AIR FORCE NUCLEAR WEAPONS CENTER

Never Doubted, Always Feared

Increasing SE Performance Through Quantifiable Measurement of Required Program Documentation

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Purpose: Improve SE Doc Review Methodology

Needs

- Know if org writes good SE docs
- Consistent review
- Repeatable
- Measureable
- Referenced to higher guidance
- Reviewer agnostic

Challenges

- Define “good”
- Reviewer skill level variance
- Ability to compare across programs
- No review history maintained
- How drive improvement
- How drive behavior

Over 3 Year Period, Averaged <1 Comment Per Doc

Compare Old vs New Methodology

Old Review Methodology

- Who is available
- Fidelity proportionate to review time
- Quality varies with individual
- No office standard/criteria
- Not repeatable
- No remembrance/tie to last review
- Not defendable
- Qualitative

New Review Methodology

- Defined review standard
- In compliance with higher level guidance/regs
- Systemic issues identifiable
- Criteria based
- Reviewer agnostic
- Repeatable
- Comparable to other programs
- Past reviews clear/accessible/comparable
- CPI enabled
- Drives behavior
- Quantitative

In 1st Year of the New Method, averaged >18 Comments Per Doc

New Method's Process Steps

1. Define documents
2. Clearly define content areas to review
3. Define quantifiable assessment criteria for each content area
4. Document in a "Document Review Guide"
5. Panel to score documents & validate the Doc Review Guide
6. Give clear/quantifiable statements about G/Y/R findings
7. Measure and track metrics
8. Leverage Continuous Process Improvement across organization

Clear Office SME for Each Document

Step 1: Define Documents

Home Office Required to Review these System Engineering Documents:

SEP:	**Systems Engineering Plan**
LCSP:	**Life Cycle Sustainment Plan**
PESHE:	**Programmatic Environment, Safety, and Occupational Health Evaluation**
PPP:	**Program Protection Plan**
CMP:	**Configuration Management Plan**
RMP:	**Risk Management Plan**
TEMP:	**Test and Evaluation Master Plan**

Note: Doing System Engineering Technical Reviews next

Required by DoD 5000.02 Operation of the Defense Acquisition System

Step 2: Define Content Areas to Review

SEP:	**59 OSD-mandated template paragraphs**
LCSP:	**35 OSD-mandated template paragraphs**
PESHE:	**40 AFLCMC PESHE template paragraphs**
PPP:	**104 elements to cover the 11 sections in DOD's PPP Outline & Guidance**
CMP:	**73 Elements: 69 from MIL-HDBK-61B, 3 best practices, 1 Cyber**
RMP:	**33 AFMC RMP template paragraphs**
TEMP:	**52 OSD's DOT&E TEMP Guidebook template paragraphs**

…How to eat an elephant—one bite at a time….

Judgement Call, But Using Higher Guidance Adds Credibility

Step 3: Define Assessment Criteria

Assessment Criteria: State definitively what that doc's para has to have to get a "green"

- **Example: Introduction—1 para or two pages of material? What is minimum info to include**
- **Goldilocks Approach: Not too much, not too little, but want "just right"**
- **Exercise: Get a good intro and a bad intro and list the reasons why one better than other**

Samples: Technical Schedule and Schedule Risk Assessment

- Identify team member responsible for technical schedule planning and execution. (R/Y/G)
- Describe how program tasks are identified & managed. Clearly describe the process, tracking tools used, and how reviewed. (R/Y/G)
- List sched/planning assumptions (e.g. other pgms completing, test resources availability, key technologies being available, etc.).(R/Y/G)
- Identify which team member is responsible for keeping the schedule up-to-date? (R/Y/G)
- IMS current/updated, date within 3 months of date submitted to approval authority. Planned significant activities included. (R/Y/G)
- Summarize schedule risk assessment process. Process must include schedule updates, impacts, mitigation plan (R/Y/G)

Scoring

Green: "Meet the requirement & intent with no further improvement needed"
Yellow: "Does not meet the criteria for Green or Red"
Red: "Absent/incorrect to the point we cannot concur/approve the document"

Defining Criteria, or What Constitutes "Good", is Hardest Part!

