AF Systems Engineering Assessment Model (AF SEAM)

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Agenda

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-
evelopment process
-
F SEAM tool suite:
  - Management guide
  - Assessment tool (Spreadsheet)
  - Training
-
F SEAM Assessment Process
-

Why AF SEAM

Problem:

- AF programs late, over cost, & do not provide the performance expected
- SECAF directed action to revitalize SE across the AF
- No standard tool/method for assessing SE processes

Goals:

- Promote consistent understanding of SE
- Ensure core SE processes are in place and being practiced
- Facilitate sharing “Best Practices”
- Provide “Brain Drain” insurance
- Improve AF leadership visibility into SE process maturity

Improved program performance & reduced technical risk

AFSEAM Development Team Members

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

Phenomenal Team Support !

Background

- 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

Background (con't)

- **Original task: AFMC EC Action Item**
  - **Objective: "Develop standard AF assessment model"**
  - **Tools were in place @ 4 Centers**
- **12 On-Site Team Engagements**
  - **Representatives from EN Home Offices**
    - **4 Product Centers, 3 ALCs, AEDC, HQ AFMC/EN, CSE**
  - **Met 9 times at 5 different locations in one year**
  - **Conducted 3 baseline assessments at 3 Centers**
- **12 Briefings to Senior Leaders**
  - **AFMC Engineering Council Meetings (4)**
  - **ALC EN Meeting**
  - **SAF/AQR (2)**
  - **AF Tech Leaders Round Table**
  - **OSD (AT&L) & Boeing SE Advisory Group**
  - **National Research Council (National Academies)**
  - **Final to AFMC/EN – 5 Aug 08, & Final to SAFF/AQR – 11 Aug 08**

Development Process

- **Environmental Scan Up Front**
  - **External Benchmarking**
  - **Existing Best Practices**
- **Collaborative Reviews/Inputs**
  - **Software Engineering Institute (CMMI)**
  - **NDIA**
  - **AF HSIO**
  - **LHA Development Team**
  - **TD 1-12**
  - **INCOSE**
  - **Industry Partners**

Collaborative build – Included greater SE community

Development Process 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

Development Process Principles & Objectives

AF CSE

Best Practices from Government & Industry

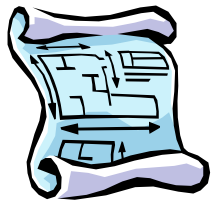
Baseline Practice of Systems Engineering

