Transforming a Level 5 Software Process into an Integrated Engineering Process

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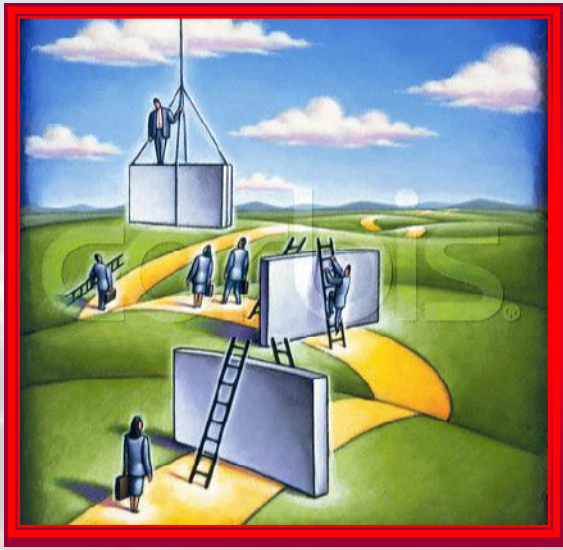
Problem Statement

How do you effectively and efficiently transform a *SW-CMM Level 5* organization to *CMMI*?

What are the technical issues?

What are the *cultural* issues?

What "good" behaviors should be sustained?

