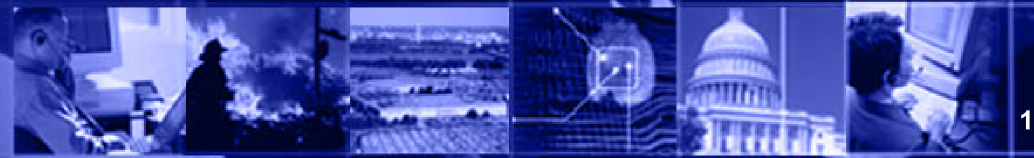

WBS - Work Breakdown Structure

SPM Release 3.1,2,…N

SW Req. Analysis 6.2.4

SW Arch. Design 6.2.5

SW Det. Design 6.3.6

SW Code & Test 6.2.7

SW Integration 6.2.8

Long Description	Charge Code	Activity Number	Start Date	Finish Date
	PM024		1/2/2004	12/31/2004
Project Planning - SPM SW IPT DEV	PMPP4	A904393490PMPP4	1/2/2004	12/31/2004
Management Oversight - SPM SW IPT DEV	PMMO4	A904393490PMMO4	1/2/2004	12/31/2004
Requirements Management - SPM SW IPT DEV	PMSR4	A904393490PMSR4	1/2/2004	12/31/2004
Configuration Management - SPM SW IPT DEV	PMCM4	A904393490PMCM4	1/2/2004	12/31/2004
Quality Assurance Management - SPM SW IPT DEV	PMQA4	A904393490PMQA4	1/2/2004	12/31/2004
Risk Management - SPM SW IPT DEV	PMRM4	A904393490PMRM4	1/2/2004	12/31/2004
Project Improvement (Closure) - SPM SW IPT DEV	PMPI4	A904393490PMPI4	1/2/2004	12/31/2004
Management Indicators - SPM SW IPT DEV	PMMI4	A904393490PMMI4	1/2/2004	12/31/2004
Project Execution - SPM SW IPT DEV	PMPE4	A904393490PMPE4	1/2/2004	12/31/2004
EVMS Accounting - SPM SW IPT DEV	PMEV4	A904393490PMEV4	1/2/2004	12/31/2004
Team Communication - SPM SW IPT DEV	PMTC4	A904393490PMTC4	1/2/2004	12/31/2004
Peer Review Management - SPM SW IPT DEV	PMPR4	A904393490PMPT4	1/2/2004	12/31/2004
Project Training - SPM SW IPT DEV	PMPT4	A904393490PMPR4	1/2/2004	12/31/2004
Reserve - SPM SW IPT DEV	R0032	A904393490R0032	1/2/2004	12/31/2004
KM and DVP SY Requirements Rel 3.3	YR003	A904393490YR003	7/1/2004	12/31/2004
SPM Req Anal SPM Summary	SR03S	A904393490SR03S	7/1/2004	12/31/2004
KM SW Requirements Anal SPM SW IPT DEV Rel 3.3	SRKM3	A904393490SRKM3	7/1/2004	12/31/2004
DVP SW Requirements Anal SPM SW IPT DEV Rel 3.3	SRDP3	A904393490SRDP3	7/1/2004	12/31/2004
SPM Arch Des SPM Summary	SA03S	A904393490SA03S	8/1/2004	10/31/2004
KM SW Arch Anal SPM SW IPT DEV Rel 3.3	SAKM3	A904393490SAKM3	8/1/2004	10/31/2004
DVP SW Arch Anal SPM SW IPT DEV Rel 3.3	SADP3	A904393490SADP3	8/1/2004	10/31/2004
SPM Det Des SPM Summary	SD03S	A904393490SD03S	8/1/2004	10/31/2004
KM SW Detailed Design SPM SW IPT DEV Rel 3.3	SDKM3	A904393490SDKM3	8/1/2004	10/31/2004
DVP SW Detailed Design SPM SW IPT DEV Rel 3.3	SDDP3	A904393490SDDP3	8/1/2004	10/31/2004
SPM Code & Test SPM Summary	SC03S	A904393490SC03S	9/1/2004	11/30/2004
KM SW Coding and Testing SPM SW IPT DEV Rel 3.3	SCKM3	A904393490SCKM3	9/1/2004	11/30/2004
DVP SW Coding and Testing SPM SW IPT DEV Rel 3.3	SCDP3	A904393490SCDP3	9/1/2004	11/30/2004
SPM SW Int Summary	SI03S	A904393490SI03S	9/1/2004	12/15/2004
KM SW Integration SPM SW IPT DEV Rel 3.3	SIKM3	A904393490SIKM3	9/1/2004	12/15/2004
DVP SW Integration SPM SW IPT DEV Rel 3.3	SIDP3	A904393490SIDP3	9/1/2004	12/15/2004
SPM Qual Test	SQ03S	A904393490SQ 03S	10/15/2004	12/31/2004
KM SW Qualification Testing SPM SW IPT DEV Rel 3.3	SQ KM3	A904393490SQ KM3	10/15/2004	12/31/2004
DVP SW Qualification Testing SPM SW IPT DEV Rel 3.3	SQ DP3	A904393490SQ DP3	10/15/2004	12/31/2004
KM and DVP SY Integration Rel 3.3	YI003	A904393490YI003	11/1/2004	12/31/2004
DVP M&S VV&A	VVDP0	A904393490VVDP0	7/1/2004	10/31/2005
SPM SY / Infrastructure Admin	YA000	A904393490YA000	7/1/2004	10/31/2005
KM and DVP SPM CDR Coordination & Support	DC000	A904393490DC000	7/1/2004	10/31/2005
CDR Support				
NGIT IIS IDE				
ODCs (ODC Misc) One - Many			1/2/2004	10/31/2005

Identify and track where you will collect costs

FUTURE SURFACE COMBATANT PROGRAM DD(X)

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PBS – Product Breakdown Structure

Work Breakdown Structure for the DD(X) SPM SW IPT Release 3.3	
Long Description	Activity Number
KM and DVP SY Requirements Rel 3.3	A904393490YR003
Work Breakdown Structure for the DD(X) SPM SW IPT Release 3.3	
SPM Req Anal SPM Summary	A904393490SR03S
KM SW Requirements Anal SPM SW IPT DEV Rel 3.3	A904393490SRKM3
DVP SW Requirements Anal SPM SW IPT DEV Rel 3.3	A904393490SRDP3
SPM Arch Des SPM Summary	A904393490SA03S
KM SW Arch Anal SPM SW IPT DEV Rel 3.3	A904393490SAKM3
DVP SW Arch Anal SPM SW IPT DEV Rel 3.3	A904393490SADP3
SPM Det Des SPM Summary	A904393490SD03S
KM SW Detailed Design SPM SW IPT DEV Rel 3.3	A904393490SDKM3
DVP SW Detailed Design SPM SW IPT DEV Rel 3.3	A904393490SDDP3
SPM Code & Test SPM Summary	A904393490SC03S
KM SW Coding and Testing SPM SW IPT DEV Rel 3.3	A904393490SCKM3
DVP SW Coding and Testing SPM SW IPT DEV Rel 3.3	A904393490SCDP3
SPM SW Int Summary	A904393490SI03S
KM SW Integration SPM SW IPT DEV Rel 3.3	A904393490SIKM3
DVP SW Integration SPM SW IPT DEV Rel 3.3	A904393490SIDP3
SPM Qual Test	A904393490SQ03S
KM SW Qualification Testing SPM SW IPT DEV Rel 3.3	A904393490SQ KM3
DVP SW Qualification Testing SPM SW IPT DEV Rel 3.3	A904393490SQ DP3
KM and DVP SY Integration Rel 3.3	A904393490YI003

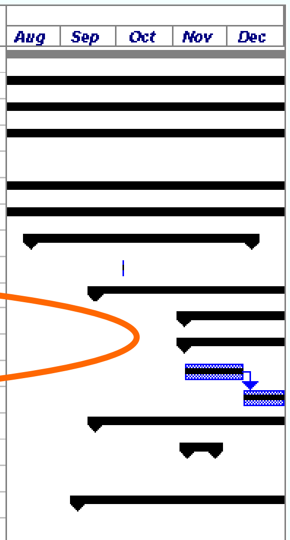
Project:	DD(X) Phase III Design/Build Smart Product Model: Releae 3.3	Product List			Size			Date		Configuration Management
Version:	V02_DRP									
PBS Num.	Name of Product (Don't type in these cells)	Activity Number (Optional)	Build	BPM Phase	Unit	Est. Size	Actual Size	Due	Done	Library Location (Optional)
1	ConOps (KM portion) ConOpsRel3Bld3V1.24.d	A904393490YR003	Build 3.3	SY Req (SY Req. Analysi	Pages	6	69	6-Jul-04	24-Aug-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
2	ConOps PR Artifacts	A904393490YR003	Build 3.3	SY Req (SY Req. Analysi	D-Pages	6	6	8-Jul-04	26-Aug-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
3	KM SRS (updated)	A904393490SRKM3	Build 3.3	SW Req Analysis	Pages	6	80	12-Jul-04	12-Oct-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
4	KM SRS PR Artifacts	A904393490PMPR4	Build 3.3	SW Req Analysis	D-Pages	6	6	14-Jul-04	22-Sep-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
5	KM Arch Diagrams (draft)	A904393490SRKM3	Build 3.3	SW Req Analysis	Diagrams	9		22-Jul-04	19-Nov-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
6	KM SDD Arch Sections (draft)	A904393490SRKM3	Build 3.3	SW Req Analysis	Pages	6		22-Jul-04	9-Dec-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
7	KM NDS Eval Reports	A904393490SRKM3	Build 3.3	SW Req Analysis	Pages	6	0	22-Jul-04	7-Oct-04	SPM Development\SCIs\KM SCI\1_Requirements Phase
8	KM Arch Diagrams (final)	A904393490SAKM3	Build 3.3	SW Arch Design	Diagrams	6		28-Jul-04	9-Dec-04	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
9	KM SDD Arch Sections (final)	A904393490SAKM3	Build 3.3	SW Arch Design	Pages	5	60	28-Jul-04	16-Nov-04	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
10	KM Arch Sec PR Artifacts	A904393490SAKM3	Build 3.3	SW Arch Design	D-Pages	6	6	30-Jul-04	17-Nov-04	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
11	KM Build Plan	A904393490SAKM3	Build 3.3	SW Arch Design	Pages	3	13	4-Aug-04	24-Nov-04	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
12	KM Qual Test Plan	A904393490SAKM3	Build 3.3	SW Arch Design	EFI-Pages	7	50	3-Aug-04	27-Jan-05	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
13	KM NDS Eval Reports (updated)	A904393490SDKM3	Build 3.3	SW Detailed Design	Pages	6	0	19-Aug-04	7-Oct-04	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
14	KM Detailed Design Diagrams	A904393490SDKM3	Build 3.3	SW Detailed Design	Diagrams	28		10-Aug-04	31-Jan-05	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
15	Completed KM SDD	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	12	69	18-Aug-04	31-Jan-05	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
16	KM SDD PR Artifacts	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	6	6	20-Aug-04	31-Jan-05	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
17	KM Build Plan (updated)	A904393490SDKM3	Build 3.3	SW Detailed Design	Pages	4	13	2-Sep-04	22-Dec-04	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
18	KM SW Integ/Test Plan	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	18		30-Aug-04	22-Dec-04	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
19	KM SW Integ/Test Plan PR Artifacts	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	6	6	1-Sep-04	22-Dec-04	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
20	KM SW Qual Test Cases/Procs	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	22	92	7-Sep-04	25-Feb-05	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
21	KM SW Qual Cases/Procs PR Arts	A904393490SDKM3	Build 3.3	SW Detailed Design	EFI-Pages	6	6	9-Sep-04	16-Feb-05	SPM Development\SCIs\KM SCI\3_Detailed Design Phase
22	KM Midterm Rev. Prod.	A904393490SCKM3	Build 3.3	SW Code and Test		1		24-Sep-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
23	KM Midterm Rev. Pres.	A904393490SCKM3	Build 3.3	SW Code and Test	Pages	5		24-Sep-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
24	KM Code	A904393490SCKM3	Build 3.3	SW Code and Test	LOC	4500		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
25	KM Code PR Artifacts (x9)	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-Pages	54		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
26	KM SW Unit Test Plans (x30)	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-Pages	15		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
27	KM SW Unit Test Cases/Procs (x30)	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-Pages	15		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
28	KM SW Unit Test Code (x30)	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-LOC	1500		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
29	KM SW Unit Test Reports (x30)	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-Pages	75		18-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
30	KM SW Integ Test Cases/Procs	A904393490SCKM3	Build 3.3	SW Code and Test	EFI-Pages	22		25-Oct-04		SPM Development\SCIs\KM SCI\4_Code and Unit Test Phase
31	KM SW Integ Test Cases/Procs (update)	A904393490SIKM3	Build 3.3	SW Integration	EFI-Pages	7	92	28-Oct-04	25-Feb-05	PM Development\SCIs\KM SCI\6_SW Integration Phase
32	KM SW Integ Test Code	A904393490SIKM3	Build 3.3	SW Integration	EFI-Pages	600		28-Oct-04		PM Development\SCIs\KM SCI\6_SW Integration Phase

Identify and track what artifacts to build and the effort it will require

IMS – Integrated Master Schedule

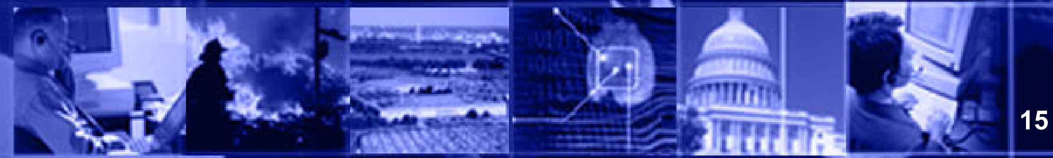
Project:	Product List			Date	
Version:					
PBS Num.	**Name of Product**	**Activity Number**	**BPM Phase**	**Due**	**Done**
8	**KM Arch Diagrams (final)**	**A904393490SAKM3**	**SW Arch Design**	**28-Jul-04**	**9-Dec-04**
9	**KM SDD Arch Sections (final)**	**A904393490SAKM3**	**SW Arch Design**	**28-Jul-04**	**16-Nov-04**
10	**KM Arch Sec PR Artifacts**	**A904393490SAKM3**	**SW Arch Design**	**30-Jul-04**	**17-Nov-04**
11	**KM Build Plan**	**A904393490SAKM3**	**SW Arch Design**	**4-Aug-04**	**24-Nov-04**
12	**KM Qual Test Plan**	**A904393490SAKM3**	**SW Arch Design**	**3-Aug-04**	**27-Jan-05**
13	**KM NDS Eval Reports (updated)**	**A904393490SDKM3**	**SW Detailed Design**	**19-Aug-04**	**7-Oct-04**

ID	*Work Package*	*Task Name*	*Start*	*Finish*	*% Complete*
0		**SPM DVP\CSCI Development (193400)**	**Thu 7/1/04**	**Fri 9/30/05**	89%
1		**DD(X) Program Milestones**	**Fri 7/30/04**	**Fri 7/29/05**	**0%**
6		**SPM Development / Release 3.3 7/04-12/04 - Complete 3/4/05**	**Thu 7/1/04**	**Fri 4/8/05**	**99%**
7	**A904393490YR003**	**System Requirements Summary**	**Thu 7/1/04**	**Fri 3/11/05**	**100%**
8		System Requirements Analysis (SY Req)	Thu 7/1/04	Mon 7/19/04	100%
9		**IDE/SPM Element Requirements**	**Thu 7/1/04**	**Fri 3/11/05**	**100%**
13		**System Architectural Design (SY Req)**	**Tue 7/20/04**	**Fri 3/11/05**	**100%**
16	**A904393490SR03S**	**Software Requirements Analysis**	**Mon 8/16/04**	**Wed 12/15/04**	**100%**
25		*Phase Completion: Software Requirements Analysis - Not Required*	Mon 10/4/04	Mon 10/4/04	100%
26	**A904393490SA03S**	**Software Architectural Design**	**Mon 9/20/04**	**Fri 2/25/05**	**100%**
27	**A904393490SAKM3**	**KM**	**Mon 11/8/04**	**Tue 2/1/05**	**100%**
28		**KM SDD**	**Mon 11/8/04**	**Tue 2/1/05**	**100%**
29		Complete Draft Architecture with Requirements Trace	Mon 11/8/04	Thu 12/9/04	100%
30		KM SCI Qualification Test Plan (Draft)	Fri 12/10/04	Tue 2/1/05	100%
31	**A904393490SADP3**	**DVP**	**Mon 9/20/04**	**Fri 2/25/05**	**100%**
38		**SPM Build Plan (Draft)**	**Tue 11/9/04**	**Wed 11/24/04**	**100%**
41		*Phase Completion: Software Architectural Design*	Tue 3/1/05	Tue 3/1/05	0%
42	**A904393490SD03S**	**Software Detailed Design**	**Fri 9/10/04**	**Fri 3/18/05**	**100%**
64		*Phase Completion: Software Detailed Design (n/a)*	Fri 2/25/05	Fri 2/25/05	100%



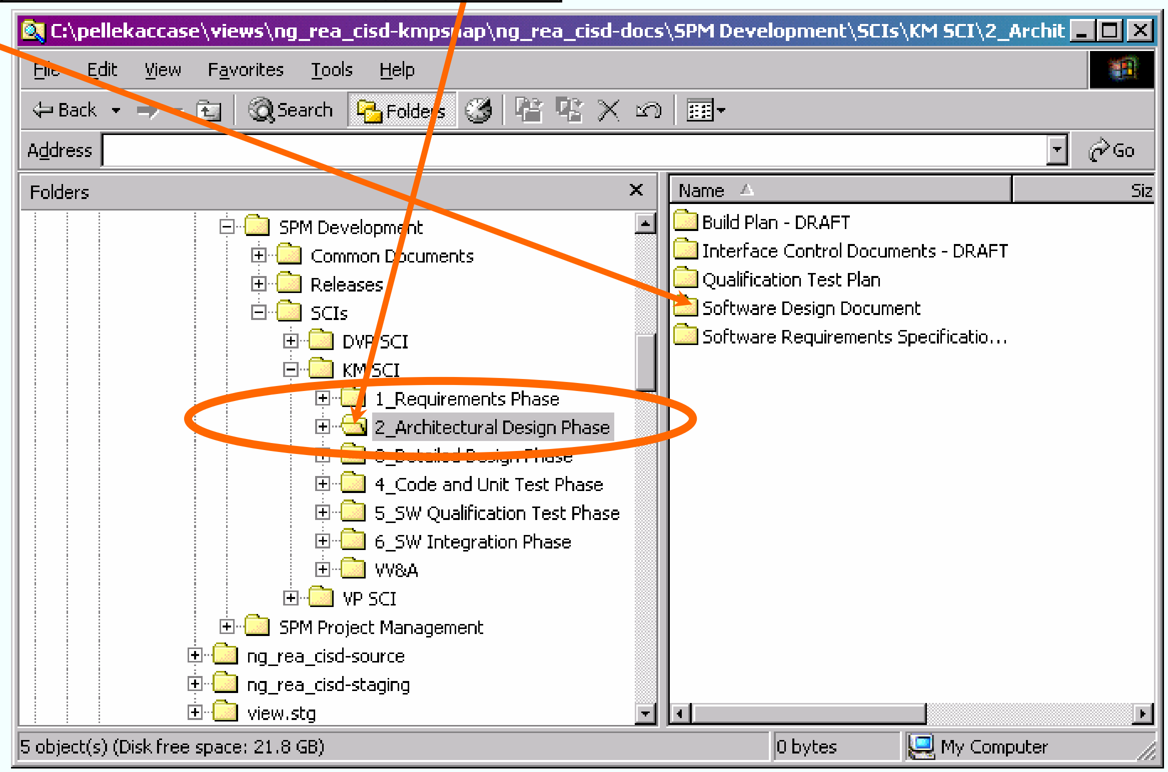
Identify and track when to construct each artifact and how long it will take

FUTURE SURFACE COMBATANT PROGRAM DD(X)



Software Development Library

Project: / Version:	Product List			Configuration Management
PBS Num.	Name of Product	Activity Number	BPM Phase	Library Location (Optional)
8	KM Arch Diagrams (final)	A904393490SAKM3	SW Arch Design	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
9	KM SDD Arch Sections (final)	A904393490SAKM3	SW Arch Design	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
10	KM Arch Sec PR Artifacts	A904393490SAKM3	SW Arch Design	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
11	KM Build Plan	A904393490SAKM3	SW Arch Design	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
12	KM Qual Test Plan	A904393490SAKM3	SW Arch Design	SPM Development\SCIs\KM SCI\2_Architectural Design Phase
13	KM NDS Eval Reports (updated)	A904393490SDKM3	SW Detailed Design	SPM Development\SCIs\KM SCI\3_Detailed Design Phase



Define where to store information for quick retrieval

Development Support Activities

- Project Planning (Project Manager)
- Project Management and Control (Project Manager)
- Decision Analysis Resolution (DAR POC)
- Requirements Management (Req. Mgt. POC)
- Technical Solutions (TS Lead)
- Product Integration (PI Lead)
- Configuration Management (CM POC)
- Quality Assurance (Quality Engineer)
- Risk Management (RM POC)
- Training Plan (Training Lead)
- VV&A (VV&A Lead)
- Peer Reviews (Peer Review Lead)
- Phase Completion Reviews (Peer Review Lead)

People make the difference - Identify process owners who are experienced and capable

Manage & Control Tracking Tools – Enablers

- **WBS – Used to record and track cost and effort**
- **PBS – Used to plan and track completed products and size**
- **IMS – Used to plan and track work performance**
- **Requirements Tracking Workbook – Used to record and track number of planned and completed requirements by build (Obtained from SRS)**
- **Peer Review Tracking Workbook – Used to record and track number of planned and completed peer reviews (Obtained from IMS and Peer Review Summary sheets)**
- **Defect Tracking Workbook – Used to record and track number of planned defects, opened or closed defects by severity (Obtained from Peer Review, Testing, and fielded reports)**
- **Training Plan Workbook – Used to record and track number of planned and completed training requirements (Obtained from SDP)**
- **SPM SW Developer Metric Collection Enabler for DD(X) – Used to assist the Developers in providing monthly metrics in a standard format**

The key to metrics are suitable tracking tools

Make Enhancements

- When an item is out of place
- When a place can't be found
- When many items can be consolidated
- When you hear complaints
- When you've reached a metric threshold
- When you've reached months end, the end of a phase, the end of a build, a milestone, or deliverable

FUTURE SURFACE COMBATANT PROGRAM DD(X)

Improve, update, and adjust early and often

Keys to Success

Understand what, why, who, and how
Identify experienced and capable process owners
Create your own organizational thought process
Use the model to facilitate communication
Use the model for efficiency and effectiveness
Categorize to establish your library structure
Customize enablers to support information gathering, tracking and analyzing
Improve, update, and adjust early and often
Organization is the best policy

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Process Area & Goal Profile by Maturity Level

Level	Process Area	PA	SG1	SG2	SG3	SG4	GG2	GG3
Level 5	Causal Analysis and Resolution	●	●	●				●
	Organizational Innovation and Deployment	●	●	●				●
Level 4	Quantitative Project Management	●	●	●				●
	Organizational Process Performance	●	●					●
	Organizational Environment for Integration							
	Decision Analysis and Resolution	●	●					●
	Integrated Supplier Management							
	Integrated Teaming							
	Risk Management	●	●	●	●			●
	Integrated Project Management	●	●	●				●
	Organizational Training	●	●	●				●
	Organizational Process Definition	●	●					●
	Organizational Process Focus	●	●	●				●
	Validation	●	●	●				●
	Verification	●	●	●	●			●
	Product Integration	●	●	●	●			●
	Technical Solution	●	●	●	●			●
Level 3	Requirements Development	●	●	●	●			●
	Configuration Management	●	●	●	●		●	●
	Process and Product Quality Assurance	●	●	●			●	●
	Measurement and Analysis	●	●	●			●	●
	Supplier Agreement Management	●	●	●			●	●
	Project Monitoring and Control	●	●	●			●	●
	Project Planning	●	●	●	●		●	●

NGIT DES SCAMPI
March 2005

Northrop Grumman IT
DES

- PA : - Not Satisfied (red)
- PA : - Satisfied (green)
- GOAL : - Not Satisfied (red)
- GOAL : - Satisfied (green)