People

with Skills, Training & Motivation

Tools & Technology

the Means to Execute



Process & Procedures

the Glue that Holds it Together

Lean Assessment of Integrated Team

Continuous Process Improvement

Defining the Methodology

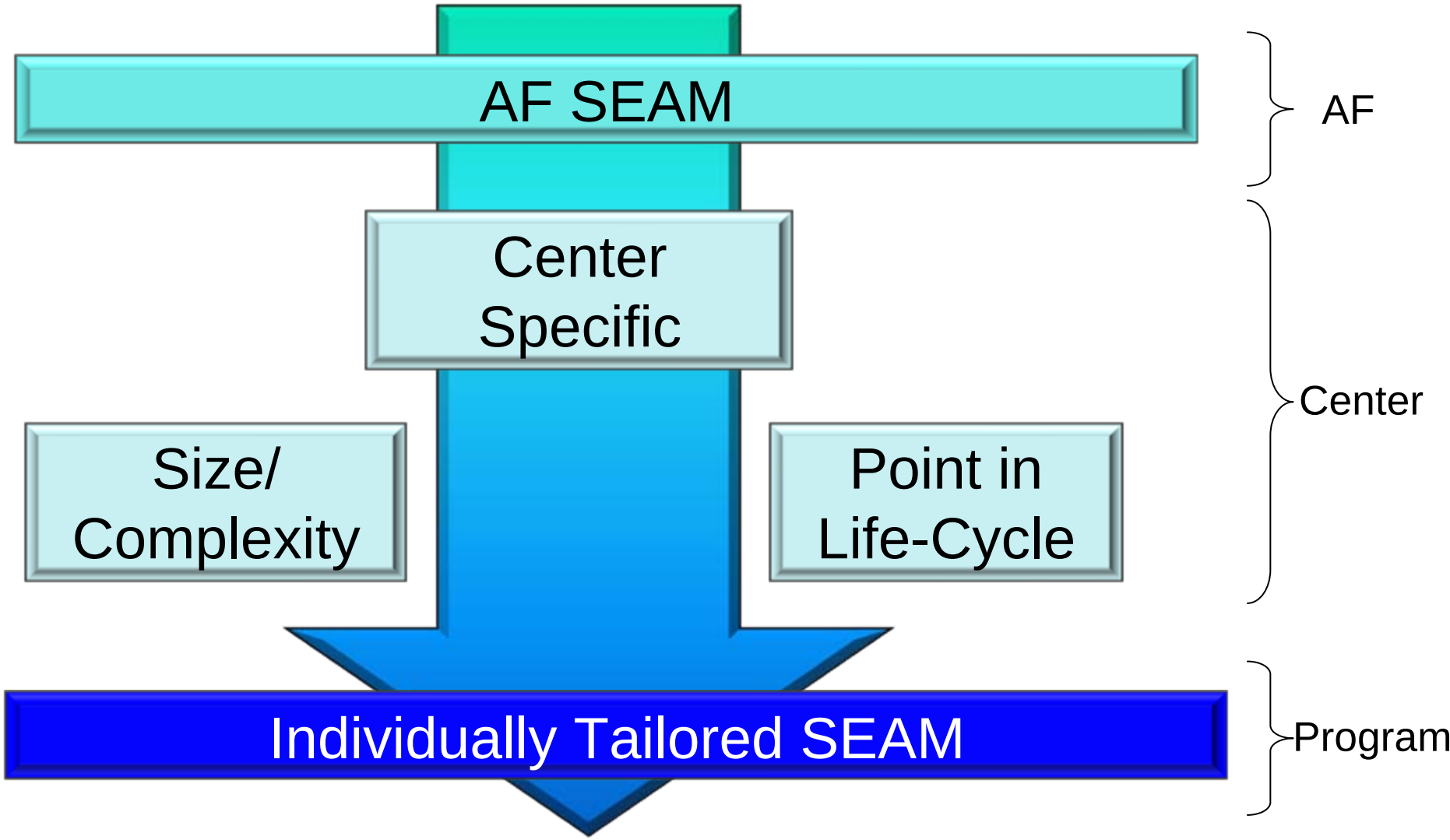
- Hands Off
- Promulgate Policy
  - Directives
  - Instructions
  - Checklists
  - Guidance
- Expect Compliance

- AF SEAM
  - Collaborative & inclusive
  - Leanest possible best practices “Must Dos”
  - Clearly stated expectations
  - Program team & assessor team
  - Training
- Self-assessment of program with optional validation

- Hands On
- Comprehensive Continuous Process Improvement
  - Highly detailed process books
  - Training
- Independent Assessment
  - Deep dives

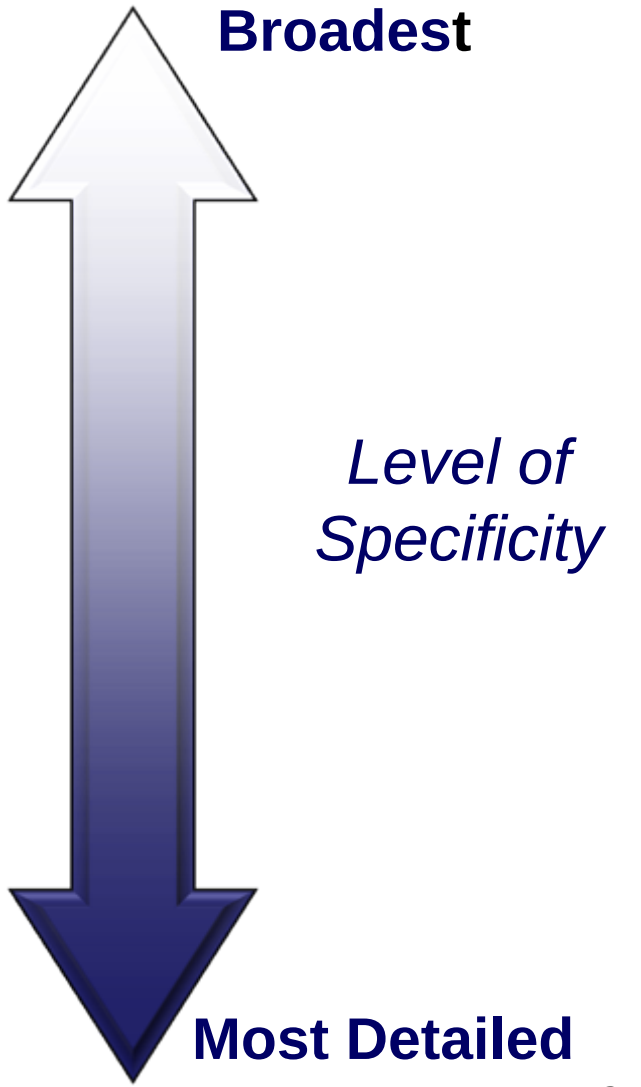
Assessment methods that balance time & effectiveness