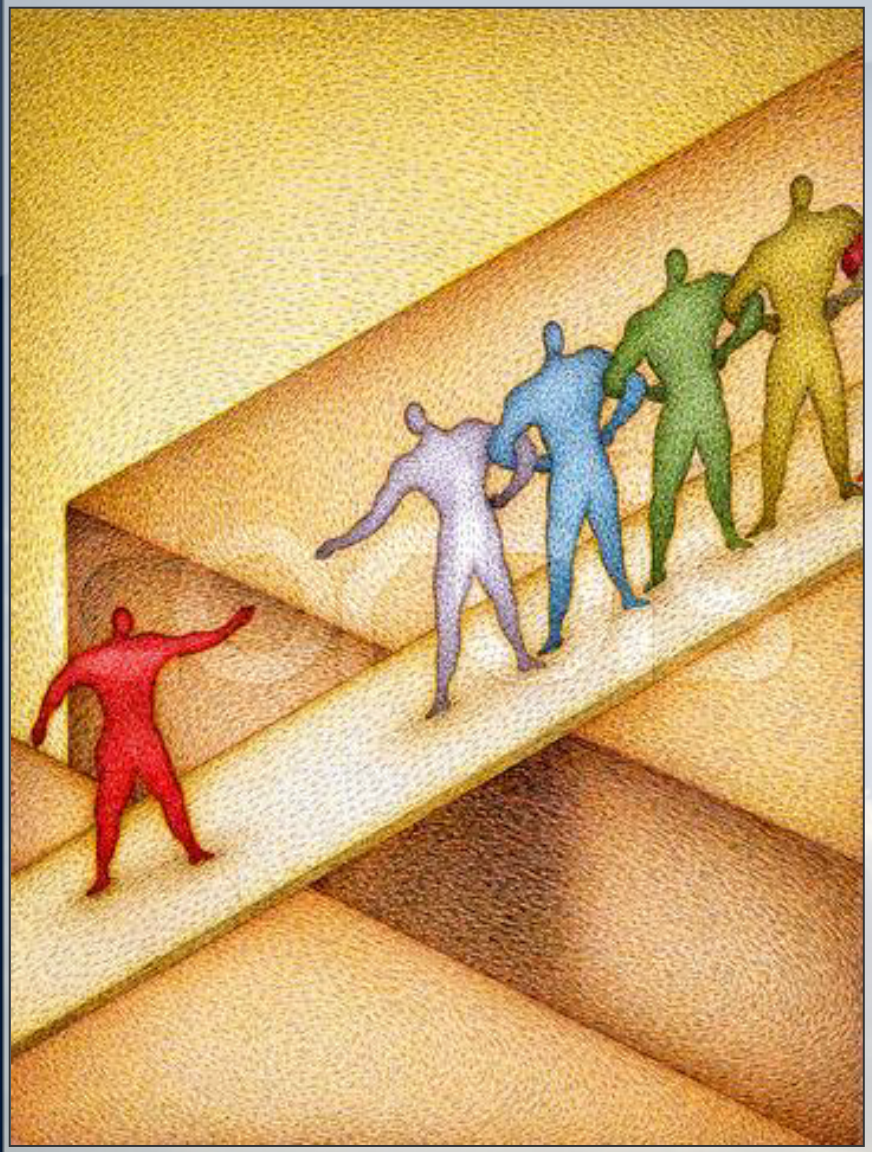


What "bad" behaviors should be avoided?

Technical Issues in Transitioning to CMMI

- Understand differences between SW-CMM and CMMI
  - Continuous Capability vs. Staged Maturity
  - Process Areas vs. Key Process Areas
  - Generic Practices vs. Common Features
  - "New" Terminology and Concepts
- Map the existing process set to CMMI
  - Usually results in a set of "gaps" to be filled
  - Write new processes?
    Or patch the old ones?
- Expand the scope of the organization
  - Start with "Software-Intensive Systems"
  - Expand to include non-software systems?
  - Other engineering disciplines are now expected to learn from the experience of the software engineering discipline

Cultural Issues in Transitioning to CMMI

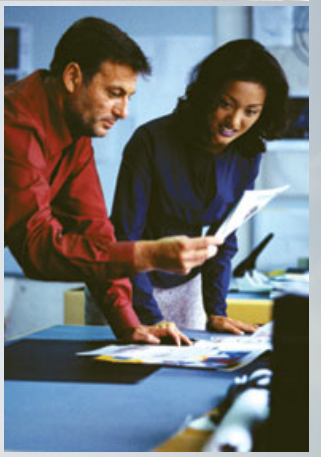


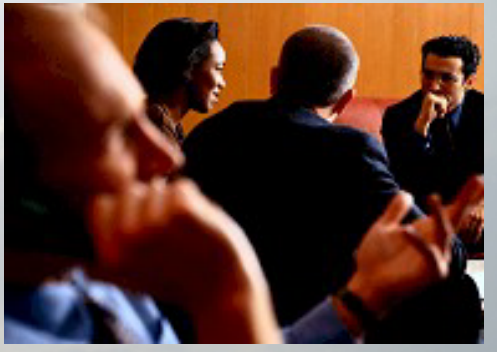
- How does the organization define Systems Engineering?
  - What is it?
  - Who does it?
  - When does it get done?
- How integrated are the engineering disciplines on each project?
- How much process focus exists outside software engineering?
- How open are the "hard engineering" disciplines to learning from "soft(ware) engineering"?
- How do you transition from SEPG to EPG?

"Good Behaviors" in SW-CMM

Behaviors to sustain using CMMI…

- Complete and detailed planning as captured in Software Development Plans
- Use of organizational standard processes and process assets
- Project management using facts and data
- Use of peer reviews to find defects earlier and cheaper
- Quantitative management and improvement of process performance and product quality
- Use of defect prevention (causal analysis) to eliminate root causes of product defects





"Bad Behaviors" in SW-CMM

Behaviors to discourage or eliminate using CMMI…

- Treating software as "different" or "special"
- Putting a wall and moat around the software project
- Failure to recognize the systems engineering nature of software engineering
- Writing processes and other assets in "software-centric" language
- Maintaining a "closed" organization process set

Performance Improvement History

Project and organizational measurements were showing steady improvement in key indicators.

