

Software Maintenance Data Collection Questionnaire

This questionnaire has been prepared to capture “maintenance data” for use in a study looking at how to improve software operations, maintenance and sustainment activities that occur after Milestone C of the weapons systems life cycle. All “data” will be treated assuming the strictest confidence. Such data will be protected using procedures developed for that purpose.

1. Introduction

This questionnaire is structured to collect software operations, maintenance and sustainment data at the program, release and/or component levels. Data collected at the program level will be used to scope how much software the Department of Defense (DOD) is maintaining at the inventory level. Data captured at the release level will be used to provide decision-makers with insight into how much software costs to operate, maintain, and sustain once it enters this inventory after Milestone C of the weapons system life cycle. Finally, data collected at the component level will be used to determine what factors drive the cost of maintenance, when and why. Data captured becomes more and more detailed as we focus at components.

1.1 Questionnaire Overview. This questionnaire is provided in three sections. Section 2 captures program level data, while Section 3 collects software release data. These two sections should be filled out by all programs participating in the survey. Section 4 collects more detailed data, i.e., typically at the software component or build level. To minimize the burden on programs, this section should be completed only when the data is readily available. If the data is being submitted is for multiple releases and/or components, fill out a separate Section 4 for each of them. If you have cost model data, complete Section 5 and provide copies of the related files.

1.2 Completing the Questionnaire. This version of the questionnaire has been designed to be easy and quick to use. If you only have summary software maintenance data at the program or release level, we will take it. If you have more detailed data (e.g., COCOMO-II or other cost model (SEER, etc.) estimate files), we can use them as well in their raw form. All we ask is that you supply what you have in a form in which we can use it.

1.3 Protecting Your Data. The procedure that we use to protect your proprietary data from inadvertent disclosure is available at our web site at www.softwaremaintenance.com.

1.4 Useful Information. A Glossary of Software Operations Maintenance and Sustainment terms and other informational aids that have been developed to help you complete this questionnaire are also available at our web site.

1.5 Points of Contact. For questions on this data collection effort, contact the either of the following team leaders:

Donald J. Reifer, RCI (Project Lead)
Internet Electronic-Mail

Voice: (928) 237-9060, Cell: (310) 922-7043
dreifer@earthlink.net

Cheryl Jones, U.S. Army (Project Lead)
Internet Electronic-Mail

Voice: (973) 724-2644
cheryl.jones5@us.army.mil

2. Program Level Information

This Section provides information about the submitter and application type.

2.1 Contact Information. Provide the name, organization, and phone number of the person completing this form so that we may contact them should we have any questions (*Fill In*).

Name: _____

Organization: _____

Address: _____

State/Province: _____ Country: _____ Postcode: _____

Phone Number: _____ Cell Phone Number: _____

Email: _____ Date Submitted: _____

2.2 Submitter Role. Identify the role of the person submitting the information (*Circle One*).

Program Manager	Group Leader	Customer
Project Lead	Analyst or Programmer	End User
Chief Engineer	Metrics Manager	Other _____

2.3 Program Information. Provide the following information about the program (*Fill In*).

Name of Program: _____

Year Transitioned to Maintenance: _____ Number of Fielded Versions Maintained: _____

2.4 Application Type. Select the two entries that best describe the software operating environment and primary application domain (*Circle One of Each Category*).

Operating Environments

Avionics	Manned Mobile	Unmanned Ground
Business	Missile & Unmanned Airborne	Unmanned Space
Manned Space	Shipboard	Web
Manned Ground	Telecommunications	Other: _____

Application Domains

Bus	Logistics	Signal Processing
Command & Control	Maintenance & Diagnostics	Simulation/Modeling
Communications	Mission Management	Situation Awareness
Controls & Displays	Mission Planning	Sonar
Database	Payload	Test & Evaluation
Electronic Warfare	Platform	Tool & Tool Systems

Executive

Process Control

Training

Information Assurance

Radar

Weapons Delivery

Other: _____ Other: _____

For each fielded version (*Fill In*).

Fielded Program Version Name	Primary Life Cycle Support Location	Government or Contractor or Both?	Workforce Size (Equivalent Heads)
			Government: Contractor:
			Government: Contractor:
			Government: Contractor:
			Government: Contractor:
			Government: Contractor:

For each fielded version (*Fill In*).