Model Construct



AF SEAM Content

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



AF SEAM - CMMI-ACQ v1.2

AF SEAM Processes

- Requirements
- Design
- V&V
- Decision Analysis
- Configuration Mgmt
- Risk Mgmt
- Project Planning
- Sustainment
- Manufacturing
- Tech Mgmt & Ctrl
- Generic Practices

CMMI Color Legend: Green = Covered, Yellow = Partially, Red = Not Covered

CMMI-ACQ Processes v1.2

REQM – Requirements Management (RM) MA – Measurements & Analysis PMC – Project Monitoring & Control PP – Project Planning PPQA – Process and Product Quality Assurance SSAD – Solicitation & Supplier Agreement Dev CM – Configuration Management	2
DAR – Decision Analysis and Resolution AM – Agreement Management ARD – Acq Requirements Development ATM – Acq Technical Management VAL – Acq Validation VER – Acq Verification OPD – Organizational Process Definition OPF – Organizational Process Focus IPM – Integrated Project Management (IPPD) RSKM – Risk Management OT – Organizational Training	3
OPP – Organizational Process Performance QPM – Quantitative Project Management	4
OID – Organizational Innovation & Deployment CAR – Causal Analysis & Resolution	5

CMMI Maturity Levels:
1 Initial, 2 Managed, 3 Defined, 4 Quantitatively Managed, 5 Optimizing

AF SEAM - CMMI-DEV v1.2

AF SEAM Processes

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Process Area	*Maturity Level*
Causal Analysis and Resolution	5
Configuration Management	2
Decision Analysis and Resolution	3
Integrated Project Management +IPPD	3
Measurement and Analysis	2
Organizational Innovation and Deployment	5
Organizational Process Definition +IPPD	3
Organizational Process Focus	3
Organizational Process Performance	4
Organizational Training	3
Product Integration	3
Project Monitoring and Control	2
Project Planning	2
Process and Product Quality Assurance	2
Quantitative Project Management	4
Requirements Development	3
Requirements Management	2
Risk Management	3
Supplier Agreement Management	2
Technical Solution	3
Validation	3
Verification	3

