Logistics Management Institute

Improving Depot Maintenance Cost Assessments

Review of the DoD Depot Maintenance Cost System

LG101T1

May 2002

Robert C. Steans
Harry J. Applegate

LMI®

Improving Depot Maintenance Cost Assessments

Review of the DoD Depot Maintenance Cost System

LG101T1

May 2002

Robert C. Steans
Harry J. Applegate

LOGISTICS MANAGEMENT INSTITUTE
2000 CORPORATE RIDGE
MCLEAN, VIRGINIA 22102-7805

Executive Summary

The management of DoD organic depot maintenance requires visibility into the work performed and resources consumed. Because the DoD's financial systems contain little production-specific data, and its production management systems are peculiar to each military service, a standard reporting process is required. The DoD Depot Maintenance Cost System (DMCS) provides this process. The DMCS collects depot maintenance cost and labor-hour data and maintains that data in a relational database to support analyses of depot operations.

The DMCS is designed to collect detailed information on each job order and contract for depot maintenance services. The report record format has 50 active fields, including descriptive data and quantitative cost, labor, and production data. Thirty standard tables are produced each year. In addition, inquiries and special reports can present data in various formats, including multiple-year trends. These products are used for cost-trend analysis, resource oversight, budget evaluation, and in response to Congressional queries.

DMCS procedures are contained in Chapter 14, Volume 6A, of the DoD *Financial Management Regulation* (FMR). Chapter 14 directs the services to maintain a quarterly data file and provide an annual data submission to the Office of the Secretary of Defense, which is accompanied by an assessment of data accuracy, completeness, and reasonableness as well as an analysis of trends and developments affecting the data. In addition, Chapter 63, Volume 11B, of the FMR establishes cost accounting requirements for depot maintenance activities of the DoD Working Capital Fund (WCF) and serves as a model for cost identification by non-WCF activities.

In May 2001, the Assistant Deputy Under Secretary of Defense for Maintenance Policy, Programs, and Resources (ADUSD[MPP&R]) announced a review of the effectiveness of the current DoD Depot Maintenance Cost System processes for collecting, editing, and analyzing data on depot maintenance costs.

PROCEDURES AND PROCESSES

LMI's review of the DMCS focused on its procedures and processes, including whether (1) the activities and types of costs to be reported are adequately defined, (2) alternate data sources may streamline data collection and improve standardization, and (3) use of a milestone (an as-of date) other than financial completion may improve the suitability of DMCS data for their intended uses.

From our review we found the following to be true:

- Current guidance in Chapters 14 and 63 fully captures the activities and costs of WCF organic activities; however, non-WCF and contract costs are described in general terms only. Including more specific non-WCF and contract language would reduce the potential for differing service interpretations and would clarify the areas subject to reporting. In particular, applying lessons learned in development of Title 10, "50/50" reporting requirements would strengthen Chapter 14 and improve consistency in reporting processes.

- None of the potential data sources reviewed offered a feasible alternative that could be developed as a standard source for DMCS data. Current service-unique processes for collecting data from a combination of production and financial systems are successful and remain the most viable alternative.

- Although the financial completion milestone results in older cost data than other alternatives, the milestone captures the most complete job order cost data, is most suited to supporting job order and unit-of-output cost analyses, and, as the current standard, is the most feasible to employ.

As a result of our review, we recommend updates to Chapter 14 to

- clarify the depot-level and depot-performed dimensions of the depot maintenance definition;

- add an addendum specifying the cost categories to include and exclude in reporting; and

- clarify the definitions of funded and unfunded costs.

We also recommend Chapter 14 retain current guidance and processes for the financial completion milestone and DMCS data sources.

USES OF DMCS DATA

In addition to procedures and processes, our review included the uses of DMCS data set forth in Chapters 14 and 63, assessed the characteristics of the data with

respect to its suitability for accomplishing those uses, and identified areas in which additional Chapter 14 guidance would facilitate data analysis.