Organization is the best policy, staying organized is the challenge

Question and Answer

Project Acronyms & Translations

Acronym	Description
BPS	Build Process Model
CMMI	Capability Maturity Model Integration
CPI	Cost Performance Index
CPT	Cross Product Team
CWBS	Contract Work Breakdown Structure
DD(X)	Next Generation Destroyer
DES	Defense Enterprise Solutions
DMS	Defense Mission Systems
DVP	Dynamic Virtual Prototype
EVMS	Earned Value Management System
GP	Genera Practice
IDE	Integrated Data Environment
IMS	Integrated Master Schedule
IPT	Integrated Product Team
IWO	Interoffice Work Order
KM	Knowledge Management
LOC	Line of Code
MPR	Monthly Project Review

Acronym	Description
NAVSEA	Naval Sea Systems Command
PA	Process Area
PBS	Product Breakdown Structure
PM	Product Model
PMT	Project Management Team
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SCI	Software Configuration Item
SDL	Software Development Library
SDP	Software Development Plan
SP	Specific Practice
SPI	Schedule Performance Index
SPM	Smart Product Model
SPP	Software Process Planning
SQA	Software Quality Assurance
SW	Software
VPM	Virtual Product Model
VV&A	Verification, Validation and Accreditation
WBS	Work Breakdown Structure

FUTURE SURFACE COMBATANT PROGRAM DD(X)

Capability Maturity Model Integration (CMMI®) Tailoring for an IT/MS Services Environment

Approach and Lessons Learned by BAE Systems Information Technology (BAE-IT)

Mandy Parmer
Stacy Savage

Executive Summary

BAE SYSTEMS

- BAE-IT is a provider of Information Technology/Mission Support (IT/MS) Services
- CMMI® provides a narrow, undefined view of IT/MS Services as a product
- BAE-IT cleared new ground by developing and implementing a methodology to interpret CMMI for IT/MS Services
- Presentation will share approach, critical success factors and lessons learned

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Briefing Roadmap

- Overview of BAE-IT Operational Environment and Challenges
- Comparison to Alternative Models
- BAE-IT's Methodology for tailoring CMMI® for IT/MS Services through defining:
  - Process Improvement (PI) Participants
  - Process Architecture
  - Transitioning Activities
  - Tailoring Guidelines
  - Tools and Measurements
  - Success Factors/Lessons Learned

Operational Environment – BAE-IT

– BAE-IT's primary "product" is IT/MS Services (Information Technology (IT) and Mission Support (MS) Services)

– Specific BAE-IT IT/MS Services include:

Operations and Services (O/S)

- Service Support
- Delivery of an Information Technology infrastructure
- Systems Engineering

Operations and Maintenance (O/M)

- Application/Software "Maintenance"
- Support of deployed products

Software Engineering & Development (SWD)

- Rapid Response Development
- Independent verification, validation & automated testing
- "Full-scope" SW Development

Comparison to Other Models

- CMMI® Selected as best fit for the blended BAE-IT activities (IT/MS Services)
- International Organization for Standardization (ISO) 9000 series focuses primarily on quality management
- Information Technology Infrastructure Library (ITIL) focuses on IT service management
- Within BAE-IT, CMMI® was implemented in such a way as to ensure it can accommodate ISO and ITIL requirements

Model Challenges

– Services not commonly viewed as a “product”

– Examples and suggested artifacts geared to Software/Systems Engineering

– Minimal documentation of “value-added” processes that pertain to multiple business types

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Operational Challenges – BAE-IT

- Nature of BAE-IT business and customer requirements dictate limited exposure and transfer of project artifacts

- BAE-IT is a customer-facing organization fostering projects with disparate, mature and ingrained legacy processes and procedures and a foundation in Integrated Project Teaming

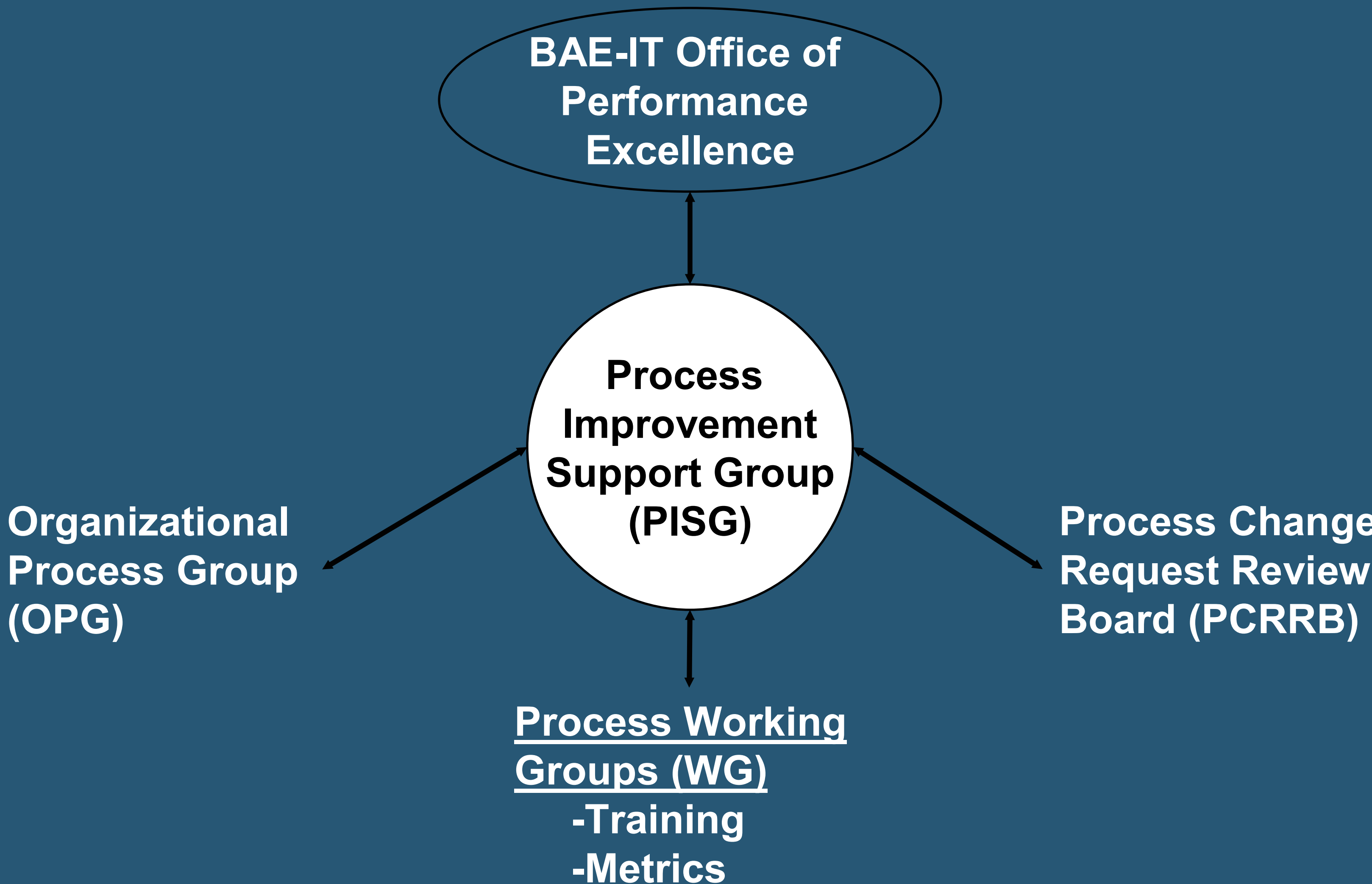
BAE-IT Approach to CMMI®

– Overall approach is similar to any organization implementing process improvement

– Significant tailoring occurs during implementation

High-Level Steps

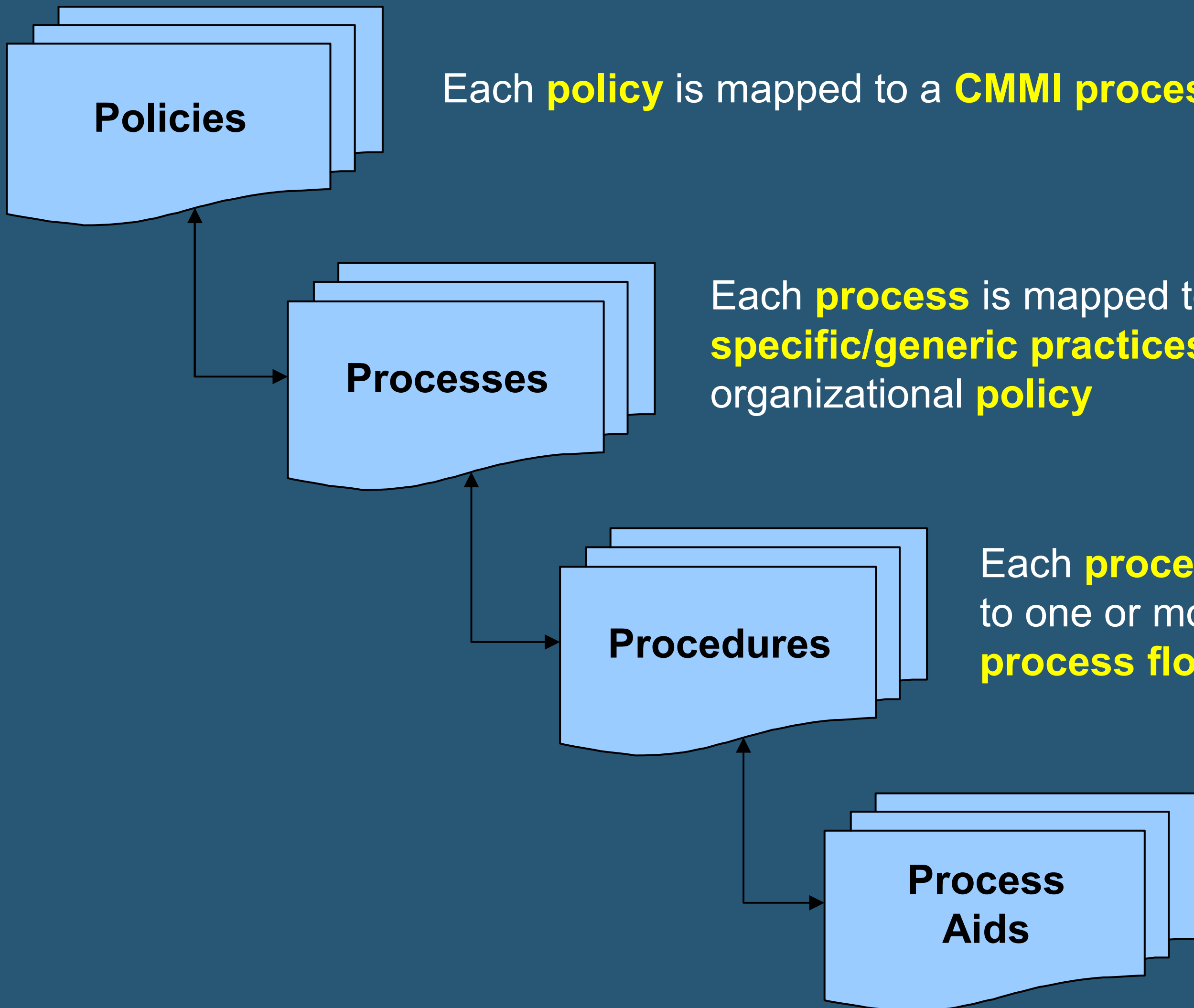
Process Improvement Participants



Process Architecture – What is it?

- Similar to any other system architecture
  - Consists of core and sub components
  - Defines interaction between components
  - Hierarchy of processes
- Foundation for process improvement
- Provides guidance and structure to organizational entities
- Must cover all organizational business types and be flexible enough to incorporate future business
- Streamlines redundant legacy processes

BAE-IT's Process Hierarchy



Each **policy** is mapped to a **CMMI process area**

Each **process** is mapped to CMMI **specific/generic practices** and an organizational **policy**

Each **procedure** is mapped to one or more **processes** and a **process flow diagram**

Each **process aid** is mapped to one or more **procedures**

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Process Mapping Matrix

Policy	Process Input	Process Number	Process	CMMI Requirement	Process Output
Policy name mapped to the process	*Inputs are outputs identified in another process*	*Unique process naming convention with the following equivalencies:* *PCS- Process* *VER- Verification* *002- Verification Process number 2* *vvv- process version*	*Process Name*	*CMMI specific practices that map to a specific process are identified. A single requirement can be mapped to more than one process.*	*Outputs are inputs identified in another process*
Verification	**PCS-VER-001** **SP1.1** Verification work product list Verification methods Verification environment **SP1.2** Verifications procedures **SP1.3** Verification criteria	**PCS-VER-002-vvv**	Perform Peer Reviews	**SG2- Perform Peer Reviews** **SP2.1** Prepare for peer reviews **SP2.2** Conduct peer reviews **SP2.3** Analyze peer reviews	**SP2.1** Peer review schedule; Peer review checklist; Work product entry and exit criteria; Peer review criteria **SP2.2** Peer review results; Peer review data **SP2.3** Peer review action items

Steps for Transitioning

- Select Pilot Project/Process Improvement (PI) Personnel
- CMMI® Training
- Tailoring
- Project Level Implementation
- Tools and Metrics
- Internal Evaluations (Internal Readiness Review)
- External Evaluations (Class C and B assessments and SCAMPI℠ Class A Appraisal)

Pilot Project/PI Personnel Selection

- Pilot Project Selection
  - Selected to ensure full representation of BAE-IT business activities and adequate lifecycle coverage
  - Project activities well suited for process improvement
  - Organizational PI activities organized as a “project”

- Process Improvement Personnel Selection
  - Selected for knowledge of project types and process improvement activities
  - Incorporated project points of contact and process improvement support group (PISG) “project liaisons”

Training

Two type of training established:

- Awareness
  - Tailored to address specific levels of PI staff
  - Set expectations for participation
  - Communicated strategy to entire organization

- Role Based
  - Common set of organizational roles established to cover all project types
  - Process and Domain training developed
    - Process – BAE-IT specific processes
    - Domain – Subject Matter training
  - Required training dictated by role

Tailoring

– Tailoring Guidelines established specifically for IT/MS Service project types

– Process level questionnaire, designed for IT/MS, used to assist in process selection

– Fostered collaborative development of project tailoring plans

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Process Tailoring Interview Questions

CMMI Sub practice Examples	O/S Project (Tier 1 Help Desk Support) Questions	O/S Project Answers
Identify work products for verification (SP1.1-1)	What types of services do you provide that need to be analyzed against a set of established requirements?	Requirements include customer Service Level Agreements which are aligned with the Help Desk Institute Industry Standard for Operations. The following operations are provided: -Tier 1 Help Desk Support which includes: 1. Verify that calls are answered and closed within required threshold and to customer satisfaction 2. Verify that tickets have been properly routed
Identify verification environment requirements (SP1.2-2)	What are the logistics necessary to prepare for verification of a service product?	On a daily basis, Tier 1 project manager performs random ticket analysis –based on ticket classifications. The manager uses Excel metric spreadsheet (with macros), Help Desk Query Spreadsheet, procedures database, SRS ticket audit trail report, and resolution follow-up worksheet

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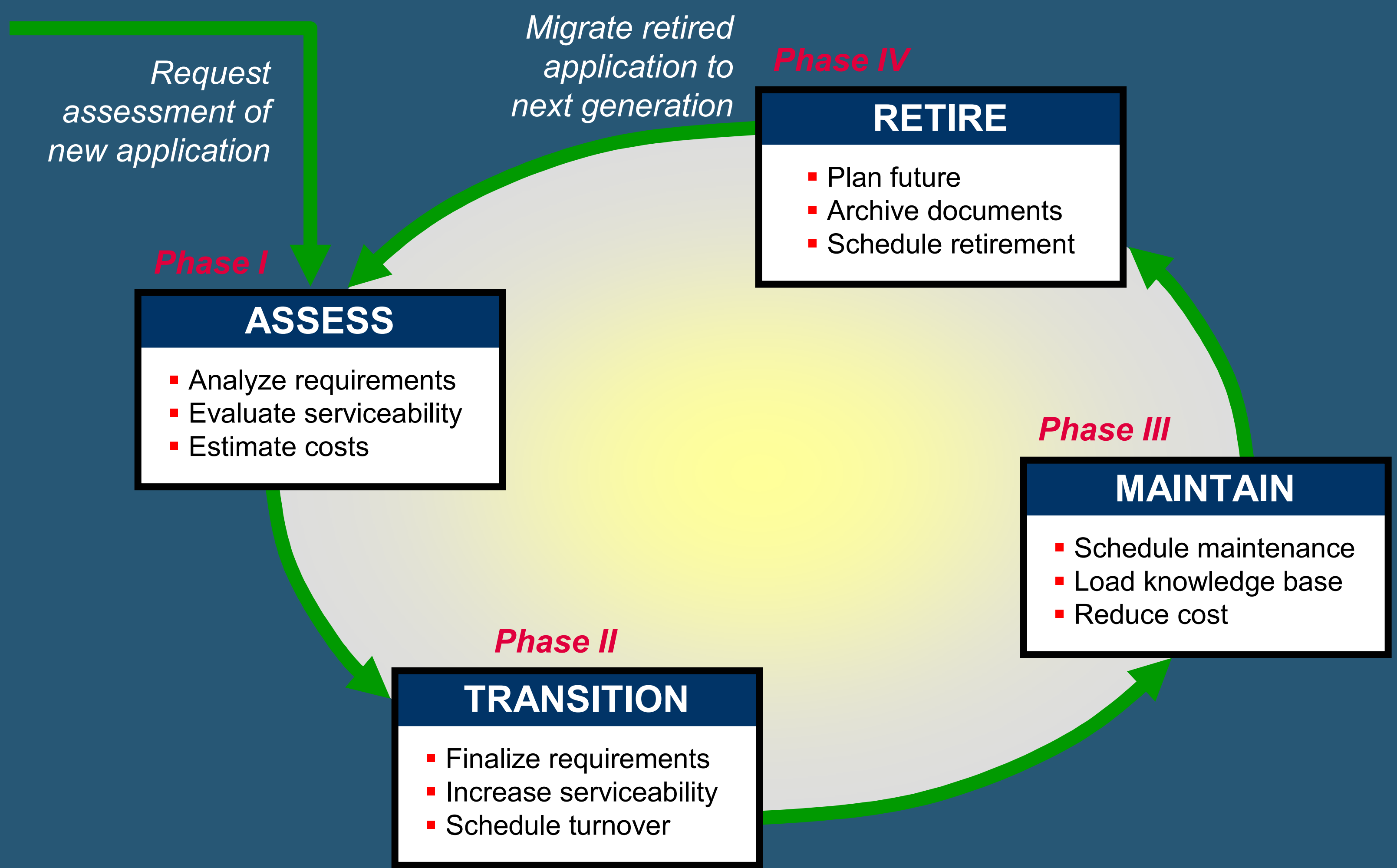
Tailoring Plans

- Tailoring occurs at process and procedure levels
- Tailoring Plans developed for each project type – include:
  - Mandatory processes
  - Process waivers
  - Tailored processes / procedures
  - Lifecycle Models (LCM) – waivers and tailoring
- Tailoring Plans reviewed at organizational level but owned and updated at project level

Sample O/M Lifecycle Model



Project Level Implementation

- Staff, both at organizational and project level, trained for two-way communication
- Process Selection as a collaborative tailoring activity
- Large-scale procedure tailoring for IT/MS services. Process areas receiving the most tailoring included:
  - VER, REQM, PPQA, CM, PP, and PMC

Process Selection Sample

Verification (VER)	
SG 1 Prepare for Verification **SP 1.1-1** Select Work Products for Verification **SP 1.2-2** Establish the Verification Environment **SP 1.3-3** Establish Verification Procedures and Criteria SG 2 Perform Peer Reviews **SP 2.1-1** Prepare for Peer Reviews **SP 2.2-1** Conduct Peer Reviews **SP 2.3-2** Analyze Peer Review Data SG 3 Verify Selected Work Products **SP 3.1-1** Perform Verification **SP 3.2-2** Analyze Verification Results and Identify Corrective Action	In an IT services environment, the most common work product is the service itself which does not naturally lend itself to verification. However, verification, the act of testing the product against specification, is necessary in an IT managed support model. **O/M**: For verification in the O/M environment on requirement of transition into the program was the provision, by the functional staff, of a testing environment. In many support programs problem resolution is typically provided in the production environment. The BAE-IT O/M model requires that a test environment be established so that verification can be performed. Additionally, any change in the support item, whether it be code or structure, must go through the verification process – to include a peer review using specially modified peer review forms. **O/S:** Daily reviews of a random selection of tickets for ticket routing and proper ticket closure techniques serve as the basis for verification in the O/S environment.

Process Area/Activity Based Tools

- Risk Register – standardized, automated risk tool for risk identification, quantification, mitigation and tracking
- Training Database – consolidated repository to track training
- Automated Configuration Management (CM) – Configuration Management controlled through automated tools

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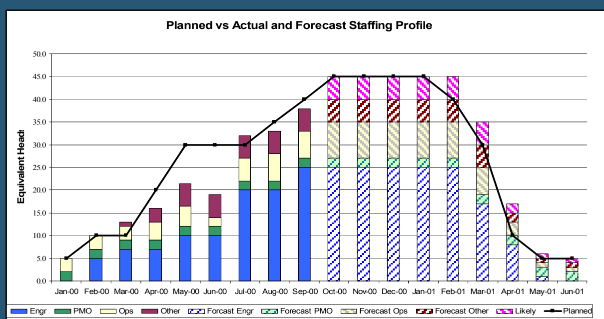
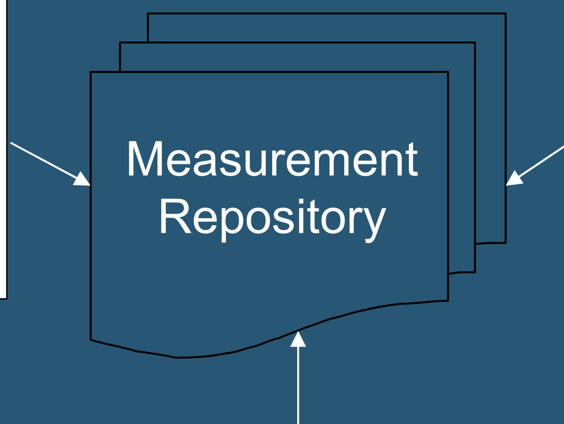
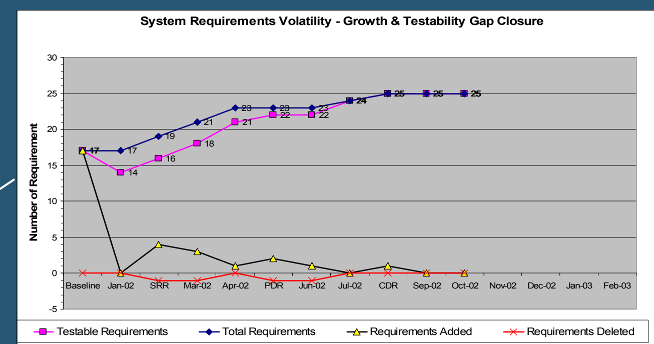
Process Area/Activity Based Tools

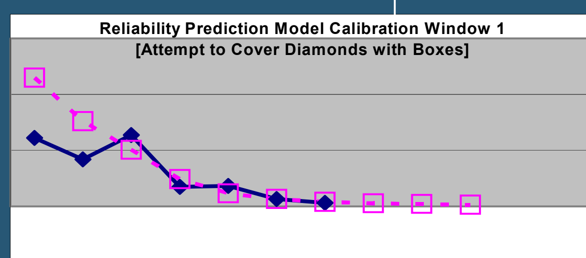
– Measurement Template/Repository – linked, dynamic workbook for tabular and graphical measurement representation

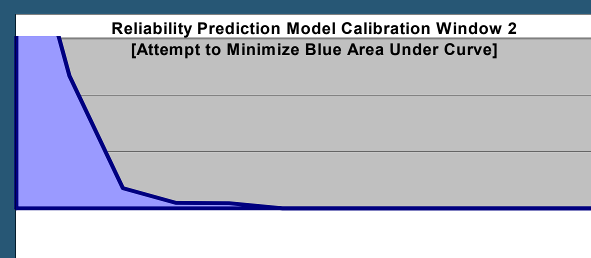






Reliability Prediction Model Parameters	
Weekly Reliability Threshold	0.0500
Calculated Lambda - Method 1	0.4635
Calculated Lambda - Method 2	0.9269
Calculated Lambda - Method 3	0.6879
Calibration Lambda	2.0000
Calibration Theta	0.0075
Sum of Squared Differences	0.4322





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Process Improvement Tools

– Tailoring Plan Template – template for development and implementation of project specific process selection tailoring

– Process Asset Templates – templates for each level of process architecture documentation