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*

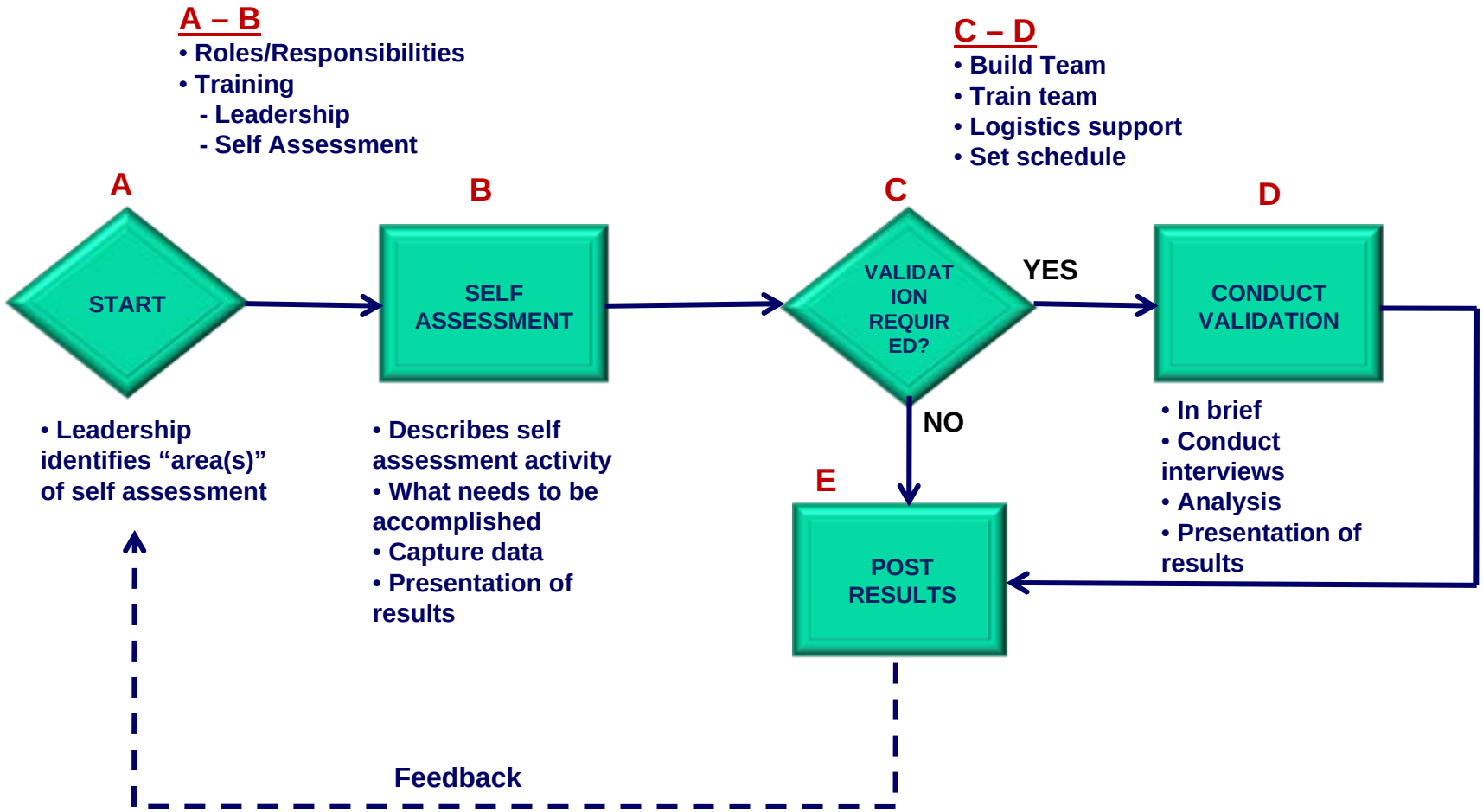
Sample Specific Practice

- **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

#	Practice Description
GP1	Description of process
GP2	Plans for performing the process
GP3	Adequate resources for performing the process
GP4	Responsibility & authority for performing the process
GP5	Train the people performing the process
GP6	Monitor & control the process
GP7	Review activities, status, & results of the process