Step 4 & 5: Author Review Guide; Validate Via Panel

4. Write Review Guide
   - Section 1: Introduction—purpose, update plan, and all references (document & date)
   - Section 2: All elements with criteria and specific references (exact para)
   - Section 3: Scoring—calculations, metric template, roll-up method

5. Validate Review Guide and score documents (first time only)
   - Assemble panel of at least three independent peers
   - Independently score at least three documents & assess document's clarity/accuracy
   - Get together and compare scores
   - For any variances in score, discuss:
     - Why difference
     - What should be "correct" score
     - Edit Review Guide element to clarify/focus so all panel members would score same
   - Update Review Guide with all panel's changes

Future Document Reviews Can Be Done by Anyone

Step 6: Clear/Quantifiable Findings

State explicitly reason for every score—Red, Yellow and even Green
Document in clear spreadsheet for easy comparison to other reviewed docs

Doc	Content Area	Score + Rationale	Improvements
SEP	Technical reviews conducted when all exit criteria are met	SEP para 4.4.3 indentifies all the tech reviews. However, the para does not identify mandated exit criteria, as specified by the DAG, para 3.3	Document exit criteria for each Tech Review. Ensure all Tech Reviews on IMS. Show proof, such as review minutes, that all exit crieteria are met.
CMP	Create Technical Baselines	CMP para 3.1.1 adequately describes the technical baselines. CMP para 2.1.4 and 6.5 describe a good audit process to ensure accuracy.	To ensure baselines are created from CIs, a table showing CI mapping to the baselines would improve/support that all baselines are all-inclusive.
RMP	Determine risk sources and categories	The RMP, para 4.2, identifies the bare minimum of risk categories--cost, schedule, and performance. The intent is to look at the full range of risk categories to better identify the potential individual risks.	Rewrite RMP pare 4.2 to list all applicable (e.g., product support, environmental, T&E, supply chain, IA/cyber security, etc.). You can have a risk category that you consider, without having an actual risk in the risk register.

Must State Exactly What Is Wrong and What Must Be Done to Fix

Step 7: Measure and Track Metrics

Easy to do
Maintain the past scores and accompanying rationale
Update/input immediately after every review
Brief leadership as often as can

Next few slides give real examples…

Note: We call them "Icicle Charts"

Real Benefit is Leveraging Efforts to Fix Systemic Problems

Overall Document Performance

Document Aggregate		1/1/2019	7/1/2019
Successfully Met Criteria (%)	PPP	95	95
	LCSP	88	89
	SEP	81	83
	RMP	66	66
	TEMP	58	58
	PESHE	45	51
	CMP	37	37

Note: Not all documents reviewed in this 6 month timeframe

Baseline Established for CPI

Review of 3 SEPs

SEP Sections					
1 INTRO	**2** - PGM TECHN'L REQMTS	**3** - ENGR RESOURCES & MGT		**4** - TECHNICAL ACTIVITIES & PRODUCTS	
1.0	2.1.1	3.1.1	3.4.1	4.1.1	4.4.1
1.1	2.1.2	3.1.2	3.4.2	4.1.2	4.4.2
1.3	2.1.3	3.1.3	3.4.3	4.1.3	4.5.1
1.4	2.1.4	3.1.4	3.4.4	4.2.1	4.5.2
1.5	2.1.5	3.1.5	3.4.5	4.3.1	4.5.3
	2.1.6	3.1.6	3.4.6	4.3.2	4.6.1
	2.2.1	3.2.1	3.5.1	4.3.3	4.6.2
		3.2.2	3.5.2		4.7.1
		3.3.1	3.5.3		4.7.2
		3.3.2	3.5.4		
		3.3.3	3.6.1		
		3.3.4	3.6.2		
		3.3.5	3.6.3		
		3.3.6	3.6.4		
			3.6.5		
			3.6.6		
			3.6.7		

