Air Force
Systems Engineering Assessment Model
(AF SEAM)

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Outline

1. **Background**
   - **AF SEAM Pedigree**
   - **AF SEAM Goals**

2. **Model Contents (What is Included)**
   - **Process Areas (PAs)**
   - **Practices (Specific)**
   - **Practices (Generic)**
   - **References (What)**
   - **Other Information/Elaboration**
   - **Typical Work Products**
   - **Methodology**

AF SEAM Background

- **In 2006, AFMC Engineering Council Action Item to:**
    - Provide an AF-wide SE Assessment Model
    - Involve AF Centers (product and logistics)
    - Leverage current CMMI®-based models in use at AF Centers
    - Baseline Process capability & usage

- **Definition of AF Systems Engineering Assessment Model:**
    - **A single AF-wide tool which can be used for the assessment and improvement of systems engineering processes in a program/project.**

AF SEAM Goals

- Goals
  - Ensure a Consistent Understanding of SE
  - Ensure Core SE Processes are in Place and Being Practiced
  - Document repeatable SE "Best Practices" across AF
  - Identify Opportunities for Continuous Improvement
  - Clarify Roles and Responsibilities
  - Improve Program Performance & Reduce Technical Risk

Why We Need SE Assessment

- Lack of Disciplined System Engineering (SE) has been a major contributor to poor program performance

- Many Problems Have Surfaced Repeatedly with AF Programs
  - Missed or Poorly Validated Requirements
  - Poor Planning Fundamentals
  - Lack of Integrated Risk Management
  - Lack of Rigorous Process
  - Lack of Process Flow Down

- Restoring SE Discipline in AF Programs Is Key to Improved Performance and Credibility
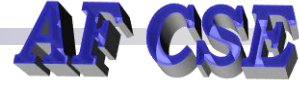
Benefits

- Restoring Disciplined SE
  - Clear Definition of Expectations
  - Well Aligned with Policy

- Established Assessment Methods & Tools
  - Best Practices Baseline
  - Driving Improvement

- Moving towards
  - Deeper Understanding of SE Processes
  - More Efficient Programs

Why AF SEAM

- ## AF SEAM is a composite of Industry & DoD SE best practices
  - ### Maps to CMMI -ACQ 1.2 & -DEV 1.2
  - ### Consistent w/ Industry and DoD guidance
- ## Advantages to using AF SEAM
  - ### Streamlining of CMMI process areas to AF programs
  - ### AF-centric w/ end-to-end life cycle coverage
  - ### More focused document requires less program overhead
  - ### Does not require SEI certified assessors
- ## Impact to AF programs
  - ### Assure programs are achieving desired outcomes
  - ### Ensure program teams have adequate resources
    - #### Qualified People, Process Discipline, Tools/Technology

AF SEAM Pedigree

- All AF product Centers selected and tailored some version of the Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI®) to baseline process institutionalization
- SEI CMMI® is the Defense Industry-wide accepted method for process appraisal and improvement
- The SEI CMMI® incorporates principles and practices from recognized industry and US Government system engineering and related standards such as:
  - **AFI 63-1201**   **Life Cycle Systems Engineering**
  - **Defense Acquisition Guidebook, Chapter 4**
  - **MIL-STD 499B**   **System Engineering**
  - **ANSI/EIA 632**   **Processes for Engineering a System**
  - **IEEE/EIA 731**   **Systems Engineering Capability Model**
  - **ISO/IEEE 15288**   **Systems Engineering-System Life Cycle Processes**
  - **INCOSE**   **System Engineering Standard**
  - **IEEE 1220**   **Application and Management of the Systems Engineering Process**
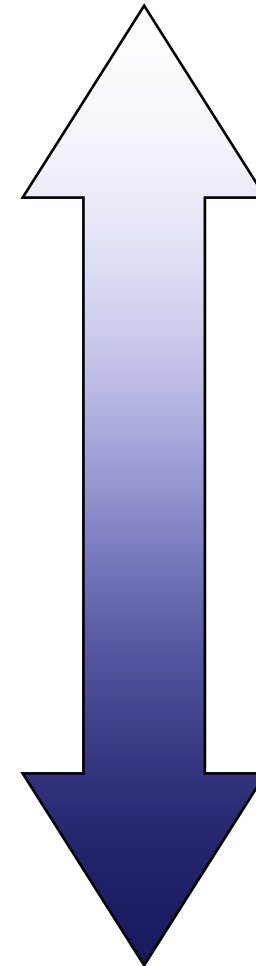
AF SEAM Content