Process Detail Outline



Assessment

Assessment Methodology Criteria

- 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

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

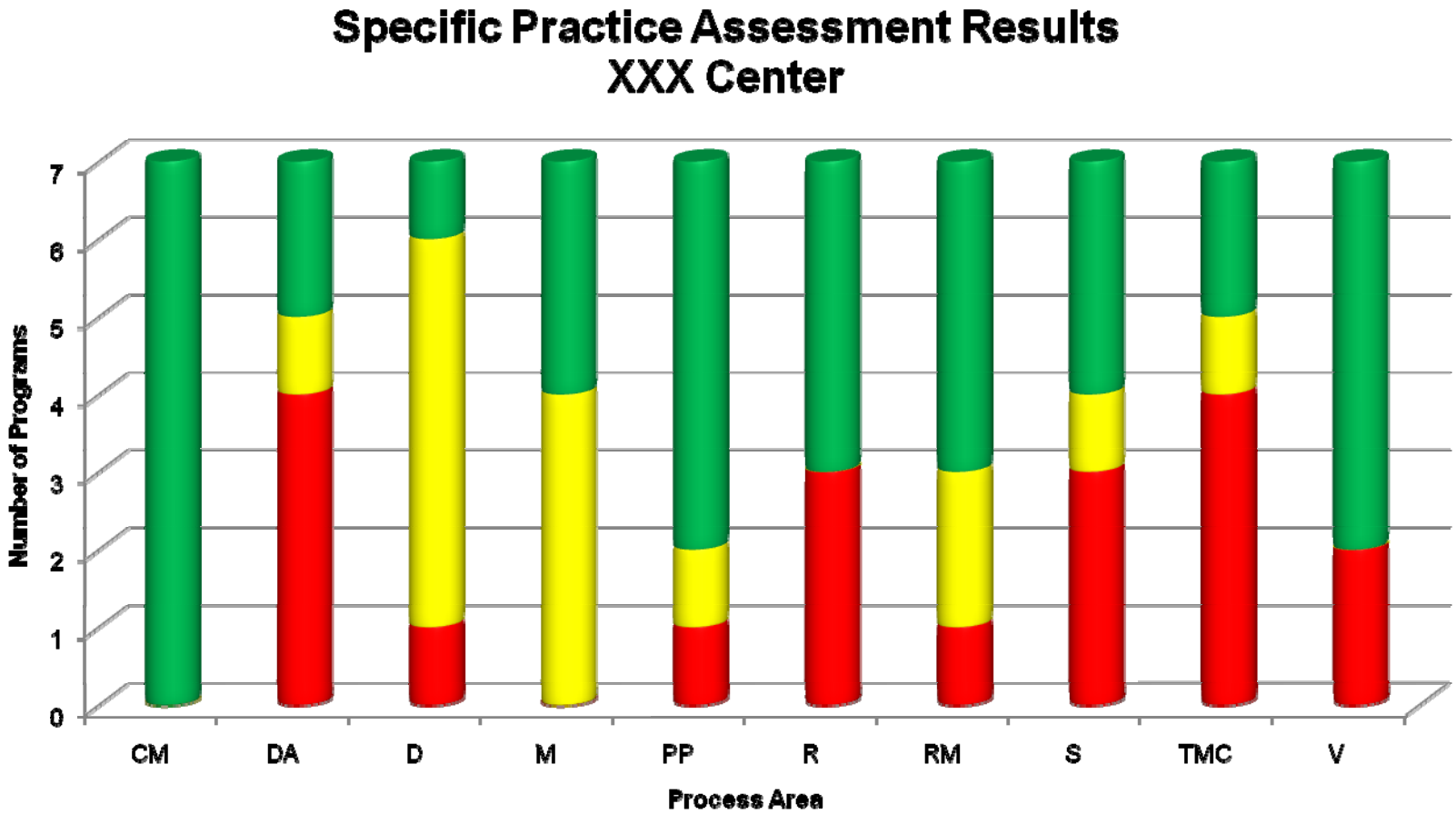
PA LEGEND
90-100%
65-89%
0-64%

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

Spreadsheet tool provides this output

Scoring Roll-Up



Generic Practices Summary

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

[redacted]