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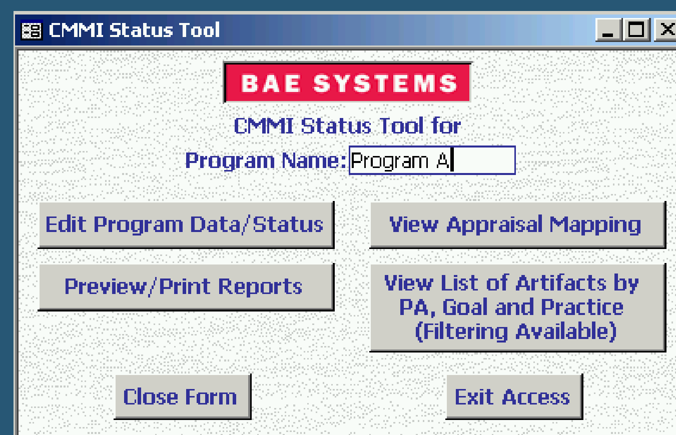
Process Improvement Tools

- CMMI® Status Database – developed by Mandy Parmer and recognized as a best practice by assessment team.
- Database is used to:
  - Map process assets against the model
  - Provide status reports to organization
  - Serve as Process Implementation Indicator Database (PIID) for assessment team



Process Improvement Metrics

– Process Improvement Support Group (PISG) treated as a project and reported a series of measures

  – Schedule – Performance against scheduled activities
  – Status – Milestone tracking
  – Cost – Budget tracking
  – Risk – “Risk Register” reporting monthly
  – Quality – Process and Product Quality Assurance (PPQA) and Process Change Request (PCR) tracking

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Internal/External Evaluations

- Internal Readiness Review (IRR)
  - Artifact Review and Mock Interviews
  - Progress reviewed against CMMI Status Database
  - Gauge readiness for external appraisals
  - All findings documented and tracked in Process Action Plan

- Class C and B assessments and SCAMPI^{SM} Class A Appraisal

Critical Success Factors

- Participation by cross-representation of project types
- Consultant and lead appraiser support/guidance
- Development of IT/MS Service specific tailoring questionnaire to support process development
- Ongoing communication with lead appraiser to provide details on tailoring
- Conduct Internal Readiness Reviews (IRRs)
- Tie corporate goals to success
- Use of CMMI Status Database and Automated CM

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Lessons Learned

- Perform Formal Gap Analysis
- Develop Process Architecture early
- Risk Analysis of implementing Tailoring Guidelines
- Dedicated, funded personnel for documentation
- Outsource role based domain training
- Use of ETVX to write procedures
- Implement Project Level Configuration Control Board (CCB)
- Use ITIL framework to support Operations and Services (O/S) Lifecycle Model (LCM)

Conclusions and Next Steps

– BAE-IT forged new ground in the tailoring of CMMI for use in an IT/MS Services environment

– BAE-IT is participating in the SEI Steering Committee working towards the inclusion of Services into the CMMI® framework

– BAE-IT is continuing its process improvement activities including goals to:
  – Reach Level 4
  – Include additional projects
  – Incorporate ITIL methodologies as part of the process improvement initiative

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Presenters

- Stacy Savage – Managed the organization process improvement activities during BAE-IT’s successful transition to CMMI® Level 3

- Mandy Parmer – Managed the project level pursuit of CMMI Level 2 and participated as project level lead for BAE-IT’s transition to CMMI® Level 3

Back Up Slides

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History - CMMI®

- Public Release Start Ver 0.2 in Aug 1999
- CMMI® Ver 1.1 released in 2001 to combine a series of overlapping CMMs
- CMMI® focus remains Software/Systems engineering
- Current version of model provides little guidance or suggested work products for IT Services
- SEI currently looking to expand model disciplines to cover IT services

Acronyms

BAE-IT	BAE Systems Information Technology
CCB	Configuration Control Board
CM	Configuration Management
CMMI ®	Capability Maturity Model Integration
ETVX	Entry Test Verification and eXit
IRR	Internal Readiness Review
IS/MS	Information Technology/Mission Support
ISO	International Organization for Standardization
ITIL	Information Technology Infrastructure Library

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Acronyms (Cont'd)

LCM	Lifecycle Model
MA	Measurement and Analysis
O/M	Operations and Maintenance
O/S	Operations and Services
PCR	Process Change Request
PCRRB	Process Change Request Review Board
PI	Process Improvement
PIID	Process Implementation Indicator Database
PISG	Process Improvement Support Group

Acronyms (Cont'd)

PMC	Project Monitoring and Control
PP	Project Planning
PPQA	Process and Product Quality Assurance
REQM	Requirements Management
SCAMPI^{SM}	Standard CMMI® Appraisal Method for Process Improvement
SWD	Software Engineering and Development
VER	Verification
WG	Working Group

Raytheon
Customer Success Is Our Mission

"Barrier Busting" – Obtaining Active Leadership Support

Raytheon Missile Systems
Mike Scott & Eric Ziegler

November 2005

Introduction

Raytheon
Missile Systems

Barriers impede performance. Having the right environment that focuses on the removal of these barriers can help ensure success.

- This presentation addresses:
  - Establishing and communicating clear goals
  - Having the right sponsors in the game
  - Setting up a leadership structure that works
  - Constant communication to all the stakeholders
  - Having a team that is focused on success

To maintain speed and agility you must identify and remove barriers quickly

Clear Goals

Raytheon
Missile Systems

- Executive leadership set measurable goals and a vision for our process initiative
  - The initiative was about improving the enterprise and the way we do business
    - This was reinforced throughout our 18 month quest
  - Enterprise wide goals
    - Business goals
    - Program performance goals
    - Process improvement goals

- Goals socialized and accepted throughout the organization

Clearly communicated goals get everyone on the right road

Sponsorship

Raytheon
Missile Systems

- Site President
  - Set Vision and Goal
  - Quarterly Reviews
  - Weekly with the Executive Interface
- Executive Advisors Group
  - VPs from Engineering, Quality, Finance, Operations
  - Twice monthly reviews
- Executive Interface
  - Full-time assignment to the team
  - Chief Barrier Buster

Participatory Sponsorship is crucial

Leadership

Sets the vision and goals. Breaks down **ENTERPRISE BARRIERS**.

Provides interface to enterprise executives. Breaks down **ORGANIZATIONAL BARRIERS**.

Makes programmatic decisions and direction. Breaks down **PROGRAM BARRIERS.**

Responsible for all technical decisions and direction. Break down **TECHNICAL BARRIERS**.

Site President

Executive Interface

Program Manager

Chief Engineer

Executive Advisors

Provides guidance and direction. Breaks down **ENTERPRISE BARRIERS.**

Leadership sets the expectation and must provide the behavior example for the team

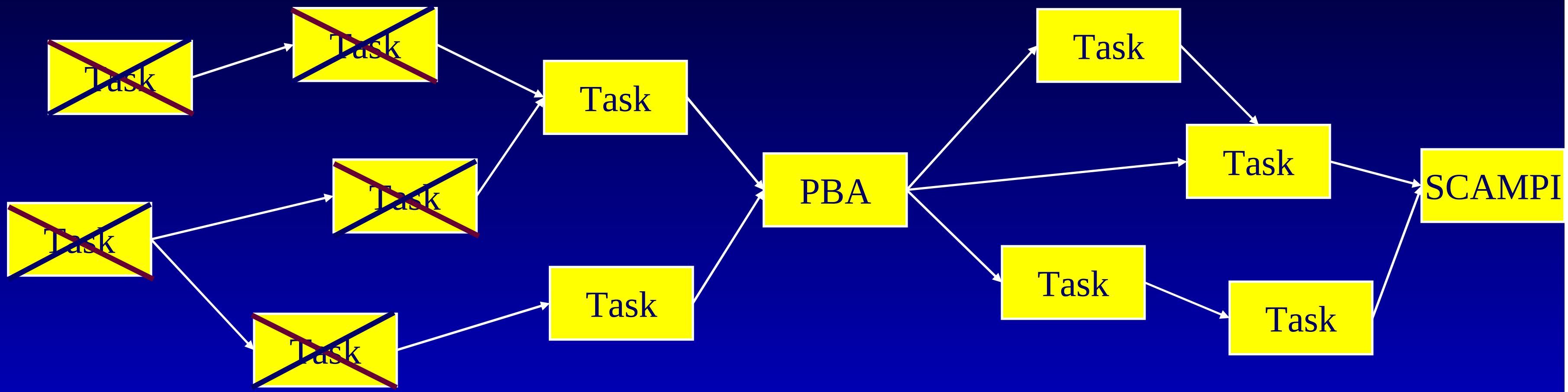
Communication

Raytheon
Missile Systems

- Up
  - Quarterly with Site President
  - Twice monthly with Executive Advisors Group
  - Daily with Executive Interface
- Across
  - Twice monthly Program Manager Lunch
  - Twice monthly Functional Manager breakfast
  - Deployment leads assigned to each focus program
- Down
  - Weekly information sharing
  - Daily status and barrier identification/removal

Constant and clear communication keeps everyone vectored in the same direction

Team Focus



- Detailed plans at the task level focus the team
- Daily Stand-ups
  – Status completions
  – Identify risks
  – Identify/resolve barriers (everyone felt comfortable bringing issues to the table)
  – Immediate corrective action
  – Meaningful, daily metrics

A team that is focused on results will be successful

The Results

- Identification and removal of barriers was issue focused not punitive
- We all owned and participated in Barrier Busting
- No barrier remained on the list for more than a week
  – Nearly all resolved in the same day
- Empowered Teams that learned to break down their own barriers
- Achieved all initiative goals on-schedule and under budget

To maintain speed and agility you must identify and remove barriers quickly

Contrasting CMMI and the PMBOK

CMMI Technology Conference & User Group

November 2005

Wayne Sherer
U.S. Army ARDEC

Sandy Thrasher, PMP
Anteon Corporation

Agenda

- Purpose & Overview
- Considerations for Comparison
- Similarities Between CMMI and PMBOK
- "Grey" Areas and Differences
- How PMBOK Supplements CMMI
- How CMMI Supplements PMBOK
- Conclusions

Purpose

- Contrast process requirements contained in CMMI to the process requirements in the PMBOK

Overview

- PMBOK provides additional project management processes for CMMI Organizations
- CMMI provides a process management structure and Systems and Software Engineering Best Practices
- Combining them will result in better and more complete project management of engineering projects

Considerations for Comparison

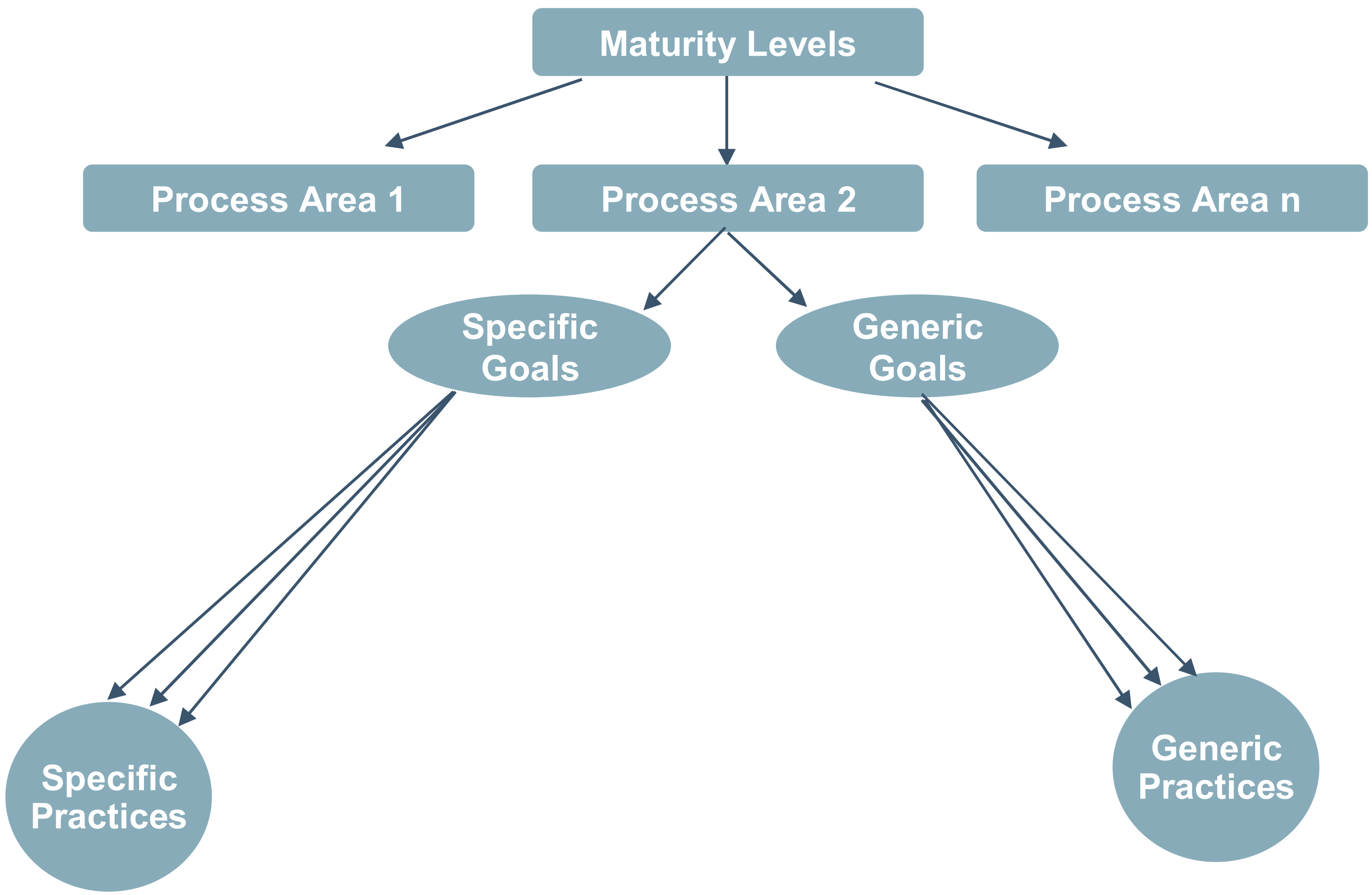
Coverage

- CMMI
  - Addresses Project Management of engineering endeavors
  - Addresses a larger organization composed of engineering projects
- PMBOK
  - Addresses Project Management without addressing the type of project or directly addressing the larger organization
- The depth of coverage varies between the documents

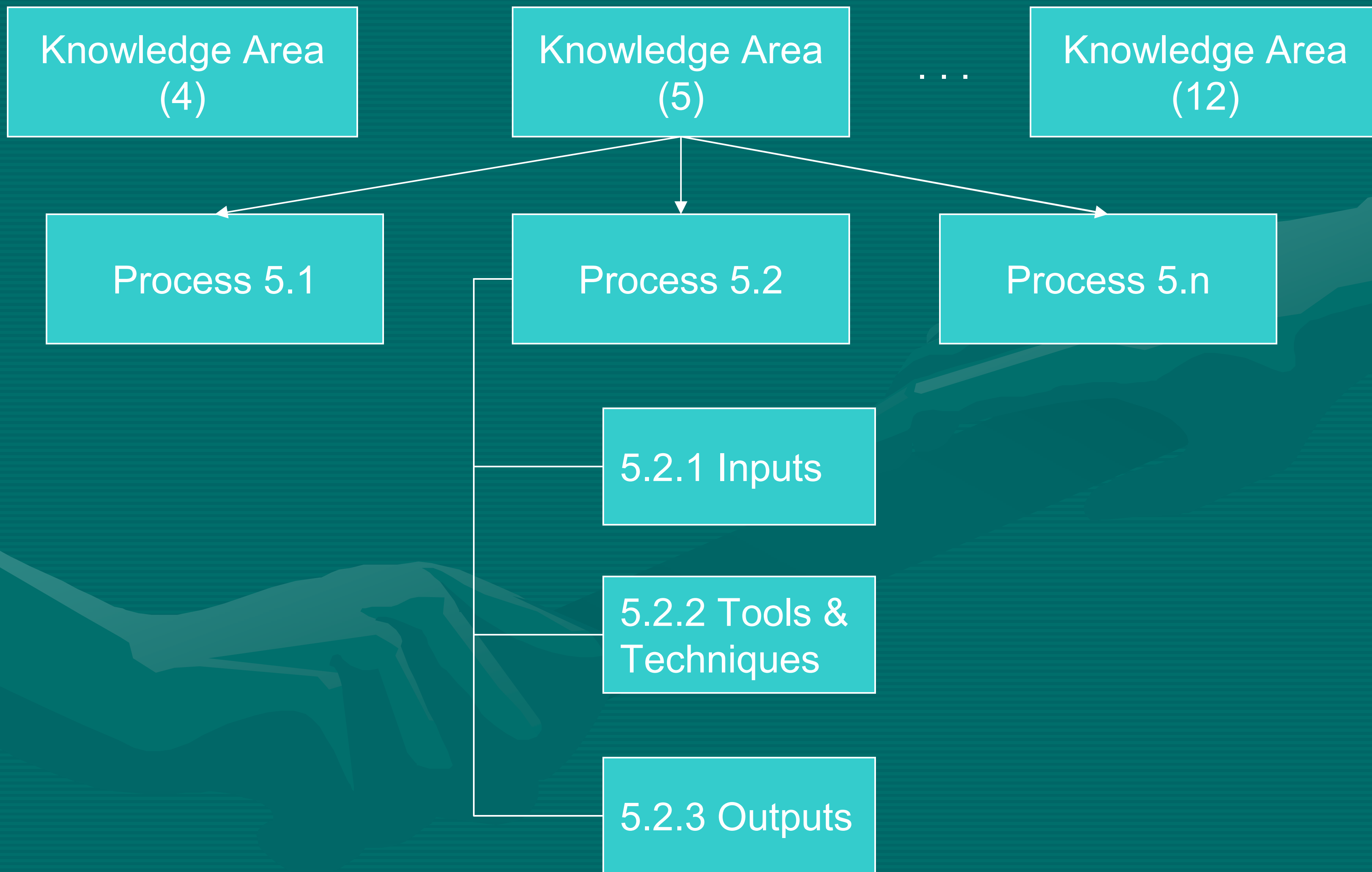
Intent & Structure

- PMBOK supports training Project Managers for Project Management Professional (PMP) certification
- CMMI supports organizational process improvement for achievement of maturity and/or capability levels
- While both have a project management focus, the structure of these documents is different

Model Components in the Staged Representation



PMBOK Components



Similarities Between CMMI and PMBOK

Processes Addressed by Both

- Requirements Management or Scope Control
- Project Planning
- Managing and Controlling Project Execution
- Quality Assurance
- Supplier or Procurement Management
- Risk Management
- Measurement

"Grey" Areas

- The following are implied or partly addressed by PMBOK
  - Configuration Management
  - Causal Analysis
  - Generic Practices
- The following is partly addressed by CMMI
  - Human Resource Management

Definition & Context Differences

- Verification and Validation – Definitions in both documents are basically reversed
- Risk – In PMBOK, risk is an uncertainty and can be positive or negative
- Procurement Management - PMBOK considers buyer and seller points of view
- Progressive Elaboration Vs. Establish and Maintain

How PMBOK Supplements CMMI

How PMBOK Supplements CMMI

- Project Charter (or Initiation)
- More guidance and details on
  - Planning,
  - Management and Control,
  - Human Resource Management,
  - Quality Assurance,
  - Risk, and
  - Procurement
- Close Project + Accepted Deliverables

How PMBOK Supplements CMMI

- Project Charter
  - Issued by sponsor external to the project organization
  - Provides reasons for selecting a project
  - Formally authorizes existence of a project
  - Identifies and gives authority to project manager

How PMBOK Supplements CMMI

- More guidance and details on planning
  - Additional Planning Documents (Scope Management Plan, Schedule Management Plan, Cost Management Plan, Staffing Management Plan, Communications Management Plan, Procurement Management Plan)
  - Project Time Management (Activity Definition, Activity Sequencing, Activity Resource Estimating, Activity Duration Estimating, Schedule Development, and several possible support tools)

How PMBOK Supplements CMMI

- More guidance and details on management and control
  – Performance measurement analysis and forecasting using earned value calculations - formulas and examples are provided
  – Integrated change control details with links to the implementing sections of the PMBOK

How PMBOK Supplements CMMI

- More guidance and details on Human Resource Management
  - Human resource planning
  - Acquiring the project team
  - Developing the project team
  - Managing the project team

How PMBOK Supplements CMMI

- More guidance and details on Quality Assurance
  - Quality Planning
    - Considers Cost of Quality
    - Suggests tools with descriptions: Design of Experiments, Cost-Benefit Analysis, Benchmarking
  - Quality Control
    - Suggests tools with descriptions and some examples: cause and effect diagram, control charts, flowcharting, histogram, Pareto chart, run chart, scatter diagram, statistical sampling, defect repair review
    - Links outputs back into other processes

How PMBOK Supplements CMMI

- More guidance and details on risk
  - Risk planning and budgeting
  - Example risk parameters
  - More information on how to identify risks
  - Qualitative and quantitative risk analysis
  - Risk response planning

How PMBOK Supplements CMMI

- More guidance and details on contracting or Procurement Management
  - Considers buyer and seller
  - Request seller responses (solicitation)
  - Considerations for evaluation
  - Includes contract closure and payment

How PMBOK Supplements CMMI

- Close Project + Accepted Deliverables
  - Part of Project Management Plan
  - Administrative closure procedures
  - Contract closure procedures
  - Formal acceptance of product

How CMMI Supplements PMBOK

How CMMI Supplements PMBOK

- Engineering Best Practices
- Organizational Process Management
- Data Management
- Decision Analysis

How CMMI Supplements PMBOK

- Engineering Best Practices
  - Requirements Elicitation
  - Requirements Decomposition & Design
  - Requirements Traceability
  - Management of Interfaces
  - Planning and preparation, including environment, for Integration, Verification, and Validation
  - Product Integration

How CMMI Supplements PMBOK

- Organizational Process Management
  - Process Needs (drivers & improvements)
  - Process Asset Library
  - Process Training
  - Quantitative Quality and Process Performance Objectives
  - Process Innovation and Deployment

How CMMI Supplements PMBOK

- Data Management
  - Planning for Data Management
  - Monitoring Data Management

How CMMI Supplements PMBOK

- Decision Analysis
  - Formal Decision Analysis and Resolution with expectations on how to structure the decision process

Conclusions

Conclusions

- CMMI and the PMBOK
  - Can support each other and
  - Supplement each other
- Implementing PMBOK can help CMMI organizations support and maintain their Project Management Professionals (PMP)
- Implementing CMMI can help PMBOK based organizations with Process Management and engineering best practices

The Mappings Are Available

- Link to - https://bscw.sei.cmu.edu/pub/bscw.cgi/0/79783
- Click on "Comparisons of CMMI & Other Standards/References"
- Then click on "CMMI and PMBOK"
- There will be three files, start with "CMMI and PMBoK Mappings"

Contact Information

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Data Management: The Hidden Enabler or (The Key Data and Work Product Integrator)

5th Annual CMMI Technology Conference & User Group 14-17 November 2005

Gary F. Norausky
&
Les Stamnas

Data Management, Configuration Management and the CMMI

- Data Management and Configuration Management according to CMMI:
  - ✓ CMMI V1.1's glossary contains the following definitions:
    - *Configuration Management:* A discipline applying technical and administrative direction and surveillance to (1) identify and document the functional and physical characteristics of a configuration item, (2) control changes to those characteristics, (3) record and report change processing and implementation status, and (4) verify compliance with specified requirements.
    - *Data Management:* Principles, processes, and systems for the sharing and management of data.
      - Project Planning Process Area (SG2, SP 2.3-1) and the monitoring of project data within the Project Monitoring And Control Process Area (SG1, SP 1.4-1).
      - Data is described in terms of "documentation," and thus the confusion begins
      - Data Management consists of processes and systems that plan, acquire, and provide control for product and product-related business data, consistent with requirements, throughout the product and data life cycles.
  - ✓ Misconception: "Data" is somehow a "new thing," if it is considered in the Project Planning process for management purposes

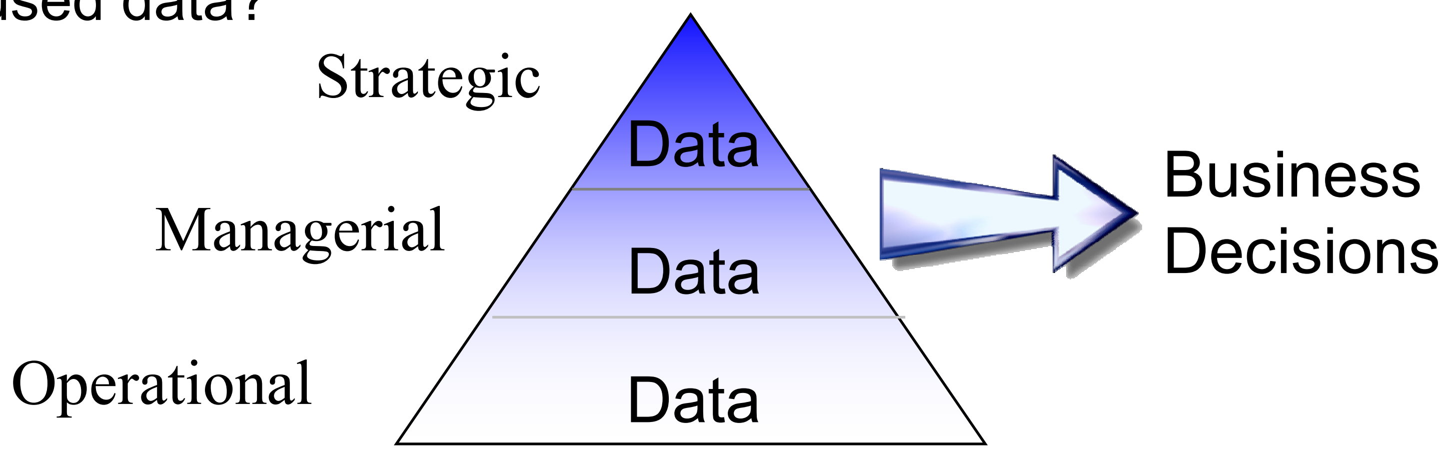
What is Data?

