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Customer Success Is Our Mission

"Two Steps Forward – One Step Back: A New Dance Step Or Interpreting The CMMI Model"

Presented to National Defense Industrial Association
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Denver, Colorado

Adrio DeCicco
Space and Airborne Systems
Raytheon El Segundo, CA
November 17-20, 2003

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Space And Airborne Systems (SAS)

- Engineering Is Using The CMMI Model To Measure Process Maturity

- The Plan Developed By Raytheon's (SAS) Organization At El Segundo, California Was To:
  - Reorganize To Form An Integrated Process Group
  - Complete CMMI And Appraisal Training
  - Perform A Gap Analysis Between The Existing Organization's Standard Process And The CMMI Model
  - Expand The Organization's Standard Process
    - Generate Procedures, Work Instructions, And Enablers Where Necessary
  - Apply Process Improvements To Process And Product Development
  - Conduct A Series Of Appraisals To Measure Maturity

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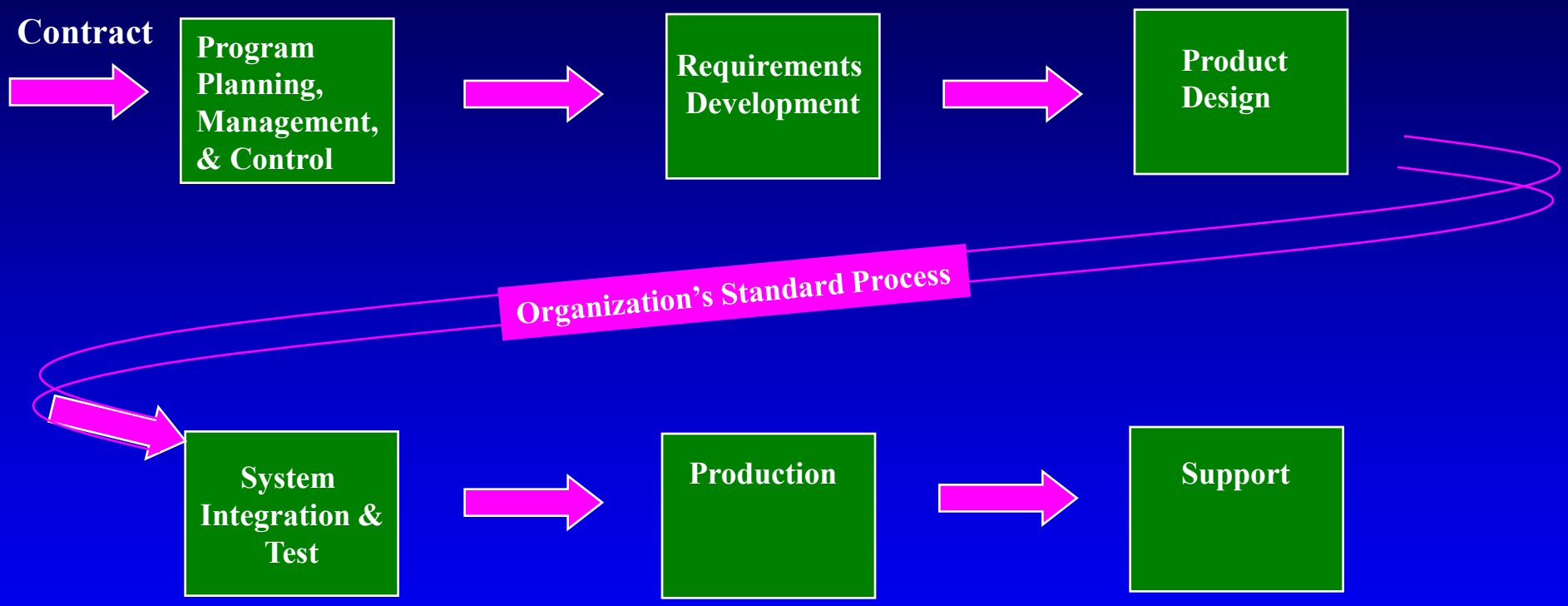
Space And Airborne Systems (SAS)