… then Along Came CMMI

In 2001, Boeing did a pilot SCAMPI appraisal of a set of representative software and hardware development projects. Some general findings were…

- Hardware development projects operate differently and are managed differently from software projects
- Risk Management and Supplier Management were very strong
- Project Planning tended to be limited to schedules
- Engineering practices were performed, but not to defined processes
- Product quality and process performance were managed reactively

Organization Challenges

Boeing IDS – St. Louis is a large, diverse site…

Business units…

- *Naval Systems*
- *Air Force Systems*
- *Aerospace Support*

Engineering Disciplines…

- *Software*
- *Electronic Systems*
- *Systems and Flight Engineering*
- *Design and Manufacturing*
- *Flight and Laboratory Operations*

Programs and product lines…

- *Tactical Aircraft*
- *Weapon Systems*
- *Training Systems*
- *Support Systems*

- *Multi-site programs*
- *Over 4000 engineers*
- *Over 100 significant identifiable projects!*

Keys to our CMMI Approach

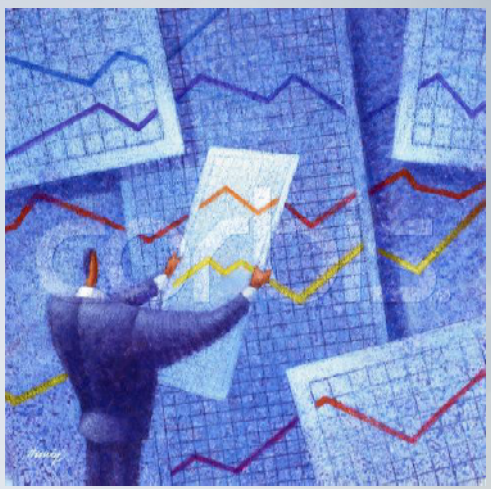
Meet Company Goals for CMMI Levels and Support Long-Term Performance Improvement

Involve Projects During Process Development to Capture Current Project Practices

Develop an Integrated Set of Engineering Processes, not Parallel SW and SE Processes