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1.0	2.1.1	3.1.1	3.4.1	4.1.1	4.4.1
1.1	2.1.2	3.1.2	3.4.2	4.1.2	4.4.2
1.3	2.1.3	3.1.3	3.4.3	4.1.3	4.5.1
1.4	2.1.4	3.1.4	3.4.4	4.2.1	4.5.2
1.5	2.1.5	3.1.5	3.4.5	4.3.1	4.5.3
	2.1.6	3.1.6	3.4.6	4.3.2	4.6.1
	2.2.1	3.2.1	3.5.1	4.3.3	4.6.2
		3.2.2	3.5.2		4.7.1
		3.3.1	3.5.3		4.7.2
		3.3.2	3.5.4		
		3.3.3	3.6.1		
		3.3.4	3.6.2		
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1.1	2.1.2	3.1.2	3.4.2	4.1.2	4.4.2
1.3	2.1.3	3.1.3	3.4.3	4.1.3	4.5.1
1.4	2.1.4	3.1.4	3.4.4	4.2.1	4.5.2
1.5	2.1.5	3.1.5	3.4.5	4.3.1	4.5.3
	2.1.6	3.1.6	3.4.6	4.3.2	4.6.1
	2.2.1	3.2.1	3.5.1	4.3.3	4.6.2
		3.2.2	3.5.2		4.7.1
		3.3.1	3.5.3		4.7.2
		3.3.2	3.5.4		
		3.3.3	3.6.1		
		3.3.4	3.6.2		
		3.3.5	3.6.3		
		3.3.6	3.6.4		
			3.6.5		
			3.6.6		
			3.6.7		

Systemic Problem Areas Are: Para 3.6.1, 3.6.3, 3.6.5, & 4.3.3

Review of 3 CMPs

INTRODUCTION	ORGANIZATION	ESTABLISHMENT OF BASELINES	CONFIGURATION IDENTIFICATION	CONFIGURATION CONTROL	CONFIGURATION STATUS ACCOUNTING	CONFIGURATION AUDITS AND REVIEWS	DATA MANAGEMENT	INTERFACE MANAGEMENT
1.1	2.1	3.1	4.1	5.1	6.1	7.1	8.1	9.1
1.2	2.2	3.2	4.2	5.2	6.2	7.2	8.2	9.2
1.3	2.3	3.3	4.3	5.3	6.3	7.3	8.3	9.3
1.4	2.4	3.4	4.4	5.4	6.4		8.4	9.4
1.5	2.5		4.5	5.5	6.5			9.5
	2.6		4.6	5.6	6.6			9.6
			4.7	5.7	6.7			9.7
			4.8	5.8	6.8			
			4.9	5.9	6.9			
			4.10	5.10				
			4.11	5.11				
			4.12	5.12				
			4.13	5.13				
			4.14	5.14				
			4.15	5.15				
			4.16	5.16				
			4.17					
			4.18					
			4.19					

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1.1	2.1	3.1	4.1	5.1	6.1	7.1	8.1	9.1
1.2	2.2	3.2	4.2	5.2	6.2	7.2	8.2	9.2
1.3	2.3	3.3	4.3	5.3	6.3	7.3	8.3	9.3
1.4	2.4	3.4	4.4	5.4	6.4		8.4	9.4
1.5	2.5		4.5	5.5	6.5			9.5
	2.6		4.6	5.6	6.6			9.6
			4.7	5.7	6.7			9.7
			4.8	5.8	6.8			
			4.9	5.9	6.9			
			4.10	5.10				
			4.11	5.11				
			4.12	5.12				
			4.13	5.13				
			4.14	5.14				
			4.15	5.15				
			4.16	5.16				
			4.17					
			4.18					
			4.19					

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1.2	2.2	3.2	4.2	5.2	6.2	7.2	8.2	9.2
1.3	2.3	3.3	4.3	5.3	6.3	7.3	8.3	9.3
1.4	2.4	3.4	4.4	5.4	6.4		8.4	9.4
1.5	2.5		4.5	5.5	6.5			9.5
	2.6		4.6	5.6	6.6			9.6
			4.7	5.7	6.7			9.7
			4.8	5.8	6.8			
			4.9	5.9	6.9			
			4.10	5.10				
			4.11	5.11				
			4.12	5.12				
			4.13	5.13				
			4.14	5.14				
			4.15	5.15				
			4.16	5.16				
			4.17					
			4.18					
			4.19					

Proof Why CMPs "Worst" Document!