Fielded Program Version Name	Annual POM Budget				
	FY____ (\$)	FY____ (\$)	FY____ (\$)	FY____ (\$)	FY____ (\$)

For each fielded version (*Fill In*).

Fielded Program Version Name	Sources of Funding (%)			
	R&D (\$)	O&M (\$)	Production (\$)	FMS (\$)

For each fielded version (*Fill In*).

Fielded Program Version Nam	Other Contracted Expenditures (\$)		
	Software Licenses	Acquisition Support	Software Support

For each fielded version (*Fill In*).

Fielded Program Version Name	Software Configuration Item(s)	Added (SLOC) [100%]	Deleted (SLOC) [65%]	Modified (SLOC) [100%]	Carried Forward ¹ (SLOC) [7%]	TOTAL
	TOTAL (all)					
	Less Data ²					
	Adjusted via formulas					

NOTES

¹ Carried forward represents code that must be tested when the build is requalified, but is not changed in any manner. It assumes that the common code is included in the source line counts. It is computed using the size of the previous release less any code modified or deleted from it.

² Data are assumed not part of the line counts.

MORE NOTES

- The formula for determining work unit in terms of SLOC (effective or equivalent source lines of code as defined for use in COCOMO and other cost models) is as follows:

$$\text{SLOC}_{\text{work}} = \text{SLOC}_{\text{new}} + (0.65) \text{SLOC}_{\text{deleted}} + \text{SLOC}_{\text{modified}} + (0.07) \text{SLOC}_{\text{CF}} + (0.10) \text{SLOC}_{\text{AG}}$$

Where SLOC_{AG} = auto-generated code

Other Size Measures. If you are using other size measures (function points, features points, etc.), describe how you convert these to Source Lines of Code (SLOC). For example, identify the number of SLOC/function point by programming language that you used and where you got this number (*Fill In*).

Counting Tool: Identify the counting tool, if any, that you use to develop your SLOC counts (*Fill In*).

3. Software Release Information

The Section provides basic information about a release and its characteristics. Each release is typically targeted to be part of a different fielded program version.

3.1 Program Name. Provide the name of the program. If sensitive, leave blank (*Fill In*).

3.2 Project Environment. Provide the information about the project being reported (*Fill In*).

Project acronym: _____ Release Number: _____

Hardware platform (host): _____ Operating System: _____

Hardware platform (target) _____ Operating System: _____

Programming language(s): _____

Number of distinct end users: _____ Number of user locations _____

3.3 Release Type. Identify whether the release embraces new features or is it an upgrade of an existing product (*Circle One*).

Major New Capability

Upgraded Capabilities

Patch Release

Other: _____

3.4 Release Process. Identify the process used to develop the release (*Circle One*).

Waterfall

Incremental

Agile

Other: _____

3.5 Release History. Typically there can be four or more releases being maintained in parallel for the system using the funds available for the project. These include the fielded release, the release that is due to be fielded in the near-term, the release or releases that are under development, and the requirements release for the next update (may include prototyping and some code development). For each of these releases, provide a bar chart showing their timelines across the fiscal years (*Fill In*).

Release	FY__	FY__	FY__	FY__	FY__	FY__
Requirements Rev. No.						
Dev. Rev No.						
Dev. Rev No.						
Dev. Rev No.						
To be Fielded, No.						
Fielded, Rev. No.						

3.6 System Integration Environment. Provide a description of your integration and test lab and associated test environment (*Fill In*).

Location: _____

Brief Description of Capabilities: _____

Does the Lab use actual production hardware as part of the facility (***Circle One***)?

Yes No

Production hardware in this instance is actual weapons systems equipment like a radar or avionics.

Does the Lab use actual users (soldiers, sailors, airmen, etc.) to exercise the system under realistic operating conditions (***Circle One***)?

Yes No

Does the Lab use a set of regression test cases to revalidate software once changes have been made to the operational configuration (***Circle One***)?

Yes No

Were test tools and equipment used during development acquired and used as part of the facility (***Circle One***)?

Yes No

3.7 Activities Included. Identify the work activities that you perform as part of your software maintenance and sustaining engineering effort.

Software Maintenance (*Circle all that Apply*).

