FAS*Track** to* CMMI®

CMMI®
Technology Conference & Users Group
November 13-16, 2006
Denver Colorado

Presented by Al Florence
The MITRE Corporation

The author's affiliation with The MITRE Corporation is provided for identification purposes only, and is not intended to convey or imply MITRE's concurrence with, or support for, the positions, opinions or view points expressed by this author.

* FAS*Track* is coined by Al Florence for process improvement

Agenda

- **Impediments to Process Improvement (PI)**
- Real Examples of Impediments
- FAS*Track* to Process Improvement
- Real Examples of FAS*Track*
- Summary
- References
- ?s
- Contact Information

What are the Impediments to PI? (1 of 2)

- When improving processes in organizations the following often occurs:
  - Process Improvement (PI) is done for process sake
    - Needs to be done for business sake
  - Management wants immediate feedback
  - Management wants Level 3 in six months
  - Staff fails to “buy-in” to PI
  - PI efforts linger forever, are ignored, fail, or are cancelled
  - Recidivism sets in

- Management is not aware of effort required:
  - Fails to provide adequate funding
  - Fails to provide adequate schedule
  - Fails to provide adequate resources
  - Fails to provide adequate PI staff/skills

What are the Impediments to PI? (2 of 2)

- Management is not involved
  - Fails to provide leadership
    - Needs to be actively involved
    - Needs to "crack-the-whip"
- Organizations not ready for PI *(not addressed herein)*
  - If organizations are not ready for change PI will fail
  - All units in an organization need to want to improve
- Supplier mature in process but not acquirer *(not addressed herein)*
  - It is very difficult for a contractor to be Level 2 or Level 3 if the acquisition Agency is Level ***nothing***
  - A project will perform to the lowest level of either party
    - The lower level party brings the higher level one down to its level

Where are we?

- Impediments to Process Improvement (PI)
- Real Examples of Impediments
- FAS*Track* to Process Improvement
- Real Examples of FAS*Track*
- Summary
- References
- ?s
- Contact Information

Real Examples of Impediments (1 of 4)

Example 1

- An organization attempting Level 3
  - Management schedule is 6 months
  - Organization has no documented processes
  - Organization is not following many processes
  - Management fails to provide enforcement or support
  - Organization fails to achieve even Level 2 in six months
  - I quit

Example 2

- At a CMM conference
  - Overheard at dinner table about a company involved in PI
  - Someone asked how far they had gotten
  - In one year they had implemented a process for *conducting meetings*!

Real Examples of Impediments (2 of 4)

Example 3

- Large acquisition agency
  - Implements Quality Assurance (QA)
  - Lacks QA expertise
    - Extensive training and mentoring required
  - 3 MITRE staff - 80%, 3 Government staff - 300%
  - Insists on extensive process documentation
    - About 7 procedures for QA each about 13 pages
    - Extensive guidelines and training
    - Write, review, re-write, re-review... *(change "happy" to "glad")*
    - Preciosity sets in

Real Examples of Impediments (3 of 4)

Example 3 (comp.)

- Reorganizes several times
  - Each time new managers and staff need to agree on QA approaches
  - Each time new managers and staff need to be trained
- After about 9 months QA process in place
- Organization reorganizes several more times
  - New mangers and staff need to accept QA and be retrained
- QA falls apart
- QA effort restarted again two years later from scratch
- *Exactly the same scenario is experienced in attempting to implement Configuration Managment (CM)*

Real Examples of Impediments (4 of 4)

Example 4

- Project plans
  - System Engineering Management Plan
  - Software Development Plan
  - Configuration Management Plan
  - Quality Assurance Plan
  - Etc.
- Often takes months to develop
- Involve tons of people
- Cost in excess of $100K!
- I have experienced this many times on different projects at different corporations

Where are we?