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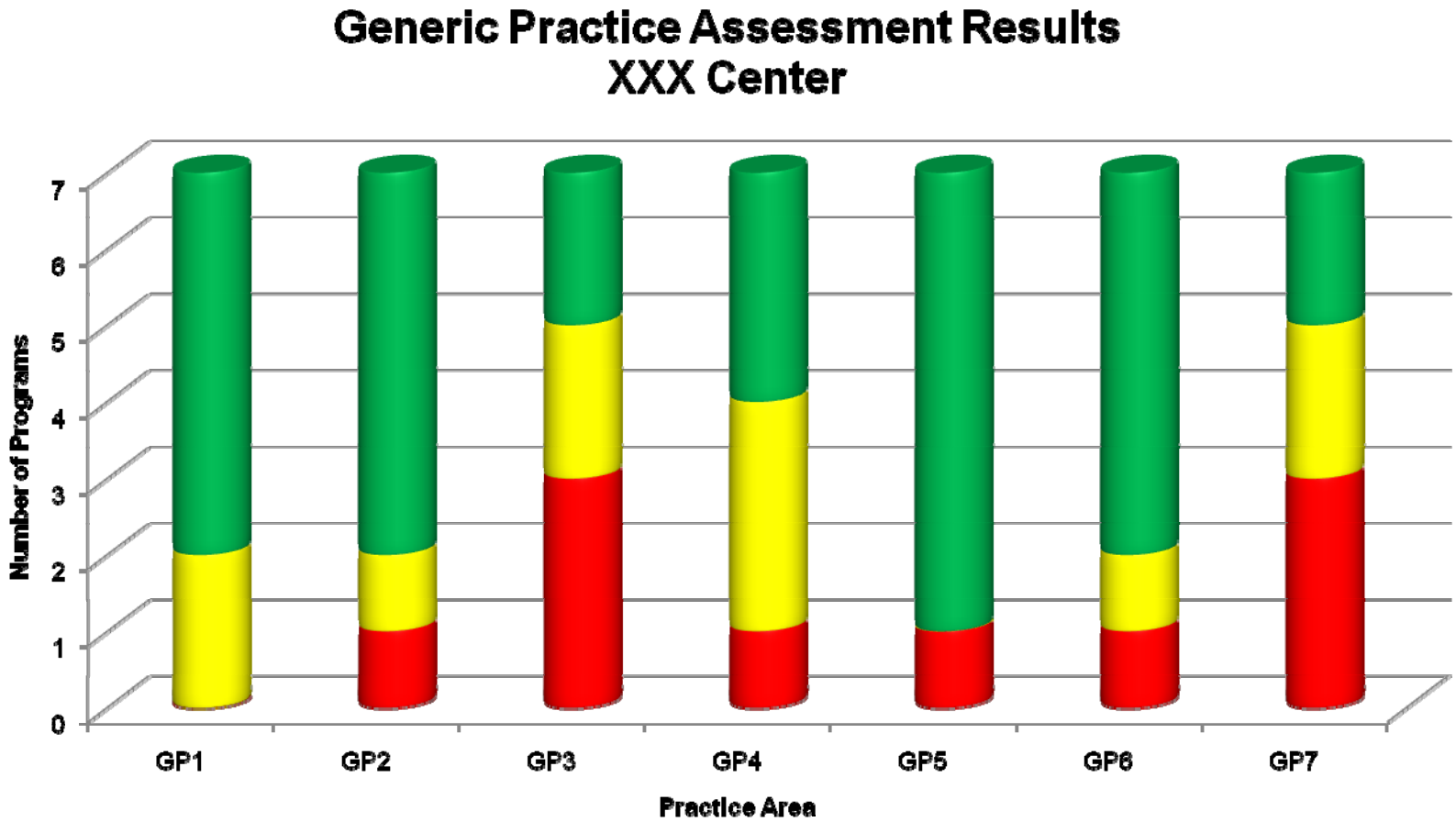
Spreadsheet tool provides this output

Scoring Roll-Up



Spiral 1 Tool Suite

- anagement Guide
- ssessment Tool (Spreadsheet)
- raining
  - Orientation/Overview
  - Self-Assessment
  - Validation Team

Spiral 2 Considerations / Lessons Learned

- **Capability Enhancement**
  - Re-look at process areas for improvements
  - Further refine assessment methodology
  - Strengthen inclusion of software
  - Capture and promulgate best practices/lessons learned
  - Examine potential use for SE health assessment & mergence w/ other tools (e.g. Probability of Program Success)
  - Migrate to web-based platform
- **Charter**
  - Establish vision & mission
  - Establish governance
  - Support team by providing resources
  - Signed @ appropriate level
- **Funding**
  - Spiral 2 & Sustainment
- **Lead POC/Steering Group**
  - Staff support
  - Community of Interest
  - Configuration control

