

Headquarters U.S. Air Force

I n t e g r i t y - S e r v i c e - E x c e l l e n c e

The Software Maturity Matrix; A Software Performance Metric



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Overview

- n Introduction**
- n Software Metrics**
- n Software Maturity Matrix (SwMM)**
- n SwMM Relationship to CMM-based Improvement**
- n Summary & Conclusion**



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Introduction

- n Background**
- n Vision**
- n Status**



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Background

- n Portfolio of the PEO for Command and Control & Combat Support contains the greatest concentration of software intensive programs of any PEO portfolio.**
- n Software development issues are among the most critical in the AFPEO/C2&CS portfolio.**
- n Software metrics now reported to PEO as part of periodic execution plan reviews.**



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Vision

- n Identify incipient software problems and mitigate them early.**
- n Franchise the AFPEO/C2&CS processes and procedures to other organizations.**



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Status

- n Metrics are in third spiral of development.**
- n Software Maturity Matrix started early and will end last.**
- n Introduction of statistical controls is months away.**



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Software Metrics

- n Why Measure?**
- n Measurement Principles**
- n AFPEO/C2&CS Reportable Software Metrics**



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Why Metrics?

Objective measurements are the key to objective communication.



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Measurement Principles

- n Focus on a Key Few**
- n Keep Them Simple**
- n Insure Reliability and Repeatability**
- n Measurements are for Managing**
- n Use Them!**
 - n Unused measurements have the same value as last night's unused hotel room or an empty airline seat.**
- n Be Prepared to Change or Modify Them**



Software Metrics for AFPEO C2&CS

- n Size Growth**
- n Workforce Size and Qualifications**
- n Requirements Fulfillment (Software Maturity Matrix)**
- n Quality Trends**
- n *Selected* Earned Value Information**



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Why Requirements Fulfillment?

- n Meeting Requirements Is How We Will Be Measured**
- n Controlling Requirements Is the First Step to Cost and Schedule Control**
- n Mutual Understanding of Requirements Is the Foundation of a Successful Integrated Product Development Team**



Software Maturity Matrix (SwMM)

- n **Purpose**
- n **Description**
- n **Evolution**
- n **Implementation**



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SwMM Purpose

- n Forces Developer Requirements Capture (User, Derived, & External)**
- n Forces Developer Analysis of Maturation Over Time**
- n Identifies Areas of Non/Under/Over Performance**
- n Basis of Objective Discussion of Status**
- n Flags Areas Needing Management Attention**



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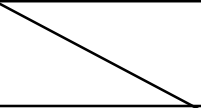
What is an SwMM?

- n Format**
- n Expected Values Over Time**
- n Actual Values at Selected Milestones**
 - n At Least Four Milestones per Year**
- n Application and Tailoring**
- n Evolution**



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SwMM Format

	MS 1	MS 2	MS 3		MS n
RQT 1					
RQT 2					
RQT 3					
RQT n					



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SwMM Initial Entries: Expected Values

	MS 1	MS 2	MS 3		MS n
RQT 1	/ms 1 r 1 EV	/ms 2 r 1 EV			/ms n r 1 EV
RQT 2					
RQT 3			/ms 3 r 3 EV		
RQT n	/ms 1 r n EV				/ms n r n EV



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SwMM MS Entries: Actual Values

	MS 1	MS 2	MS 3		MS n
RQT 1	AV 1/ EV 1				AV n/ EV n
RQT 2					
RQT 3			AV 3/ EV 3		
RQT n					AV n/ EV n



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SwMM Analysis

	MS 1	MS 2	MS 3		MS n
RQT 1					
RQT 2					
Spare Mem.	200% /200%	180% /175%	130% /150%	/125%	/100%
RQT n					



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SwMM Evolution

	MS 1	MS 2	MS 3		MS n
RQT 1					
RQT 2					
Spare Mem.	200% /200± 50%	180% /175± 30%	130% /150± 25%	/125± 10%	/100%
RQT n					



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SwMM Implementation

This example is at an early stage of development.



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GCSS-AF Software Maturity Matrix - CINC 57 (1)

-
- | | |
|---|--|
| n Strategic Cargo and Personnel Movement | n LSA of COA |
| n Intratheater Cargo and Personnel Movement | n Timely, near real time, accurate information |
| n Equipment and Supplies Asset Visibility | n Location and Status of Class III: POL |
| n Personnel and Equipment Deployment Visibility | n LSA for Each Supply Class by Mission Phase |
| n Prepositioned Equipment and Material Availability | n Transportation Asset Availability and Node Throughput Capability |
| n Location and Status of Class IX: Repair Parts | n Status and Location of POL |
| n Location and Status of Class VII: Major End Items | n POL Requirements by Mission Phase |
| n Location and Contents of Prepositioned Stocks and Supplies | n Unit and Personnel Location and Status Tracking |
| n Location of LOCs and PODs | n Logistics units, stockage locations, LOC |
| n Projected Arrival of Forces, Supplies, and Equipment | n Logistics units status in AOR |
| n Location and Status of Class V: Ammunition | n Project lift and transportation requirements |
| n Decision Tools and Logistics Estimate Capability | n Compare time-phased requirements vs available resources |
| n Inter- and Intra-theater forces, equipment, and supplies movement | n Predict POD and POE requirements |
| n Prepositioned WRM | n Conduct operational mission logistics analysis |
| n Notional TPFDD | n Assess transportation infrastructure shortfalls |
| n LOC/POE information | n Reliable and current secure communications |
| n Logistics Analysis for an Operational Mission | n Status of laterally distributed logistics assets |
| n Transportation Asset Location and Availability | n Determine POL movement and theater capabilities |
| n Transportation Infrastructure Information | n Simplify JOPES TPFDD process |
| n Munitions Requirements by Phase | n Project POL consumption with usage |
| | n Project Munitions consumption with usage |
-