- Process Areas (PAs)
- Goals
- Practices
- Informative Material
  - Description
  - Typical Work Products
  - Reference Material
  - Other Considerations

Broadest

Level of Specificity

Most Detailed

Principles & Objectives

Best Practices from Government & Industry

People

with Skills, Training & Motivation

Tools & Technology

the Means to Execute

Baseline Practice of Systems Engineering

Lean Assessment of Integrated Team

Process & Procedures

the Glue that Holds it Together

Continuous Process Improvement
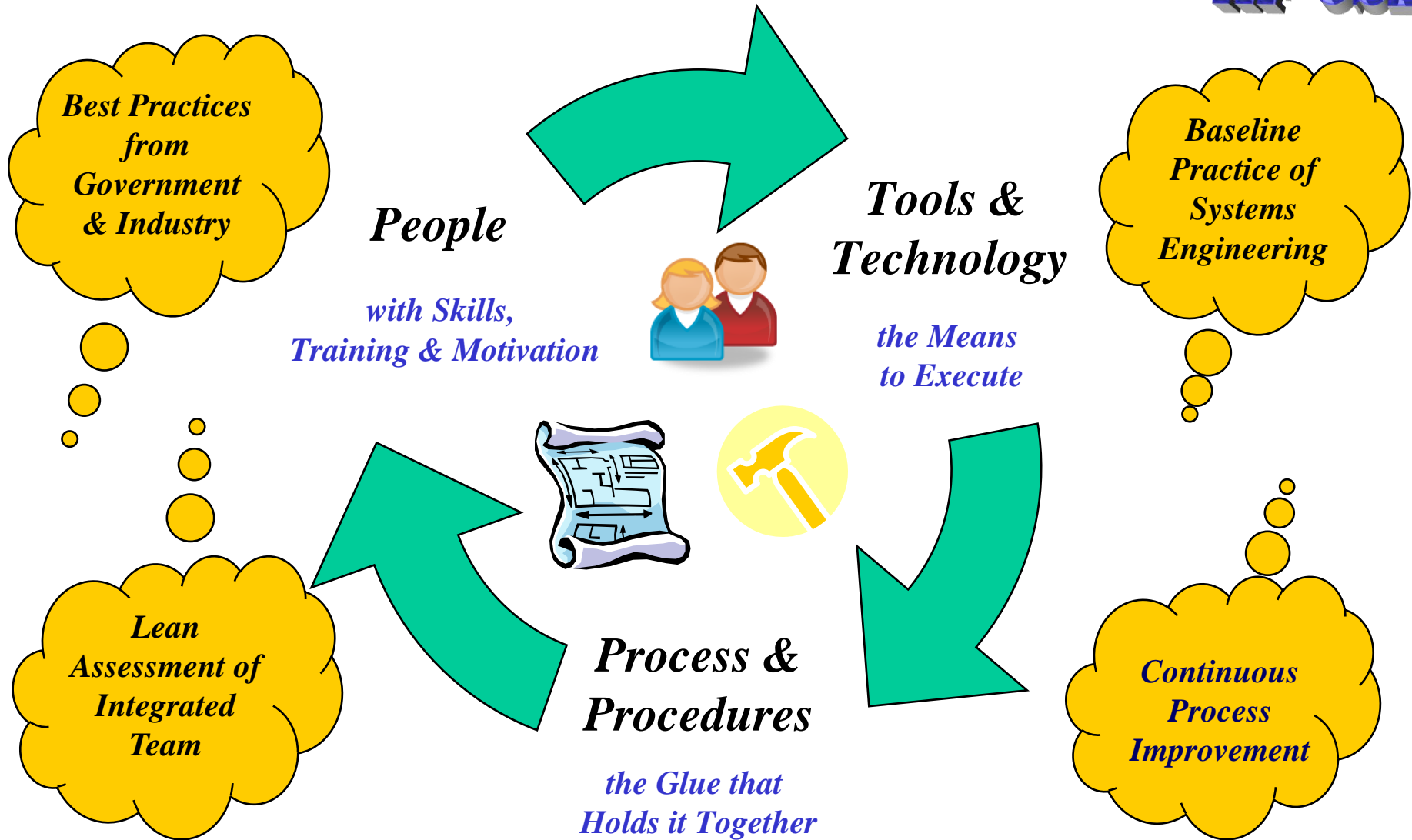
Why Focus on Process?