- Impediments to Process Improvement (PI)
- Real Examples of Impediments
- FAS*Track* to Process Improvement
- Real Examples of FAS*Track*
- Summary
- References
- ?s
- Contact Information

FAS*Track* to Process Improvement (1 of 5)

- A solution to PI impediments may be in FAS*Track*
  - A process that is in need of time critical improvement is quickly implemented without much of the fanfare and tedious documentation that bogs down PI efforts
  - The process is quickly defined and executed immediately as a pilot
  - During the pilot's execution, the process is refined, as necessary, and the process documentation is enhanced as required
  - Data and artifacts are collected on the pilot's execution which may be used as proof that the process is, or is not, successful and for continued process improvement
  - Additional FAS*Track* pilots are executed as necessary throughout the PI efforts

FAS*Track* to Process Improvement (2 of 5)

- FAS*Track* implementation provides:
  - Early results to management
  - Buy-in from senior management and staff
  - Momentum to continue
  - Early process execution and artifact collection
  - Proof that process works
  - On-the-fly maturing of the processes
  - PI done for business sake

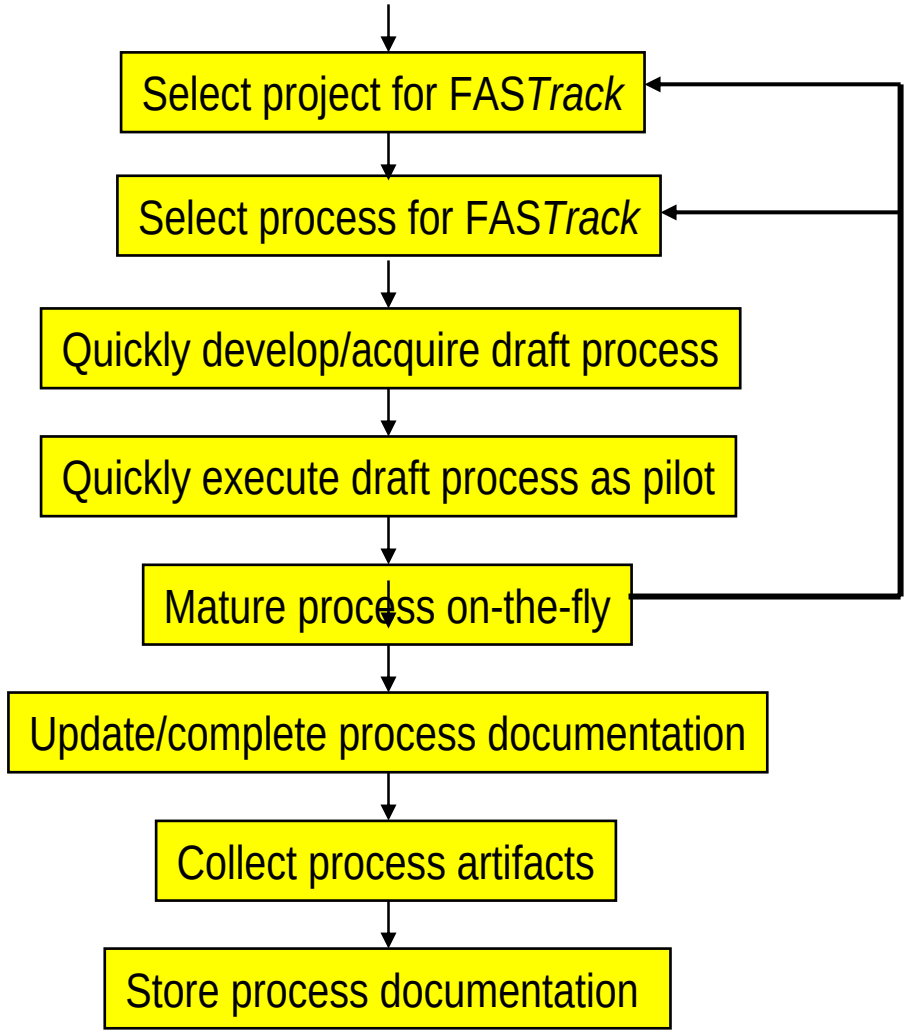
FAS*Track* to Process Improvement (3 of 5)

- Identify project/process for FAS*Track*
- If a process exists
  - Tailor and use
- If process does not exist quickly:
  - Develop draft
    - Process procedure
    - Procedure templates
    - Procedure guidelines
    - Procedure training
  - Select Standards
- Execute process
  - Start when draft procedure is developed
  - Continue as other drafts are done
- Collect artifacts