- SAS Experienced Some Diversified Opinions Of Interpreting The CMMI Model To Measure Process Maturity And Implementing The Organization's Standard Process To Make Process Improvements
  - Utilized Several Raytheon And Consultant Personnel In Attempting To Understand The Meaning And Intent Of The Model
- Started With Evaluating How To Make The Existing Organization Standard Process CMMI Compliant And Defining The Architecture

Applying The Organization's Standard Process To A Typical Product Development Process



Process And Product Development Is Achieved Using The Organization's Standard Processes

Issue: Design Of Organization's Standard Process And Architecture

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- CMMI: Organizational Process Definition (OPD): Establish And Maintain A Usable Set Of Organizational Process Assets
  - Explanation Of How "Organizational Process Assets" Is Used In The CMMI Product Suite
    - Includes The Following; Organization's Set Of Standard Processes, Architecture, Process Elements, Description Of Life Cycle Models, Tailoring Guidelines & Criteria, Measurement Repository, & Library
  - Explanation Of "Process Architecture"
    - Describes The Ordering, Interfaces, Interdependencies, And Other Relationships Among The Process Elements
      - … And Between Process Elements And External Processes (For Example Contract Management)

Issue: Design Of Organization's Standard Process And Architecture (Cont'd)

- CMMI: Organizational Process Definition (OPD)
  - Standard Process: Describes The Fundamental Process Elements That Are Expected To Be Incorporated Into Any Defined Process.
    - ☐ It Also Describes The Relationships (e.g. Ordering And Interfaces) Between These Process Elements
      - » Defined Process Provides A Basis For Planning, Performing, And Improving The Project's Tasks And Activities
      - » Is A Managed Process That Is Tailored From The Organization's Set Of Standard Processes …
  - ☐ Process Element: The Fundamental Unit Of A Process
    - ☐ A Process May Be Defined In Terms Of Sub-processes Or Process Elements
      - » For Example: Estimating Element; Peer Review Element
    - ☐ A Sub-process Can Be Further Decomposed; A Process Element Cannot

Design Of Organization's Standard Process And Architecture

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- From Applying CMMI Definitions From OPD, SAS Engineering Further Expanded The Organization's Standard Process
  - Added Procedures, Work Instructions, And Enablers

- From Appraisal Findings The Interpretation Of The Meaning Of "Defined Process" Was Addressed With Differing Opinions
  - Processes Should Be Sufficiently Defined To Answer "What To Do" And "How To Do It"
    - Opinions Varied On The Level Of Detail Needed When Developing New Procedures, Work Instructions, And Enablers
    - On The One Hand, It Was Document Your Process The Way You Conduct Business
      - Don't Copy The CMMI Model As Part Of The Organization's Standard Process
    - On The Other Hand, It Was The Organization's Standard Process Does Not Contain Enough Information Showing How To Do Tasks (Both The Existing And CMMI Based)
    - Enablers Being "Informational" Were Viewed As Not Acceptable By Some Because They Are Not Directive
    - Some Were Of The Opinion That All Sub-practices Had To Be Addressed To Be Compliant

Design Of Organization's Standard Process And Architecture

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- As A Result The Level Of Detail In Work Instructions Varied Widely As Did The Criteria For Determining When A Work Instruction Was Needed
- After Much Consternation, The Solutions:
  - We Looked Within Engineering And Support Disciplines To Determine Areas Of Product Development That Needed Improvement
    - ☐ Detailed Work Instructions Were Generated In Those Areas
  - Procedures Were Developed That Contain CMMI Based "What To Do's" From The Specific And General Practices
  - Use Enablers As Informational To Help Programs Share Templates, Guides, Etc., That Can Help Enhance Program Processes And Products
  - Pushed Back To Show That The Existing Organization's Standard Process Is CMMI Compliant
  - Addressed Sub-practices In Terms Of Value Added To Process And Product Development For SAS' Businesses

SAS Engineering's Organization Standard Process

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EMS Was Developed By The EPG (Systems, Software, CM/DM, Quality, & SCM With HW Participation)

SAS IPDP	Tailorable What To Do How To Do It
Policy Procedure	Not Tailorable What To Do
Work Instructions	Tailorable What To Do How To Do It
Enablers Task Descriptors	Guides Information

Enterprise Management System (EMS)

SAS Engineering's Process Improvements From Developing A CMMI Based Organization Standard Process