"If you can't describe what you are doing as a process, you don't know what you are doing."

- W. Edwards Deming

AF SEAM Elements

- ## 10 Process Areas (PAs)
  - ### Based in CMMI process area construct
  - ### Conforms with AFI 63-1201 & DAG Chapter 4

Process Areas (PAs)

- **Configuration Mgmt (CM)**
- **Decision Analysis (DA)**
- **Design (D)**
- **Manufacturing (M)**
- **Project Planning (PP)**

- **Requirements (R)**
- **Risk Mgmt (RM)**
- **Sustainment (S)**
- **Tech Mgmt & Ctrl (TMC)**
- **Verification &Validation (V)**

- 34 Goals - *Are Accomplished through the Specific Practices*
- 120 Specific Practices
- 7 Generic Practices (Apply to each Process Area)

AF SEAM Practices

- **Specific Practices – Each one applies to only one Process Area**

- **Each Practice has Informative Material**
  - Description
  - References
  - Typical Work Products
  - Other Considerations

- **Generic Practices**
  - Must be accomplished for each Process Area
  - Ensures specific practices are executed
  - Involves stakeholders

AF SEAM Practices

Process Area	Goals	Specific Practices	Generic Practices	Total Practices
Configuration Mgmt	3	8	7	15
Decision Analysis	1	5	7	12
Design	3	14	7	21
Manufacturing	4	12	7	19
Project Planning	3	15	7	22
Requirements	4	13	7	20
Risk Mgmt	3	7	7	14
Sustainment	4	15	7	22
Tech Mgmt & Control	4	15	7	22
V & V	5	16	7	23
Total	34	120	70	190

Sample Specific Practice

- **RMG1P1   Determine risk sources and categories**

- **Description**: Establish categories of risks and risk sources for the project initially and refine the risk structure over time (e.g., schedule, cost, supplier execution, technology readiness, manufacturing readiness, product safety, and issues outside control of team), using Integrated Product Teams. Quantify the risk probability and consequence in terms of cost and schedule.

- **Typical Work Products:**
  - Risk matrix
  - Risk management plan

- **Reference Material: USAF Operational Risk Management, AFI 90-901**

- **Other Considerations:**   Consider using Acquisition Center of Excellence Risk Management Workshops when needed. For manufacturing risks consider the capability of planned production processes to meet anticipated design tolerances. Include the supplier's capacity and capabilities in the analysis.

Generic Practices

1. Establish and maintain the description of a defined process

2. Establish and maintain plans for performing the process

3. Provide adequate resources for performing the process, developing the work products, and providing the services of the process

4. Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process

5. Train the people performing or supporting the processes needed

6. Monitor and control the process against the process plan and take appropriate corrective action

7. Review the activities, status, and results of the process with higher level management and resolve issues

Process Detail Outline

A – B
- Roles/Responsibilities
- Training
  - Leadership
  - Self Assessment

C – D
- Build Team
- Train team
- Logistics support
- Set schedule

A
START

B
SELF ASSESSMENT

C
VALIDATION REQUIRED?

YES

D
CONDUCT VALIDATION

NO

E
POST RESULTS

- Leadership identifies "area(s)" of self assessment

- Describes self assessment activity
- What needs to be accomplished
- Capture data
- Presentation of results