LCSP Document, 1 Program, 3 Reviews

Reviewed: 15 Nov 16

LCSP Sections									
1 - INTRODUCTION	2 - PRODUCT SUPPORT PERFORMANCE	3 - PRODUCT SUPPORT STRATEGY	4 - PGM REVIEW ISSUES AND CORRECTIVE ACTIONS	5 - INFLUENCING DESIGN AND SUSTAINMENT	6 - INTEGRATED SCHEDULE	7 - COST AND FUNDING	8 - MANAGEMENT	9 - SUPPORTABILITY ANALYSIS	10 - LCSP ANNEXES
1.1	2.1	3.1	4.0	5.0	6.0	7.1.1	8.1.1	9.1.1	10.0
1.2	2.2	3.1.1				7.1.2	8.1.2	9.1.2	
1.3		3.1.2				7.1.3	8.2	9.1.3	
1.4		3.1.3				7.1.4		9.1.4	
		3.1.4				7.2		9.1.5	
		3.1.5				7.3		9.2	
		3.2						9.3	
		3.3.1							
		3.3.2							

Reviewed: 18 Feb 19

LCSP Sections									
1 - INTRODUCTION	2 - PRODUCT SUPPORT PERFORMANCE	3 - PRODUCT SUPPORT STRATEGY	4 - PGM REVIEW ISSUES AND CORRECTIVE ACTIONS	5 - INFLUENCING DESIGN AND SUSTAINMENT	6 - INTEGRATED SCHEDULE	7 - COST AND FUNDING	8 - MANAGEMENT	9 - SUPPORTABILITY ANALYSIS	10 - LCSP ANNEXES
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1.3		3.1.2				7.1.3	8.2	9.1.3	
1.4		3.1.3				7.1.4		9.1.4	
		3.1.4				7.2		9.1.5	
		3.1.5				7.3		9.2	
		3.2						9.3	
		3.3.1							
		3.3.2							

Reviewed: 4 Apr 19

LCSP Sections									
1 - INTRODUCTION	2 - PRODUCT SUPPORT PERFORMANCE	3 - PRODUCT SUPPORT STRATEGY	4 - PGM REVIEW ISSUES AND CORRECTIVE ACTIONS	5 - INFLUENCING DESIGN AND SUSTAINMENT	6 - INTEGRATED SCHEDULE	7 - COST AND FUNDING	8 - MANAGEMENT	9 - SUPPORTABILITY ANALYSIS	10 - LCSP ANNEXES
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1.3		3.1.2				7.1.3	8.2	9.1.3	
1.4		3.1.3				7.1.4		9.1.4	
		3.1.4				7.2		9.1.5	
		3.1.5				7.3		9.2	
		3.2						9.3	
		3.3.1							
		3.3.2							

Tangible Improvement Over Time!

Step 8: Leverage Continuous Process Improvement

Have clearly identified Home Office POC to oversee CPI of document
Collectively decide how to fix document systemic problem areas
- **Most important first? If so, what is most important?**
- **Low hanging fruit?**
- **In paragraph order?**

Provide help/examples to one-off programs
Devise quantifiable, date specific plan to improve
Mapped against each program's IMS
Establish clear goal—ex: eliminate 20% of reds this year

Not "One and Done"—Keep Improving Process/Product

Results

Improvements:

- A Nov 2018 PESHE Review scored as 9 Green/8 Yellow/23 Red
  - Jun 19 the review improved to 29 Green/11 Yellow/0 Red
- Reviewed 2 LCSPs in last six months
  - One improved from 82% accurate to 100%
  - One improved from 89% accurate to 100%
- SEP went from 82% accurate to 100%
- PPP improved most with 95% overall average accuracy

Behavior changed:

- Pgms starting to ask for/use Review Guide as they write the doc
- Pgms using Rev Guide's templates, para's, & directions (table, figure, description)
- Leadership using metrics to assess program's Sys Eng proficiency
- Smaller, delegated pgms now voluntarily asking home office to review docs
- Areas outside Sys Eng starting to use same methodology in reviews (Cyber)

Improving Documents AND Driving Behavior

Summary

It is hard to define a “good” document
- But, you can!

Break it down into small paragraphs/elements
- Use existing regs/guides/templates!

Clearly state what must be present/included
- Comparisons will help!

The actual metrics are the easy part
- But excel at showing Sys Eng—good & bad!

Programs more receptive to changes
- Quantitative Review > Qualitative Review!

It Works—for Home Office, Program, and Leadership

Questions?