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- Two Steps Forward:
  - Evolved To An Integrated Process Organization
    - Integrated Engineering And Support Disciplines
  - Integrated The Organizational Standard Process And The Directive System
  - Integrated Engineering And Support Discipline Processes
    - Generated A CMMI And ISO/AS9100 Compliant Directive System
    - Some Discipline Specific Processes Are More Detailed Than Others
  - Generated A Process Architecture With Interfaces And Interdependencies

- One Step Backward:
  - Time And Effort Spent:
    - Establishing The Level Of Detail Contained In The Organization's Standard Process
      - What To Do/How To Do It
    - Determining The Level And Detail Of Interfaces And Interdependencies
      - Work Instructions Tied To Procedures
      - Relationships Between Work Instructions
      - Activities And Work Products That Cannot Be Tailored Out

SAS Engineering's Process Improvements From Developing A CMMI Based Organization Standard Process – Organizational Training (OT)

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- Two Steps Forward:
  - Better Defined The Flow Between The Corporate OT Strategy To SAS Engineering's Strategy
    - Resulted In A More Cohesive And Comprehensive OT Strategy
    - Integrated Organization, Program, And Process Training Plans And Activities
    - Improved Evaluation Process Of Delivered Training
- One Step Backward:
  - Time And Effort Spent:
    - Applying General Practice 2.5 "Train People" Across Process Areas
      - Determining Personnel Training "Gaps" For Each CMMI Process Area (PA)
      - Developing Criteria And Evidence To Show Necessary Skills And Expertise

IMPACT OF GENERIC PRACTICES (GPs) ON PROCESS AREAS (LEVELS 2 & 3)

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Generic Practices

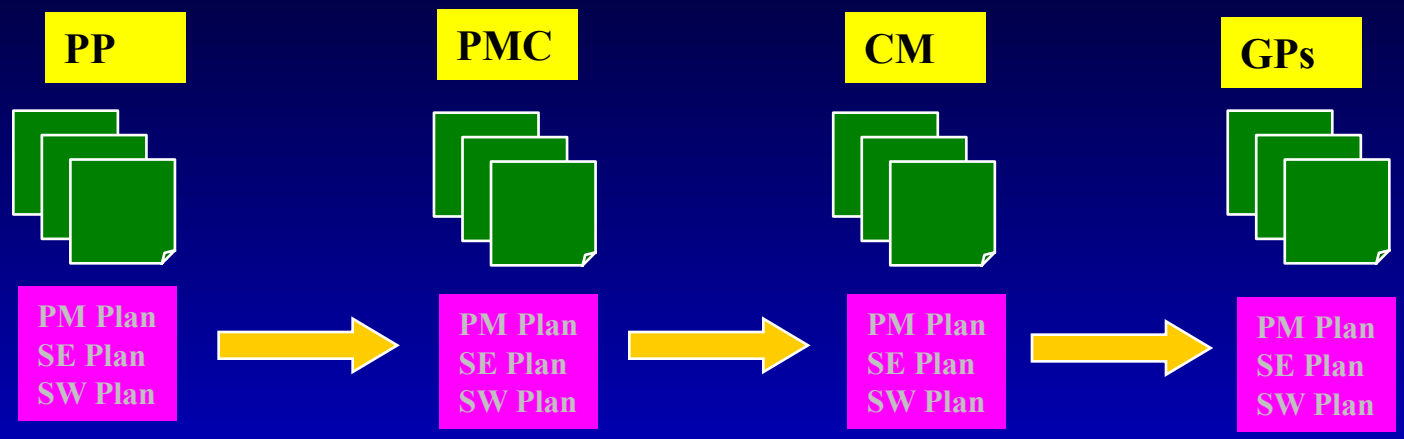
- Organizational Policy
- Plan The Process
- Provide Resources
- Assign Responsibility
- Train People
- Manage Configurations
- Id & Involve Stakeholders
- Monitor & Control The Process
- Objectively Evaluate
- Review Status With Mgt
- Establish A Defined Process
- Collect Improvement Info