- Information in various forms
  - ✓ Managerial
  - ✓ Financial
  - ✓ Technical
  - ✓ Engineering
  - ✓ Administrative
  - ✓ Security
  - ✓ Procurement

NOTE: Data is essentially anything other than hardware, software and interfaces. It includes but not limited to cost and status reports, drawings, documents, source code, and listings, etc.

Why Data is Important?

- Useful predictions require an analysis of a lot of data - the more the better - and it should be relevant to your business and the environment in which you operate
- Data forms a significant and important element within data-driven systems, one would expect that the development methods used to produce it would reflect the same degree of care and attention that is applied to the other systems' components
- The key manager question is, "Where do I get relevant, updated, focused data?"



Key Data Management Considerations

General Requirements

Data Capabilities

Process and Product Quality Assurance

Data Processes

Data Management

External Constraints

Related Business Objectives

Intended Use of the Data

Configuration Management

Risk Management

Measurement and Analysis

Decision Analysis and Resolution

Technology Issues

Data Management as a Functional Enabler

- Data Management's solution must address a functional need
- Data's value is not limited to its use in support of a particular product:
  - ✓ Data may have a life cycle longer than that of the product it describes, e.g., data from previous projects forms part of the foundation for new product and process design.
- Data also supports the enterprise in process redesign and quality.
  - ✓ Data is essential to competitive position.
  - ✓ Data is an integral part of an enterprise's intellectual assets and overall enterprise knowledge.
- Inaccurate or inconsistent data can hinder your company's ability to understand its current – and future business problems.

Data Management Plan

The prime functions of efficiency and effectiveness are:

- Administration of contract record keeping
- Data copying control
- Data quality control
- Acquisition/administration of supplier data
- Storage and retrieval systems
- Handling of classified data
- Maintenance and control of supplier-developed inform… Purchaser-furnished information
- Identification and handling of property rights-in-data
- Pricing data
- Planning, scheduling, and delivery of data

30-50% of application design time is spent on copy management. Source: IBM

30% of people's time: searching for relevant information. Source: IBM

85% of information is unstructured. Source IBM

Data Risks

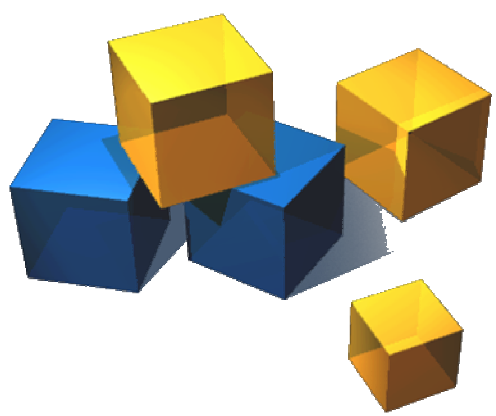
Data is often:

- Not subjected to any systematic hazard or risk analysis
- Poorly managed or controlled
- Not given any specific safety requirements
- Not assigned any specific integrity requirements
- Poorly structured, making errors more likely and harder to detect
- Not subjected to any form of verification
- Drawn from a single source

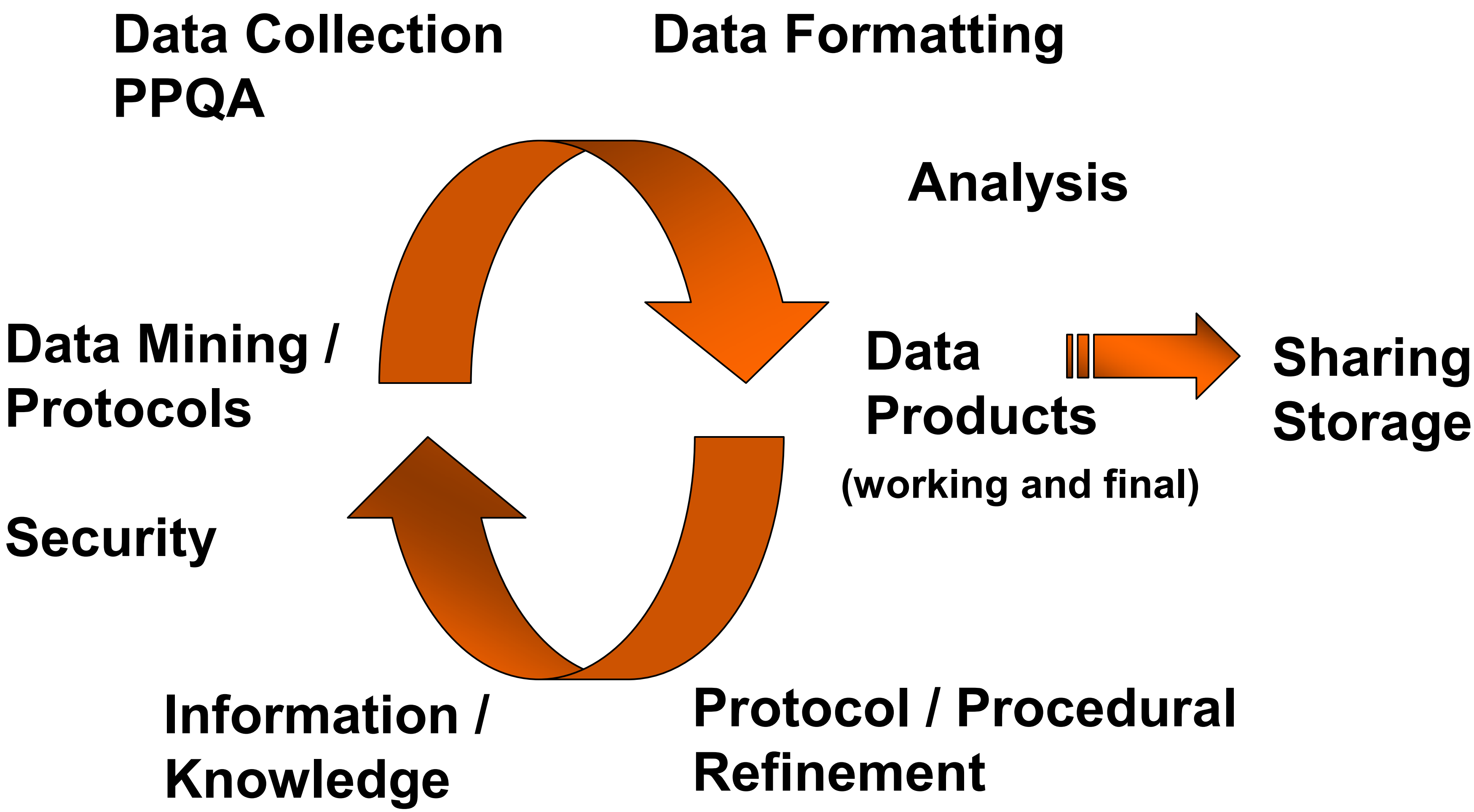
N. Storey and A. Faulkner, Data Management in Safety-Related Systems, *Proc. 20th International System Safety Conference*, Denver, 2002.

Generic Building Blocks for Data Management

- **Data Profiling** – Discover and analyze data discrepancies
- **Data Quality** – Reconcile and correct data and improve the processes that create it
- **Data Integration** – Integrate and link data across disparate sources
- **Data Augmentation** – Enhance information using internal or external data sources
- **Data Monitoring** – Check and control data integrity over time
- **Knowledge Management** – Ensure data is accurate and that the filters, relations and criteria are captured to provide context for the information reserve



Data Lifecycle and Work Flow



Steps for Developing a Data Design

- Step 1 - Preliminary scoping meetings – data managers and protocol developers/project leaders
  - Review the context, purpose and sources of project data
  - Clarify how data are acquired, entered, processed and documented
  - Who performs these steps, and the quality control measures built into these processes?
  - Discuss the timing and frequency of data entry and updates
  - Who needs access to the data at different stages of the data life cycle
  - Could certain project data qualify for protection as sensitive info?
  - What are the project needs for data distribution? When and how should data be made available to others?

Steps for Developing a Data Design

- ✓ Step 2 – Develop the “logical” data model (tables, fields, data types, domains, range limits, descriptions)

- ✓ Step 3 – Have this reviewed to make sure it meets network and national standards, and fits the project needs

- ✓ Step 4 – Complete the data design to address specific implementation details
  - Define in detail the integration needs with other past, present or future data sets
  - Identify and define needed data views. How does information need to be summarized, presented and exported? How do geographic data need to be displayed?
  - What is the intended audience for different products, and what are their specific needs?

Steps for Developing a Data Design

- Step 4 – continued …
  - Where will working data reside?
  - What will the software platform be for database implementation?
  - Does the project require a separate working database for current year data? If so, what milestone(s) must occur prior to data being uploaded into the master database for summarization and analysis?
  - Identify the types of data backups that might need to be made, and the specific project milestones that trigger these backups
  - Specify how and when certified data sets will be delivered
  - Define measures & responsibilities for protecting sensitive information
  - Clarify responsibilities and expectations for database maintenance. Are there sufficient resources to maintain the database as it is scoped?

Steps for Developing a Data Design

- ✓ Step 5 – Develop the “physical” database model (i.e., create the database)
- ✓ Step 6 – Develop the application interface - data entry, processing, summarization and reporting, exports for analysis
- ✓ Step 7 – Have everything tested and reviewed to make sure it works and meets project needs
- ✓ Step 8 – Develop documentation and training materials

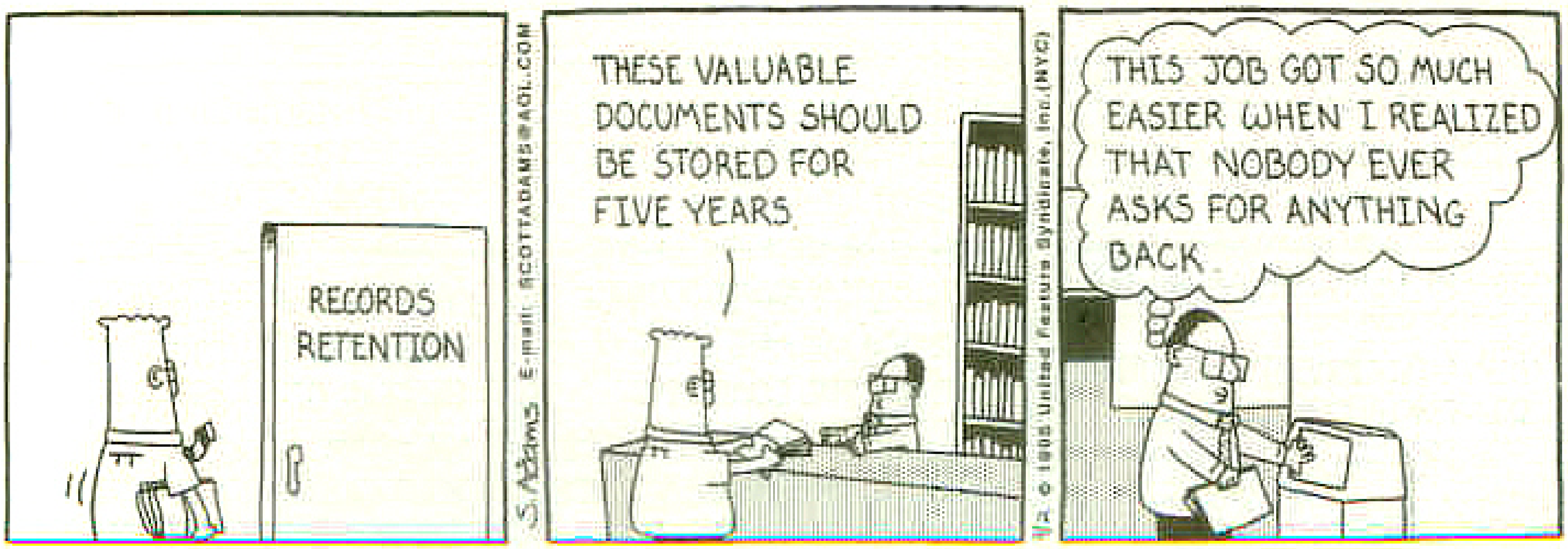
Example Standard for Data Management

- Government Electronics and Information Technology Association (GEIA) 859-2004
  - ✓ Describes DM principles and methods using a neutral DM terminology.
  - ✓ Intended to articulate contemporary DM principles and methods that are broadly applicable to management of electronic and non-electronic data in both the commercial and government sectors.
  - ✓ Addresses product data and the business data intrinsic to collaboration during product acquisition and sustainment.

GEIA 859 Data Management Principles

ID	Area	Principle
1	Focus and Scope	Define the organizationally-relevant scope relevant scope of data management.
2	Customer Support	Plan for, acquire, and provide data responsive to customer requirements.
3	Business Context	Develop DM processes to fit the context and business environment in which they will be performed.
4	Identification	Identify data products and views so that their requirements and attributes can be controlled.
5	Change Management	Control data, repositories, data products, data views, and metadata using approved change control processes.
6	Data Rights	Establish and maintain an identification,process for intellectual property, proprietary, and competition-sensitive data.
7	Data Retention	Retain data commensurate with value to the organization.
8	Process Improvement	Continuously improve data management.
9	DM/KM Connection	Effectively integrate data management (DM) with knowledge management (KM).

Not A Good Data Management Repository



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A Statistical Approach to Product Quality Assurance

Randall J. Varga

17 November 2005

Topics to be covered

- Purpose of Quality Assurance
- Classical Approach to Quality Assurance
  - How It Works
  - Deficiencies of Classical Approach
- Defect Model Approach to Quality Assurance
  - Premise
  - How It Works
  - Types of Defects
  - Benefits of this Quantitative Approach
- Conclusion

Purpose of Quality Assurance

- To provide staff & management insight into processes being used and work products being built
  - Determine process adherence
  - Evaluate work products during development and prior to delivery

Classical Approach to Quality Assurance

- Separate group from developers
  - A way of insuring independence
- QA group examines/reads the work product to be evaluated
  - Often after the work product is completed
  - Defects found are costly to correct
- QA group typically does not have the domain knowledge to judge technical quality
  - Technical quality not determined
  - Determine if formatted properly
  - Meets standards imposed

Premise

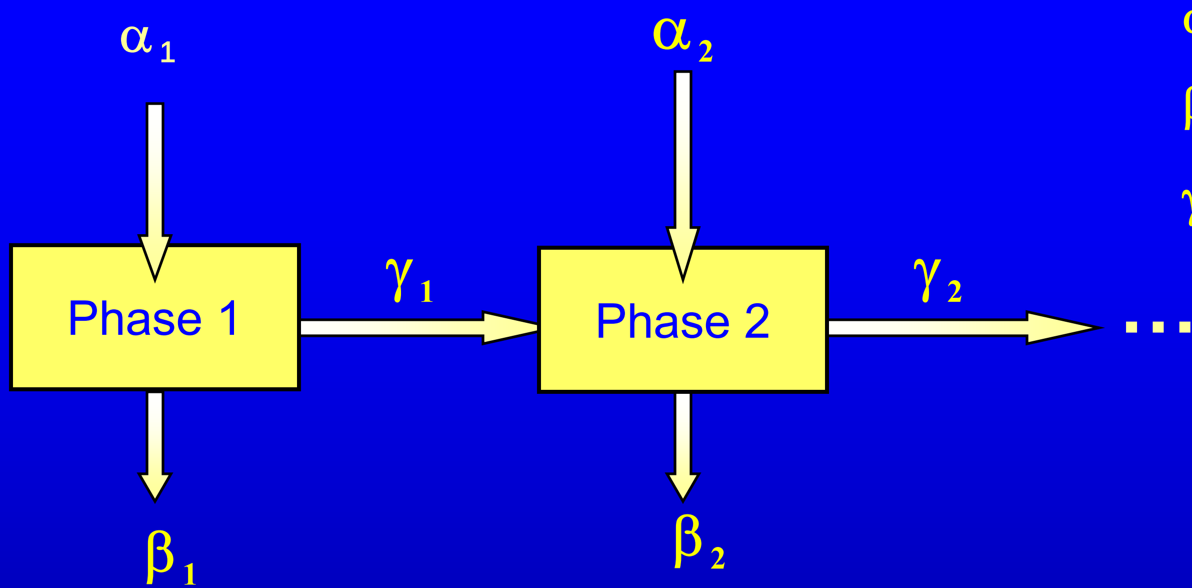
- Products are created by executing processes
- In a mature organization, process performance is known, repeatable and controlled
- Defects are inserted at statistically known rates
- Therefore by monitoring defects detected
  - Estimate of defects remaining in product can be made
  - A statement of the product quality can be quantitatively made
  - Corrective action can be taken early in the life cycle
    - Least costly to correct

Defect Modeling

α = **Defects In**

β = **Defects Out**

γ = **Remaining Defects**



$\alpha_1 = \beta_1 + \gamma_1$

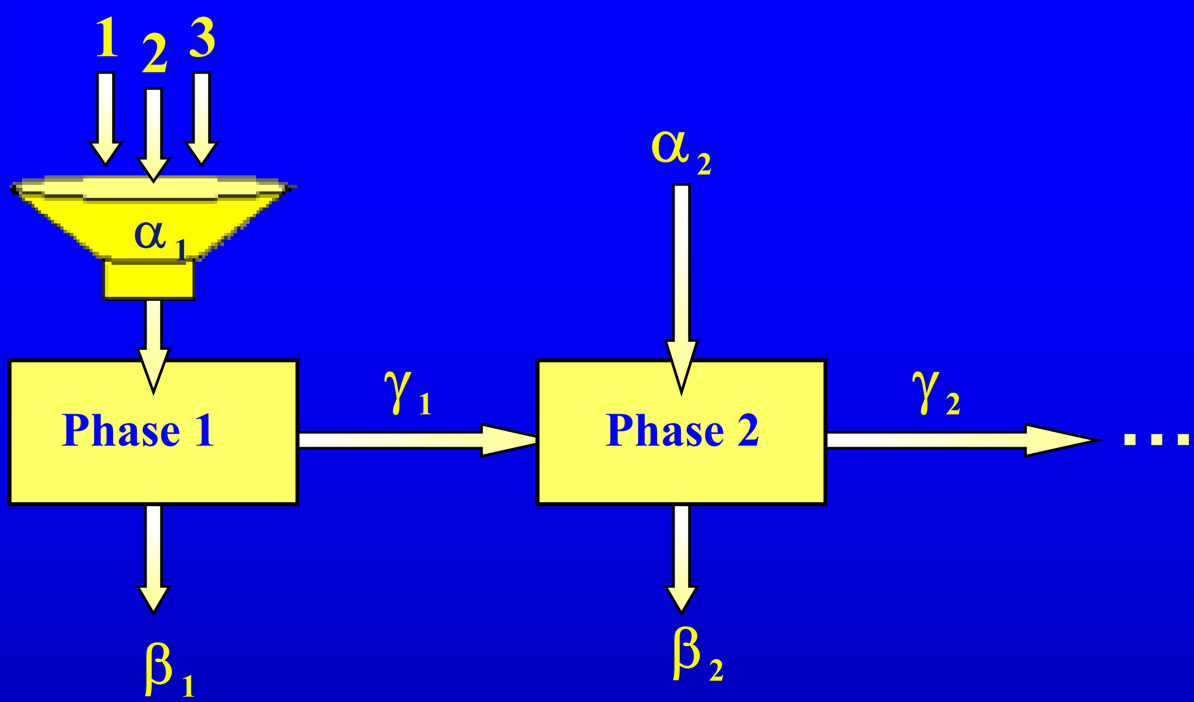
$\gamma_1 = \alpha_1 - \beta_1$

$\alpha_2 + \gamma_1 = \beta_2 + \gamma_2$

$\gamma_2 = \alpha_2 + \gamma_1 - \beta_2$

"Defects In" is known, "Defects Out" is monitored --> Therefore "Remaining Defects" left in product can be determined

Defect Modeling



1 = New

2 = Mod

3 = Revised

α = Defects In

β = Defects Out

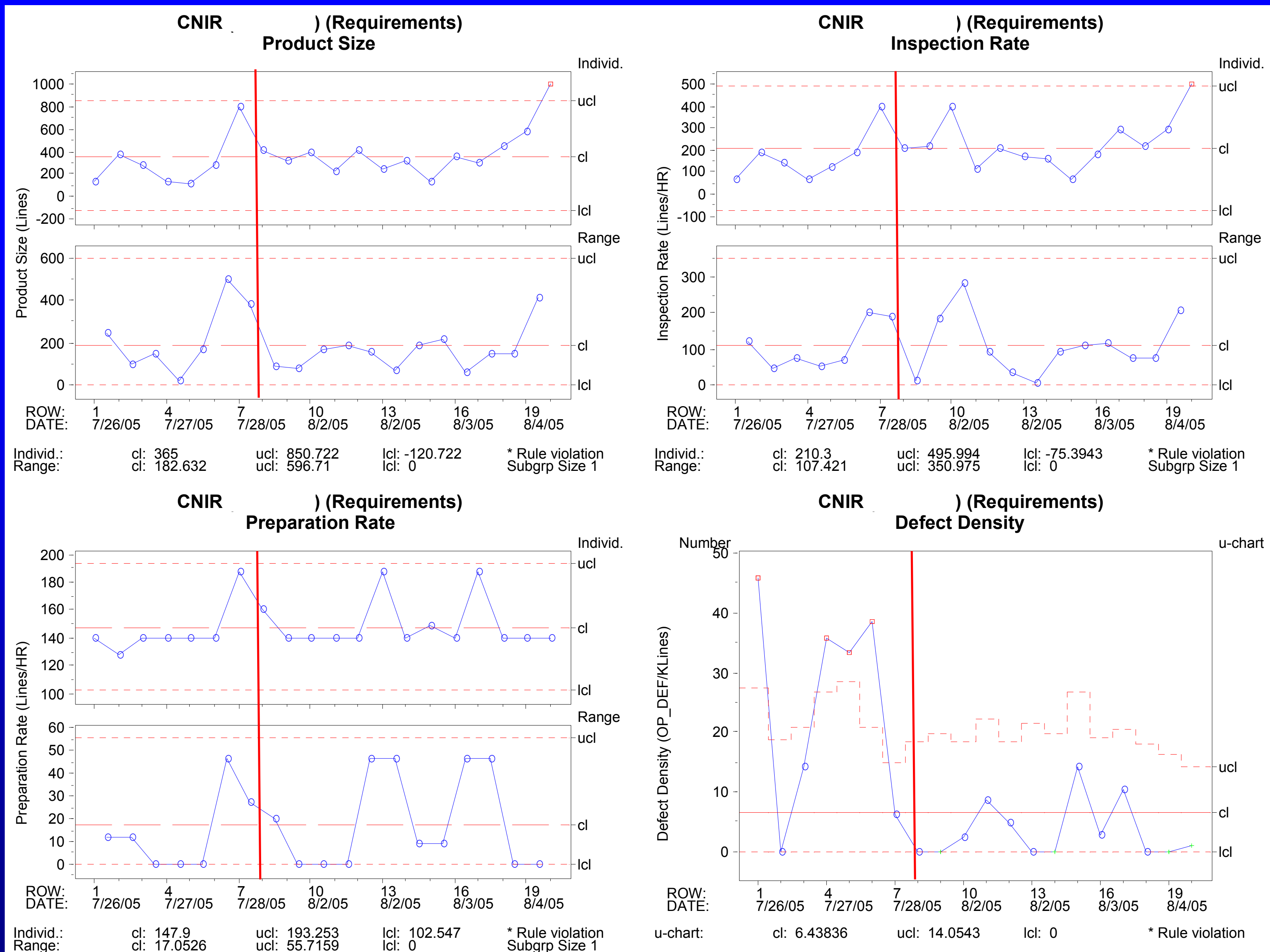
γ = Remaining Defects

$\alpha_1 = \beta_1 + \gamma_1$

$\gamma_1 = \alpha_1 - \beta_1$

$\alpha_2 + \gamma_1 = \beta_2 + \gamma_2$

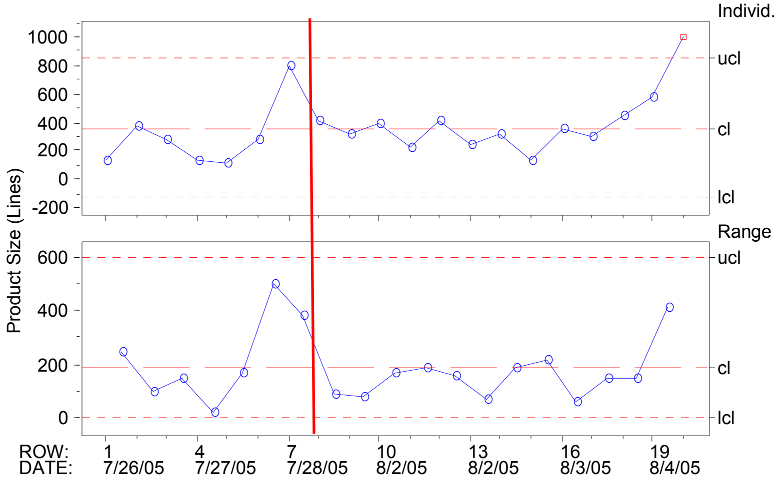
$\gamma_2 = \alpha_2 + \gamma_1 - \beta_2$