The nine defined uses of depot maintenance cost and production data can be viewed as a series of questions. The first three (What drives costs? What trends are evident? Are costs reasonable?) are central to depot maintenance cost analysis. The answers to these questions provide insight into management effectiveness and identify the cost changes driven by factors outside the control of depot maintenance activities.

The next five questions fall into three categories of data application: determining requirements, performing cost comparisons, and validating reports. The final question—Is additional guidance or direction needed?—is the outcome of the others (i.e., when analysis reveals a problem, guidance or direction is the corrective action).

To determine how to best address each question, we reviewed significant cost drivers, including customer-determined workload, the quantities of resources required, and the prices for the resources (all of which are largely outside maintenance management's control). We also assessed factors (such as staffing of overhead functions and labor and material efficiency) that are more controllable and may lead to requests for further information and management guidance whenever effectiveness indicators or cost trends are unfavorable.

We reviewed analytical methods to distinguish the effect of individual factors, including normalization and a variety of cost metrics. We determined that both normalization and cost metrics are highly dependent on the information provided by reporting activities. For example, cost-per-unit metrics can provide insight into how the costs of maintenance are changing, independent of the effect of workload changes, but are constrained by the fact that the units (workload packages) are often dissimilar and vary over time. Information on the degree to which workloads are comparable and stable is essential to effective use of these metrics. We determined that an assessment of cost trends and reasonableness is also dependent upon cost driver information not currently addressed in Chapter 14.

Our analysis revealed several other salient features:

- The record format of the DMCS report does not explicitly identify repair costs for depot level repairable spares. Many of the financial products subject to analysis and validation with DMCS data identify these costs separately. An update to the Addendum 3 end-item identification field would improve the suitability of DMCS data for this purpose.

- Current reporting procedures do not identify when expenses are incurred or the sources of funding. As a result, cost data in budgets and other non-DMCS products cannot be compared year to year. Updating the DMCS report record format to include these data would be impractical in the near

term, however, because it would require major software changes by the Defense Manpower Data Center (the executive agent for the DMCS) and the services.

- The following are the most feasible and productive uses of DMCS data:
  - Test the reasonableness of budgets and reports to Congress to ensure the products do not omit or significantly over- or understate costs.
  - Identify sources of repair.
  - Compare costs among depot maintenance sources of repair.
  - Respond to requests for information (for example, perform an analysis to identify DoD-wide depot maintenance costs by category of weapon system).
  - Identify significant differences in projected customer orders, the percentages of direct and indirect costs, projected costs per labor hour, etc.

With these factors in mind, we recommend updates to Chapter 14 to (1) revise Addendum 3 end-item field instructions to specifically identify maintenance on depot level repairable spares; (2) expand instructions for service analyses of annual DMCS reports to quantify the impact of policy, process, price, and workload changes that significantly affect costs; and (3) add an addendum that provides guidance on applying DMCS cost data to achieve these uses.

Contents

FIGURES

TABLES

Chapter 1
Introduction

In May 2001, the Assistant Deputy Under Secretary of Defense for Maintenance Policy, Programs, and Resources (ADUSD[MPP&R]) announced a review of the effectiveness of the current DoD Depot Maintenance Cost System (DMCS) processes for collecting, editing, and analyzing data on depot maintenance costs.

The ADUSD(MPP&R) established the DMCS to gain insight into DoD depot maintenance. This information system collects extensive data on work performed, labor hours expended, the cost of production, and the quantity of end items or components inducted and completed. The DMCS differentiates cost data by type of resource (labor, material, overhead, and several other characteristics).

This report focuses on the procedures and processes of the DMCS, including the data collected, sources and characteristics of the data, and use of the data to support management oversight of DoD depot maintenance. We do not attempt to assess compliance with reporting requirements or the completeness and accuracy of the data submitted. These topics fall under the purview of a separate review.