GCSS-AF Software Maturity Matrix - CINC 57 (2)

- n Project class of supply consumption from historical data
- n Project Medical supplies consumption with usage
- n Provide theater combat and civil engineering status
- n Project support requirements for incoming personnel and forces
- n Project water and subsistence consumption with usage
- n Plan, manage and track retrograde cargo
- n Conduct real-time medical supportability analysis of a COA
- n Provide battle space picture
- n Project POL consumption with usage
- n Provide engineering supportability analysis of a COA
- n Provide ground LOC analysis
- n Conduct real-time medical supportability analysis of a COA
- n Compare medical support requirements with available resources
- n Project Individual Equipment consumption with usage
- n Project construction material consumption with usage
- n Track NEO and humanitarian requirements with lift requirements



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GCSS-AF Software Maturity Matrix-FY03

	Dec-02	Jan-03	Mar-03	May-03	Jun-03	Jul-03	Sep-03
Integration Framework/Air Force Portal Capabilities							
Applications on IF							15 (goal), 10 (threshold)
Single Sign-on Applications							60 (goal), 30 (threshold)
Operate IF at more than one site	Engineering approach delivered		2nd NIPRNet site operational				
Deploy IF releases				Version 5 fielded			
Develop Deployed Operations support approach	Deployed CS approach defined						
Implement .com access	.com access for current users						
Document Management			AFP document management fielded				
Verity Search Implementation		Verity search engine fielded on AFP					
Warfighter innovations			TBD by user				
Integration Framework/Air Force Portal Characteristics							
Availability	NIPRNet-99%		NIPRNet-99.99%				
Enterprise Data Warehouse Spirals							
Capability/Data Acquisition – Maintenance		Spiral 1 complete					Spirals 2-5 complete
Capability/Data Acquisition – Supply		Wholesale and Depot Supply		Requirements Forecasting			Base Supply, DLA
Analysis & Capability/Data Acq – Finance			Plan complete			Data acquisition complete	
Analysis & Capability/Data Acq - Contracting			Plan complete			Data acquisition complete	



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GCSS-AF Software Maturity Matrix-FY04

	Dec-03	Mar-04	Jun-04	Sep-04
Integration Framework/Air Force Portal Capabilities				
Applications on IF				45
Single Sign-on Applications				100
Operate IF at more than one site		2 SIPRNet sites operational		3rd NIPRNet site operational
Deploy IF releases			Version 6 fielded	
Develop Deployed Operations support approach				
Implement .com access				
Document Management				
Verity Search Implementation				
Warfighter innovations				
Integration Framework/Air Force Portal Characteristics				
Availability		SIPRNet-99.99%		NIPRNet-99.99%



GCSS-AF Software Maturity Matrix-FY05

	Dec-04	Mar-05	Jun-05	Sep-05
Integration Framework/Air Force Portal Capabilities				
Applications on IF				100
Single Sign-on Applications				200
Operate IF at more than one site				
Deploy IF releases			Version 7 fielded	
Develop Deployed Operations support approach				
Implement .com access				
Document Management				
Verity Search Implementation				
Warfighter innovations				



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SwMM Relationship to CMM-based Improvement



Areas Addressed by the SwMM at ML2-Repeatability

- n Requirements must be defined and agreed to.**
- n Project plans must incorporate appropriate milestones and estimates.**
- n Project tracking is built in at milestones.**
- n Measurement is implicit.**
- n Verification is implicit.**
- n Requirements changes must be controlled and mapped into updates, and an audit trail must be maintained.**
- n If outside suppliers are involved, their efforts should be tracked in the same way.**
- n Conformance to requirements is implicit.**



Areas Addressed by the SwMM at ML 3 - Defined

- n The SwMM technique requires a process owner**
- n The SwMM Technique requires organization process assets and data base**
- n The organizational standard SwMM technique must be tailored for projects**
- n The SwMM can be a focus for integrated product teams**
- n Organization standard measurements are implicit**
- n Organization standard verification is implicit**
- n Organization standard SMM training can be the basis of an organization training program**
- n Product Engineering efforts are focussed on meeting the requirements delineated in the SwMM**



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Areas Addressed by the SwMM at ML 4 - Quantitatively Managed

- n Quantitative decision making is implicit**
- n Quantitative product characteristics are implicit**
- n SwMM data identifies areas for corrective action**
- n Satisfaction of direct and derived customer requirements is driven by the SwMM**



Areas Addressed by the SwMM at ML 5 - Optimizing

- n Continuous improvement culture is fostered by the need to continuously improve the “planned” values for the maturity profile.**

- n New technologies and processes can change the “Planned” values in a favorable way.**



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Summary

- n **AFPEO/C2&CS imposed software metrics set across portfolio.**
- n **One metric, the Software Maturity Matrix, tracks requirements satisfaction.**
- n **Applying the SwMM is compatible with CMM-based improvement efforts.**



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Conclusion

The Software Maturity Matrix, in conjunction with other metrics and as part of periodic reviews, provides useful management insight into software and software-intensive development programs.