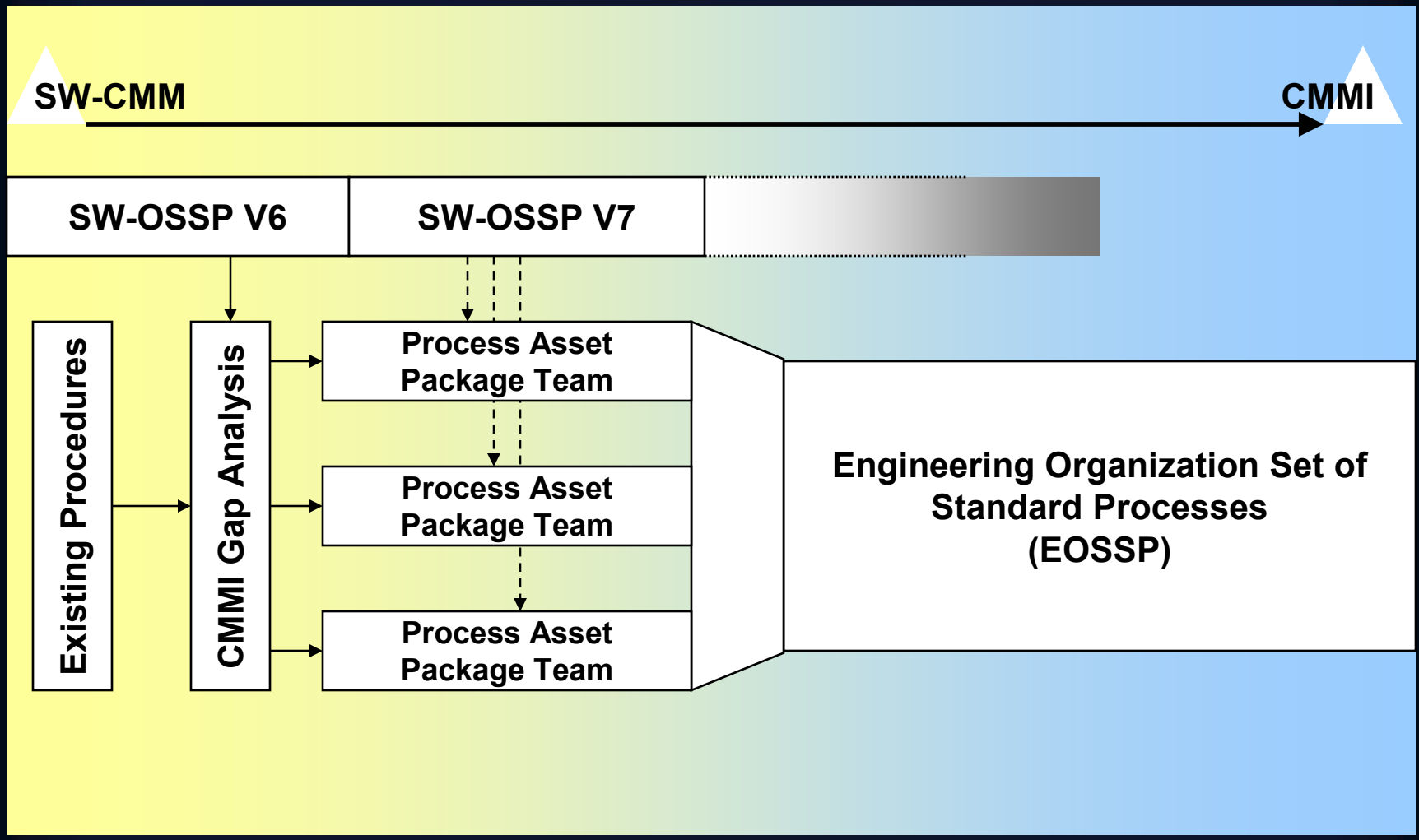
Approach

- Focus first on Software Intensive Systems
- Attempt to reuse existing process assets



- Build upon known mature projects
- Expand scope of engineering life cycle processes
  - System requirements definition and design
  - System integration
  - Program management
  - Common supporting processes
- Initially include three engineering divisions
  - Systems and Flight Engineering (SAFE)
  - Electronic Systems Engineering (ESE)
  - Software Engineering Division (SED)