- In brief
- Conduct interviews
- Analysis
- Presentation of results

Feedback
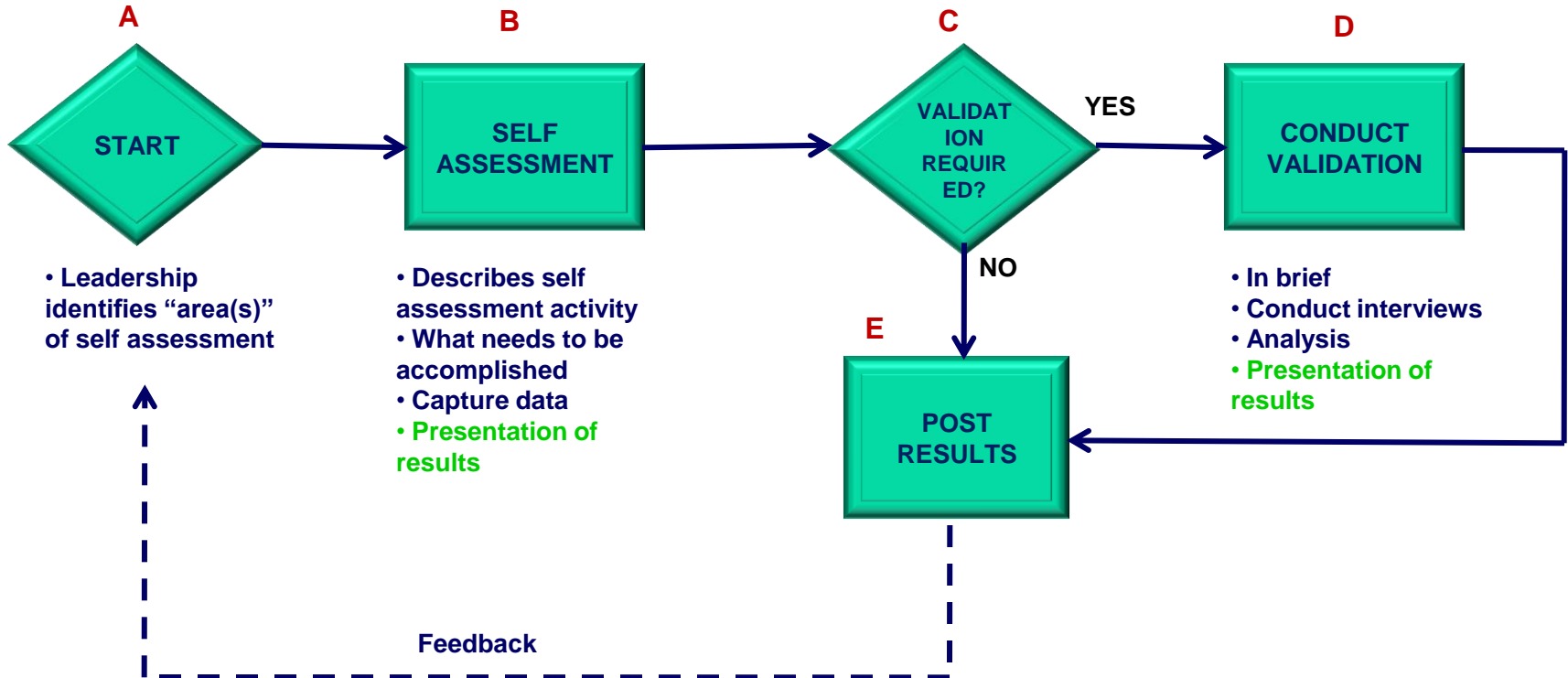
Criteria for Methodology

- Facilitate Self Assessment
- Facilitate Continuous Improvement
- Provide insight into Program/Project Processes & Capability
- Objective Assessment
- Consistent Near and Far Term Approach
- Provide Results that are meaningful for leadership
  - **Relevant to PM/PEO/CC**
  - **Simple**
  - **Understandable**
  - **Graphical**
- **Support Multi-level Measurement & Reporting**
  - **Program/Project, Squadron, Group, Wing, Center**
    - **Resource Allocation**
    - **SE Process Improvement**

Defining the Methodology

Assessment Continuum

Low ←——————————————————————→ *High*

- **Hands Off**
- **Promulgate Policy**
  - **Directives**
  - **Instructions**
  - **Checklists**
  - **Guidance**
- **Expect Compliance**
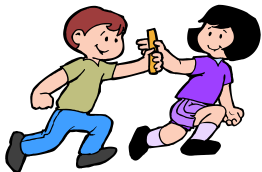
- **AF SEAM**
  - **Collaborative & inclusive**
  - **Leanest Possible Best Practices "Must Dos"**
  - **Clearly Stated Expectations**
  - **Program Team & Assessor Team**
  - **Training**
- **Self Assessment of Program with Validation Assessment**

- **Hands On**
- **Comprehensive Continuous Process Improvement**
  - **Highly Detailed Process Bibles**
  - **Training**
- **Validation Assessment**
  - **Deep Dives**

Assessment Methods that Balance Time and Effectiveness

SE Assessment Activities

Phase I
Planning

- Read Ahead Package
- Logistics Planning
- Training

Phase II
Self-Assessment

- Self Assessment Training
- Project performs self-assessment
- Provide self - assessment to review team