CMMI Process Areas

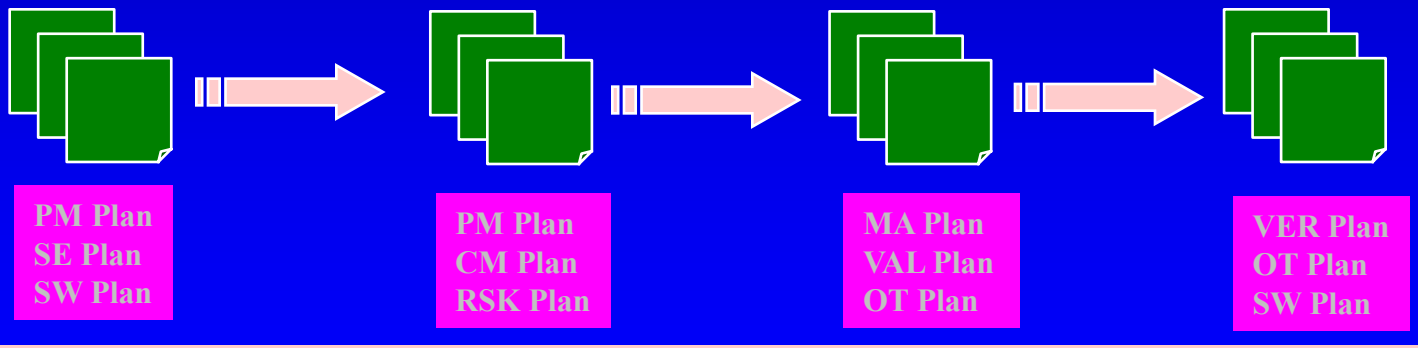
- Requirements Mgt
- Project Planning
- Project Monitoring & Control
- Supplier Agreement Mgt
- Measurement & Analysis
- Process & Product Quality
- Configuration Mgt
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation
- Org Process Focus
- Org Process Def
- Org Training
- Integrated Project Mgt
- Risk Mgt
- Integrated Teaming
- Decision Analysis & Resolution
- Org Environment For Integration

Implementation Of Generic Practices Requires A Great Deal Of Thought And Planning

Documentation Issues

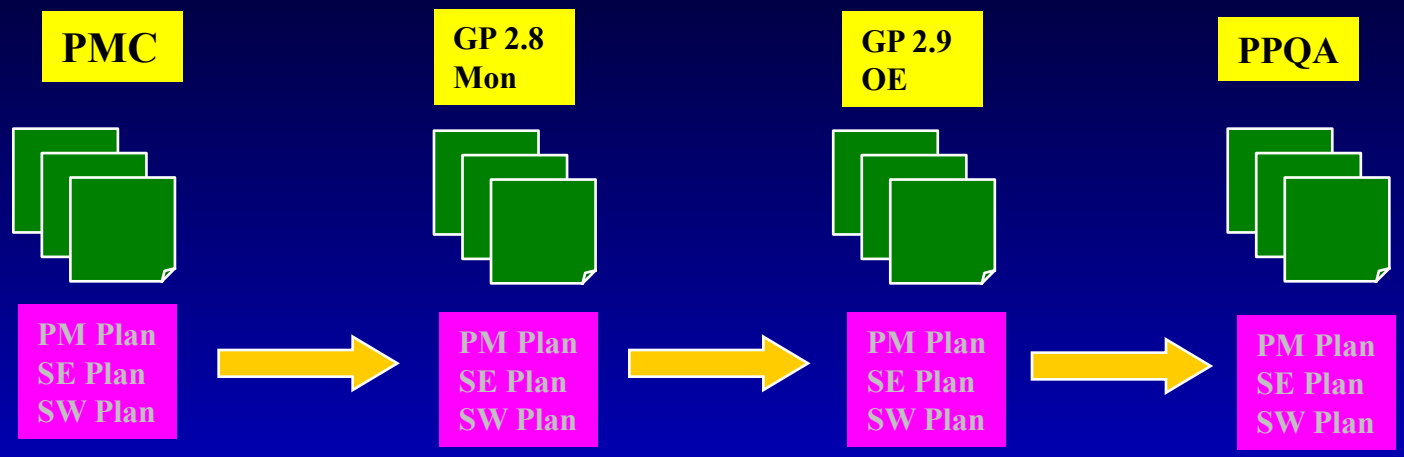


Using The Same Documents Indicates A Thread (Institutionalization)



Using A Mixture Of Documents Does Not Indicate A Thread (Institutionalization?)