APPROACH

This report discusses how the DMCS cost accounting and reporting module satisfies the nine objectives listed for the system in the DoD *Financial Management Regulation* (FMR).[1]

To support requirements assessments and analyses of resource management effectiveness, DMCS should provide data that support review of the factors affecting production costs. The DMCS should also provide data to support analysis of individual service compliance with Congressional depot maintenance reporting requirements.

BACKGROUND

A review of the nature and scope of DoD maintenance and the history of the Depot Maintenance Cost System is necessary to complete the analysis of the DMCS cost and accounting module.

[1] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 6A, Chapter 14, February 1996, para. 140103; and Volume 11B, Chapter 63, para. A.2.d.

DoD Depot Maintenance

Within the DoD, depot maintenance is a primary logistics function and essential to ensure continuing mission capability of the department's weapon systems and equipment. Maintenance at depot level differs from maintenance at either intermediate or organizational levels in that it is of greater technical complexity and scale, with DoD depots typically providing worldwide support for a specific technology or weapon system from a single location.

In addition, depot maintenance work is widely varied:

- Depot-level maintenance is performed on the full spectrum of DoD end items and components, ranging from complete weapon systems to equipment to depot-level reparable components (DLRs) to software packages.
- Maintenance output encompasses a wide range of services, including complete overhauls, repairs, condition inspections, installation of modifications, and the manufacture of replacement parts.
- The tasks performed in individual job orders change continuously, depending upon the configuration of the end items and components inducted, the nature and pace of military operations, the threat to be confronted, new technologies, and the effect of aging weapon systems and equipment on failure rates.
- Depot maintenance activities also accomplish intermediate or organizational-level work to meet operational requirements and for cost effectiveness.

The sources of depot maintenance are direct-performance in organic DoD facilities or purchase of contractor services:

- Organic depot maintenance is a continuous industrial process in which, at any point in time, work is underway on a multitude of job orders at various stages of completion. The resources utilized to perform the work encompass the full range of those needed by any independent manufacturing or maintenance enterprise: facilities and capital equipment, labor, materials, and overhead.[2]
- Contracts may cover depot maintenance services only or incorporate a range of logistics support, including intermediate maintenance, supply management, and sustaining engineering. Examples of broad logistics contracts are those for contractor logistics support (CLS) and interim contractor support (ICS). CLS and similar contracts usually extend over the life of a weapon system or end item. ICS contracts typically provide support

[2] Utilities, information services, financial management, etc.

during the transition from weapon-system or end-item production to full operational capability.

- The DMCS reflects fiscal year (FY) 2000 total DoD depot maintenance costs of $11.8 billion, including $8.2 billion performed by organic DoD maintenance facilities.

The Depot Maintenance Cost System

PURPOSE

The management of DoD organic depot maintenance requires visibility of production output and resources consumed. Because the department's financial systems contain little production-specific data and production management systems are independent and peculiar to each service, a standard reporting process is required. Apart from the DMCS, the only information generally available for contractor-performed depot maintenance entails accrued expenses for the overall contract. In addition, data on the depot maintenance performed as a part of ICS and CLS contracts is usually not available separately.[3]

The DMCS provides a reporting process to capture all depot maintenance data. Its report products are employed for cost-trend analysis, resource oversight, budget evaluation, and responses to Congressional queries. DMCS data are maintained in a relational database, and 30 standard tables are produced each year. In addition, inquiries and special reports can portray data in various formats, including multiple-year trends. The system includes extensive cost and labor-hour data to support analyses of depot operations.

The DMCS is the product of a long development and refinement process. Its data, as portrayed in standard and special reports, are designed to answer the depot maintenance questions—who, what, when, where, and how much?

HISTORY

A form of the DMCS has existed since the 1960s as the source for comprehensive production and cost information on DoD depot maintenance. The DoD Depot Maintenance Cost System has been defined in key DoD instructions:

- DoD Instruction 7220.14, *Uniform Cost Accounting for Depot Maintenance*, was published in 1963. This instruction called for uniform cost accounting for depot maintenance that was oriented toward weapon systems and equipment end items, based on total cost regardless of appropriation source, and using accrual accounting to relate costs to completed work.