FAS*Track* to Process Improvement (4 of 5)

- Mature process (on-the-fly)
- Expand
  - Procedure
  - Templates/guidelines
  - Training
- Develop/Expand Process Policy
- Select other Standards
- Store in Process Asset Library (PAL)
- 2nd, 3rd, and subsequent FAS*Tracks* can begin anytime after the initial ones have started

FAS*Track* to Process Improvement (5 of 5)



FAS*Track** to CMMI®

Where are we?

- Impediments to Process Improvement (PI)
- Real Examples of Impediments
- FAS*Track* to Process Improvement
- Real Examples of FAS*Track*
- Summary
- References
- ?s
- Contact Information

Real Examples of FAS*Track* (1 of 19)

The following examples illustrate that process improvements and process installations can be done quickly, efficiently and effectively; FASTrack

Example 1

- Contractor developing the Galileo Probe to Jupiter
  - Micro processors, assembly language, firmware based
- Had never developed space firmware
- Had estimated effort at 3 developers for 6 months
  - Thought it was equivalent to a small FORTRAN program
- Had never developed real-time assembly/firmware code
- Had no software processes or standards

Real Examples of FAS*Track* (2 of 19)

Example 1 (cont.)

- As the software development manager, I quickly
  - Developed (in about 3 weeks) a software process compliant with many CMMI Level 2 processes
    - Documented in a development plan
  - Re-estimated the effort
  - Acquired qualified staff
- Management was shocked that software could follow an engineering process
- Galileo spacecraft and probe were very successful for NASA

Real Examples of FAS*Track* (3 of 19)

Example 1 (comp.)

"Al has generated software design, methodologies, design criteria and configuration control procedures for Galileo that will be a model for all programs. These procedures are unique in their completeness and quality for the Corporation for small software projects." *G. A Kravetz*

"Many of us in the program office were originally concerned that the newness of flight software and the specific complexity of the software would compromise our estimated cost and schedule. The well organized software approach that Al has formulated and implemented has completely removed any concern. It should be noted that the software management plan generated by Al has been adapted for the entire Galileo program including the flight software for the relay receiver and the system test software." *R. J. Drean*

Real Examples of FAS*Track* (4 of 19)

Example 2

- Management for a DoD contractor would accept new requirements from the acquisition agency (Theatre Battle Management) without conducting impact assessments and would instruct staff to implement them
- Staff was working overtime and on weekends to keep up with this requirements creep
- I was new to the organization as a senior systems engineer
- I convinced management that they needed to evaluate the state of their engineering/management practices
  - They seemed unaware that things could be done different
- They allowed me to attempt to fix this problem
- I quickly developed a CM process, in two days, which included a Configuration Control Board (CCB)
- I quickly trained staff and management on the process

Real Examples of FAS*Track* (5 of 19)

Example 2 (cont.)

- The next requirements request from the customer was given to me to evaluate
- I had staff:
  - System
  - Hardware
  - Software
  - Test
  - Quality Assurance
  - Configuration Management
  - Program Management
  - Contracts
- Conduct an impact assessment against their interests not limited to:
  - Function
  - Performance
  - Cost
  - Schedule
  - Interfaces

Real Examples of FAS*Track* (6 of 19)

Example 2 (comp.)

- The impact assessment showed that the request could not be implemented
- I told the CCB that we had to reject it
  - Can we do that?
  - Watch me!
- CCB recommended rejection
- Management accepted the recommendation
  - This was the first time they had ever rejected a customer request
- This started the organization down the path to process Improvement
  - Within a few years they had achieved CMM® Level 3

Real Examples of FAS*Track* (7 of 19)

Example 3

- Contractor developing a very large criminal database application
- Going into a System Design Review
- As the newly assigned Development Manager I reviewed the System Requirements Specification
  - Requirements very poorly written: ambiguous, inconsistent, not uniquely identified, untestable, unimplementable, etc. *(so what else is new?)*
- Convinced management and the customer to delay the review by one month to fix specification
- Quickly documented a methodology for the proper specification of requirements[1]
  - Had been using this method since 1978
- Trained the system, software, and test engineers on the methodology
- We rewrote the specification and passed the review without any action items assigned to us