Phase III
Independent Validation

- Team In-Brief
- Project Brief
- Review Self-Assessment
- Collaborative Interviews
- Document Reviews

Phase IV
Report Results

- Consolidate Results
- Prepare final report / outbrief
- Deliver Final Results

Assessment Outputs

- Feedback
  - Lessons learned from assessment tool
  - Collaborative review
- Findings
  - Completed assessment tool
  - Strengths
  - Improvement opportunities
  - Output metrics
- Recommendations
- Final outbrief

Specific Practices Summary

PA LEGEND

| 90-100% |
| 65-89% |
| 0-64% |

SP LEGEND

| 1 |
| 0 |
| Not Applicable |

Percentage (of those practices scored)	75%	50%	79%	73%	87%	86%	100%	67%	83%	93%
	CM	DA	D	M	PP	R	RM	S	TMC	V
Specific Goal 1										
SP 1.1	1	1	1	0	1	1	1	1	1	1
SP 1.2	1	1	1	1	1	1	1	1	1	1
SP 1.3		0	1	1	1	1	1	1	1	1
SP 1.4		N/A	0		1	1			1	1
SP 1.5		0	0						1	
Specific Goal 2										
SP 2.1	1		1	1	0	1	1	0	1	1
SP 2.2	1		0	1	0	1	1	0	1	1
SP 2.3	0		1		1	1		0	1	
SP 2.4	0		1		1			0		
SP 2.5	N/A				1			0		
SP 2.6					1					
SP 2.7					1					
SP 2.8					1					
Specfic Goal 3										
SP 3.1	1		1	1	1	1	1	1	0	1
SP 3.2	1		1	1	1	0	1	1	0	1
SP 3.3			1	1	1	0			1	0
SP 3.4			1						1	
SP 3.5			1							
Specific Goal 4										
SP 4.1				1		1		1		1
SP 4.2				0		1		1		1
SP 4.3				0		1		1		1
SP 4.4						1		1		1
SP 4.5								1		1
Specific Goal 5										
SP 5.1										N/A
SP 5.2										N/A

Generic Practices Summary

PA/GP	GP1	GP2	GP3	GP4	GP5	GP6	GP7	GP Overall
CM	1	1	1	1	1	1	1	7
DA	0	0	1	1	1	1	1	5
D	1	1	1	1	1	1	1	7
M	1	1	1	1	1	1	1	7
PP	0	1	1	0	1	0	1	4
R	1	1	1	1	1	1	1	7
RM	1	1	1	1	1	1	0	6
S	1	1	1	1	1	1	1	7
TMC	0	1	1	1	1	1	1	6
V	1	1	1	1	1	1	1	7

GP LEGEND
1
0

PA LEGEND
6-7
4-5
<4

Summary

- **Goal is to Continue to Improve Program Performance**
  - **Too many examples of program performance/issues being tracked back to lack of SE discipline**
- **Long Term Goal –** *Revitalize & Institutionalize Systems Engineering*
  - **Use SE "Best Practices"**
  - **Assist programs in achieving desired outcomes**
  - **Assist program teams in resource planning**
    - **Qualified People**
    - **Disciplined Processes**
    - **Tools/Technology**

Back Up Slides

Team Members

| Center	Members
AAC	Ian Talbot
AEDC	Neil Peery, Maj Mark Jenks
ASC	Gary Bailey
AF CSE	Rich Freeman, Randy Bullard
HQ AFMC	Caroline Buckey
ESC	Bob Swarz, Bruce Allgood
OC-ALC	Cal Underwood, Bill Raphael
OO-ALC	Jim Belford, Mahnaz Maung
SMC	Linda Taylor
WR-ALC	Jim Jeter, Ronnie Rogers

Spiral 2

- Capability Enhancement
  - Re-look process areas for improvements
  - Further refine assessment methodology
  - Strengthen inclusion of software
  - Capture and promulgate best practices/lessons learned
  - Review scoring
  - Examine potential use for SE health assessment
  - Migrate to web-based platform
- Resources
  - Funding
  - People
  - Computer Based Training
- Schedule
  - Estimated 1-year effort
  - One member from each Center
  - Working Group meetings held approximately bi-monthly
- Lead POC/Steering Group
  - Staff support
  - Community of Interest
  - Model sustainment (continuous improvement)

