Using Sustainment Cost Data

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Sandi Enser

INTRODUCTION

According to the Department of Defense (DoD), Operations and Support (O&S) costs comprise between 45% and 69% of the life cycle cost of a system.[1] DoD and Congress are increasing their attention on O&S, including maintenance performed by the same companies that develop and produce major defense systems. DoD Program Offices sometimes justify their desire to remove the acquisition and sustainment cost reporting requirement from their contracts by stating that they do not use the data. The objective of this paper is to: 1) reaffirm and explain the latest requirements related to sustainment reporting, and 2) demonstrate a variety of ways that Program Offices could (and should) put the data to use. Note that all data used in this report are notional – there is no proprietary data included.

OVERVIEW OF REPORTING REQUIREMENTS

The Cost and Software Data Reporting (CSDR) requirement is applicable to sustainment regardless of the type of sustainment support that is being performed. It includes traditional transactions-based sustainment, Contractor Logistics Support (CLS), Performance-Based Logistics (PBL) and Interim Contractor Support (ICS). Interim Contractor Support (ICS) is the maintenance which is performed by the original equipment manufacturer during the production phase. For example, F-35 is in the production phase, and Lockheed Martin is performing sustainment on the existing aircraft (ICS). In contrast, the C-17 program is no longer in the production phase so Boeing provides maintenance to those aircraft in the sustainment phase.

Although many of the policies are in the process of being updated, they are intended to conform to OSD and Congressional direction. The most significant guidance is the 2017 NDAA[2], which mandates the following:

a. O&S cost estimates shall be Included in Milestone A estimate (this is earlier than previously required)
b. An analysis of O&S drivers must be included at each milestone review

[1] CAPE O&S Cost Estimating Guide, March 2014, page 2-2
[2] [3] National Defense Authorization Act (NDAA) for Fiscal Year 2017

c. Access to O&S data must be improved, via better centralized O&S databases and by the CAPE Cost Assessment Data Enterprise (CADE)
d. PM must collect sustainment data for any program $100M or more.

(Note: This is probably the most significant change to existing policy, adding non-ACAT I programs to the CSDR requirement. There are several non-ACAT pilot programs in process, and rather than the CSDR signature authority being the Office of the Secretary of Defense (OSD) Cost Assessment and Program Evaluation (CAPE) Deputy Director , the signature authority is the Service Cost Center Technical Director or their designee.)

The NDAA 2017 also requires more frequent Sustainment Reviews. Programs must update their O&S estimate every five years after Initial Operating Capability (IOC) and throughout the life of the program, and, in doing so, retain all data and documentation. This five-year report should include an estimate for the remainder of the program, and comparison of estimates to actuals. These actuals are reported in the CSDR data stored and available to registered government users in the OSD CAPE Cost Assessment Data Enterprise (CADE). The report should also examine the estimated versus achieved reliability, which is data available in the sustainment 1921 and 1921-5 CSDR forms.. In the future the reliability data will be expanded in the CSDR technical data form (i.e., 1921-T). Finally, the report must include analysis of depot level reparable (DLR) and Consumables cost , which is currently reported in some sustainment CSDRs and in the future will be expanded by the Maintenance and Repair Parts Report**, (**1921-M/R).

CSDRs are often the only source of actual cost data. While many contracts require Earned Value Management (EVM) data reporting, there is no EVM requirement for Firm Fixed Price (FFP) contracts. Many sustainment contracts are this contract type, and thus have no EVM reporting. A unique and useful feature of CSDRs is inclusion of typically difficult to collect profit actuals for FFP contracts and subcontracts.

Many sustainment contracts are also Indefinite Delivery/Indefinite Quantity (ID/IQ) contracts. To correct past underreporting on these contracts, the Director of OSD CAPE signed out the "Cost Analysis Data Improvement Memo" in January 2017[3]. This memo clarifies the reporting on ID/IQ contracts, requiring that the default is one report per delivery order. This memo also implemented the software maintenance form for any Government or contractor software maintenance effort over $1M a year.[4]

The software maintenance report includes information on the scope of the software maintenance effort; staffing; the size of the software effort as measured by Source Lines of Code (SLOC), Function Point (FP) or other measures; requirements counts; and the duration of various software maintenance

[3] Cost Analysis Data Improvement Memo, Director, CAPE, January 2017

[4] Cost Analysis Data Improvement Memo, Director, CAPE, January 2017

releases. This data reporting represents a significant advance in collection of heretofore difficult to acquire data that supports estimation of future software maintenance efforts.