CNIR) (Requirements)
Product Size
Individ.
ucl
cl
lcl
Range
ucl
cl
lcl
Product Size (Lines)
ROW: 1 4 7 10 13 16 19
DATE: 7/26/05 7/27/05 7/28/05 8/2/05 8/2/05 8/3/05 8/4/05
Individ.: cl: 365 ucl: 850.722 lcl: -120.722 * Rule violation
Range: cl: 182.632 ucl: 596.71 lcl: 0 Subgrp Size 1
CNIR) (Requirements)
Inspection Rate
Individ.
ucl
cl
lcl
Range
ucl
cl
lcl
Inspection Rate (Lines/HR)
ROW: 1 4 7 10 13 16 19
DATE: 7/26/05 7/27/05 7/28/05 8/2/05 8/2/05 8/3/05 8/4/05
Individ.: cl: 210.3 ucl: 495.994 lcl: -75.3943 * Rule violation
Range: cl: 107.421 ucl: 350.975 lcl: 0 Subgrp Size 1
CNIR) (Requirements)
Preparation Rate
Individ.
ucl
cl
lcl
Range
ucl
cl
lcl
Preparation Rate (Lines/HR)
ROW: 1 4 7 10 13 16 19
DATE: 7/26/05 7/27/05 7/28/05 8/2/05 8/2/05 8/3/05 8/4/05
Individ.: cl: 147.9 ucl: 193.253 lcl: 102.547 * Rule violation
Range: cl: 17.0526 ucl: 55.7159 lcl: 0 Subgrp Size 1
CNIR) (Requirements)
Defect Density
Number
u-chart
ucl
cl
lcl
Defect Density (OP_DEF/KLines)
ROW: 1 4 7 10 13 16 19
DATE: 7/26/05 7/27/05 7/28/05 8/2/05 8/2/05 8/3/05 8/4/05
u-chart: cl: 6.43836 ucl: 14.0543 lcl: 0 * Rule violation

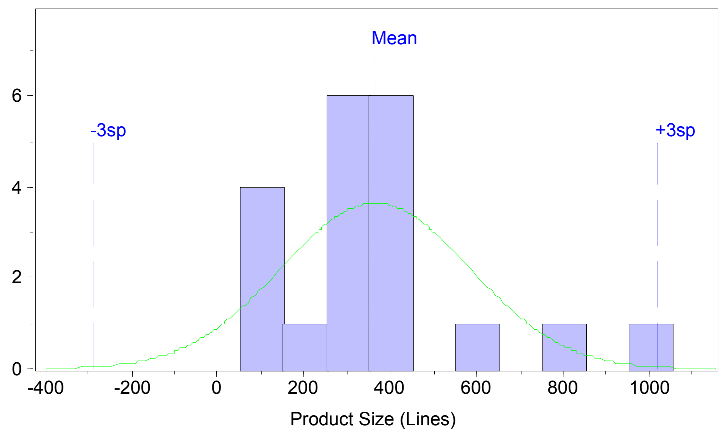
Causal Analysis

CNIR) (Requirements)
Product Size



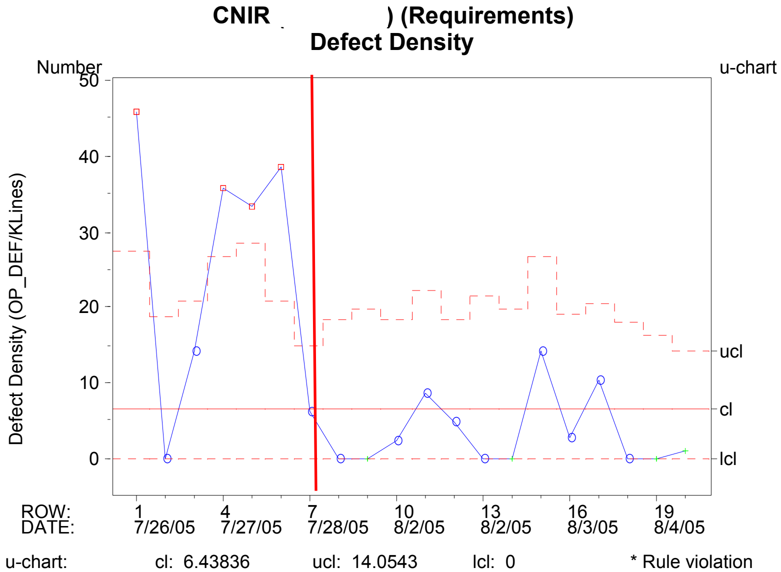
Individ.:	cl: 365	ucl: 850.722	lcl: -120.722	* Rule violation
Range:	cl: 182.632	ucl: 596.71	lcl: 0	Subgrp Size 1

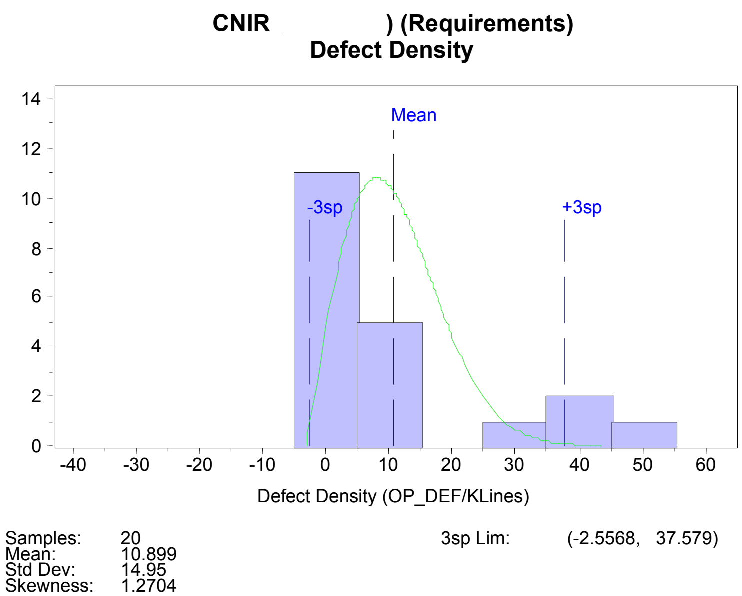
CNIR) (Requirements)
Product Size



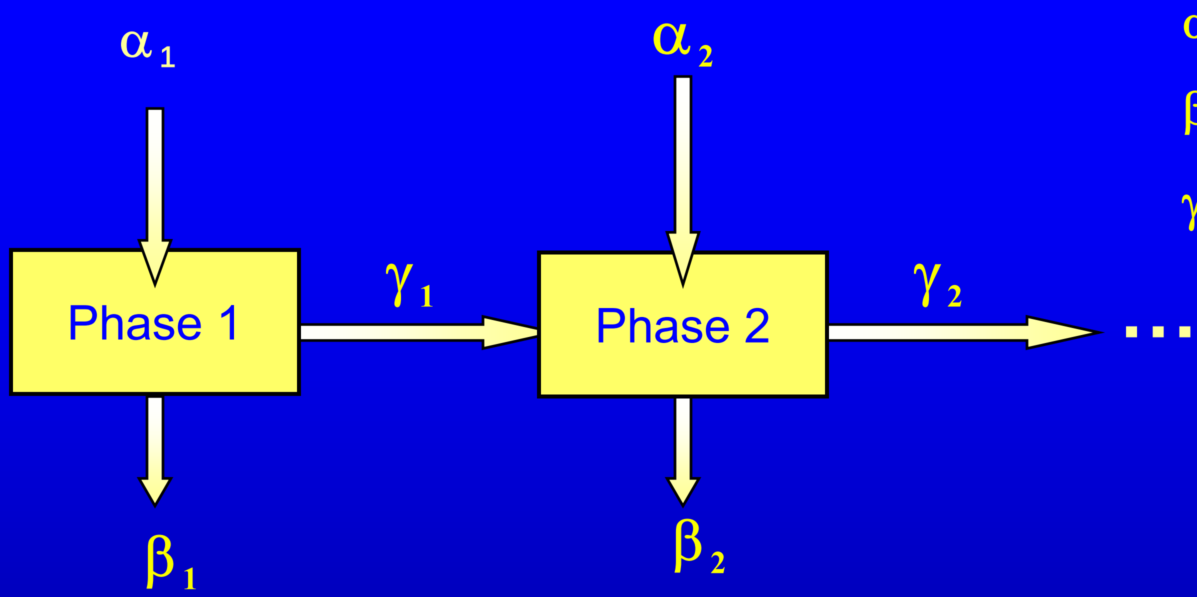
Samples:	20	3sp Lim:	(-291.2, 1021.2)
Mean:	365		
Std Dev:	218.73		
Skewness:	1.4814		

Causal Analysis





Defect Modeling



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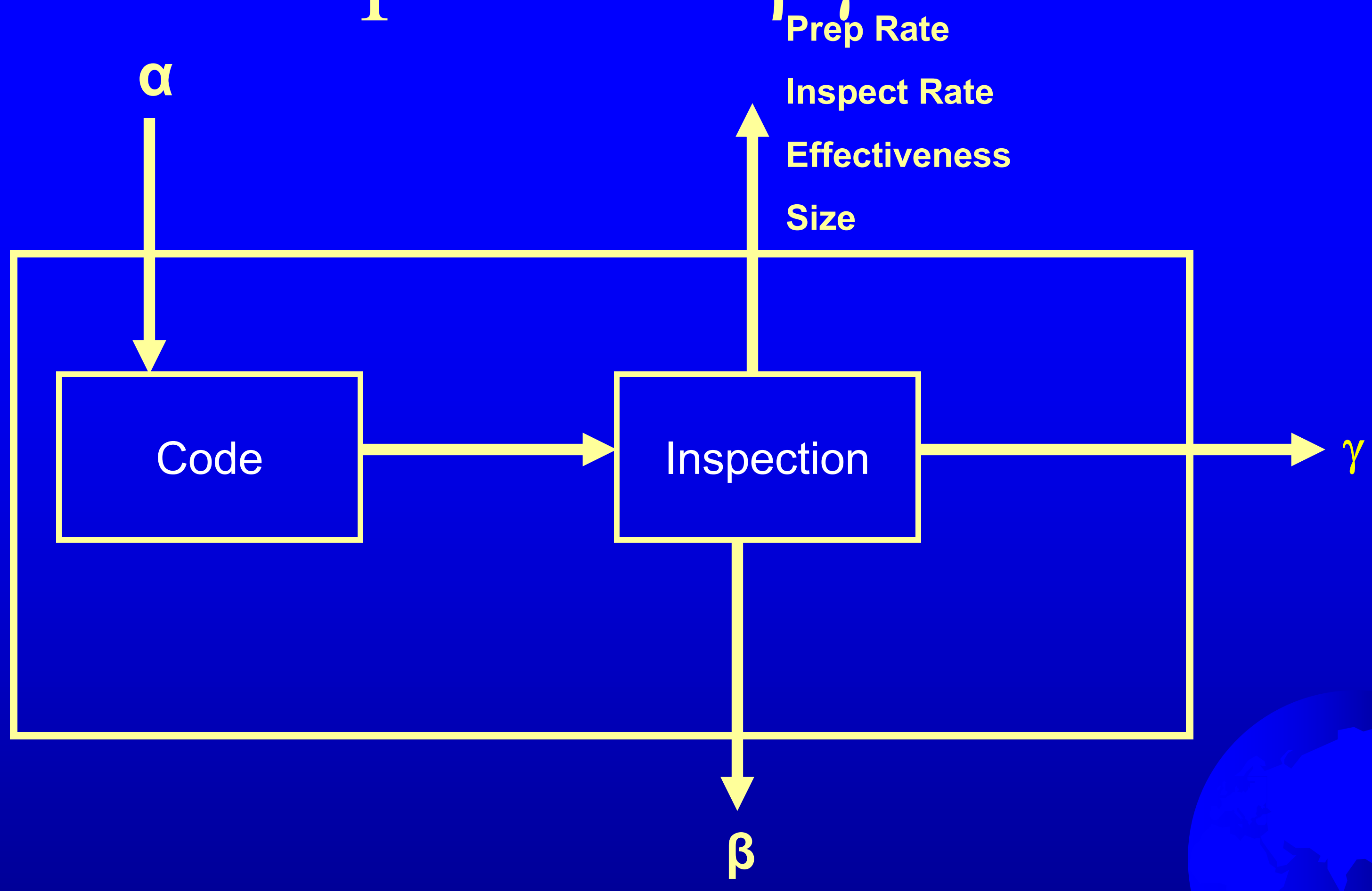
Expanded αβγ Chart



Defect Detection Methods

- “Peer Reviews”
  - Inspections (Fagan)
  - Structured Walk-Through
  - Active Reviews
- Modeling and Simulation
- Testing
  - Unit
  - Integration
  - Formal/ Sell-off
- Various Effectiveness in Methods

Sources of Defect

- Ambiguous Requirements
- Incomplete Analysis of Requirements
- Misunderstood Requirements
- Poor Design
  - No Flexibility
  - Too General
- Error in Coding
- Complexity
- Miss-execution
- COTS
- Open Source

Types of Defects

- Logic (Most Prevalent)
- Computation
- Interface
  - External
  - Internal
- Data

Acceptable Defect Levels

- Categories of Software:
  - Demonstration (Proof of Concept)
  - Windows
  - Military
  - DO-178B
    - 5 Categories f (affect of failure)
  - Manned Space Flight

- Level of latent defects permissible varies (Do not want to overkill; Too costly)

Defect Model (By the Numbers)

Know the Pedigree of Reused Code

Reused (Fielded)
Reused (Not Fielded)
Modified
New

0.2 Defects/ KSLOC

⋮

25 Defects/ KSLOC

What is the Defect Density? Not Simple

CNIR Defect Model

New Functionality

Phase	Insert	Detect
Requirements	46	37
Design	21	17
Coding	8	15
Test	0.2	$\leq$4.6
FQT	0.1	$\leq$2.5

CNIR #'s

CNIR Defect Model

Mod Functionality

Phase	Insert	Detect
Requirements	20	16
Design	21	17
Coding	5.8	10
Test	0.2	≤4.6
FQT	0.1	≤2.5

CNIR #'s

Defect Cost Example

10 K	**Reused** @ 0.2 Defects/ KSLOC	→	0.2 Defects
9 K	**Reused Prototype** @ 15 Defects/ KSLOC	→	30 Defects
7 K	**Modified Significant** @ 20 Defects/ KSLOC	→	40 Defects
5 K	**New** @ 25 Defects/ KSLOC	→	125 Defects

= 195.2 Total Defects

Therefore, 19.5 Defects/ KSLOC

Defect Cost Example (continued)

- 195 Defects in 9 KSLOC
  - @ 100% Fagan Coverage
    - → 45 Fagan Inspections
  - @ 20 Man Hours/ Inspection
    - → 900 Man Hours
  - Removing 156 Defects
    - 39 Defects Remaining
- 39 Defects
  - @ 20 Man Hours/ Defect
    - → 780 Man Hours
  - @ 40 Man Hours/ Defect
    - → 1,560 Man Hours

Total Cost: 1,880 – 2,460 Man Hour

Code/ Unit Test/ Integration

At 2 SLOC/ Man Hour, Total Cost = 4,500 Man Hours

Defect Cost Example (continued)

- 195 Defects in 9 KSLOC
  - @ 50% Fagan Coverage
    - ➔ 23 Fagan Inspections
  - @ 20 Man Hours/ Inspection
    - ➔ 460 Man Hours
  - Removing 62 Defects
    - 133 Defects Remaining

- 133 Defects
  - @ 20 Man Hours/ Defect
    - ➔ 2,660 Man Hours
  - @ 40 Man Hours/ Defect
    - ➔ 5,320 Man Hours

Total Cost: 3,120 - 5,780 Man Hours

Benefits of Method

- Quality of product is estimated quantitatively as components are created
  - Defects least costly to correct
- Systemic problems identified and steps taken to prevent repeating defects
- Additional defect detection activities can be added if deemed necessary

Conclusion

- Defect Modeling and Statistical Control of Quality provides the following advantages over the classical method
  - Technical Product Quality is objectively evaluated by personnel with domain knowledge using a formal proven approach
  - Estimate of defects remaining in product can be made throughout the product lifecycle
    - Corrective action can be taken early in the life cycle
      - Least costly to correct
  - The quality of the end product is known
    - Additional defect detection activities can be added if deemed necessary
  - Trend analysis of defects and root cause analysis can lead to proactively preventing future defects not only on the project, but throughout the organization

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Raytheon
Customer Success Is Our Mission

Using Classified Programs in CMMI Appraisals

Ken Weinberg
El Segundo, CA
kiweinberg@raytheon.com

November 17, 2005

Raytheon

Issues

- Not all appraisal team members cleared for program
- Appraisal team lead not cleared for program
- Classified artifacts cannot leave program area
- Appraisal Data Analysis tools not certified for use with classified data
- No electronic connection to the outside
- Electronic Media cannot leave closed area
- Written data must be screened to leave program area
- Cannot share data among programs with different security levels
- How is the organization able to improve its process based on analysis of lessons and issues from the programs, when the programs cannot share the information?
- Classified Areas must be stand alone compliant

Security cannot be compromised due to process or appraisal activities

Case Study 1

- Raytheon Space and Airborne Systems – El Segundo, CA, Dallas, Tx and Goleta, CA
  - Multiple Sites
  - Combination of Classified and Unclassified programs
  - Selected Appraisal team have clearances
  - External Lead Appraiser not cleared for classified programs

Case Study 2

- Raytheon Intelligence and Information Systems – Garland, Tx
  - Combination of Classified programs of various classifications
  - Appraisal team members have different levels of clearances
  - Most team members were not cleared for all programs.
  - External Lead Appraiser not cleared for classified programs

Lessons Learned

- Management not in Control
- Each Classified Area is unique unto itself
- Appraisal mini-teams must cover all PA's within each classification
- Observations must pass program security process to be released. Appraisers must be aware of security guidelines so they discuss issues generically to avoid sensitive items
- Preferable method is where team leads, and all team members are cleared for all classified areas within the Appraisal scope.

With proper planning, Classified programs can make successful appraisal programs

Team Issues

- Not all appraisal team members cleared for program
- Some members cleared for some programs and not others
- Appraisal team lead not cleared for program

Data Transfer

- Classified artifacts cannot leave program area
- Electronic Media cannot leave closed area
- Written data must be screened to leave program area
- Cannot share data among programs with different security levels

Tools

- Appraisal Data Analysis tools not certified for use with classified data
- No electronic connection to the outside

Benefits

- Classified programs cannot hide from “Process”
- Appraisals can cover more of the organization
- Process improvement is more universal
- Bidding/proposal data are more accurate

Raytheon

Questions ? ? ?

Critical Path SCAMPI℠

Getting Real Business Results from Appraisals

NATURAL SPI

SEI Partner

What You Will Get

What Is a SCAMPI?

A SCAMPI appraisal is (or should be):

- Based on the appraised organization's business performance and process improvement goals
- A defined method by which an organization objectively measures its process capability and/or organizational maturity against the CMMI
- A method for identifying an organization's process strengths and weaknesses
- A method for identifying an organization's risks to software or systems delivery
- Based on the evaluation and comparison of evidence with the intent of CMMI goals and practices
- A predictable and measurable process consistent with the ARC[1], the SCAMPI MDD[2] and the SCAMPI B & C Handbook[3]

What Is Not a SCAMPI?

These activities are sometimes called a "SCAMPI," but they are provably not SCAMPIs:

- A bunch of "experts" showing up unannounced and asking questions about your processes and then passing judgment on your organization
- Activities performed without a documented plan
- Activities that do not yield physical outputs or results
- The selling of a maturity or process capability level
- Things called "SCAMPI-like" or "kind of like a SCAMPI"
- Activities that do not provably comply with the ARC, SCAMPI MDD or the SCAMPI B and SCAMPI C Handbook

What a SCAMPI Can Do

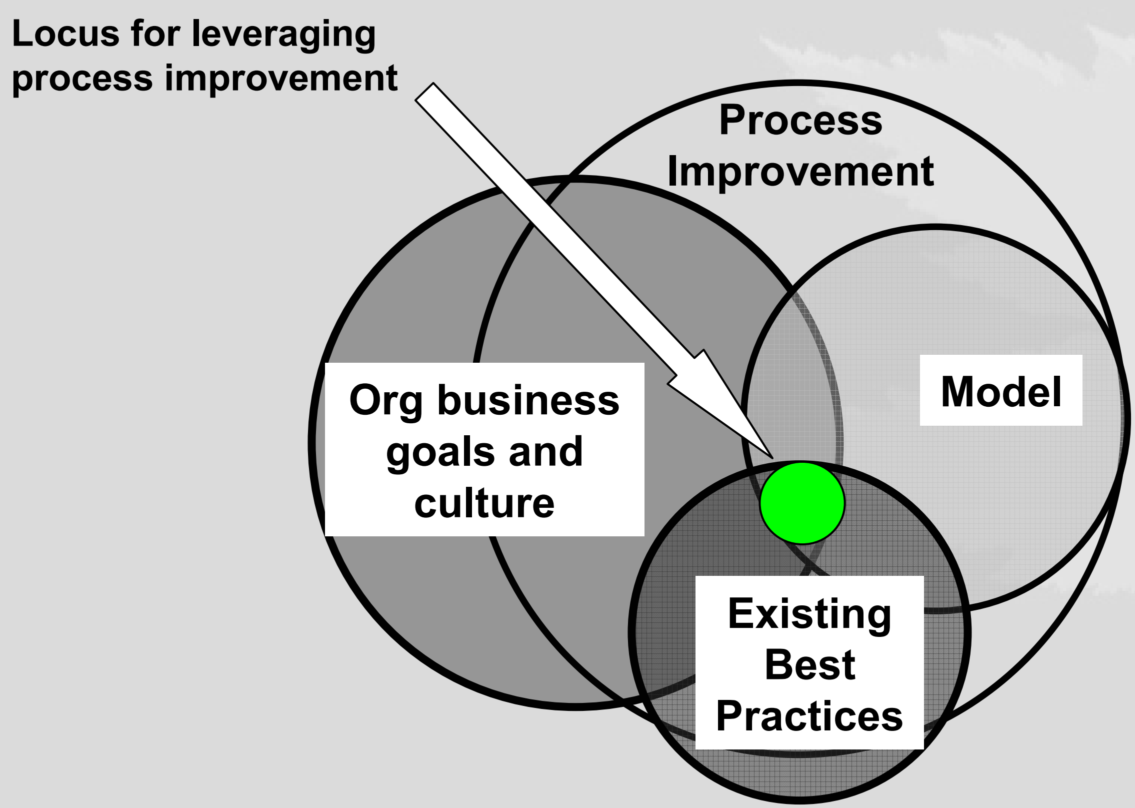
There are 4 things a SCAMPI can do:

- Objectively determine the process strengths and weaknesses against the CMMI, so that the organization knows where to focus future improvements, and/or
- Determine whether the organization has achieved a targeted maturity and/or process capability level, and/or
- Serve as a catalyst and motivator for the next phase of process improvement
- Find and quantify risks to systems or service delivery (as in acquisition risks)

Organizations care about maturity or capability levels because:

- It is perceived to give the organization credibility in software and systems delivery and helps increase their market share, and
- Gives the organization a benchmark for improving productivity, quality, and predictability.