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

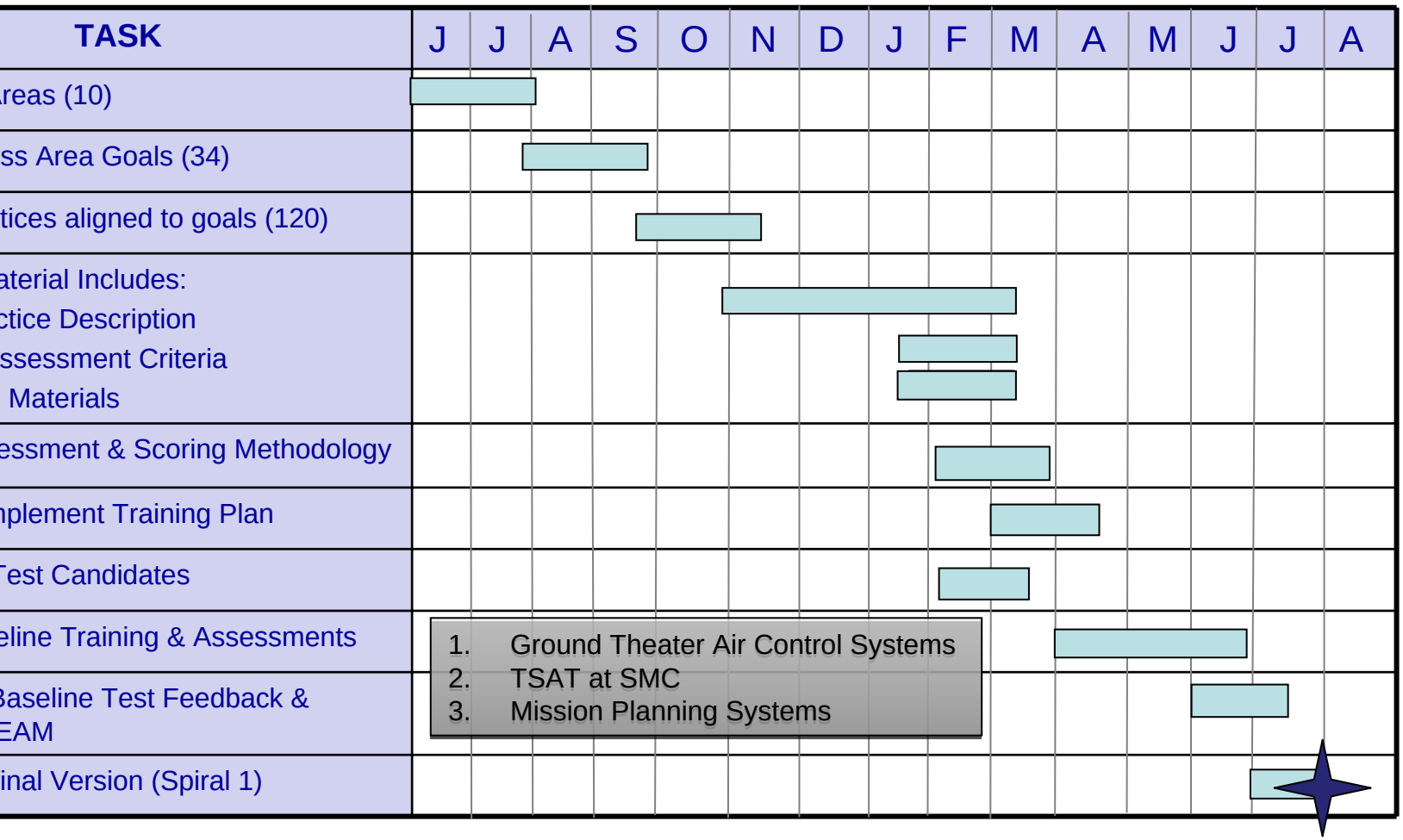
Summary

- Goal is to Continue to ***Improve Program Performance***
- Long Term Goal – ***Revitalize & Institutionalize Systems Engineering***
- Use SE ***"Best Practices"***
- Target ***resource allocation***
- Facilitate availability of ***Qualified People***
  - Using disciplined processes
  - Applying SE Tools/Technology

QUESTIONS ?

Back Up Slides

Development Schedule



DELIVERED ON TIME !

Process Areas

#	Symbol	Process
1	CM	Configuration Management
2	DA	Decision Analysis
3	D	Design
4	M	Manufacturing
5	PP	Project Planning
6	R	Requirements
7	RM	Risk Management
8	S	Sustainment
9	TMC	Technical Management & Control
10	V	Verification & Validation