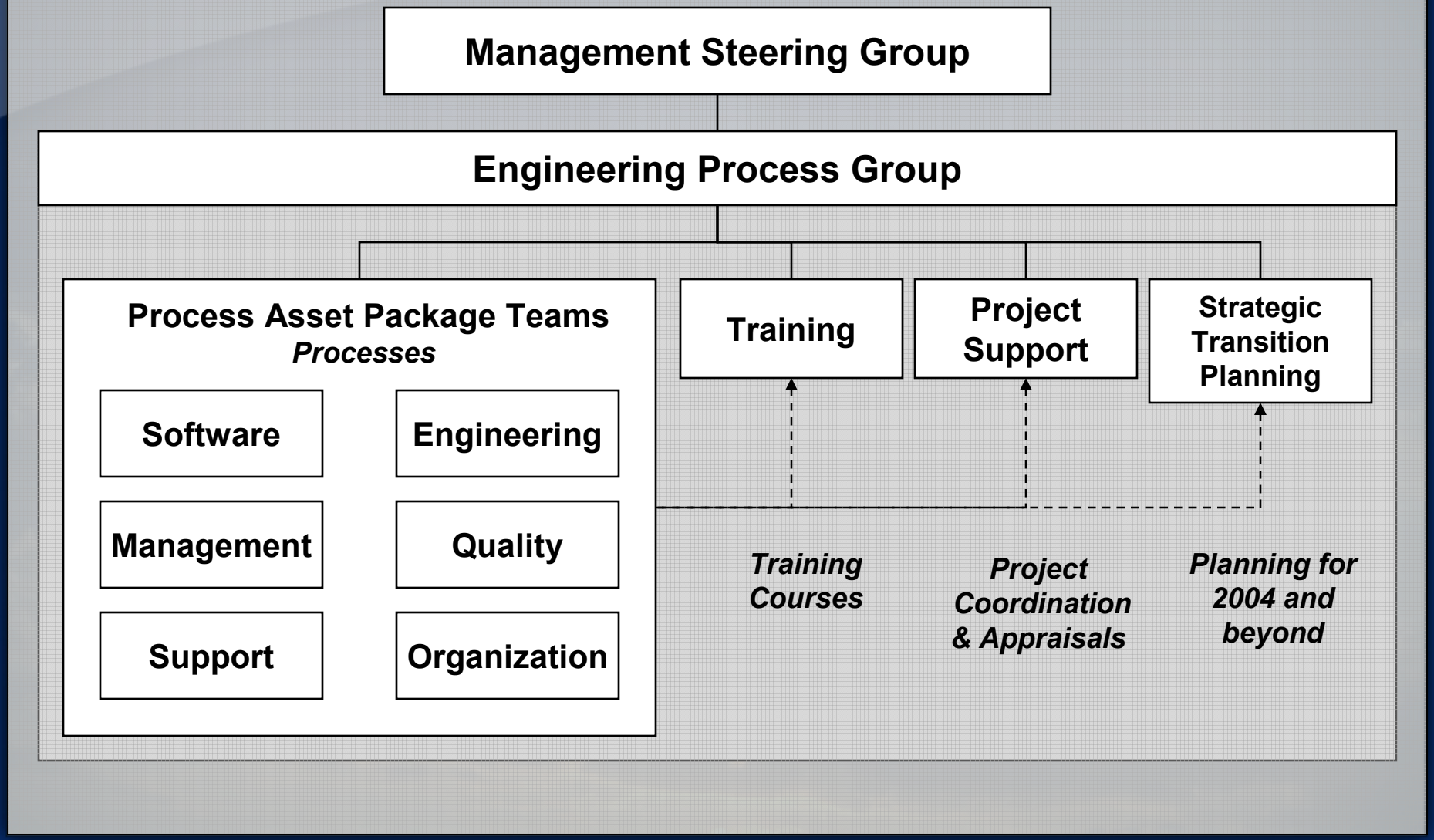
Transition Path to CMMI Processes



Primary CMMI Transition Activities

- **Process Definition**
  - Define, develop, and publish the CMMI processes
- **Organization Infrastructure**
  - Establish organizational assets and management structures
- **Project Support**
  - Facilitate and enable projects to tailor and use the processes
- **Training**
  - Identify, develop, acquire, and deliver needed training
- **Appraisals**
  - Assess and evaluate our processes and their execution
- **Strategic Transition Planning**
  - Plan for transitioning CMMI processes across the site

Transitional EPG Structure



Reuse Analysis of Existing Processes

Engineering Organization's Set of Standard Processes (EOSSP)	Reuse of Existing Processes	PAP Team
Project Organization Process		Management
Project Staffing Process		Management
Scheduling Process		Management
Standard Software Defect Prevention Process		Software
Project Process Set Definition Process		Support
Project Process Maintenance Process		Support
Risk Management Process		Support
Project Training Process		Support
Peer Review Process		Support
Problem Handling Process		Support
Standard Software Estimating Process		Software
Standard Software Requirements Analysis Process		Software
Standard Software Design Process		Software
Standard Software Implementation Process		Software
Standard Software Testing Process		Software
Standard Software Qualification Testing Process		Software
Standard Software Release Preparation Process		Software
Planning Process		Management
Project Management Process		Management
Quantitative Management Process		Management
Project Reviews Process		Management

Engineering Organization's Set of Standard Processes (EOSSP)	Reuse of Existing Processes	PAP Team
Assess Alternatives and Recommend Solution		Engineering
ESE Estimating Process		Engineering
Manage Interfaces and Ensure Compatibility		Engineering
Subsystem Qualification Testing Process		Engineering
Software Quality		Quality
SQ Audits and Evaluations		Quality
SQ Problem Tracking		Quality
SQ Pre-Award Planning		Quality
SQ Support of Supplier Software Development		Quality
SQ Support of Customer Milestones		Quality
SQ Post-Award Planning		Quality
Configuration Management Process		Support
Requirements Management		Engineering
Requirements Development		Engineering
Design/Technical Solution		Engineering
Product Integration		Engineering
Verification		Engineering
Validation		Engineering

COLOR CODE KEY	
Can be used with minor modifications	
Will require moderate modifications	
Will require a new process to be written	

Over 80% of the Software Standard Processes were reusable as Engineering Organization Standard Processes (EOSSP)

The EOSSP

Engineering Organization Set of Standard Processes (EOSSP)

Maintained by: Kelly R. Sullivan

Note: The EOSSP can also be accessed thru the EOSSP CPR.