Real Examples of FAS*Track* (8 of 19)

Example 4

- Same contractor developing a very large criminal database application
- Configuration Control Board (CCB) meeting once a week for 2 to 3 hours
  - CCB items ranged from requirements to design defects and every thing in between *(even the kitchen sink)*
  - Membership included all mangers and all technical leads
    - About 12 members
    - Program Manager (PM) Chair

Real Examples of FAS*Track* (9 of 19)

Example 4 (cont.)

- I convinced the PM to allow me to redesign the CCB and Configuration Management Process
  - CCB items ranged from baselined requirements to other important contractual, critical issues such as:
    - Statement-of-Work
    - Master Schedule
    - Costs, based on thresholds
  - CCB met monthly or as necessary
  - CCB membership
    - PM (Chair)
    - Deputy PM
    - Development Manager
    - Systems Engineering Manager
    - Test Engineering Manager
    - CM and QA Managers
    - Contracts (as necessary)

The project continued this approached and achieved, with the organization, CMM Level 3 less that 2 years after contract award without a Level 2 assessment.

[2] Unfortunately, we failed at to achieve Level 4 for many of the reasons listed earlier.

Real Examples of FAS*Track* (10 of 19)

Example 4 (comp.)

- Formed a Technical Review Board (TRB)
  - Winnow out items from CCB
  - Promote appropriate items to CCB
  - Conduct impact assessments on baseline changes
  - Make recommendations to CCB
- TRB met weekly
- TRB membership
  - Deputy PM (chair)
  - Development Manager
  - System Engineering Manager
  - Test Manager
  - CM and QA Managers
  - Technical Leads (as required)

Project continued to improve processes and acquired CMM® Level 3 compliance by Critical Design Review
It's parent organization was the first to achieve Level 3 in the corporation

Real Examples of FAS*Track* (11 of 19)

Example 5

- A DoD organization that acquires and also develops products is implementing both the CMMI® for development and the CMMI® Acquisition Module for acquisition
- Using a FAS*Track* approach
- Formed
  - Steering Committee (Senior Executive Management)
    - Approve, release, and enforce process policy
    - Approve process procedures
    - Oversee and approve Process Group's efforts
  - Process Group (3 MITRE staff 60% FTE, 5 DoD staff 25% FTE)
    - Provide status and recommendations to Steering Committee
    - Develop/acquire processes
    - Develop/acquire and present process training
    - Select projects for FAS*Track*
    - Select processes for FAS*Track*
    - Follow FAS*Track* approach

Real Examples of FAS*Track* (12 of 19)

Example 5 (cont.)

- Process Group
  - Developed Process Policy
  - Selected pilot project
  - Selected processes to pilots
  - Developed Schedule
    - Level 2 Appraisal,
    - Level 2 and Level 3 processes
    - Acquisition processes
  - Developing draft processes
  - Developing draft guidelines
  - Developing training on processes
  - Providing training
- Steering Committee
  - Signed Process Policy
  - Reviewed and approved FAS*Track* approach

Real Examples of FAS*Track* (13 of 19)

Example 5 (cont.)

- Pilot Project
  - Taking training
  - Applying FAS*Track* on processes
  - Maturing processes
- Organization had no documented procedures
- Pilot project followed undocumented methods and had some process artifacts
  - CCB Minutes
  - CM Plan
  - Baselined Requirements
  - Etc.

Real Examples of FAS*Track* (14 of 19)

Example 5 (cont.)

- Leveraged *CMMI® to develop draft procedures and training
  - Two or more processes developed and implemented per month *(note: 9 months to implement QA shown on Examples of Impediments, example 3, with many more resources)*
    - Developed draft procedure and guidelines
    - One to two procedure per process area *(3 to 4 pages vs. several procedures with up to 13 pages shown on Examples of Impediments, example 3)*
    - Developed and delivered process training (can be uses as guidelines)
- Piloting procedures on project
  - Provide mentoring
  - Mature process
  - Collect artifacts

*Credit given to SEI

Real Examples of FAS*Track* (15 of 19)

Example 5 (cont.)