[3] Interviews by LMI personnel with military service headquarters and materiel and systems command personnel.

- DoDI 7220.9, *Depot Maintenance Production Reporting*, was published in 1968. This instruction prescribed a production reporting system consistent with DoDI 7220.14.[4]

- DoD 7220.29-H, the *DoD Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting Handbook*, was published in 1975 to further the objective of uniform cost accounting for depot maintenance. Beginning in 1975, DoD also initiated the Uniform Cost Accounting and Production Reporting System (UCA) to facilitate the uniform recording of depot maintenance cost and production data.

- DoD 7220.9-M, the *DoD Accounting Manual*, was issued in 1983.

- Chapter 76, "Special Cost Accounting and Reporting Requirements for Depot Maintenance," was published in 1990 as a new chapter to the *DoD Accounting Manual* to replace DoD 7220.29-H.

- In 1990, DoD 7000.14-R, the *DoD Financial Management Regulation*, superceded DoD 7220.9-M. The regulation included two chapters that dealt separately with the cost accounting and production reporting requirements formerly embodied in Chapter 76.

CURRENT GUIDANCE

Two chapters of the *DoD Financial Management Regulation* deal with depot maintenance. They are commonly referred to as Chapter 14 and Chapter 63.

Chapter 14, Volume 6A, sets forth DMCS procedures. The chapter directs the services to maintain a quarterly file and provide an annual data submission, accompanied by an assessment of data accuracy, completeness, and reasonableness and an analysis of trends and developments affecting the data.[5] The report record format has 50 active fields, including the following:

- Descriptive data that identifies the production facility; end item, component, or service performed; type of work; and customer.

- Quantitative cost and labor hour data categorized by the factor of production (labor, material, etc.), direct, and overhead costs, and identifies whether the work was funded by the Defense Working Capital Fund (WCF).[6]

---

[4] Logistics Management Institute, *"A Comparison of DMCS and VAMOSC Depot Maintenance Cost Data Elements and Procedures,"* December 1993, p. 1-3. (VAMOSC is discussed in the section *Assessing Alternate Data Sources.*)

[5] The reports control symbol for this process is AP-MP(A)1397. DMCS is therefore informally known as the "1397" reporting process.

[6] See Appendix A for a discussion of the Defense Working Capital Fund.

- Quantitative production data that includes inductions by year, quantities produced, and shop-flow days. Report records are also categorized by whether the data apply to completed work or work in process (WIP).

Chapter 63, Volume 11B, establishes cost accounting requirements for depot maintenance activities of the WCF. The chapter defines depot maintenance and prescribes requirements for the following:

- The job order system used to aggregate costs by output
- An accounting structure
- Work measurement standards for labor, material, and indirect costs (The chapter stipulates that the standards will be developed using industrial engineering techniques and will be the basis for cost estimates.)
- Allocation of indirect costs, including overhead, general, and administrative costs.

ORGANIZATION OF THE REPORT

This report is divided into six additional chapters:

- Chapter 2, *Which Data Should Be Reported?*, assesses which costs should be reported and where to obtain the data.
- Chapter 3, *Which Milestone Is Most Appropriate?*, reviews alternatives for the "as-of" dates for reporting costs.
- Chapter 4, *What Are the Uses of DMCS Data?*, reviews the nine data functions set forth in DMCS guidance and identifies the analysis needed to satisfy those functions.
- Chapter 5, *What Are the Factors that Drive Cost?*, reviews the effect of environmental, policy and process, and management effectiveness on depot maintenance costs and assesses alternative methods for distinguishing among the factors that affect costs.
- Chapter 6, *How Can We Use DMCS Data to Meet the Objectives of Chapter 14?*, assesses the specific applications of DMCS data set forth in Chapter 14, Volume 6A, of the FMR and reviews how best to address each. The chapter also reviews how the characteristics of the DMCS affect its use when validating budgets and other non-DMCS products.
- Chapter 7, *Conclusions and Recommendations*, summarizes potential improvements to the reporting process.