Impact analysis (of changes)	Software Update	Software Repair
Software Perfective Change (i.e., run faster, uses less memory or disk space, etc.)		
Configuration Management	Quality Assurance	Requirements Analysis
Re-Architecting	Release Generation	Release Testing
Acceptance Testing	Project Management	Metrics Analysis
Other: _____		

Sustaining Engineering (*Circle all that Apply*).

Software Package Selection	Vendor Coordination	Distribution Management
Problem Analysis	Patch Generation	Emergency Repairs
Hardware Troubleshooting	Field Service	Anti-Tamper
Database Administration	System Administration	Security
User Support (web site)	User Support (help desk)	User Training
Other: _____		

Acquisition Management Support (*Circle all that Apply*).

Contractor Oversight	Independent Analyses	Source Selection Support
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Other: _____

Independent Testing (Circle all that Apply).

Independent Verification	Independent Validation	Qualification Testing
Regression Test Design	Regression Testing	Re-Qualification Testing
Safety Analysis and Test	Anti-Tamper Verification	Security Analysis and Test
Test Facility Support	Test Facility Maintenance	Test Tool Acquisition
Other: _____		

3.8 Activity Percentages: Provide us a breakdown of how your budget was allocated to these activities and tasks as available (***Fill In***).

Acquisition Management (%): _____	
Independent Test (%): _____	
Software Maintenance (%): _____	Requirement Analysis: _____
	Re-architecting: _____
	Release Generation: _____
	Release Testing: _____
	Acceptance Testing: _____
Sustaining Engineering (%): _____	Problem Analysis: _____
	Patch Generation: _____
	Emergency Repairs: _____
	CM/QA: _____
	System Admin (all): _____
	User Support (all): _____
Other: _____	
TOTAL 100%	

3.9 Labor Categories Included in Maintenance Effort. Identify the labor categories that are part of your maintenance activities (***Circle all that Apply***).

Project Management	System Engineers	Software Engineers
Hardware Engineers	Software Testers/Analysts	System Testers
Software CM	Software QA	Software Support
System Administrators	Security Engineers	Test Engineers
Other: _____		
Other: _____		

3.10 Labor Categories Included in Sustaining Engineering Effort. Identify the labor categories that are part of your sustaining engineering effort (***Circle all that Apply***).

Project Management	System Engineers	Software Engineers
Hardware Engineers	Software Testers/Analysts	System Testers
Software CM	Software QA	Software Support
System Administrators	Database administrators	Security Engineers
Field Support Engineers	Test Engineers	Test Facility Engineers
Other: _____		
Other: _____		

3.11 Stage of Maintenance. Identify the stage of software maintenance that you are presently in (*Circle One*).

Transition	PDSS	PPSS
	(Post-Deployment Software Support)	(Post-Production Software Support)

3.12 In-House or Contracted. Identify whether the project was contracted or done in-house by a government/contractor team. If done by a joint government/contractor team, identify the percentage effort for each participant (*Circle One and Fill in*).

Contracted	Government/Contractor Team
	Government (%): _____
	Contractor (%): _____

3.13 Size of Maintenance Team. Identify the average number of people for the project, release or version in terms of Full Time Equivalents (FTE) on the maintenance team and the peak staff size (*Fill in*).

Average Team Size: _____ Peak Staff Size: _____

Number of average labor hours per FTE: _____

If contracted, annual maintenance budget: _____

3.14 Metrics and Measures. Identify the metrics that the project collects and uses to provide insights into progress, quality, and productivity? Which of the following metrics do you use (*Circle One or More*)?

Backlog (open trouble reports/category)	Requirements volatility (changes/time/release)
Cycle time (days to correct defect)	Response time (hours to respond to query)
Delivery time (months)	Rework rate (number spirals to get it right)
Efficiency (size/hours)	Staff capacity (output/hour)
Overall productivity (hours/size)	System down time (hours system out of service)
Overall productivity (hours/change)	Test effectiveness (coverage/no. of tests)
Quality (defects/size – defect density)	Test efficiency (no. of tests/size)
Quality (defects/time – defect rate)	Unit costs (dollars per unit)
Quality of Service (defect aging)	Other _____

3.15 Software Defect Backlog. Identify how large the current software problem report backlog is in terms of open trouble reports by defect category (*Fill In*).