Documentation Issues



Some Issues/Considerations That Resulted From Appraisals:

- PMC:	Monitor Effort, Cost, And Schedule Against The Plan
- GP 2.8 (Monitor & Control):	Monitor & Control The Process Against The Plan
- GP 2.9 (Objective Eval):	Process Is Implemented As Planned
- PPQA, SP 2.1:	Can Be Little "q"; Not Necessarily Big "Q"
- GP 2.10 (Higher Level Mgt):	Should Have Actual Presentations & Meeting Minutes Attendee List, & Action Items
	Higher Level Management Is Senior Management; Not Program Management
- Documentation:	How Much Is Enough?
	Two Directs & Two Indirects?
	Need Directs & Indirects From PM, SE, & SW?
	Are Plans Indirects?

Issue: How To Implement Objectively Evaluate Adherence, General Practice 2.9

- As Described In The Model:
  - To Provide Creditable Assurance That The Process Is Implemented As Planned And Adheres To Its Process Description, Standards, And Procedures
  - Adherence Is Evaluated By People Within The Organization, But External To The Process Or Project, Or By People External To The Organization
  - Glossary: Objectively Evaluate – To Review Activities And Work Products Against Criteria That Minimize Subjectivity And Bias By The Reviewer
  - From Process And Product Quality Assurance (PPQA): May Be Performed, Partially Or Completely, By Peers
    - Everyone Performing QA Activities Should Be Trained In QA
    - Those Performing QA Activities Should Be Separate From Those Directly Involved In Developing Or Maintaining The Work Product And Have An Independent Reporting Channel To The Appropriate Level Of Organizational Management

Issue: How To Implement Objectively Evaluate Adherence, General Practice 2.9

- Two Steps Forward:
  - Maintained The Position That Quality Is Everyone's Job
    - Improved OE Focus Within Disciplines
  - Identified Strengths And Weaknesses
    - Perform OE On Products Very Well; Need To Improve OE Of Processes
  - Developed Additional Audit Checklists
  - Working With the QA Organization To Implement OE Across Disciplines

- One Step Backward:
  - Time And Effort Spent:
    - Developing An Integrated Approach To OE
    - Getting Buy In From Disciplines

Other Solutions

- Two Steps Forward:
  - Developed A Detailed Enabler On How To Do Requirements Management
  - Confirmed That Requirements Development Was Sufficiently Described In The Existing Organization's Standard Process
  - Identified That Validation Activities Are Addressed Throughout Product And Program Life Cycles In The Existing Organization's Standard Process
  - Developed An "Independent Review" Detailed Work Instruction
  - Developed Comprehensive Stakeholders Lists For Many Process And Product Activities
    - Should Improve Communication (Clearly Identify What Is Expected, From Whom, And By When)

Other Issues

- Two Steps Forward:
  - Implementing CMMI Based Process Improvements On Legacy Programs
    - Introduce Process Improvements As Legacy Programs Enter A Major Milestone
      - Tailor The Organization's Standard Process From That Point Forward
  - Have A Senior Systems Engineer Or A Senior Software Engineer Be Responsible For Applicable Systems Engineering Activities On Predominantly Software Programs
  - Increased Scope (Process And Product) Of Capturing Lessons Learned

- Two Steps Backward:
  - Implementing CMMI Based Process Improvements On Legacy Or Predominantly Software Or Hardware Programs Is Difficult, And Seems To Carry Little Value During Appraisals
  - Time And Effort Trying To Produce Lessons Learned Artifacts For Every CMMI Process Area

Summary

- The CMMI Model Has To Be Studied In Detail To Evaluate Content And Interpret Its Meaning
  - Process Engineers, Peers, Other Industry Colleagues, Consultants, Etc.
- Diverse Opinions Emerge On How To Define, Generate, And Implement CMMI Compliant Processes
  - Process Engineers, Appraisers, And Lead Appraisers Have Divergent Opinions On The Intent Of The Model And What Constitutes Compliancy
    - ☐ Detail And Architecture Of The Organization's Standard Process
    - ☐ Artifact Collection: Type And Number Of Documents
    - ☐ Scope, Meaning, And Application Of Generic Practices
    - ☐ Correlating An Organization's Daily Activities To CMMI Practices
- As A Result, At Times It Seems As If We Take Two Steps Forward And One Step Backward When Making Process And Product Improvements