TERMINOLOGY

Two important terms are used throughout this report:

- *Cost.* In DoD usage, the terms "cost" and "expense" are interchangeable. Accordingly, for purposes of this report, we use the term "cost" in a general sense to signify the value of resources consumed.

- *Metric.* Representations of quantity or cost data within DMCS are typically in the form of metrics, with the term "metric" meaning a standard of measurement.[7] When measuring quantities and cost, the standard is either a period of time or a unit of output, and the metric is the average quantity or cost per that standard. For example, labor hours per year or cost per overhaul.

[7] The only exception would be a point-in-time total, such as assigned personnel as of the end of a year; otherwise, cost or quantity data must be expressed in terms of time (i.e., as a metric) to be meaningful.

Chapter 2
Which Data Should Be Reported?

In this chapter, we address two questions about cost data contained in the DMCS:

- *Which costs should be reported?* Title 10 of the United States Code, the *DoD Financial Management Regulation*, and other publications set forth definitions and guidance relevant to identifying depot maintenance costs. We review whether these sources are consistent and provide sufficient information to reporting activities.
- *Where should the data be obtained?* We review current and alternative data sources to determine if the data collection process should be streamlined.

DEFINITIONS AND GUIDANCE

In our interviews with service management and personnel responsible for DMCS reporting, the subject of depot maintenance definition was raised consistently. Whether to use the definitions in Title 10 of the United States Code or the definition provided in DoD publications seemed to cause confusion as to what to report as depot maintenance in the DMCS reporting structure. This chapter addresses the definitions and guidance that affect DMCS reporting by the services.

Public Law

Depot maintenance is defined in United States Code (USC), Title 10, Section 2460, and in several DoD publications: JP 1-02,[1] DoDD 4151.18,[2] and the FMR.[3] The language in each is similar.

[1] Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, April 15, 2001, p. 126

[2] Department of Defense, DoD Directive 4151-18, *Maintenance of Military Materiel*, August 12, 1992, Enclosure 2.

[3] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 11B, Chapter 63, December 1994, Paragraph C.

10 USC 2460

In Title 10, depot-level maintenance and repair is defined as follows:

> (a) material maintenance or repair requiring the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary, regardless of the source of funds for the maintenance or repair or the location at which the maintenance or repair is performed. The term includes (1) all aspects of software maintenance classified by the Department of Defense as of July 1, 1995, as depot-level maintenance and repair, and (2) interim contractor support or contractor logistics support (or any similar contractor support), to the extent that such support is for the performance of services described in the preceding sentence.
>
> (b) Exceptions: (1) The term does not include the procurement of major modifications or upgrades of weapon systems that are designed to improve program performance or the nuclear refueling of an aircraft carrier. A major upgrade program covered by this exception could continue to be performed by private or public sector activities. (2) The term also does not include the procurement of parts for safety modifications. However, the term does include the installation of parts for that purpose.

10 USC 2466

An alternate source for definitional language is the "50/50" guidance. Congressional interest in maintaining organic depot capabilities within the DoD led to Section 2466(e)(1) of the United States Code—a statutory requirement that ensures DoD employees perform a minimum portion of the work of each service and defense agency. The FY 1998 *Defense Authorization Act* amended 10 USC 2466 to set the limit for work performed by non-government employees at 50 percent of the funds made available for depot maintenance.[4]

The effect of this legislation and the 10 USC 2460 definition was to oblige the Office of the Secretary of Defense (OSD) and the military services to develop procedures to accurately identify and report to Congress all depot maintenance, however and wherever it is performed or funded. The DoD reporting procedures are published in an annual "call" for service submissions, which has been refined and extensively audited over the last several years. The calls do not define depot maintenance, but they do include comprehensive guidelines for determining what activities and costs to include in the Congressional reports. For example,