Also, there are new reports being introduced that provide additional insights into sustainment CSDR data. The DIDs for these reports were approved in November 2017, and they are being implemented using a pilot program approach. The Technical Data Report 1921-T is an augment to the cost reports that provides more detailed information than what is currently captured in the Sustainment Remarks on the Sustainment 1921. For example, the 1921-T includes a number of PBL Metrics, such as Customer Wait Time, Mean Time Between Failure (estimated and actual), Mean Time to Repair (target and actual), Number of Repair Actions and Payment Frequency.

The Maintenance and Repair Parts Report 1921-M/R, consists of two parts. The first part, the Maintenance Event report, collects information on maintenance events (the component being repaired, the reason for the repair, the location of the repair, the repair duration etc.) The second part of the report, the Repair Parts sheet, shows the Line Replaceable Units (LRUs) or repair parts that were touched or consumed for each maintenance event. If a contract is a transactions-based purchase of parts without maintenance labor, only the second part of the report, the Repair Parts would be used. This data provides a greatly expanded view of the repair efforts, and gives the cost analyst much more concrete and detailed information.

On an important note, the OSD CAPE sustainment reporting structure reflected in the various CSDR forms is based on the OSD CAPE O&S Cost Estimating Guide[5], and is aligned with the reporting structure used in the centralized DoD O&S databases. Over time, detail has been added to the sustainment reporting structure in the areas of sustaining engineering, program management, data and technical publications, and software maintenance. The structure remains consistent with the CAPE O&S structure at the higher levels of indenture.

REPORTING PROGRESS TO DATE

The plans approval process involves significant coordination among the members of the Cost Working Group Integrated Product Team, whose members are the Program Office analyst, the DCARC analyst, the Service Cost Center Analyst and the CAPE analyst. When the CWIPT agrees on a plan, it is presented to the Director of the CAPE O&S Division, and then reviewed by the DCARC Director and finally signed by the Deputy Director of CAPE. The goal is to have an approved plan in each Request for Proposal (RFP) so that the bidder is informed of the requirement and the reporting structure they are expected to use.

The amount of sustainment data available in CADE has expanded significantly. In 2012 there were 8 programs reporting sustainment data. In 2018 the count is 65 programs with plans approved or in the

[5] CAPE O&S Cost Estimating Guide, March 2014

approval process. There have been 125 sustainment plans approved since December 2016, most of which include the new Sustainment Functional Cost Hour Report (1921-5). There have been 40 1921-5 reports received to date. In addition, an agency which previously refused to report now has 24 approved plans.