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EOSSP-EOP-001	Engineering Organization Performance Improvement Infrastructure	1 April 2004
EOSSP-EOP-002	Engineering Organization Set of Standard Processes (EOSSP)	13 November 2003
EOSSP-EOP-003	Engineering Organization Project Defined Processes	9 June 2004
EOSSP-EOP-004	Standard Organization Process Development Process	9 April 2004
EOSSP-EOP-005	Engineering Organization Release of EOSSP and CPR TOC Process	9 June 2004
EOSSP-EOP-006	Engineering Organization Process Asset Library (PAL) Management Process	29 June 2004
EOSSP-EOP-007	Engineering Organization Quantitative Management Process	29 June 2004
EOSSP-EOP-008	Engineering Organization Process Improvement, Deployment, and Waiver Review Process	9 June 2004
EOSSP-EOP-009	Engineering Organization Action Planning Process	9 June 2004
EOSSP-EOP-010	Engineering Organization Appraisal Process	9 April 2004
EOSSP-EOP-011	Engineering Organization Training Planning Process	29 June 2004
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EOSSP-EOP-015	Engineering Organization Software Technology and Process Change Management Process	29 June 2004
EOSSP-EOP-016	Engineering Organization Standard Process Change Process	9 June 2004
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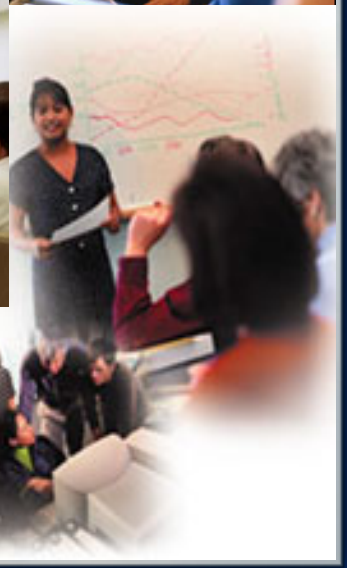
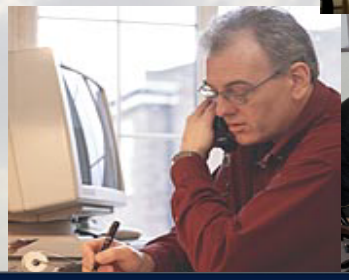
EOSSP-SP-032	Standard Technical Decision Process	1 April 2004
EOSSP-SP-033	Standard System Integration and Verification Process	6 August 2004
EOSSP-SP-034	Standard Hardware Quality Problem Tracking Process	12 April 2004

Results to Date

- We successfully formed a multi-disciplined, integrated EPG team
- We collaborated with the target projects to define and publish the EOSSP
  - Project participation in “PAP Teams”
  - Conducted “Blitz” project reviews
  - First EOSSP release published in October 2003
- We conducted Class B appraisals in December 2003, July and October 2004
  - Validated the EOSSP against CMMI ML3 practices
  - Explored ML4/5 practices using EOSSP/OSSP hybrid
  - Evaluated project execution against all Process Areas



Lessons Learned

- Having integrated processes enables, but does not drive integrated execution
- Effective and understandable tailoring guidelines are challenging to define
- When projects do not understand process applicability, they request waivers
- Some software projects have had difficulty expanding their scope to include systems engineering
- Writing “generic” processes leads to misunderstanding – better to be specific, but offer alternative process steps

What's Next?

- Expand the appraised organization to include more projects
- Include the remaining engineering disciplines and functions
  - Design and Manufacturing Engineering (DME)
  - Flight and Laboratory Operations (FLO)
- Strengthen synergy with other models/initiatives
  - 6-Sigma
  - Lean Engineering
  - Malcom Baldrige Criteria
- Complete the EOSSP processes for full Level 4 and 5 capability

Questions?

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