- the depot maintenance portion of ICS, CLS, and similar contracts, including the costs of off-equipment work, shipping, handling, management,

[4] Section 2466 is, therefore, known within the DoD as the "50/50" requirement.

engineering, and storage and issue (excluded are ICS costs before initial operational capability [IOC]);[5]

- the depot maintenance portion of warranties;
- the depot maintenance portion of special access and classified programs; and
- software costs, including depot level actions to correct, add to, or adapt existing software (excluded are costs before IOC).

DoD Definitions

DoDD 4151.18

The DoDD 4151.18 definition of depot maintenance is as follows:

> That materiel maintenance performed on materiel requiring major overhaul or a complete rebuilding of parts, assemblies, subassemblies, and end items, including the manufacture of parts, modifications, testing, and reclamation as required. Depot maintenance serves to support lower categories of maintenance by providing technical assistance and performing that maintenance beyond their responsibility. Depot maintenance provides stocks of serviceable equipment, because it has available more extensive facilities for repair than are available in lower maintenance activities. Depot maintenance includes all aspects of software maintenance.[6]

CHAPTER 63

Under the heading, "Scope of Depot Maintenance," Chapter 63 includes identical language to that of the DoDD 4151.18 definition.[7]

JP 1-02

The JP 1-02 definition of depot maintenance is similar to that of DoDD 4151.18 and Chapter 63, but it does not include the final sentence concerning software maintenance.

DoD Guidance

CHAPTER 14

Chapter 14, Volume 6A, of the FMR requires reporting of work performed in DoD depots, other DoD activities, and private-sector facilities. The reporting

---

[5] See Appendix A for a definition of "initial operational capability."

[6] DoD Directive 4151-18, op. cit., Enclosure 2, paragraph E2.1.5.

[7] Chapter 63, op. cit., paragraph C.

requirements apply to all depot maintenance, regardless of where or by whom the work is performed or how it is funded. Depot maintenance costs are to be identified either as "funded" or "unfunded."[8]

Within Chapter 14 there are four addenda that facilitate guidance:

- Addendum 1 lists the DoD facilities required to report maintenance activity.
- Addendum 2 specifies work performance categories, including overhaul, repair, and manufacture.
- Addendum 3 lists the cost categories to be reported, including overhead, general and administrative expenses, and government-furnished material.[9] Costs are identified as either funded or unfunded.[10]
- Addendum 4 specifies the work breakdown structure.[11]

CHAPTER 63

The requirements of Chapter 63, Volume 11B, of the FMR apply to depot maintenance performed on all material (regardless of ownership), to all funding sources, and to all locations. The chapter also describes sources of customer funding and the kinds of activities that perform depot maintenance; and it sets forth the general ledger accounts comprising the depot maintenance cost accounting module.[12]

EFFECTIVENESS OF DEFINITIONS AND GUIDANCE

Chapters 14 and 63

Chapter 14 requires the reporting of all DoD depot maintenance,[13] including maintenance performed in the private sector. Addendum 1 provides a list of DoD facilities that are required to report maintenance data. The data fields in Addendum 3 identify the types of cost to report. The coding structures of Addenda 2, 3, and 4 provide detailed information on the nature of reported costs.

The language of Chapter 63 on depot maintenance funding sources and locations is all-inclusive. Its structure of general ledger accounts is the basis for

---

[8] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 6, Chapter 14, February 1996, paragraph 140101.

[9] See Appendix A for a definition of "government-furnished material."

[10] See Appendix A and Chapter 6 below for further discussion of funded and unfunded costs.

[11] See Appendix A for a definition of "work breakdown structure."

[12] Chapter 63, op. cit., paragraphs A.2.b and E.