Number of Open Trouble Report by Defect Category					
	Category 1	Category 2	Category 3	Category 4	Category 5
No. Found					
No. Fixed					
No. Open					

4. Maintenance Data Collection Reporting

This Section summarizes our maintenance data collection reporting requirements for a release, typically at the build or component per the Data Item Description (DID) devised for that purpose.

4.1 Year of Development. For reporting of historical data, please provide the year in which the software development was actually started and completed (*Enter Dates*).

4.1 Year of Development. For reporting of historical data, please provide the year in which the software development was actually started and completed (*Enter Dates*).

Start <u>CS09-10 (Support)</u>	Completed _____
Start <u>CS11-12 (Develop)</u>	Completed _____
Start <u>CS13-14 (Develop)</u>	Completed _____
Start <u>CS15-16 (Develop)</u>	Completed _____

4.2 Commercial Off-The-Shelf/Government Off-The-Shelf (COTS/GOTS). Provide the requested information about COTS/GOTS used in the project, release or version.

Did your release incorporate COTS or GOTS components into deliverable (*Circle One*)?

Yes No

If so, how many packages (*Fill In*)? _____

How much effort in Staff-Months or FTE did it take to configure these components so that they could be used effectively (*Fill In*)? _____

How much effort in Staff-Months or FTE did it take to integrate these components into the system and test them (*Fill In*)? _____

Do you maintain a “market watch” function to keep track of the COTS marketplace (*Circle One*)?

Yes No

4.3 Schedule. Identify the estimated and actual start and delivery dates by capability release (*Fill in Table including Release Version Number*).

Timing	Estimated Begin Date	Estimated End Date	Actual Begin Date	Actual End Date
Requirements Rev. No.				
Dev. Rev No.				
Dev. Rev No.				
Dev. Rev No.				
To be Fielded, No.				
Fielded, Rev. No.				

Note:

- We assume that fielded and soon to be fielded releases are supported on an annual basis as part of your sustaining engineering workload. If not, please note the frequency of update below (*Fill In*)

Frequency of Updates to Fielded Release _____ To Be Fielded Release _____

Starting point (**Circle One**)

Systems Requirements Review

Change Board Review Authorization

Software Requirements Review

Other _____

End point (**Circle One**)

End of Software Test & Integration

End of System Test & Integration

End of Acceptance Test

Delivery to Field

Other _____

4.4 Effort. If you are a contractor, summarize the estimated and actual effort in staff-hours and staff-months by capability release (**Fill in Table**).

Timing	Estimated Effort (Staff-Hours)	Actual Effort (Staff-Hours)	Estimated Effort (FTE)	Actual Effort (FTE)
Requirements Rev. No.				
Dev. Rev No.				
Dev. Rev No.				
Dev. Rev No.				
To be Fielded, No.				
Fielded, Rev. No.				

Costing Conventions (**Circle One**).

Staff Months (152 hrs/month)

Staff Hours

Full Time Equivalents (FTE)

Other: _____

If you are a government person, provide the following information about effort (**Fill in Table**).

Timing		Planned (\$)	Actual Effort (\$)	Estimated Effort (FTE)	Actual Effort (FTE)
Start of release (FY__)	Organic				
	Contracts				
	Total				
Start of FY__	Organic				
	Contracts				
	Total				
Start of FY__	Organic				
	Contracts				
	Total				
Start of FY__	Organic				
	Contracts				
	Total				
Start of FY__	Organic				
	Contracts				
	Total				

4.5 Cost. Summarize the following actual costs in dollars (\$) for the project, release or version by the following cost categories per the timing specified (*Fill in Table*).

Cost Category	Timing				
	Start of Release	Start of FY__	Start of FY__	Start of FY__	Delivery of Release
Estimated labor (\$)					
Actual labor costs (\$)					
Estimated license costs (\$)					
Actual license costs (\$)					
Estimated facilities costs (\$)					
Actual facilities costs (\$)					
Estimated C&A costs (\$)					
Actual C&A costs (\$)					
Estimated IAVA costs (\$)					
Actual IAVA costs (\$)					
Estimated field software engineers costs (\$)					
Actual field software engineers costs (\$)					
Estimated contractual capability sets costs (FY XX/XX) (\$)					
Actual contractual capability sets costs (FY XX/XX) (\$)					
Estimated system mission capability costs (\$)					
Actual system mission capability costs (\$)					
TOTALS					

4.6 Sources of Funds. Provide the following information about the sources of funds (R&D, O&M, Production, FMS, or Other) and allocation in dollars (\$) for the costs identified in the previous section by release number per the timing specified (*Fill in Table*).