EXAMPLES OF SUSTAINMENT DATA UTILITY

Examples of Sustainment CSDR Data Utility

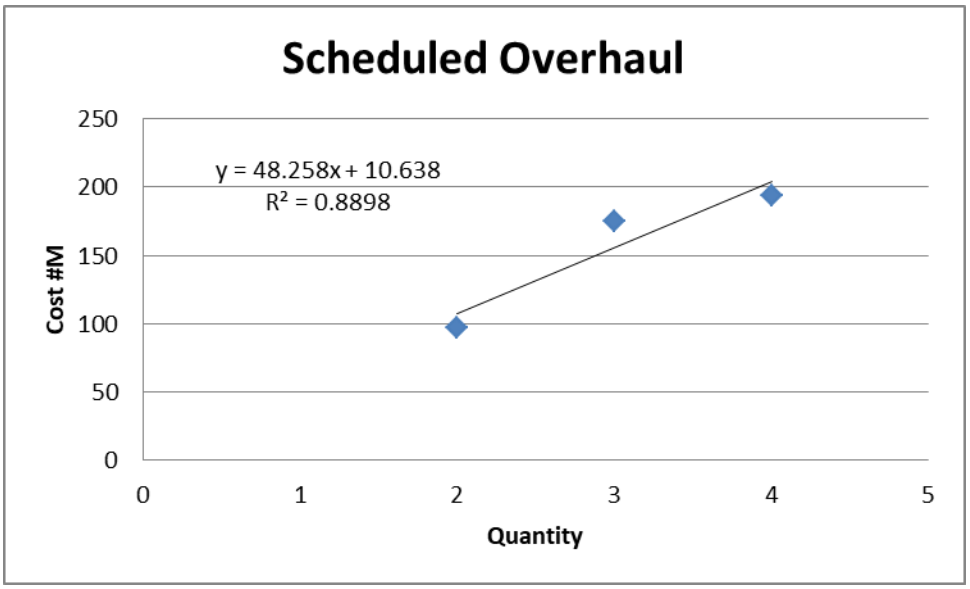
This section provides a few example applications of the some of the data types currently being reported in sustainment CSDRs and discusses some other important uses of the data.

The first data use example is for Scheduled Overhaul.

The cost analyst has been able to develop the following scheduled overhaul database using the data from CSDR form 1921:

		Qty	Cost	Qty	Cost	Qty	Cost
1.3.4	Depot Maintenance	Year 1	Year 1	Year 2	Year 2	Year 3	Year 3
1.3.4.1	Scheduled Overhaul		175,021,359		97,349,476		193,865,420
1.3.4.1.1	Airframe/Hull/Vehicle Scheduled Overhaul	3	135,045,009	2	75,037,205	4	145,325,003
1.3.4.1.2	Propulsion Scheduled Overhaul	N/A	N/A	N/A	N/A	N/A	N/A
1.3.4.1.3	Electronics/Avionics Scheduled Overhaul	3	27,920,005	2	15,309,056	4	30,230,995
1.3.4.1.4	Other Major Subsystems Scheduled Overhaul	N/A	N/A	N/A	N/A	N/A	N/A
1.3.4.1.5	Other Scheduled Overhaul	3	12,056,345	2	7,003,215	4	18,309,422

Regression Analysis shows that there is a valid relationship that can be derived from this data, where the X axis is quantity and Y axis is cost in Millions:



The cost analyst can use the linear relationship -- (quantity of scheduled overhauls * 48.258) +10.638 -- to estimate the cost of future scheduled overhauls. If the future quantity is 5 (and the capacity of the depot is not constrained below 5), the estimated future cost of 5 overhauls is $259M.

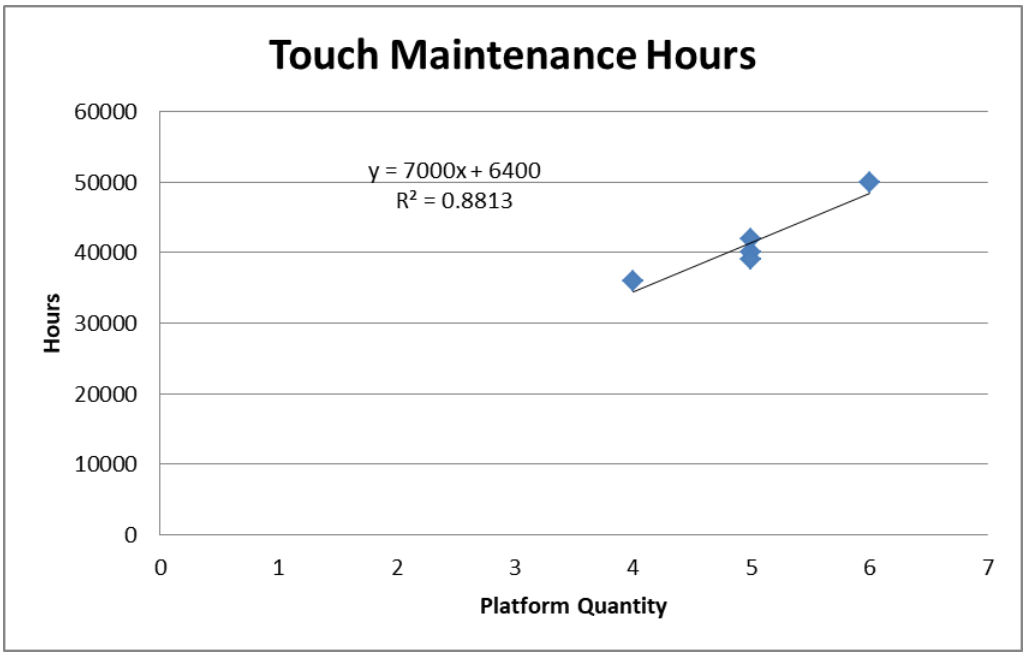
Absent other data, this relationship could also be used to estimate unscheduled overhauls.