QA Plan Tailoring (1 of 4)

1.	Introduction
1.1	Purpose
1.2	Scope
1.3	Plan Organization
1.4	Related Documents
1.5	Tailoring this Plan
1.6	Plan Maintenance
2.	Quality Goals and Objectives
3.	Quality Assurance Program
3.1	Process Steering Committee
3.2	Process Group
3.3	Enterprise-Level Quality Assurance
3.4	QA Manager
3.5	QA Personnel
3.6	Program/Project Management
3.7	Programs/Projects Personnel
3.8	QA Measurement and Metrics
3.9	QA Risks
4.	QA Resources
4.1	Facilities and Infrastructure
4.2	Tools
4.3	Costs
5.	QA Training
5.1	Senior Management Orientation
5.2	Program/Project Staff
5.3	QA Staff

APPENDIX A QUALITY ASSURANCE TASKS - TAILORING TABLE

A QA plan has been developed that is generic and should cover QA needs for most projects.

It has a tailoring mechanism built into an appendix where the detailed QA activities are described.

Projects use the appendix to appropriately tailor the plan to the project's specific needs and to the scope of the application.

Projects can accomplish this tailoring with minimum resources and costs.

Real Examples of FAS*Track* (16 of 19)

Example 5 (cont.)

QA Plan Tailoring (2 of 4)

Appendix A

Describes the activities to be executed to effectively administer the QA program. It provides a tailoring schema used to tailor this plan to be used on specific programs and projects.

Allows for quickly adapting plans to projects

All too often project plans: (Project Management Plan, System Engineer Plan, Software Development Plan, Configuration Management Plan, Quality Assurance Plan, etc.) take months and tons of people to developer, and can cost in excess of $100K.

Real Examples of FAS*Track* (17 of 19)

Example 5 (cont.)

QA Plan Tailoring (3 of 4)

Appendix to QA Plan
QUALITY ASSURANCE TASKS
TAILORING TABLE

QA tasks are shown in the table along with task numbers. Responsible organizations are shown along with QA process areas. References to procedures are included for those tasks that require them. The table allows programs and projects to tailor the QA process to the scope of a specific application by indicating "Y" for "used" and "N" for "not used". Additional QA tasks can be added at the end of each section, if needed, for a specific application. The main body of this plan should not be tailored since all QA tasks are included in this appendix.

TAILORED FOR PROJECT/PROGRAM:_____
Program/Project Manager:_____
Date:_____
OTC Process Group:_____
Date:_____
OTC Enterprise-Level Quality Assurance:_____
Date:_____
OTC Process Steering Committee_____
Date:_____

Real Examples of FAS*Track* (18 of 19)

Example 5 (cont..) Appendix *QA Plan Tailoring (4 of 4)*

	Y/N
3.4 QA Manager	
a. Primarily responsible for overseeing QA task assigned to programs/projects and to QA personnel	
b. Works closely with the Process Group and serves on the group whiled developing QA process artifacts and QA orientation and training	
c. Provides QA orientation and training	
d. Works with Program/Project Management in tailoring and applying QA.	
e. Attempts to resolve QA non-compliance with program/project management	
f. Escalates QA non-compliance to Steering Committee	
3.5 QA Personnel	
a. Support the development/acquisition of QA processes and best practices	
b. Support the development and tailoring QA plans	
c. Conduct product reviews on external products delivered by contractors and suppliers 1. QA Product Review Procedure	
d. Conduct product reviews at the enterprise level and on programs/projects 1. QA Product Review Procedure	
e. Conduct process audits at the enterprise level and on programs/projects 1. QA Process Audit Procedure	

Real Examples of FAS*Track* (19 of 19)