What A SCAMPI Can Do:
Finding the starting point for process improvement



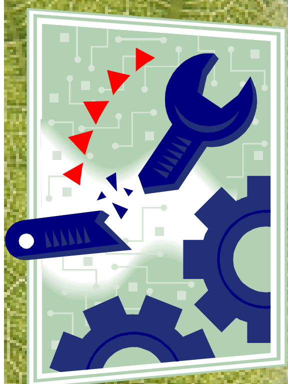
Things a SCAMPI Cannot Do:

Why Organizations Erroneously Conduct SCAMPIs

A SCAMPI appraisal cannot …

- Yield information about an organization’s future performance in software or systems delivery
- Indicate anything about the quality, effectiveness, or efficiency of an organization’s processes
- Provide results that are consistent with other SCAMPI appraisals
- Identify all the risks to an organization’s software, systems, or service delivery
- Indicate anything about customer satisfaction, employee satisfaction, profitability, resource management, market share, innovation … success

Problem Definition:
What is Wrong with CMMI Appraisals?

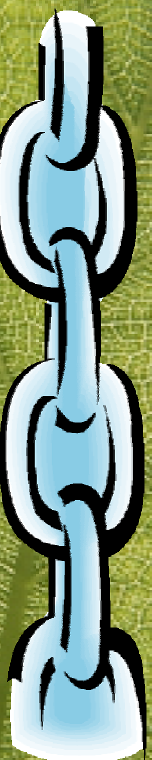


There are two main reasons why you're not getting what you want from SCAMPIs:

1. The focus is usually on finding CMMI coverage and compliance, not finding risks to software, systems, or service delivery.
2. SCAMPI results are not comparable because no one verifies the appraisal methodologies are followed … there is no industry quality assurance of appraisals.

Both these factors are causing the systemic, industry-wide problem of maturity and capability level devaluation.

The Critical Path SCAMPI



The Critical Path (CP) SCAMPI is designed and implemented to yield actionable business information while simultaneously minimizing appraisal effort, cost, and schedule.

The CP SCAMPI accomplishes this business result by narrowly defining the scope of the appraisal to target specific appraisal goals and information needs.

The CP SCAMPI provably satisfies the appropriate level of Appraisal Requirements for the CMMI (ARC).

Critical Path SCAMPI Key Attributes

The key attributes and features of the CP SCAMPI are:

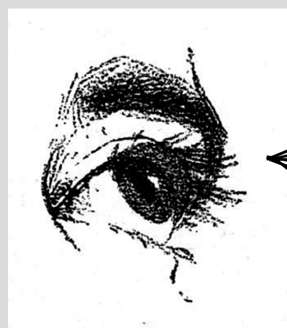
- ☑ Appraisal goals define very specific management information needs
- ☑ Appraisal organization and Model scope are narrowly defined
- ☑ Appraisal effort and cost are heavily front-loaded to planning and preparation (up to 50% of total)
- ☑ Traceability between appraisal Model scope and organization documents is defined in advance (no discovery)
- ☑ Target documents are acquired prior to start of appraisal on-site activities
- ☑ Team training exercises use real PIID characterization so that team learning also produces results
- ☑ SCAMPI is planned and managed as a project; progress and performance is measured against plans

The Critical Path SCAMPI Approach

At the core of a CP SCAMPI, appraisal goals and targeted results are tightly linked to "threads" in the CMMI. For example:

Appraisal Goal:
How reliable are the contractor's effort and cost estimates for developing software?

Appraisal Focus



CMMI Thread

- **REQM SP1.4**
- **PP SP1.2**
- **PP SP1.4**
- **PP GP2.2**
- **PP GP2.8**
- **PP GP3.2**
- **MA**

Defining Appraisal Goals

The most critical component of a successful CP SCAMPI is defining the appraisal goals and information needs. Be very clear about the targeted results and what will be done with that information.

Typical SCAMPI Goals

- Determine capability level
- Determine maturity level

CP SCAMPI Goals

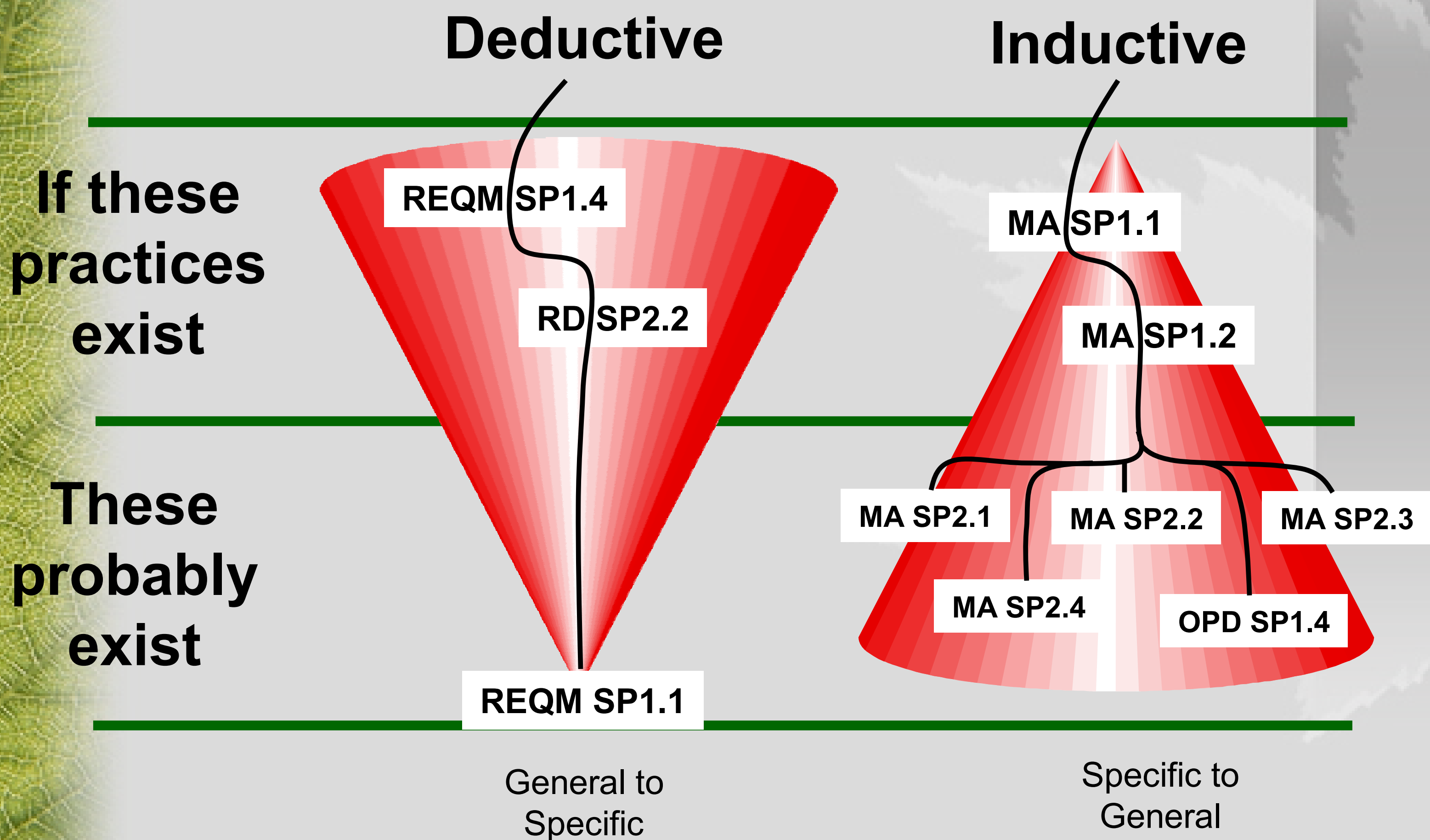
- How accurate are the organization's estimates and plans?
- Determine risks introduced in project planning
- Determine ability to manage project and technical risks
- How compatible are the subcontractor's processes with ours?
- What are the organization's standard deviations in SPI, CPI, and EV?

Narrowly Focused SCAMPI Model Scope

The Model scope for a SCAMPI should be driven by the appraisal goals and information needs. CP SCAMPIs drill down deep but not wide using **deductive and inductive reasoning** to define a CMMI thread to be pursued by the appraisal team.

Typical SCAMPI CMMI Scope | **CP SCAMPI CMMI Scope**

Pursuing CMMI Threads Through Logic



Pursuing CMMI Threads Through Logic

Sample Deductive CMMI Thread: Risk planning

Appraisal Team drills down on:	RSKM SP 1.1	Determine risk sources and categories
And then deduces:	RSKM SP 2.1	Identify risks
	PP SP 2.2	Identify project risks

Deductive Reasoning: A project can identify risks without having historical risks sources and categories. But the only reason an organization would go through the trouble of compiling and organizing risk sources and categories would be to serve as a source for project risk identification and analysis.

Pursuing CMMI Threads Through Logic

Sample Inductive CMMI Thread: Requirements validation

Appraisal Team drills down on:

RD SP 3.5	Validate requirements with comprehensive methods

And then induces:

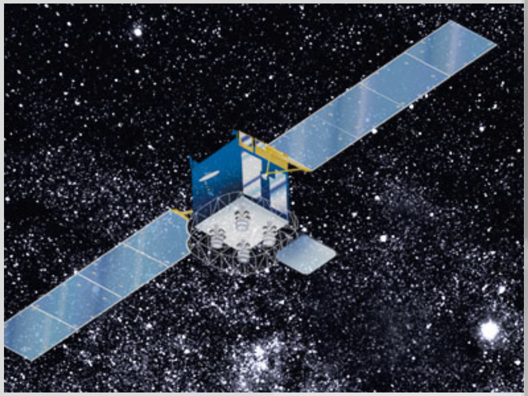
REQM SP 1.4	Maintain bi-directional traceability of requirements
RD SP 2.3	Identify interface requirements
RD SP 3.1	Establish operational concepts and scenarios
RD SP 3.2	Establish a definition of required functionality

Inductive Reasoning: It is reasonable to induce that if a program/project is able to comprehensively validate requirements, then it has also defined the requirements' functionality (RD SP3.2-1), developed operational concepts/scenarios, use cases, prototypes (RD SP3.1-1), identified the interface requirements (RD SP2.3-1), and that the requirements have been analyzed using some or most of these derivative work products.

A CP SCAMPI Success Story

Success!

Major space acquisition program office needed to know how reliable were the contractors' software effort, cost, and schedule estimates.



Performed CP SCAMPI that:

- Pursued goal-based focus to drill down on PP SP1.2 and measures (MA for PP)
- Through deduction, determined that software effort and cost estimates (PP SP1.4) were very accurate and reliable
- Also determined that budget and schedule estimates (PP SP2.1) were also accurate
- Gave Program Management assurance and confidence in contractor's software estimates

But What About Problem 2 …

OK, CP SCAMPI might answer the problem with SCAMPI's focused on the wrong things, but what about quality assurance for SCAMPI appraisal?

ARC Traceability Question

Appendix D, ARC/MDD Traceability Table in the SCAMPI Method Definition Document (MDD) traces SCAMPI MDD processes and activities to ARC requirements.

But how do you know the SCAMPIs you're paying for are conducted in accordance with the SCAMPI MDD or SCAMP B and C Handbook?

ARC Traceability Answer

Verify that in the performance of a SCAMPI, there are activities and/or work products that trace back to the ARC, SCAMPI MDD, or SCAMPI B and C Handbook.

Appraisal Requirements for CMMI: Data Consolidation and Validation

Requirement ID	Requirement Description	Lowest Class	Requirement Traceability / Satisfaction	Requirement Satisfied?
4.5	Data Consolidation and Validation			
4.5.1	The method shall require appraisal team consensus in decisions when determining the validity of observations, creating findings, and establishing ratings.	B	Consensus was covered during training. All practice and goal ratings were completed by consensus	Yes
4.5.2	The method shall require a mechanism for consolidating the data collected during an ...ccording to the following criteria:			
4.5.2	...ective evidence seen or heard during data			
4.5.2	...ased without attribution, and expressed in terminolo... used at the organizational unit.			
4.5.2.c	The obse...ation is relevant to the appraisal reference model and can be associated with a specifi... model component.	C	Controlled by ma...ing to a specific SP, GP i... he PIID mapping tool	Yes
4.5.3	The method shall require a mechanism for validating each accurate observation according to the following criteria:			
4.5.3.a	The observation is corroborated.	B	Required at least 2 sources (at least 1 direct and 1 indirect evidence) for each mapping for each project - documented in	Yes

ARC Requirement

SCAMPI Activity or Work Product

How You Can Determine the Future of CMMI Appraisals

Many of you are acquirers or suppliers of SCAMPIs and CMMI appraisals. You don't have to be victims of an unregulated industry.

Things you can do to increase the value of CMMI appraisals and their results:

1. As acquirers, change your RFIs/RFPs to request historical project, process, and product performance measures, not just capability or maturity levels.
2. Make sure the goals for your appraisal specifically define what you really want for results.
3. Ask your lead appraiser to prove – not just claim – that what you're paying for is a SCAMPI or ARC-compliant appraisal.

References

1. Appraisal Requirements for CMMI[SM] (ARC), V1.1; CMU/SEI-2001-TR-34. Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2001.

2. Standard CMMI Appraisal Method for Process Improvement (SCAMPI[SM]), V1.1: Method Definition Document (MDD); CMU/SEI-2001-TR-34. Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2001.

3. Standard CMMI Appraisal Method for Process Improvement (SCAMPI): Handbook for Conducting SCAMPI B and SCAMPI C Appraisals; CMU/SEI-2001-TR-34. Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2004.

4. Natural SPI SCAMPI[SM] Overview, Copyright 2004-2005 Natural SPI Inc.

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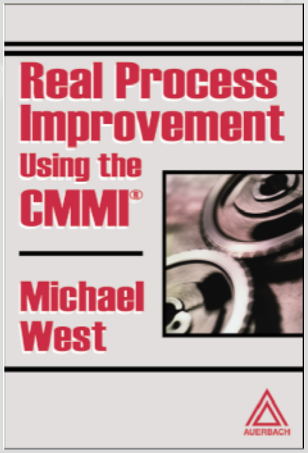


Questions?

5th Annual CMMI Technology Conference & User Group

Space and Missile Systems Center

Process Improvement

14-17 November 2005

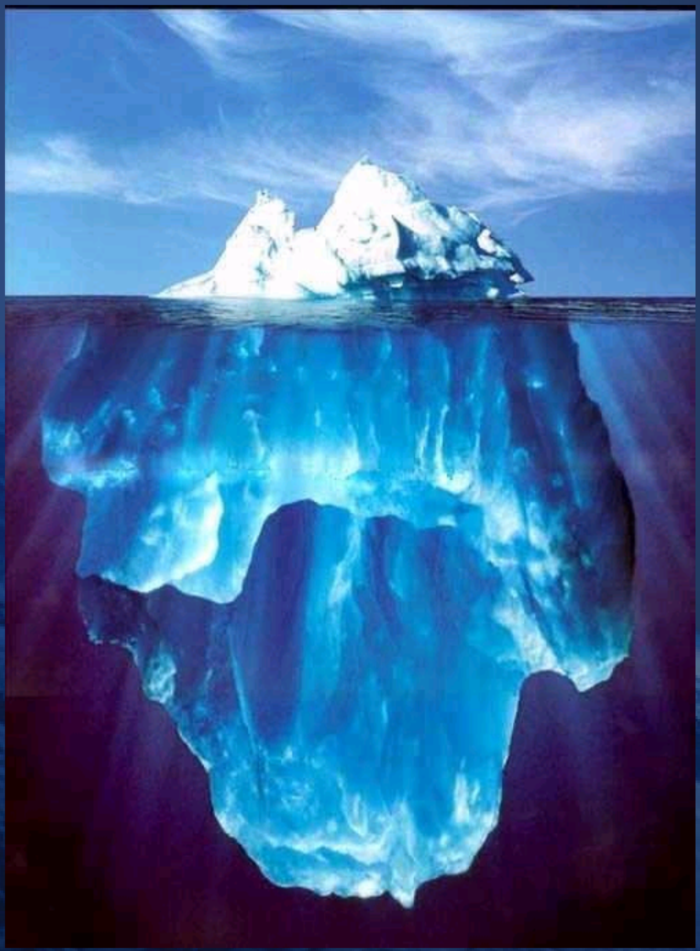
Los Angeles AFB, CA

Keith Wright
Howard Hayden

Outline

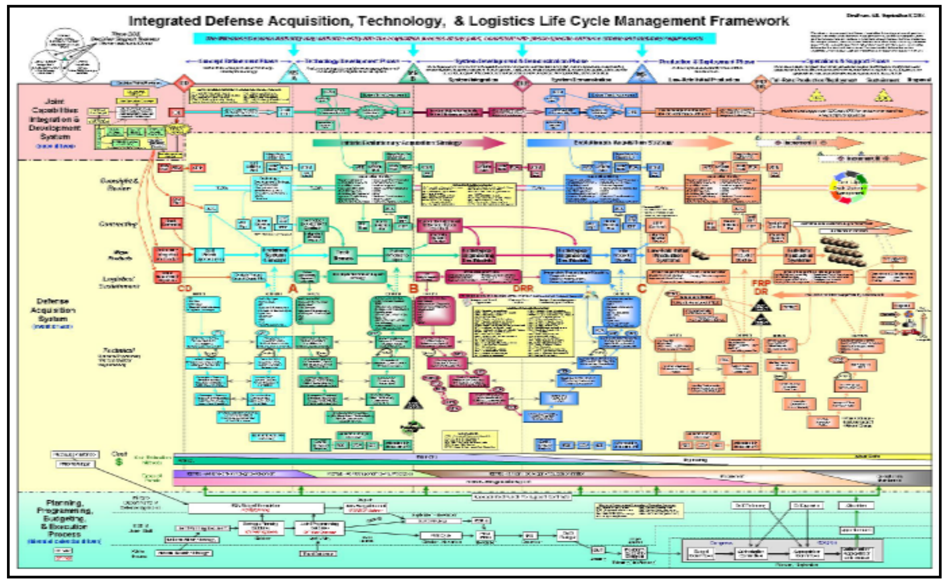
- Background – the Acquisition Problem
- Tailored CMMI® Model for Acquisition
- Appraisal Process for Benchmarking
- The NASA Experience
- Results and Process Improvements
- Lessons Learned
- Summary

The Problem



Background – the Acquisition Problem

- **In 2003 after a decade of DoD acquisition reform, space policy changes, and constrained budgets there were serious programmatic and technical issues in space acquisition**
  - Reduced Air Force program office staffs
  - Shift of total system performance responsibility to prime contractors
  - Limited government programmatic insight and oversight
  - Increasingly more complex programs with cost/schedule growth



- **The 2003 National Security Space Acquisition Policy 03-01**
  - *"Robust SE is essential to the success of any program. Program offices must focus attention on the application of SE principles and practices throughout the system life cycle."*

SMC Process Assessment Strategy

- **Air Force Space and Missile Systems Center (SMC) at Los Angeles AFB, CA launched a proactive *Systems Engineering Revitalization (SER)* initiative to renew SMC's commitment to world class systems engineering and restore program management excellence**
- **SMC Commander directed the Center to:**
  - "Establish status of process knowledge and implementation within various SMC SPOs (process baselining)"
  - Evaluate which processes need improvement and make suggestions for implementing process improvement
  - Support/complement with data from a variety of program reviews to achieve "revitalization" goals
- **The Capability Maturity Model Integration (CMMI®) framework was selected to baseline SMC processes**
  - A Defense Industry-wide accepted method for process appraisal and improvement

SMC Process Assessment Approach

- **Baseline the current process capabilities of program offices**
  - Appraisals to focus on ***SPO process existence and use***
    - Not to be an appraisal of product quality
  - To assess status of process institutionalization
    - Not a report card on personnel
  - To identify strengths and weaknesses of processes compared to SMC-CMMI-A Model - ***No numerical program ratings***
  - To capture the Center's ***Best Practices***
    - Not to require significant program office resources

- **Formed an SMC Product Development and Appraisal Team of trained appraisers with extensive space program experience:**
  - Systems Acquisition Directorate (SMC/AX) – team leadership
  - Software Engineering Institute (SEI)
  - Aerospace Corporation
  - SETA Contractors

CMMI-A Complements Integrated Reviews

SMC-CMMI-A

An Early Acquisition Model

Process Improvement

A CMMI® Acquisition Model Was Needed

- **No CMMI® acquisition model was available at the time**
- **CMMI® and SA-CMM® Models were adapted for SMC processes**
  - **CMMI® did not cover government acquisition sufficiently**
    - Selected Process Areas were adopted (11 of 25)
    - Practices were added from the Software Acquisition CMM® (SA-CMM®) for SE & PM
  - **Some terminology was changed to more recognizable language**
    - E.g., "project" to "program", "supplier" to "contractor / vendor"
  - **Simplified the generic practices**
- **"Specialty engineering" disciplines critical to space systems were added to supplement what the model didn't address**

EMI / EMC	**Manufacturing**	**Safety**
Human Factors Engineering	**Parts, Materials, Processes**	**Software Engineering**
Integrated Logistics Support	**Quality Assurance**	**Survivability**
Mass Properties	**Rel/Maint/Avail**	**Test & Evaluation**

- **Adapted CMMI® Class B Appraisal Requirements for the acquisition organization**
  - **Four levels of practice implementation (FI, PI, NI, NA)**
  - **A Managed (Level 2) organization was targeted**

5 Optimizing
4 Quantitatively Managed
3 Defined (Qualitative)
2 Managed
1 Performed
0 Incomplete

Additions from SA-CMM®

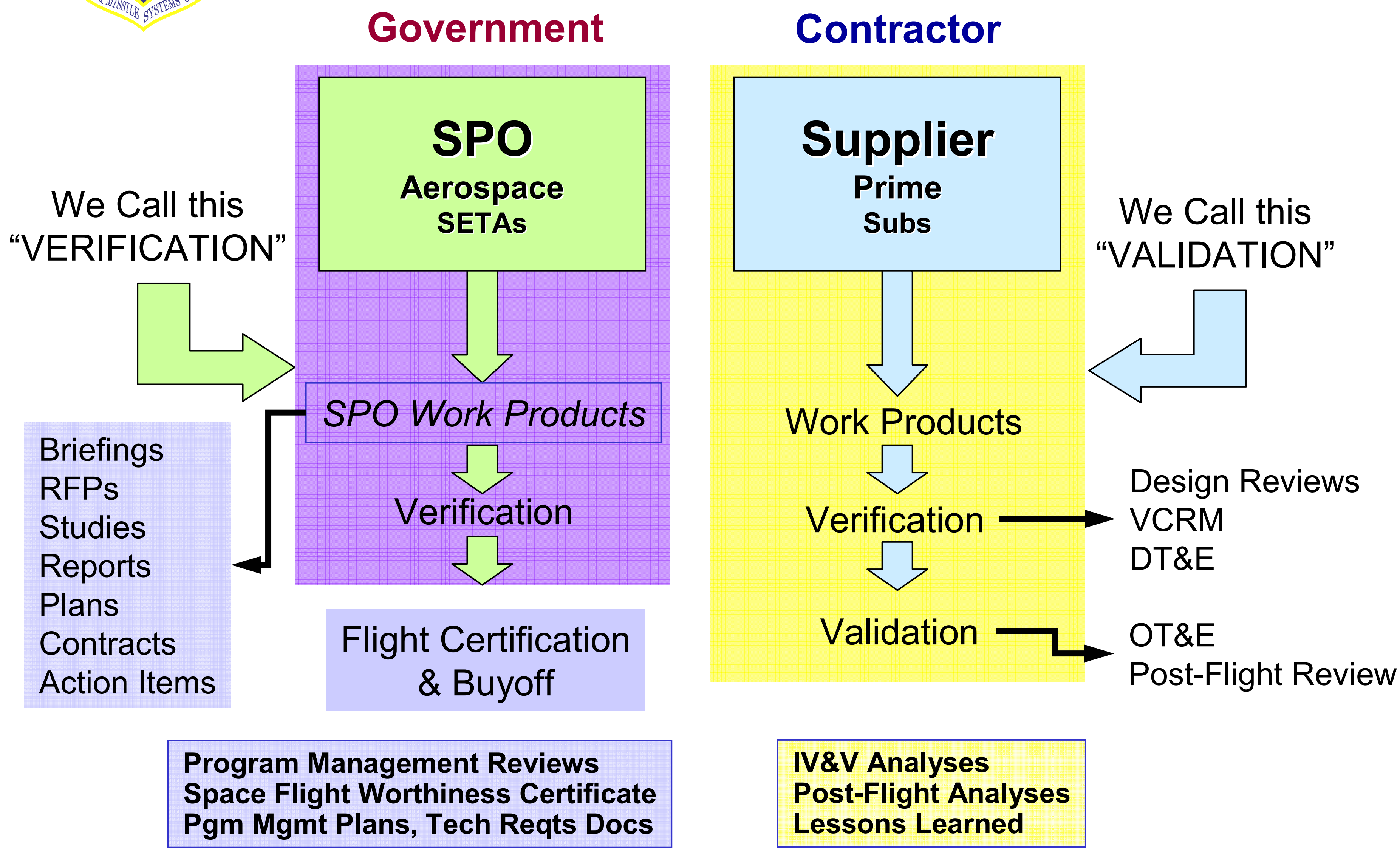
Augmented CMMI® Process Areas	Activity Additions from SA-CMM®
• Project Planning • Project Monitoring and Control	• Acquisition Strategy • Operations and Sustainment
• Contractor / Vendor Management (Supplier Agreement Management) (Integrated Supplier Management)	• Solicitation • Contract Tracking and Oversight
• Requirements Development	• Develop Verification Requirements
• Requirements Management	• Baseline Requirements and Analyze Changes for Impacts
• Risk Management	• Report Status of Identified Risks