The next data use example is Touch Maintenance hours, which are available from the 1921-5 Sustainment Functional Cost Hour Report.

The cost analyst has the following data table:

Year 1	Year 2	Year 3	Year 4	Year 5
5	4	5	6	5
40000	36000	39000	50000	42000

Regression Analysis results in the following relationship, where the X axis is quantity and the Y axis is hours:



Using this equation, the future estimate for Touch Maintenance for a Quantity of 7 platforms is

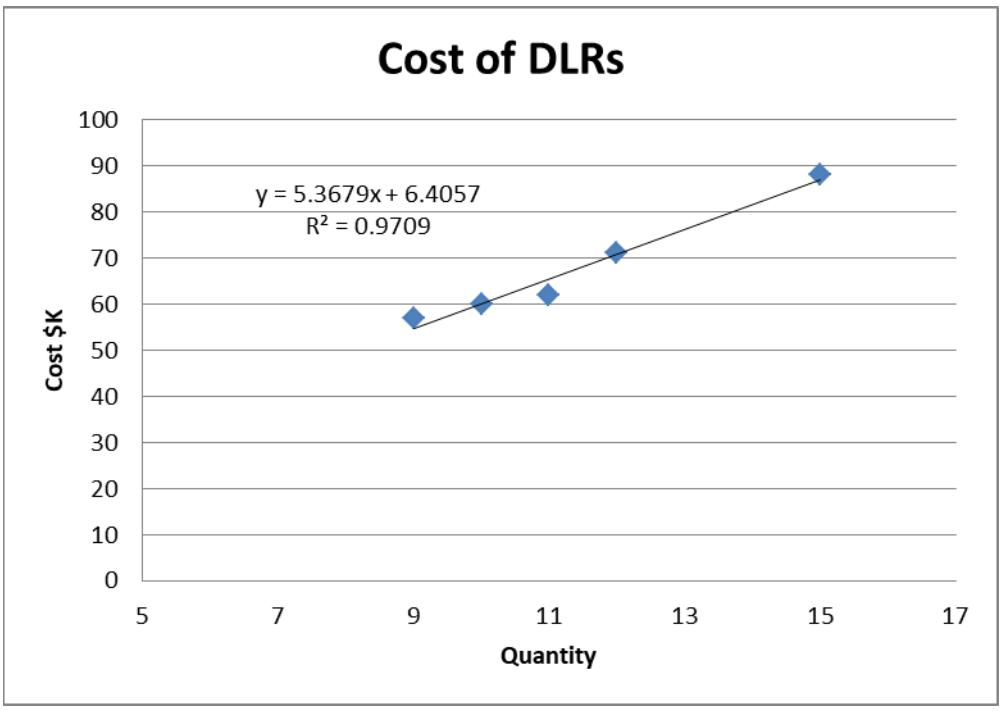
7 * 7000 + 6400, or 55,400 hours.

The final data use example is for Depot Level Reparables (DLRs).