Release	Sources of Funds	Start of FY__	Start of FY__	Start of FY__	Start of FY__	Start of FY__
Requirements Rev No.	OPA					
	OMA					
	R&D					
Dev Rev No.	OPA					
	OMA					
	R&D					
Dev. Rev No.	OPA					
	OMA					
	R&D					
Dev Rev No.	OPA					
	OMA					
	R&D					

To Be Fielded, No.	OPA					
	OMA					
	R&D					
Fielded, No.	OPA					
	OMA					
	R&D					

4.7 Latent Defect Information. Summarize the following defect information for the project, release or version per the timing specified (*Fill in Table*).

Defect Information	Totals
Number of latent defects existing prior to release found during maintenance	
Number of these latent defects that were fixed in this release	
Number of new defects (those inserted by maintenance actions) found in this release	
Number of these new defects that were fixed in this release	
Total number of latent and new defects found during maintenance fixed in this release	
Total number of latent and new defects deferred to the next release	

For the latent defects discovered, from which past release/version did they escape (*Circle One*)?

Previous release or version

More than one release or version in the past

4.8 Earned Value. Provide the earned value information identified if you are in the process of developing a maintenance release or version per the timing specified (*Fill in Table*).

Parameter of Interest	Start of FY__	Start of FY__	Start of FY__	Delivery of Release
Budgeted Cost of Work Performed (BCWP)				
Actual Cost of Work Performed (ACWP)				
Budgeted Cost of Work Scheduled (BCWS)				
To Completion Performance Index (TCPI)				
TCPI (Estimate at Completion)				
Budget at Completion (BAC)				
Estimate at Completion (EAC)				

If you do not use earned value to track progress, what other approach do you use (*Circle One*)?

Microsoft Project charts

Excel spreadsheet

Rate of progress chart

Other _____

4.9 Test Effort. Summarize the following test information for the project, release or version per the timing specified for your original estimates, fiscal year updates and actuals (*Fill in Table*).

	Start of Release	Start of FY__	Start of FY__	Start of FY__	Delivery of Release
Number of test cases	<i>Fill In (Number)</i>				

- Dry run					
- Dry run regression					
- FQT					
- FQT regression					
Effort to develop test cases (staff-hours)	Fill In (Staff-Hours)				
- Dry run					
- Dry run regression					
- FQT					
- FQT regression					
Number of tests run	Fill In (Number)				
- Dry run					
- Dry run regression					
- FQT					
- FQT regression					
Effort to run tests (staff-hours)	Fill In (Staff-Hours)				
- Dry run					
- Dry run regression					
- FQT					
- FQT regression					
- Test Procedures					
Actual test cost (\$)	Fill In (\$)				
- Dry run					
- Dry run regression					
- FQT					
- FQT regression					
- Procedures					

Notes: If you have any backup materials, please attach them to the questionnaire.

5. Software Cost Model Information

This Section identifies the cost model and settings used to estimate the maintenance effort.

5.1 Cost Model. If you used a parametric cost model to estimate resources for the release, please indicate which package you used (*Circle One*).

COCOMO-81 COCOMO II REVIC SEER
 SLIM True-S Other _____

Please supply the estimate file along with your response to this questionnaire. We would like two files if you have them. First, we need the file developed which contains your original estimate of the cost. Then, we need the file updated to reflect your next fiscal year(s) submittal. Finally, we would like the actuals when the product was delivered (actual size, actual parameter settings, etc.). If you only have one or the other, we will take whatever you have. But, please indicate which file is being supplied.

The COCOMO II model is preferred because the mathematics is public domain and we can calibrate it easily with open source tools. The other software cost models can fill the bill as well. However, we have elected not to capture data for them because of license issues. The Tables that follow provide brief descriptions of how to rate the model parameters. When in doubt, we suggest that you refer to either the book “*Software Cost Estimation with COCOMO II*” authored by Barry Boehm and crew in 2000 or the Center for Systems and Software Engineering’s web site at the University of Southern California (USC) at <http://sunset.usc.edu> for more and the most current information.