[13] Chapter 14, op. cit., paragraphs 140101 and 140104.

understanding the costs incurred. The job order system provides the means to relate costs to production output. Similarly, the labor and material standards are essential for assessing effectiveness.

The net effect of Chapters 14 and 63 is an emphasis on reporting requirements for WCF activities. Guidance for non-WCF depot maintenance consists of general language:

- Reporting applies to "other DoD activities and private-sector activities." [14]
- "Other DoD activities ... may use other cost finding procedures to satisfy [Chapter 14's] reporting requirements." [15]
- "The depot maintenance workload performed in all DoD and contractor facilities, including the depot portion of Contractor Logistics Support (CLS), shall be included in the report ..."[16]

In addition, Appendix 3 includes 27 fields of labor-hour and cost data provided, as applicable, by reporting activities.

Unfunded Costs

Because approximately 50 percent of DoD depot maintenance is funded outside the WCF, the requirement to report unfunded (non-WCF) costs is essential to capturing all relevant costs. However, the guidance for reporting unfunded depot maintenance costs may require an update.

Chapter 14's unfunded cost definition is at variance with the requirements of Addendum 3. Specifically, paragraph 140104 of the narrative defines funded costs as "costs included within the budget of and financed by an operation and maintenance appropriation or revolving funds available... to the reporting activity." The cost field descriptions in Addendum 3 make no reference to funded or unfunded, rather Addendum 3 identifies all costs, other than military personnel or government furnished material, as either "DBOF" (Defense Business Operations Fund, now WCF) or "non-DBOF."[17]

For WCF activities, the distinction between DBOF and non-DBOF corresponds to the difference between funded and unfunded. For non-WCF activities, the effect of Appendix 3 is that report records identify a single funding source for all costs: non-WCF. This may limit use of the data of any analyses in which the source of customer funding is important, such as validating a depot maintenance funding

[14] Chapter 14, op. cit., paragraph 140101.

[15] Chapter 14, op. cit., paragraph 140101.

[16] Chapter 14, op. cit., paragraph 140301.

[17] Military personnel and government-furnished material are presumably considered unfunded.

requirement in a service's operations and maintenance (O&M) budget. The effect of this DMCS characteristic is reviewed in Chapter 6.

Section 2466

The 50/50 procedures have been effective when developing comprehensive reporting of all service-managed organic and contract depot maintenance. Many of the procedures embodied in the latest 50/50 data calls were developed and refined over the last few years. Because the last update of Chapter 14 was in 1995, and because 50/50 guidance on identifying depot maintenance costs is a precedent for other applications, the DMCS reporting process can clearly benefit by applying lessons learned from 50/50 development—especially by adding guidance on reportable contract cost determination.

Moreover, it is clear that Congressional and OSD emphasis on 50/50 reporting has resulted in identification of maintenance sources that are not reported through the DMCS. Data compiled by the OSD staff for the FY 2000 DoD 50/50 report to Congress valued DoD obligations for depot maintenance at $16.4 billion, of which $7.7 billion (47 percent) was performed by contractors.[18] DMCS data reflect an FY 2000 total cost of $11.0 billion, of which $2.5 billion (23 percent) was performed by contractors.[19] Although the completeness of DMCS reporting is beyond the scope of this report, the significant difference between the results achieved by the two processes suggests that strengthening Chapter 14's reporting provisions would be beneficial.

Furthermore, combining 50/50 and DMCS reporting into a unified data collection and reporting system also merits consideration. Although such a change would be long-range (requiring process re-engineering and Congressional concurrence), consolidation could eliminate duplication and significantly enhance DMCS data collection.

The Two Dimensions of Depot Maintenance

Section 2460 and DoD definitions differ in emphasis. By focusing on the number of activities, including contractors that perform depot maintenance, Section 2460 suggests depot maintenance is a category of work that may be performed by various activities. The DoD definitions stress the scope of tasks that comprise depot maintenance and, by noting that depot maintenance performs some lower level maintenance, suggest that depot maintenance is a kind of organization.