Scoring Roll-Up
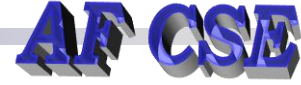
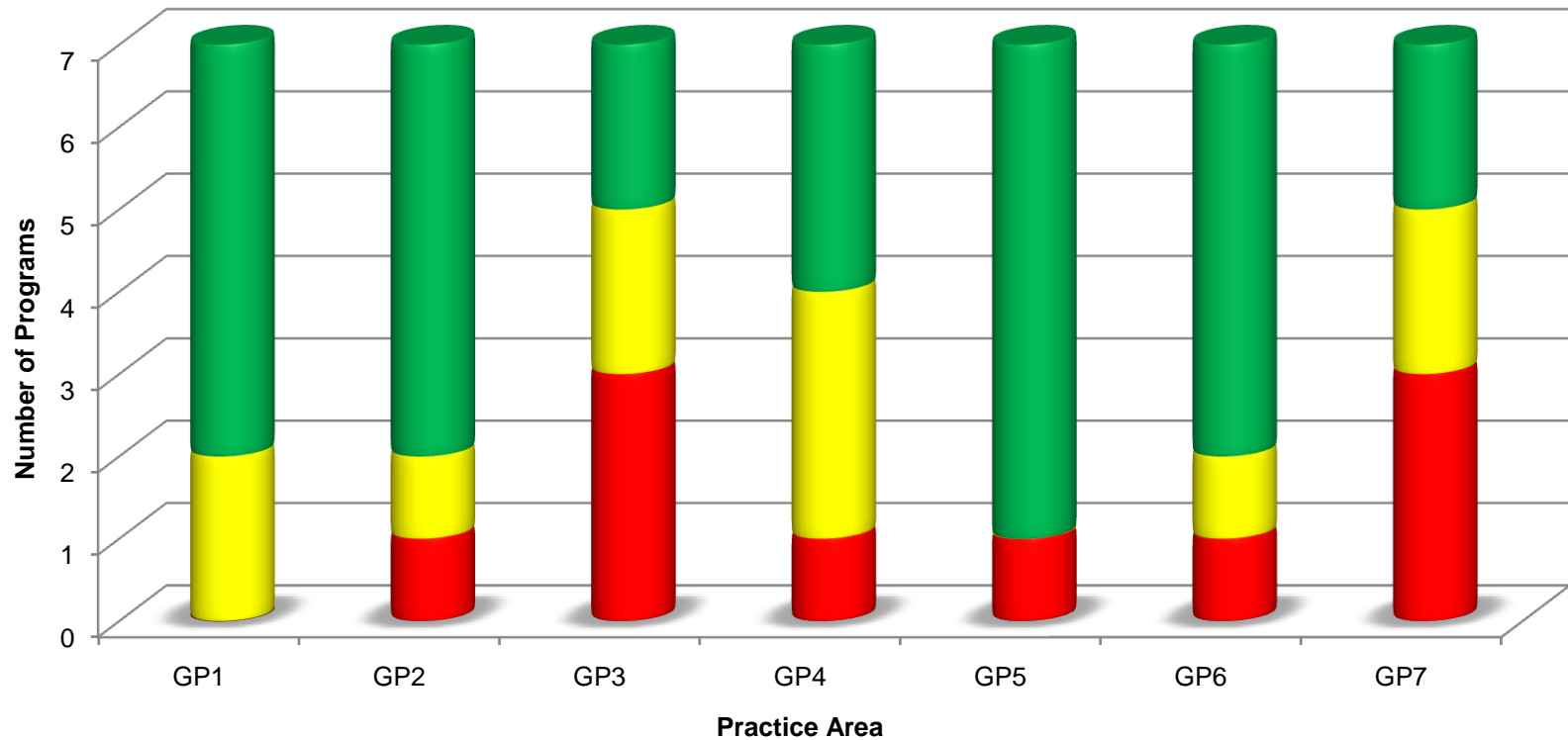**Specific Practice Assessment Results**
XXX Center
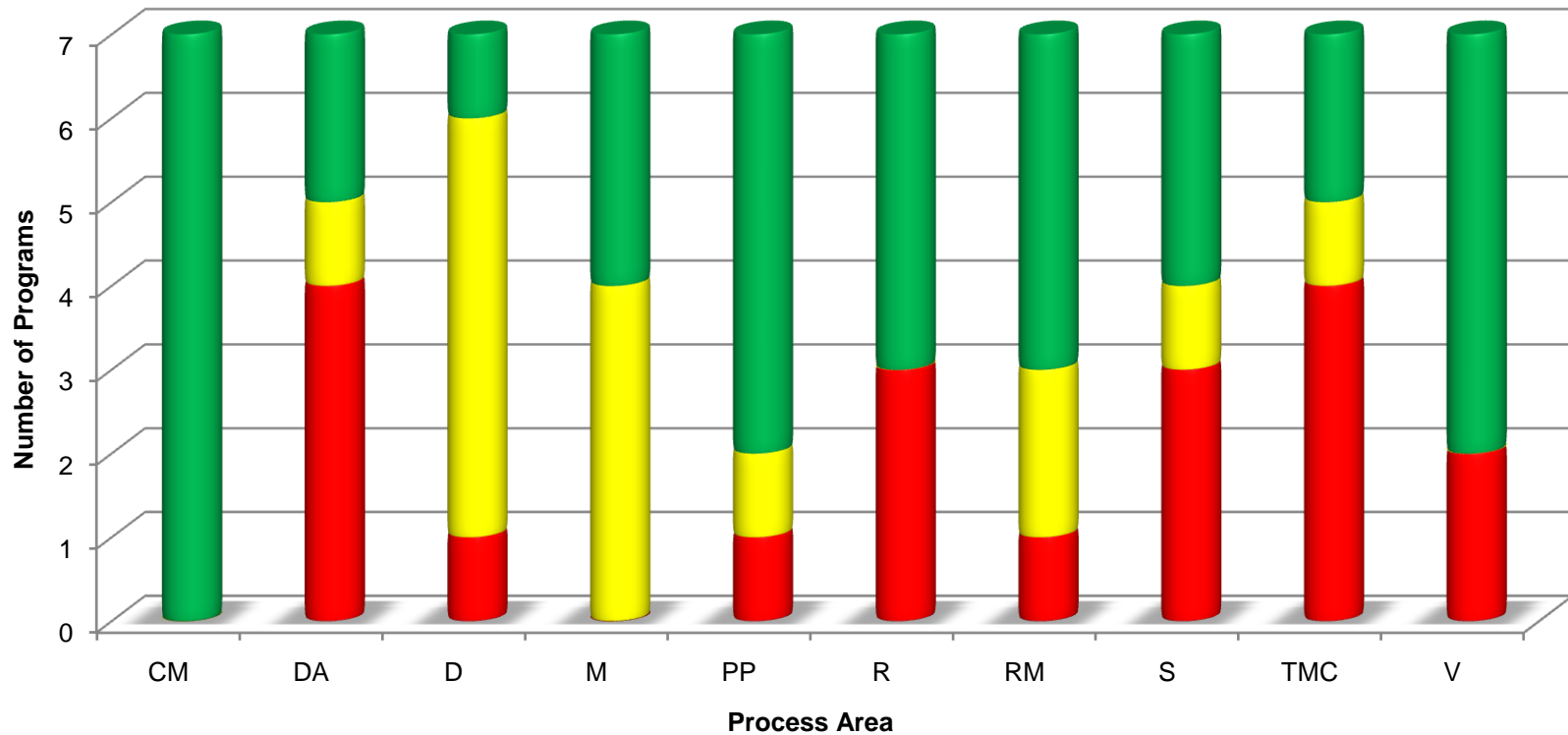
Scoring Roll-Up

Generic Practice Assessment Results
XXX Center

Implementation By Center

CENTER	5 AUG 08 - FEEDBACK
✓ AAC	"AAC began integrating AF SEAM in our established program assessment process in January 2008 and expects to complete this integration in FY09."
✓ AEDC	"We will begin implementing AF SEAM in October."
✓ ASC	"We are creating a plan to migrate from our current tool to SEAM, tailored with AFMC and ASC specific areas of interest."
✓ ESC	"We have initiated tailoring efforts to implement AF SEAM by the end of the calendar year. We will be working closely with SMC, our acquisition partner, on the tailoring and implementation effort."
✓ OC-ALC	"Strongly support, have plans in place, ready to go!"
✓ OO-ALC	"We are implementing now."
✓ SMC	"SMC plans to adopt AF SEAM and comply with related policies."
✓ WR-ALC	"We'll begin implementation at Robins with pilot assessments in F-15 and Avionics."

Development process yielded 100% buy-in