Level 2 Level 3 Level 4
Level 5 AM Unique

Example 5 (comp.) *Level 2 Appraisal in February 07 Scheduled*

Category	Process Area [Level]	CMMI®	CMMI®-AM	Timeline
Project Management 	Project Planning [2]	YES	YES	May 06
	Project Monitoring and Control [2]	YES	YES	May 06
	Supplier Agreement Management [2]	YES	NO	Sep 06
	Integrated Project Management (IPPD) [3]	YES	YES	Oct 06
	Integrated Supplier Management (SS) [3]	YES	NO	Oct 06
	Integrated Teaming (IPPD) [3]	YES	YES	Dec 06
	Risk Management [3]	YES	YES	July 06
	Quantitative Project Management [4]	YES	NO	N/A
	Solicitation and Contract Monitoring [AM]	NO	YES	Sep 06
Support 	Configuration Management [2]	YES	YES	Feb 06
	Process and Product Quality Assurance [2]	YES	NO	Mar 06
	Measurement and Analysis [2]	YES	YES	June 06
	Decision Analysis and Resolution [3]	YES	YES	Jan 07
	Organizational Environment for Integration (IPPD) [3]	YES	Imbedded	
	Causal Analysis and Resolution [5]	YES	NO	N/A
Engineering 	Requirements Management [2]	YES	YES	Jan 06
	Requirements Development [3]	YES	YES	Jan 06
	Technical Solution [3]	YES	NO	Aug 06
	Product Integration [3]	YES	NO	Jan 07
	Verification [3]	YES	YES	Aug 06
	Validation [3]	YES	YES	Aug 06
	Transition to Operations and Support [AM]	NO	YES	Dec 07
Process Management 	Organizational Process Focus [3]	YES	NO	Feb 07
	Organizational Process Definition [3]	YES	NO	Feb 07
	Organizational Training [3]	YES	NO	July 06
	Organizational Process Performance [4]	YES	NO	N/A
	Organizational Innovation and Deployment [5]	YES	NO	N/A

FAS*Track* on Schedule

Where are we?

- Impediments to Process Improvement (PI)
- Real Examples of Impediments
- FAS*Track* to Process Improvement
- Real Examples of FAS*Track*
- Summary
- References
- ?s
- Contact Information

Summary (1 of 2)