The cost analyst has been able to create the database below using CSDR form 1921. The database includes quantity and cost data by year for specific by DLRs identified by National Item Identification Number (NIN):

	Year 1	Year 1	Year 2	Year 2	Year 3	Year 3	Year 4	Year 4	Year 5	Year 5
	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
NIN 123456789	10	60	12	71	11	62	15	88	9	57
NIN 456792009	5	100	6	119	4	82	5	98	5	97
NIN 789123012	1	200	2	398	1	199	3	580	1	199

Regression analysis results for NIIN 123456789 (the first row) are shown below, where the X axis is Quantity and the Y axis is unit cost:



Therefore the cost analyst can estimate future costs of NIIN 123456789 using the relationship, Quantity * 5.3679 +6.4057. For example, the cost of a future quantity of 20 of that part is $113.78. A similar approach can be used for Consumables and Repair Parts if the cost detail is available.

Detailed DLR data can also be used to identify problem parts. If the repair plan assumes a certain number of a certain part will be used, and the actual use is higher, that could indicate that substituting

an alternative part might reduce the demand. Conversely, if a part is being repaired less frequently than the repair plan suggests, the cost analyst could coordinate with the reliability analyst to determine the assumptions in the reliability metrics such as Mean Time Between Failure (MTBF), and perhaps the stock of that part could be reduced in the future.

Another use of sustainment CSDR data is assessment of overhead costs. All U.S. companies are required to provide an annual 1921-3 Contractor Data Business Report, while Foreign companies operating overseas but providing hardware to DoD are exempt. This report is typically completed by Corporate rather than by local financial staff. The report includes direct costs for all contracts performed by that business unit/location, and an explanation of indirect (overhead) costs. The cost analyst can assess the impact of losing a contract – overhead costs would be allocated against fewer direct costs, so the overhead on each contract could rise. Conversely, the impact of gaining new or significantly larger contracts by that business unit – overhead costs would be allocated against more direct costs, and the overhead costs to each contract should generally be lower.

As noted earlier in the paper, CSDRs report Profit/Loss data for all contract types (firm fixed price contracts included), useful information that is not available via EVM reporting which is in fact does not apply to firm fixed price contracts. The cost analyst can use these factors to evaluate the reasonableness of prime and major subcontractor profit levels.

This same data can also be useful to contract negotiations. Identification of actual profit rates that appear unreasonably high represent a warning to negotiators that they should scrutinize future proposed profit rates for potentially excessive profit. Contractors bids are also often evaluated by hours in various categories, and the hours breakout in the 1921-5 Sustainment Functional Cost Hour Report 1921-5 could provide visibility to help assess the hours bid.

Another important use of sustainment CSDR data is support to Business Case Analyses (BCA) performed by Product Support Managers (PSM). The PSM will also use data from CSDRs and each Service's centralized Visibility and Management of O&S Cost (VAMOSC) databases. The PSM coordinates with the financial/cost analysts, logisticians and contracting officers to ensure the available data is sufficient to perform the BCA. Typically, the objective of the BCA is to analyze tradeoffs between government provided depot maintenance and contractor provided depot maintenance. The BCA defines the status quo, and compares it to alternative support strategies. The BCA can also help determine whether or not a PBL is appropriate and what the PBL metrics and goals should be.

CONCLUSIONS

In order to develop valid estimates, the cost analyst must have access to CSDR data to augment any O&S data that may be available via EVM reporting or Service VAMOSC databases . The CSDR reports are mandatory in most cases, and the resulting data can be used in a variety of analyses that are not possible with other data sources alone. Government cost analysts can access the CSDR data in CADE with a Common Access Card (CAC). CADE's relational database supports cross-platform, cross-program and cross-service queries. This feature reduces the time that an analyst needs to spend searching for

the data and manipulating it in another tool like Microsoft Excel, and reduces the probability of data entry errors.

Cost analysts should gain a thorough understanding of the potential utility of the various data available in CSDRs. They should use this knowledge to actively advocate for their Program Managers and Contracting Officers to include the CSDR requirements and the supplemental reports on all contracts for their program. The data collected through this contractually required data reporting will improve the credibility of estimates and other analyses that relate to what historically averages 45-69% of the life cycle cost of DoD systems, supporting better program, service and DoD decision making.

REFERENCES

CADE. “Guidelines for the Preparation and Maintenance of CARD Tables (v14).” Section d.

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Cummings, Cheri, et al. “Software Development Estimating Handbook: Phase One.” Naval Center for Cost Analysis, Feb. 1998.