The SMC CMMI-A Model

- **Began with 101 specific practices across 11 Process Areas**
  - **Program Planning (16)**
  - **Program Management (11)**
  - **Risk Management (8)**
  - **Contractor / Vendor Management (16)**
    - **Solicitation preparation and evaluation**
    - **Contract tracking and oversight**
  - **Requirements Development (13)**
  - **Requirements Management (6)**
  - **Verification (6)** *(of SPO products)*
  - **Validation (5)**
  - **Configuration Management (7)** *(of SPO products)*
  - **Decision Analysis and Resolution (6)**
  - **Organizational Training (7)**
  - **Integrated Teaming (7)**
  - **Technical Solution (2)**
  - **Product Integration (6)**
  - **Causal Analysis & Resolution (5)**

Process Areas added for NASA appraisals

Verification and Validation – A Distinction



*Process Implementation Characteristics**

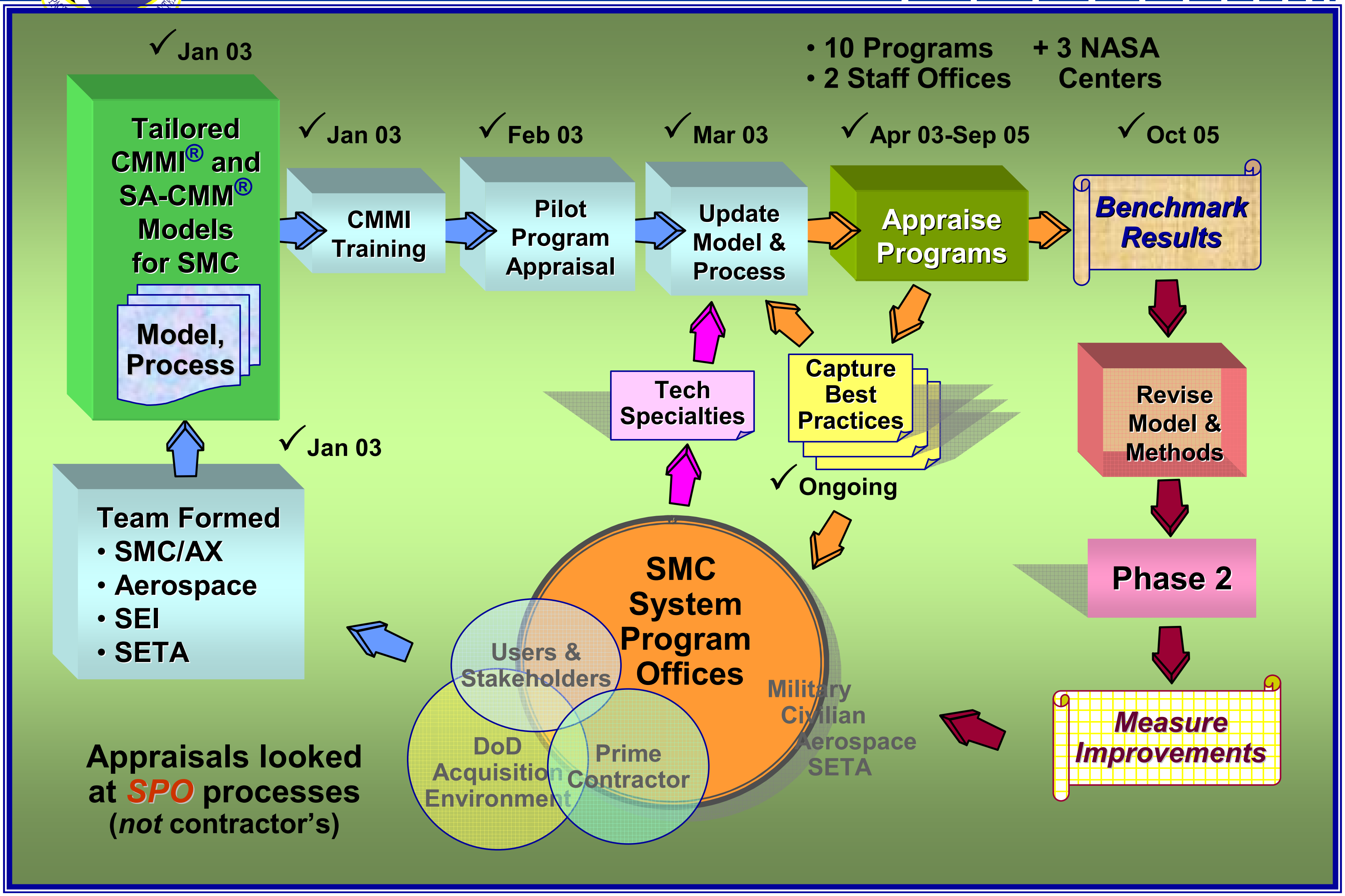
- **Do processes exist?**
- **Are they used?**
- **Are they documented?**
- **Do others know about them?**
- **Are they reviewed by management?**
- **Are there adequate resources to perform the processes?**
- **Is there process training?**

*** SMC Adaptation of SEI CMMI® Generic Goals and Practices***

The Appraisal Process

Process Improvement

SMC Appraisal Process



Appraisal Products

Process

Products

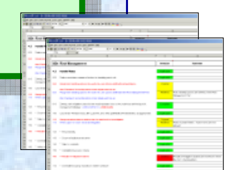
SPO Interviews and Document Review

SMC Specialty Discipline Appraisal

CMMI-A Process Area Appraisal

Detailed Specialty Discipline Status (Spreadsheets)

Detailed Program Process Area Status (Spreadsheets)

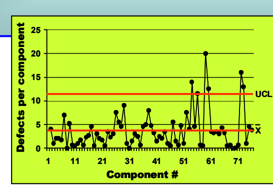


SPO Outbrief

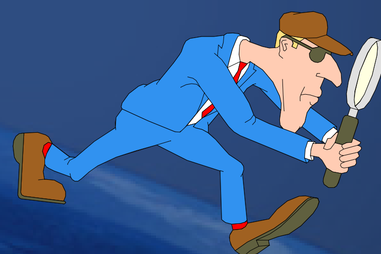
- Best Practices
  - Strengths
  - Weaknesses
    - Recommendations

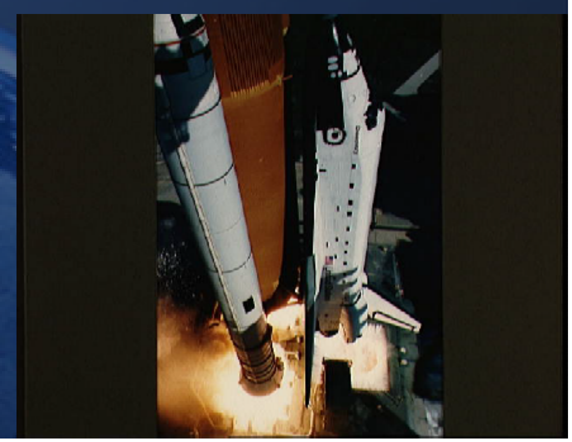
SMC Composite Results

- Best Practices
- Statistics
  - Processes
  - Specialties



The NASA Experience





NASA Return to Flight Support

- **Columbia Accident Investigation Board (CAIB) Report cites the Aerospace Corporation's Launch Verification Process as an independent safety program that should be considered**

- **NASA requests appraisals of the JSC, KSC, and MSFC centers' Systems Engineering & Integration Office similar to the appraisals for SMC**
  - Added key AF appraisal team members to an Aerospace team
  - Modified and used the SMC CMMI-A model to be more "operational"
    - Added Integrated Teaming, Technical Solution, Product Integration, Causal Analysis & Resolution

- **NASA asks for *process improvement recommendations***

Lessons Learned

- **Best Practices were shared between the two organizations**

- **The NASA appraisals reinforced SMC's original thought to include these PAs in its model:**
  - Technical Solutions
  - Product Integration
  - Integrated Teaming

- **Improvement recommendations became a standard appraisal product**
  - They are prioritized and actionable
  - Sample documented processes are provided

AF Results and Process Improvements

Process Improvement

Processes Appraised

Process Categories and Areas:

Engineering

- Requirements Development (RD)
- Requirements Management (RM)
- Technical Solution (TS)
- Product Integration (PI)
- Verification (of SPO products) (VER)
- Validation (of system) (VAL)

Support

- Configuration Management (CM)
- Decision Analysis & Resolution (DAR)

Process Categories and Areas:

Project Management

- Program Planning (PP)*
- Program Management (PM)*
- Contractor / Vendor Management (CVM)*
- Risk Management (RiM)
- Integrated Teaming (IT)

Organizational Process Management

- Organizational Training (OT)

116 practices across 14 process areas

SMC Technical Specialties Surveyed

EMI / EMC	Quality Assurance
Human Factors Engineering	RMA
Integrated Logistics Support	Safety
Mass Properties	Software Engineering
Manufacturing	Survivability
Parts, Materials, & Processes	Test & Evaluation

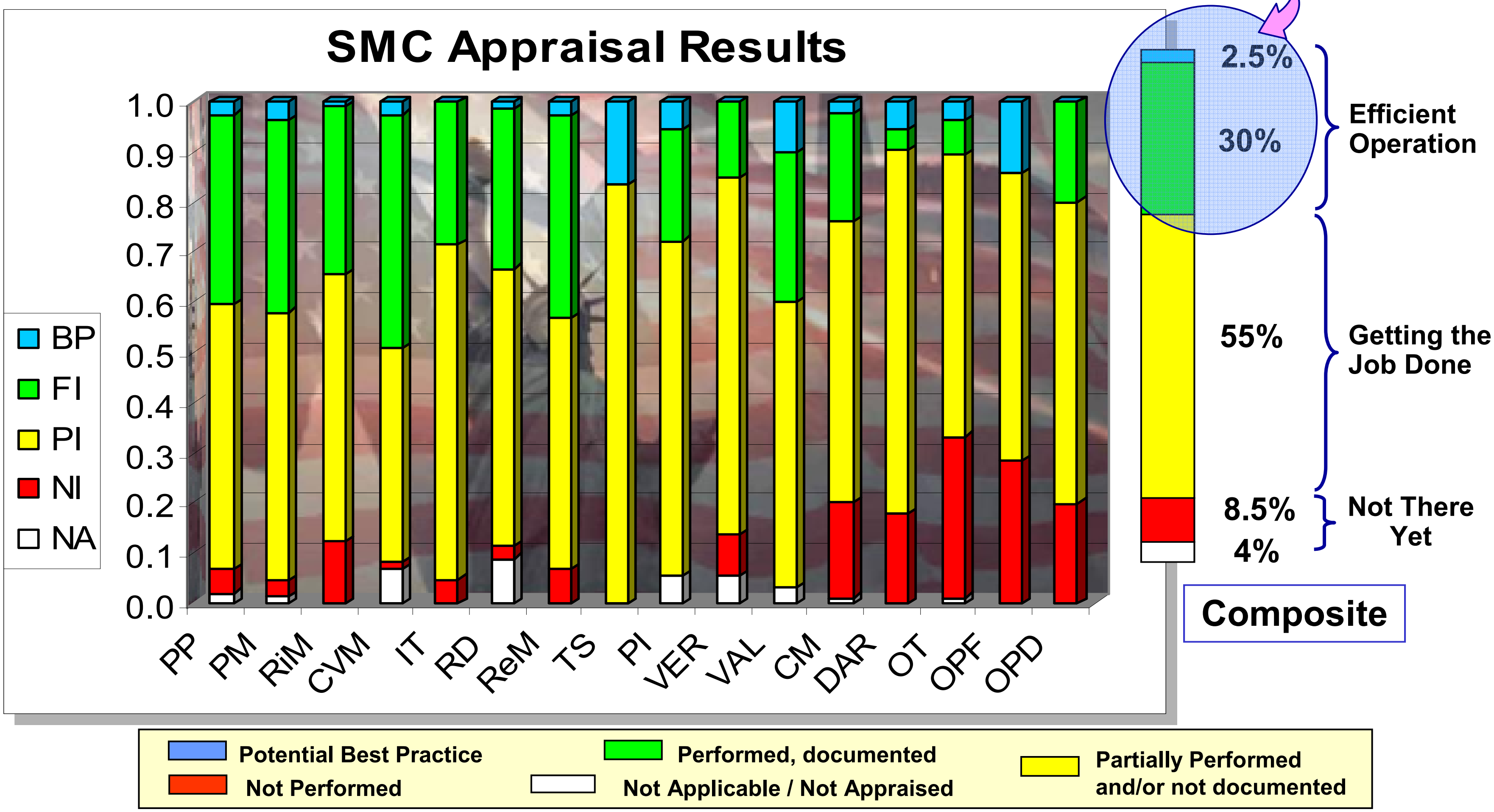
* Revised names

Rules for Practice Implementation

- **Best Practice (BP)**
  - Potential for SMC-wide sharing
- **Fully Implemented (FI)**
  1. The practice is performed with no substantial weaknesses
  2. The practice must be documented, used and known
  3. At least two pieces of objective evidence exist (documents and/or interviews)
- **Partially Implemented (PI) - (weaknesses found)**
  - The practice is at least minimally performed but not sufficiently documented or known
- **Not Implemented (NI) - (weaknesses found)**
  - No significant aspect(s) of the practice is/are implemented
- **Not Applicable (NA)**
  - The practice does not apply to this (phase of the) program

Results to Date

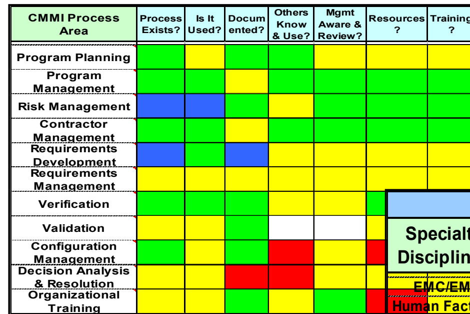
- 12 Programs and Staff Offices Have Been Appraised
- Nearly 40 "Best Practices" Identified
- About One-Third of Practices are Fully Performed



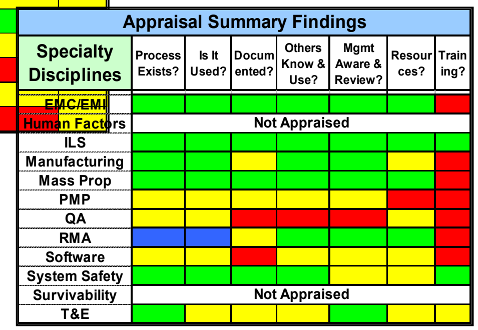
Results Are Provided to and Owned by the Program Managers

- **Actionable results**
  - Owned by the SPD/PM
  - Observations not attributed
  - Recommendations
- **Process area findings**
  - Best Practices
  - Strengths & Weaknesses
- **Personnel feedback**

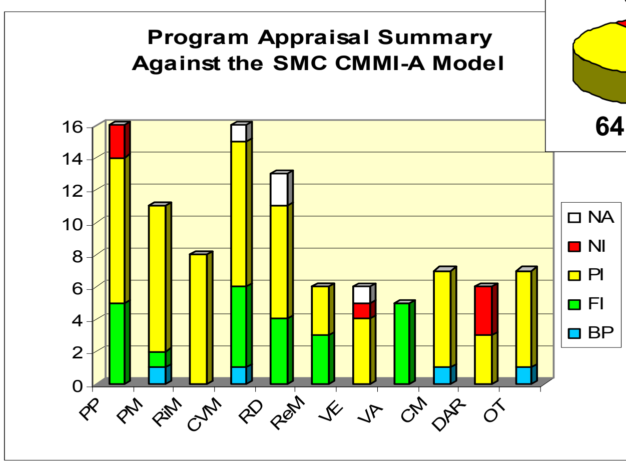
Process Results

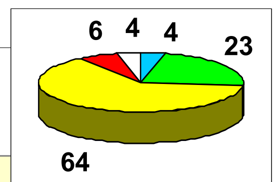


Technical Specialties

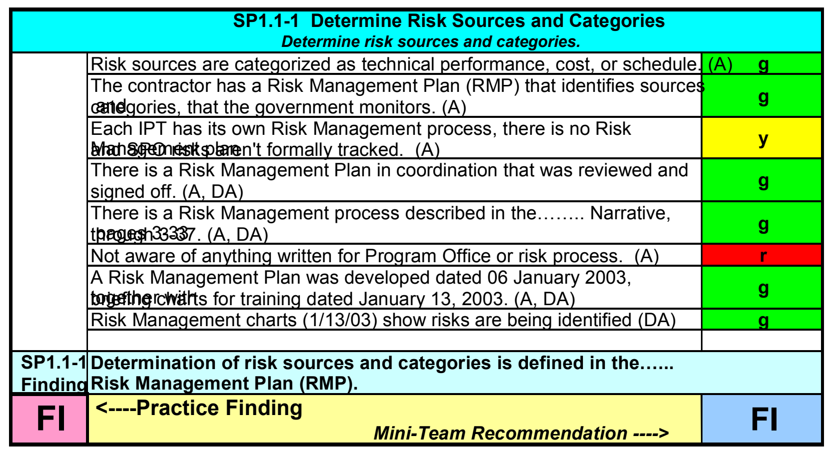


Statistics





Detailed Data



SP1.1-1 Determine Risk Sources and Categories *Determine risk sources and categories.*		
	Risk sources are categorized as technical performance, cost, or schedule. (A)	g
	The contractor has a Risk Management Plan (RMP) that identifies sources and categories, that the government monitors. (A)	g
	Each IPT has its own Risk Management process, there is no Risk Management plan and SPO risks aren't formally tracked. (A)	y
	There is a Risk Management Plan in coordination that was reviewed and signed off. (A, DA)	g
	There is a Risk Management process described in the........ Narrative, through page 3337. (A, DA)	g
	Not aware of anything written for Program Office or risk process. (A)	r
	A Risk Management Plan was developed dated 06 January 2003, together with briefing charts for training dated January 13, 2003. (A, DA)	g
	Risk Management charts (1/13/03) show risks are being identified (DA)	g
SP1.1-1 Finding	**Determination of risk sources and categories is defined in the...... Risk Management Plan (RMP).**	
FI	**<----Practice Finding** ***Mini-Team Recommendation ---->***	**FI**

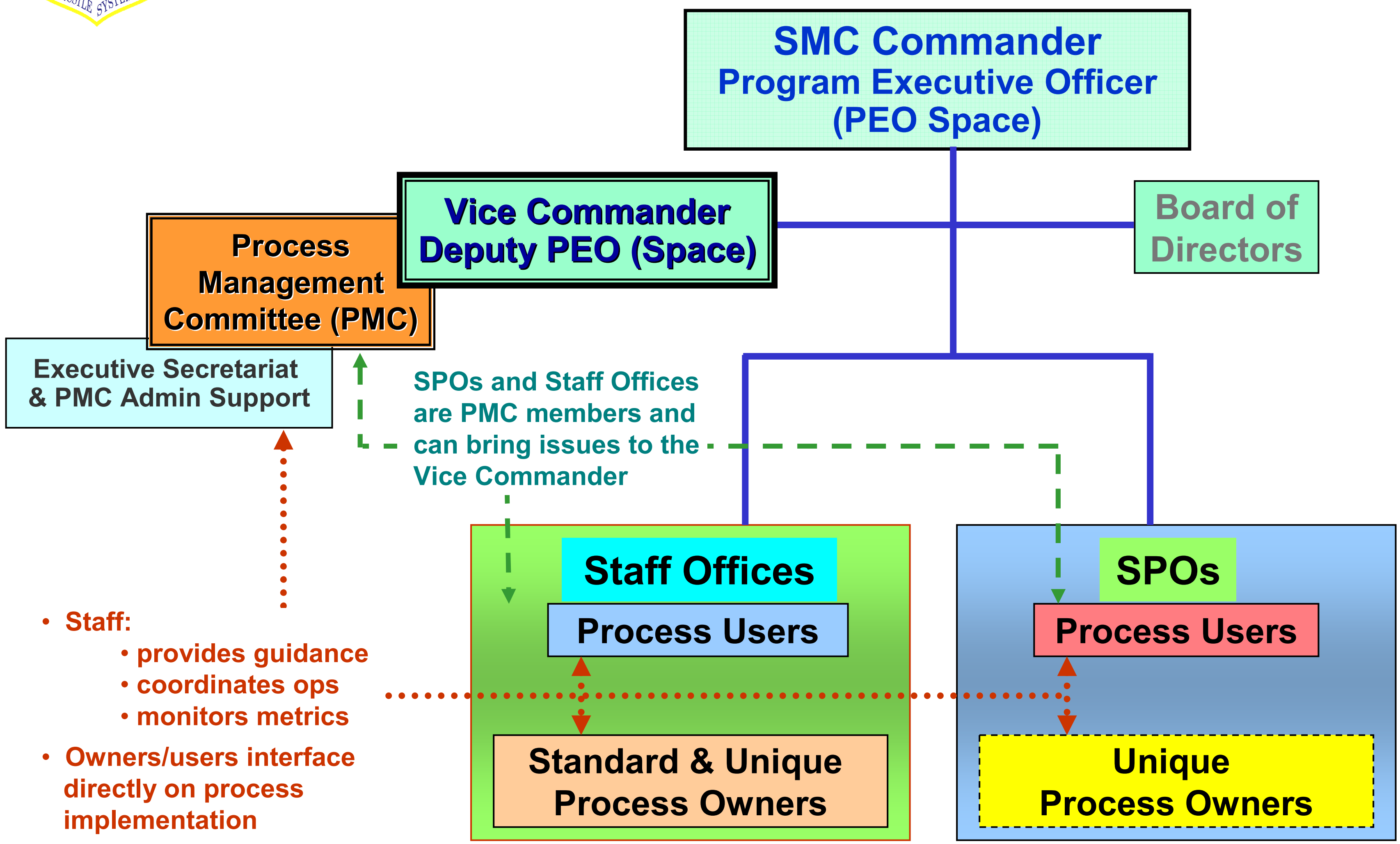
SMC Process Policy Guidance Established

- ***SMC Vision*** **– continue as the Center of Excellence for space and missile systems acquisition by producing quality products and capabilities for our warfighters and nation on time and at cost**

- **A Commander's Policy was published that directs process improvement implementation**
  - Effective use of ***documented processes*** is key

- **Established a *Process Management Committee* to ensure smooth transformation of the Center to process centric operations**
  - Chaired by the Deputy Commander
  - All programs and staff offices are members
  - Center Best Practices are being captured and made available

Process Improvement Structure



Standard Processes have Center-wide application
Unique processes apply only to the specific program or office

Lessons Learned

Process Improvement

Lessons Learned

- **<u>Expectations</u> (2003)**
  – SPOs would be skeptical
  – SPOs would be uncooperative
  – 24 appraisals in 18 months
  – We could get direct artifacts to review well in advance
- **<u>Reality</u> (2005)**
  – Skepticism became enthusiasm
  – SPOs requested appraisals
  – 12 appraisals in 30 months
  – Discovery was how we had to do it (and it was tough)

- **It is essential to have a knowledgeable SPO point of contact to:**
  – Coordinate and schedule interviews
  – Help locate documentation
  – Be a process improvement “owner” inside the organization when it’s over
- **Making improvement recommendations along with appraisal results provides immediate, useful feedback**

Summary

- **Programs were benchmarked and improvements observed**
- **An infrastructure is now in place to manage process improvement**