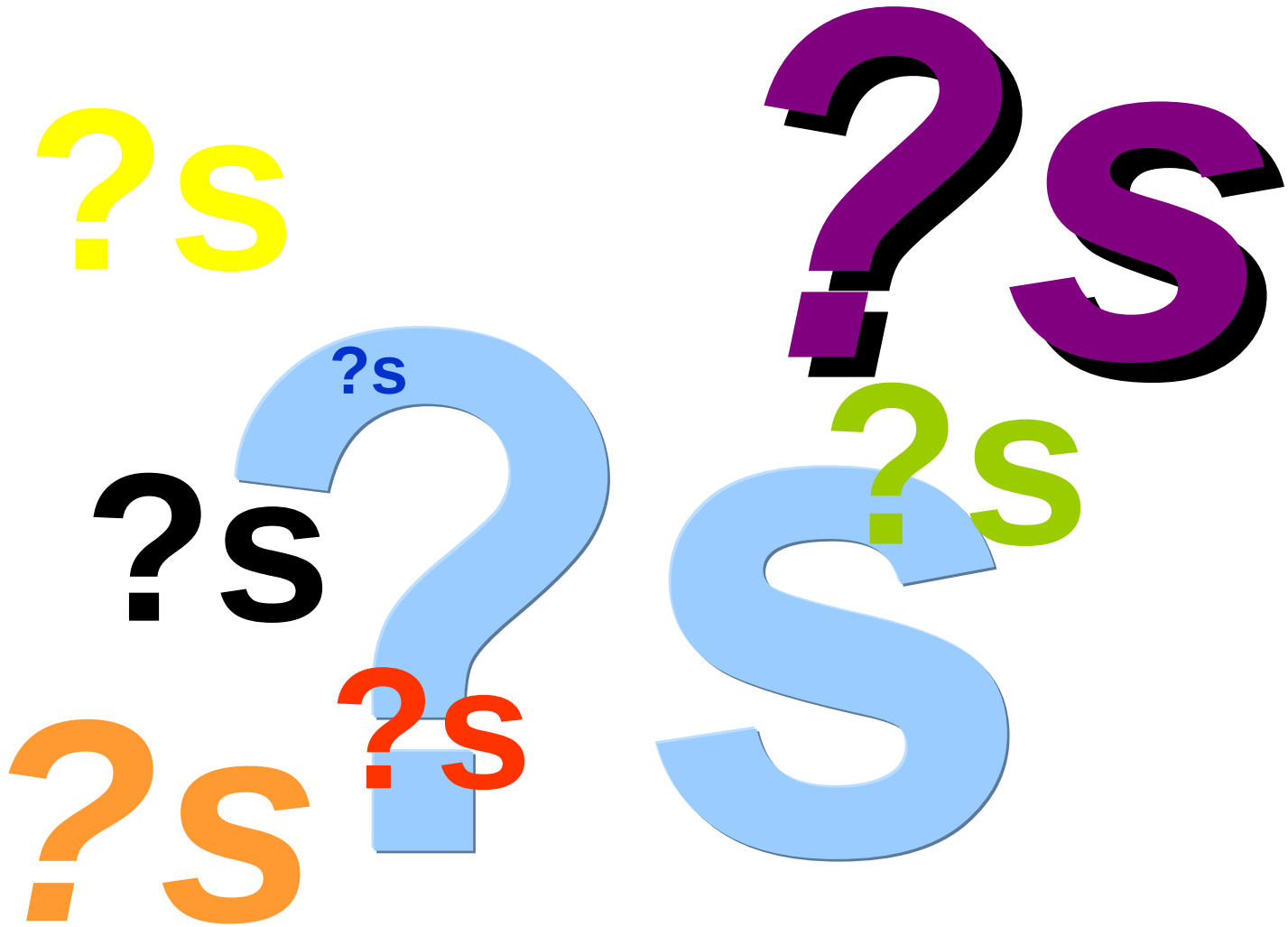
- CMMI implementation can be:
  - Costly
  - Time consuming
  - Prone to failure
- Many reason for this
  - Management support
  - Schedule constraints
  - Funding
  - Immediate expectations
  - Excessive process documentation
  - Failure to get buy-in
  - Etc.

Summary (2 of 2)

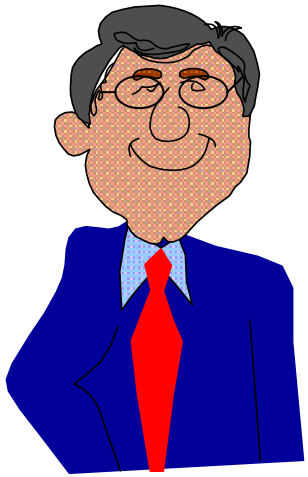
- FAS*Track* provides
  - Early results to management
  - Buy-in from senior management and staff
  - Momentum to continue
  - Early process execution and artifact collection
  - Proof that process works
  - On-the-fly maturing of the processes

References

1. Florence, Al. *Proper Specification of Software Requirements*;
   a. PSQT/PSTT Conference, March 2002.
   b. NDIA System Engineering Conference, October 2005
   c. SEPG Conference, March 2006
   d. CROSSTALK, The Journal of Defense Software Engineering. April 2002
      i. *Won best paper award at MITRE, 2003*
      ii. *Used by David A. Cook, Ph.D. as required reading by his graduate students in Systems Engineering*
   e. Quality Assurance Institute Journal, October 2003
2. Florence, Al*; Success at Level 3, Failure at Level 4, Lessons Learned;*
   1. Software Technology Conference (STC), Salt Lake City. 2001
   2. Software Engineering Process Group (SEPG) Conference, New Orleans. 2001
   3. CrossTalk, The Journal of Defense software Engineering; August, 2001
   4. Quality Assurance Institute Journal, April, 2002
3. *Capability Maturity Model® Integration (CMMI), Version 1.1.* Software Engineering Institute. March 200


?s
?s
?s
?s
?s
?s
?s

Contact Information



Al Florence
Florence@MITRE.org
(703) 983-7476