5.2 COCOMO II Scale Factors. Rate the five COCOMO II scale drivers in the Table that follows. These are the factors in the exponent of the equation. When in doubt use the nominal setting. Please provide the as many as three versions of this Table that were requested. When in doubt about the ratings, refer to the textbook or the web site.

	Very Low	Low	Nominal	High	Very High	Extra High	Estimate Rating
Precedentedness	Thoroughly un-precedented	Largely un-precedented	Somewhat un-precedented	Generally familiar	Largely familiar	Largely familiar	
Development Flexibility	Rigorous	Occasional relaxation	Some relaxation	General conformity	Some conformity	Some conformity	
Architecture/Risk Resolution	Little 20%	Some 40%	Often 60%	Generally 75%	Mostly 90%	Mostly 90%	
Team Cohesion	Strongly adversarial	Occasionally cooperative	Moderately cooperative	Largely cooperative	Highly cooperative	Highly cooperative	
Process Maturity	CMM Level 1 (lower half)	CMM Level 1 (upper half)	CMM Level 2	CMM Level 3	CMM Level 4	CMM Level 5	
Notes: Scale drivers are identified in Green Books.							TOTAL

5.3 COCOMO II Cost Drivers. As your next step, rate COCOMO II’s seventeen cost drivers. These factors are used to adjust the project estimates to factors that have been found to have influence over it. Again, when in doubt use the nominal setting. Please provide the three versions of this table that were requested; i.e., the original estimate, the update and the actuals. When in doubt about the ratings, refer to the textbook or the web site.

	Very Low	Low	Nominal	High	Very High	Extra High	Estimate Rating
Required Software Reliability	Slight inconvenience	Low, easily recoverable losses	Moderate, easily recoverable losses	High financial loss	Risk to human life		
Data Base Size		$D/P < 10$	$10 \leq D/P < 100$	$100 \leq D/P < 1000$	$D/P \geq 1000$		
Product Complexity	Simple	Straight-forward	Routine, some math, multi-file	Processing intense	Interrupt-driven	Complex real-time	
Required Reusability		None	Across project	Across Program	Across Product Line	Across Multiple Product Lines	
Documentation Match to Life Cycle Needs	Many life cycle needs uncovered	Some needs uncovered	Right-sized to life cycle needs	Excessive for life cycle needs	Very excessive for life cycle needs		
Execution Time Constraints			$\geq 50\%$ use of available exec. time	70% use	85% use	95% use	
Main Storage Constraints			$\geq 50\%$ use of available storage	70% use	85% use	95% use	
Platform Volatility		Major - 12 months Minor - 1 month	Major - 6 months Minor - 2 weeks	Major - 2 months Minor - 1 week	Major - 2 weeks Minor - 2 days		
Analyst Capability	15 th percentile	35 th percentile	55 th percentile	75 th percentile	90 th percentile		
Programmer Capability	15 th percentile	35 th percentile	55 th percentile	75 th percentile	90 th percentile		
Personnel Continuity	48%/year	24%/year	12%/year	6%/year	3%/year		
Application Experience	≤ 2 months	6 months	1 year	3 years	6 years		
Platform Experience	≤ 2 months	6 months	1 year	3 years	6 years		
Language/Tool Experience	≤ 2 months	6 months	1 year	3 years	6 years		
Use of Software Tools	Edit, code, debug	Simple front-end, backend CASE, little integration	Basic life cycle tools, moderate integration	Strong, mature tools, moderate integration	Strong, mature tools, well integrated with processes		
Site – Collocation	International	Multi-city and multi-company	Multi-city and multi-company	Same city or metro area	Same building or complex	Fully co-located	
Site – Communications	Some phone, mail	Individual phone, FAX	Narrow-band email	Wide-band electronic comm.	Wideband electronic comm., some video conf.	Inter-active multi-media	
Required Development Schedule	75% of nominal	85% of nominal	100% of nominal	130% of nominal	160% of nominal		
Multiply these factors times each other to get the Effort Multiplier Factor (EMF)							

5.4 Comments. Please feel free to provide us any additional explanatory information (basis of estimate, etc.) that you feel can help us to better understand your data by attaching pages to this questionnaire.