Appraisals yielded positive results that are shared Center-wide

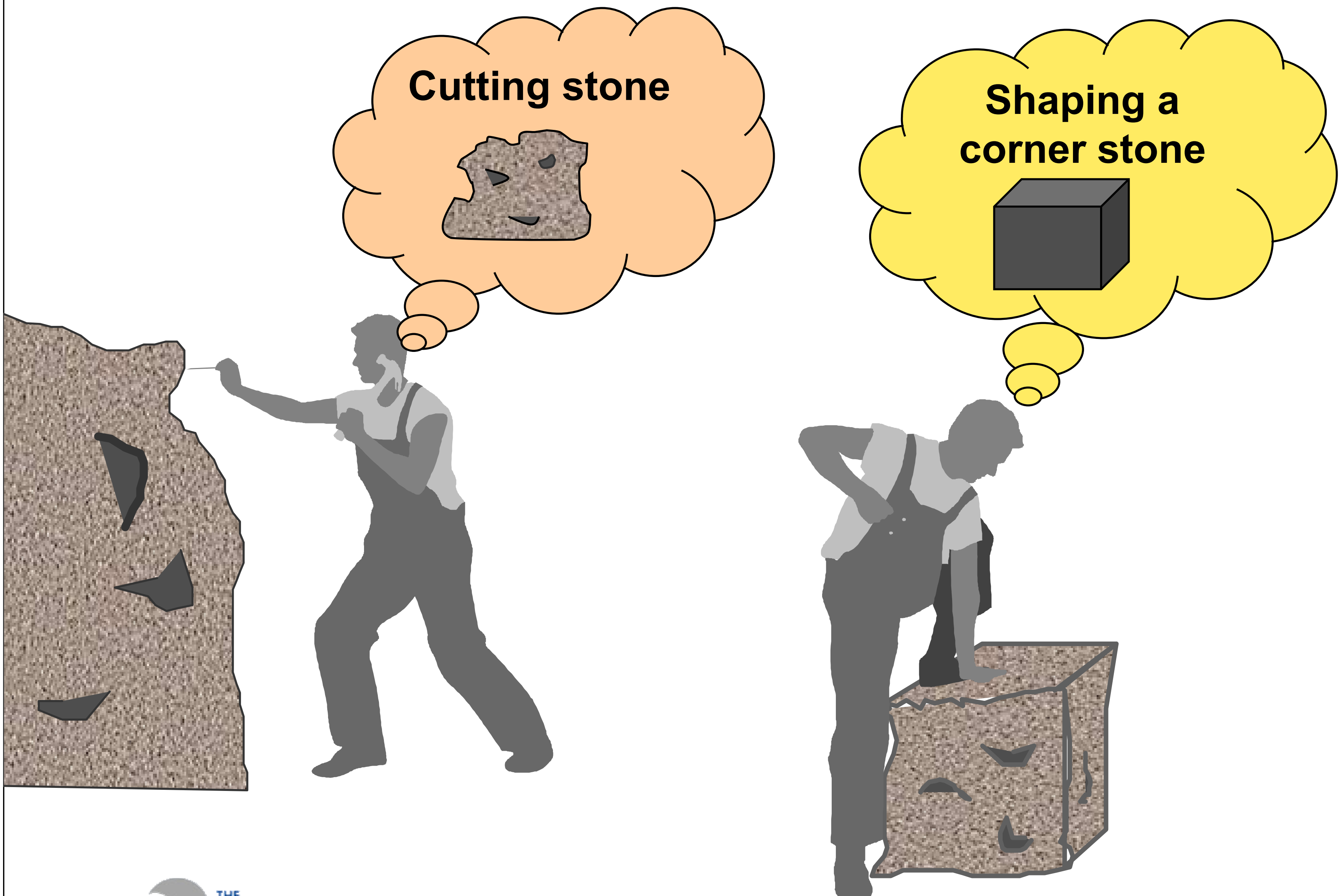

Questions?
CMMI-A
Decisions
Risk Management

Don’t Write the Wrong Processes!

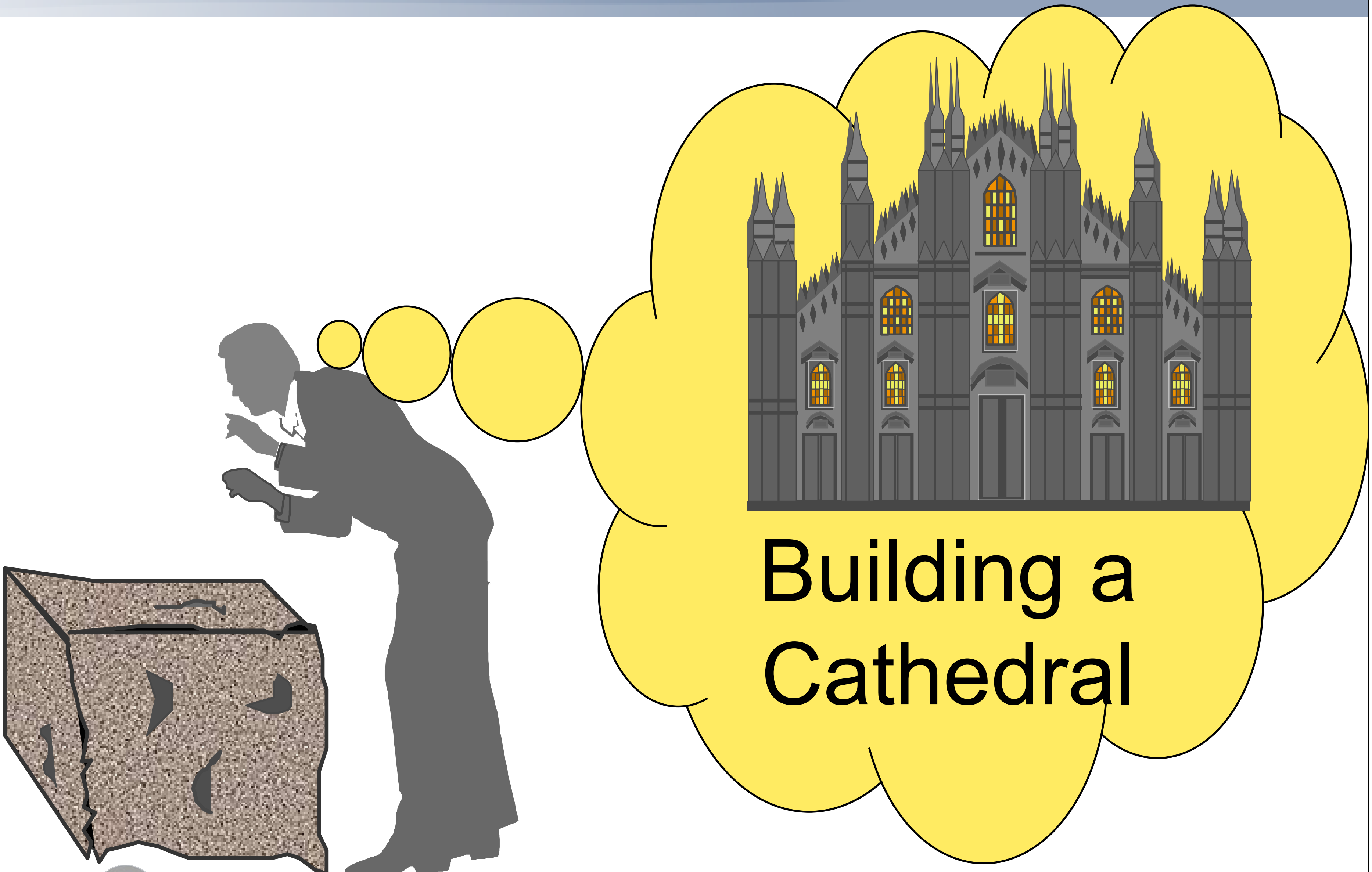
Focusing On The Long Term Objective To Reduce Rework

Suzanne Zampella
SEI-Authorized SCAMPI(sm) Lead Appraiser, CMMI® Instructor
The Center for Systems Management

Perspective—What are you doing?

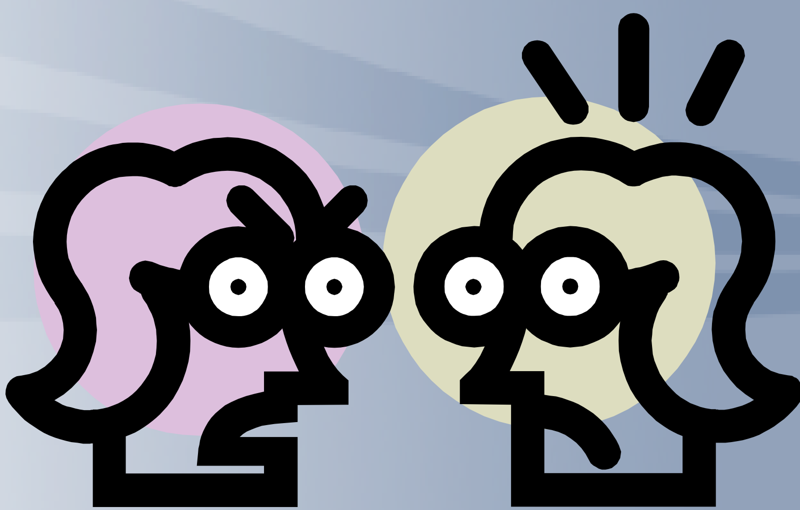


Perspective—What are you doing?



Level Setting

Clarifications to facilitate common understanding



What is a process?

- Activities that can be recognized as implementations of practices in a model (CMMI glossary)
- A complete, end-to-end set of activities that together create value for a customer (Hammer)
- A series of actions or operations conducing to an end (WWWebster)
- A sequence of steps performed for a given purpose (IEEE)
- The logical organization of people, materials, energy, equipment, and procedures into work activities designed to produce a specified end result (Pall, Gabriel A. Quality Process Management. Englewood Cliffs, N.J.: Prentice-Hall, 1987.)

Did that help?

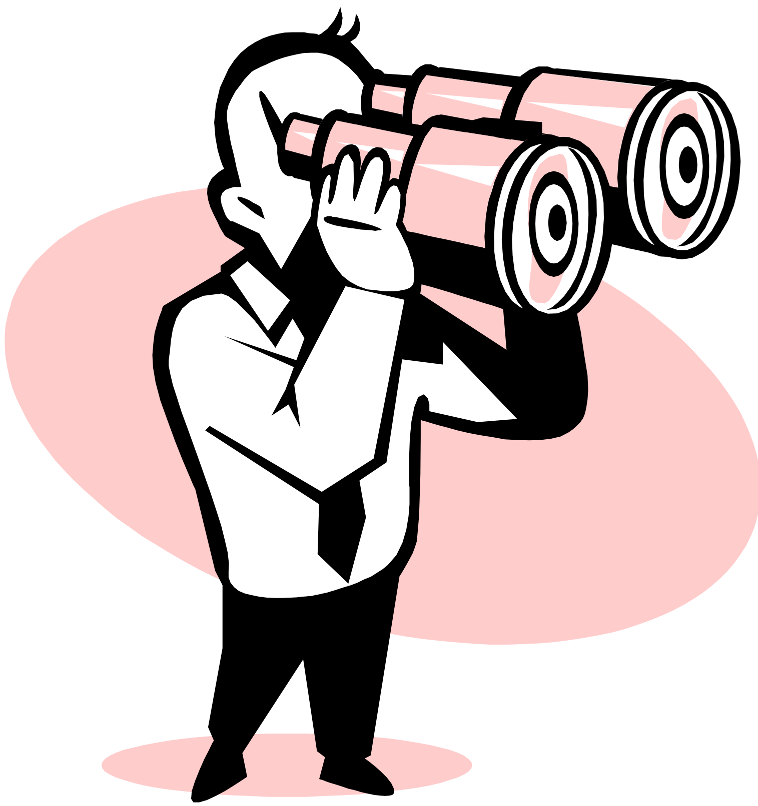
What do we need?

- Our definition has to help us address two issues:
  - ✓How does the overall system partition into pieces?
  - ✓What attributes should each piece possess?

Lots Of Things Are *Called* Process

- **Process System**: The complete set of process assets needed to equip and run the organization
- **High-level Process**: An abstraction of a functional need, not sufficiently decomposed to fully define the work (the software development process)
- **Process Grouping**: A logical grouping, usually by discipline (the CM process grouping) with multiple entry and exit points
- **Process Element**: A series of steps to transform inputs into outputs and meet a specified objective; at a sufficient level of detail to accomplish the task

Remember the Objective



- Support and enhance your business using industry best practices
  - Least expensive process that will still do the job (Crosby)
- Not
  - “Make me a cookie cutter copy of every other company out there”

A Word *from* the CMMI *about* the CMMI

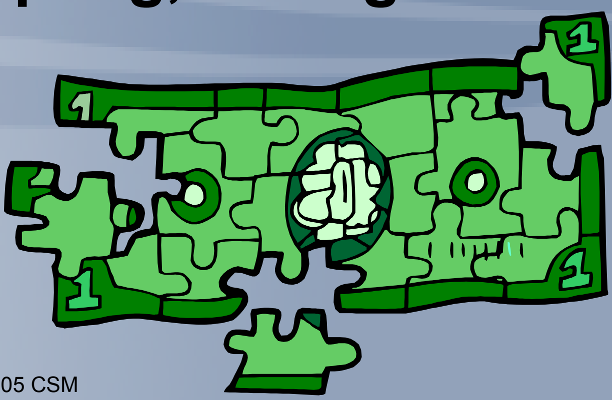
- "CMMI **models are not processes** or process descriptions. The actual processes used in an organization depend on many factors, including application domain(s) and organization structure and size. In particular, the **process areas** of a CMMI model typically **do not map one to one with the processes** used in your organization."
- "Organizations must **use professional judgment to interpret CMMI** practices. Although process areas depict behavior that should be exhibited in any organization, practices must be interpreted using an in-depth knowledge of the CMMI model being used, the organization, the business environment, and the specific circumstances involved."
- "To interpret practices, it is important to **consider the overall context in which they are used** and determine how well the practices satisfy the goals of a process area within that context."

Designing the Process System

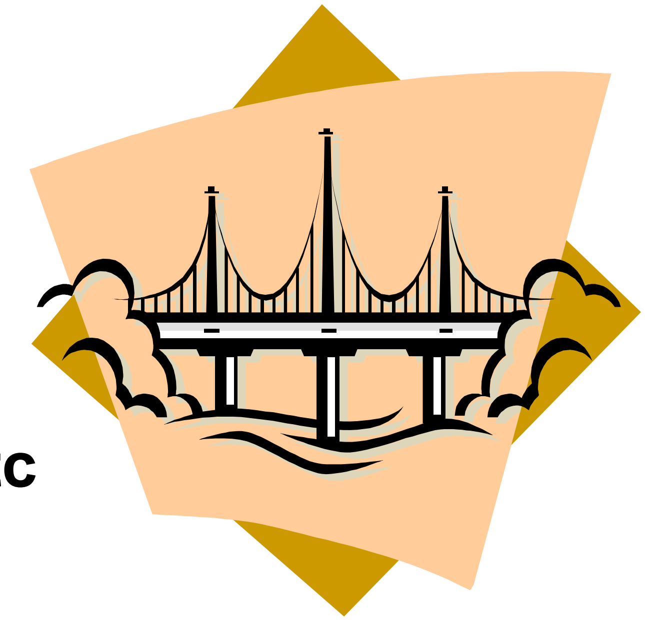
How you do business

Holistic perspective on business

Modularity, loose coupling, strong cohesion

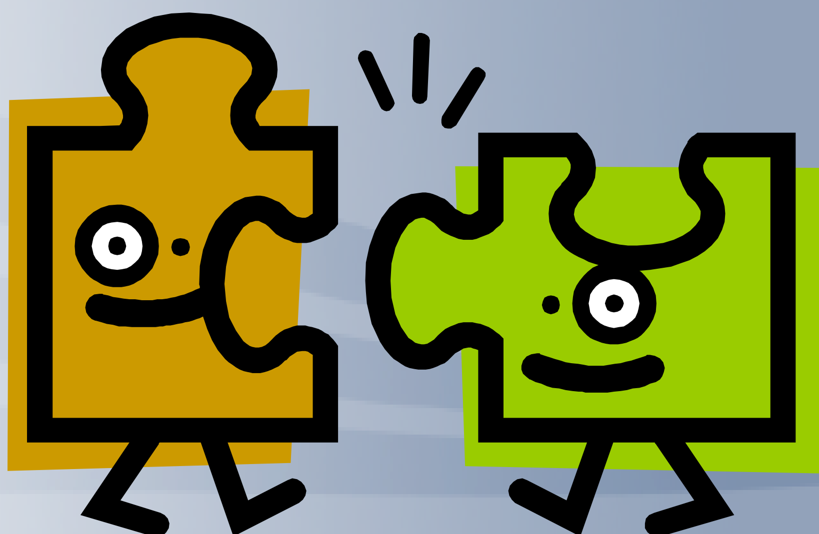


You Need an Engineered Process System



- Why
  - Many user groups
  - Many interfaces
  - Lots of information flows
  - Integrated with 6σ, ISO-9000, etc
- What
  - Clear integration of the process elements (ordering, interfaces, interdependencies)
  - Satisfies the process needs and objectives of the organization
  - Documented, peer reviewed, revised as necessary

Each Process Element



Process Element

- "The fundamental unit of a process. A process may be defined in terms of subprocesses or process elements. A subprocess can be further decomposed; a **process element cannot be further decomposed**."
- "Each process element **covers a closely related set of activities** (for example, estimating element, peer review element). Process elements can be portrayed using templates to be completed, abstractions to be refined, or descriptions to be modified or used. A process element can be an activity or task."

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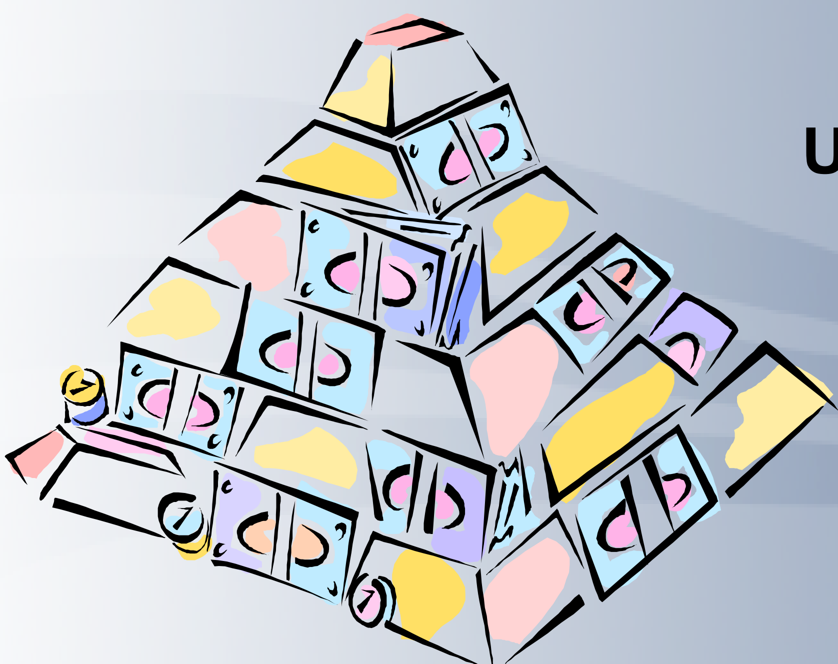
What does a process look like?



Understand the end state

See lower levels as intermediate steps or incremental releases of the process system

Shoot for the Goal

- If you understand where you're going, you can implement a flexible design with hooks and handles to implement future capability.
- For example, rough-in the basement bathroom before you pour the foundation; even though you're not going to finish the bath until 5 years from now.
- Doing it right now is cheaper in the long run.

Look First at Desired End–a L4 Process

Definition: "A quantitatively managed process is … controlled using statistical and other quantitative techniques … quality and process performance are understood in statistical terms and are managed throughout the life of the process."

Focus: Statistically understood at organizational and project levels

Documentation: Performance baselined and modeled; Statistical baselines of key subprocesses

Plan: To meet specific quality and performance objectives

Track:

- Progress using statistical methods
- Special causes of variation
- Quality measures
- Key subprocesses for statistically stability

Level 4 Process System

- Resembles component based process definition
- Includes a collection of process elements that meet the process architecture
- The performance of each element in terms of product quality and process performance is known
  - Some statistically, some just quantitatively
- Allows organization to set realistic organizational process performance goals
  - which are adapted for project circumstances
- Supports projects' informed decisions on which process elements to use, based on the process element's ability to support
  - requirements for quality and performance
  - constraints such as budget and schedule

Somewhat less at Level 3

Definition: "A defined process … is tailored from the organization's set of standard processes according to the organization's tailoring guidelines, and contributes work products, measures, and other process-improvement information to the organizational process assets."

Focus: Organization-based architecture of component pieces (Process elements)

Documentation: Documented to standards with sufficient detail for trained, skilled people to execute consistently; Contain entry, exit criteria, roles, verifications, etc.

Plan: Planned using historical data

Track:

- Organization standard measures
- Progress within thresholds

Even Less at Level 2

Definition: The process description, with relevant standards and procedures.

Focus: Project

Documentation: Including

- Performance objectives
- Dependencies among the activities, work products, and services
- Measurement requirements

Plan: Planned

Track: Progress

Process Descriptions -1

Specify, 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.

L2 starter process:

Activities/Steps: What is done to accomplish this process.

Performance and Quality Objectives:

- **ML2: Subjective;**
- **ML4: Many Quantitative, Some Statistical**

Measures: What data do we need from this process to track

- **ML2: Project Progress;**
- **ML3: Organizational Requirements;**
- **ML4: Support Organizational Statistical Objectives.**

Process Descriptions -2

L3 completion:

Purpose: Why is this process here, what value does it add?

Entry Criteria: What causes this process to be kicked off? and/or What must I have to begin?

Exit Criteria: How do I know when I'm done?

Participants: Roles and responsibilities regarding the process.

Verifications: Approvals and reviews.

Interfaces: Other processes; supporting standards and assets.

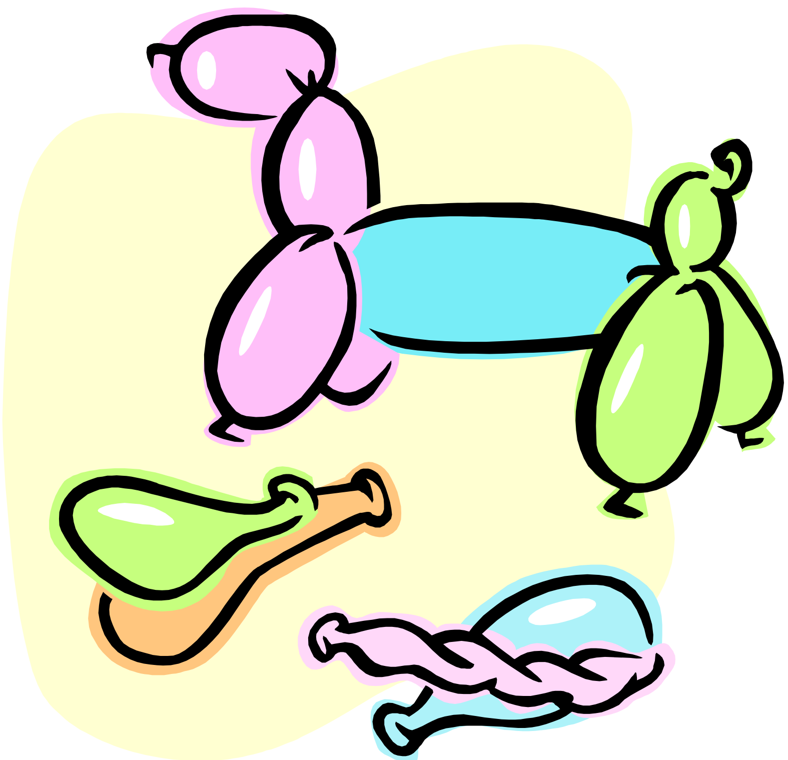
Impacts of Understanding the *SYSTEM*

Interrelationships of Processes

Flow of Data and Measures

Balloon Jumble

- Squeeze one area, it puffs out in others – can you predict?



- Do you understand enough of how your processes interact to understand how a change in one area will impact another area?
- Are you ready to do it with measures?

Summary

- The right process reflects your organization: culture, structure, and type of work.
- The right process is part of a system with clear interfaces, well-defined boundaries, and purpose.
- The right process is sufficiently modular that it addresses one purpose.
- The right process is sufficiently modular that a measure of that process means something specific.
- The right process is one that lays the foundation for the future.

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Q&A

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