---

[18] Data provided by the ADUSD(MPP&R) staff. A report based on these data, *Distribution of DoD Depot Maintenance Workloads, Fiscal Years 2000 and 2001*, February 2002, was provided to Congress by the Under Secretary of Defense (Logistics and Materiel Readiness) on February 4, 2002. The report was prepared in compliance with Section 2466(e)(1) of the United States Code.

[19] AR(M)1307 includes only WCF organic depots. For purposes of this study, data from 3 Air Force, 4 Army, 6 Navy, and 2 U.S. Marine Corps (USMC) depots are considered.

Considered together, the definitions indicate there are two dimensions to depot maintenance:

- Depot-performed maintenance, which consists of all maintenance, manufacturing, and related work performed in or by DoD depots, regardless of scope or technical level. This principle is set forth in Chapter 14:

  > If lower echelons of maintenance normally performed below a depot maintenance facility are performed at a depot maintenance facility that is funded by the DBOF, the cost incurred by the depot for these functions shall be reported under the appropriate work performance category described in Addendum 2 to this chapter.[20]

  The principle is also explicitly stated in DoD "50/50" guidance.

- Depot-level maintenance, or work that requires a high degree of technical capability that can be accomplished only by a depot or a similarly qualified DoD facility or contractor. This principle is supported by

  - Chapter 14 language that DMCS applies to depot maintenance workloads in DoD activities other than depots and in private-sector activities, and

  - the fact that both JP 1-02 and DoDI 4151.18 define intermediate and organizational-level maintenance (implying that maintenance that is neither intermediate nor organizational-level is depot level).

DMCS Data Sources

DMCS data are collected through both manual and computerized processes from service production and Defense Finance and Accounting Service (DFAS) financial systems. In other words, the data do not originate from a single source with a single set of policies and operating standards. Furthermore, data derived from production systems may not include adjustments made after the data flow from production to financial systems.

In this section, we consider whether alternative sources may provide a more direct or more standard means of obtaining depot maintenance cost and production data.

DFAS-Managed Financial Systems

DFAS's depot maintenance financial systems are standardized within the DoD for WCF depots, O&M-funded maintenance organizations, and other activities. The data in these systems are generally not sufficient to meet the needs of the DMCS.

[20] Chapter 14, op. cit., paragraph 140202.

- For WCF activities, the cost accounting module prescribed by Chapter 63 and reported through the AR(M)1307, Defense Business Operations Fund Accounting Report, contains relatively complete costs, but little of the production-specific data needed to assess workload changes and the effectiveness of performing facilities.

- For non-WCF maintenance performed in DoD facilities, depot maintenance data are generally limited to the costs for which the activity is directly funded. These totals may not include the costs of military personnel and overhead costs, and may not be comparable with WCF activities.

- Total costs are available for contractor-performed depot maintenance; however, for work performed as CLS and ICS, or similar logistics support contracts, costs that are attributable to depot maintenance costs generally are not identified separately.

DoD is developing plans to coordinate and modernize its more than 600 financial-management systems. Goals for this effort are as follows:

- Ensure accurate, timely financial-management information for making business decisions.

- Eliminate redundant databases and systems.

- Standardize business and financial practices and systems.

- Enable sharing of financial-management data across the department.

- Enable collection of cost information by project, business line, or weapon system life cycle.

- Align financial management and cost management to performance goals.

- Reduce the cost of financial management.[21]

This effort should provide a common framework for financial systems, which will facilitate DMCS reporting.

Military Service Production Systems

Within the DoD, depot maintenance cost and production data reside on a multitude of WCF and non-WCF systems that range from suites of interfaced modules at the depots to locally developed applications. Service production systems are a principal source for DMCS data; however, data content and format differ widely. All the services are either studying or implementing a transition to more comprehensive enterprise systems—but these initiatives are also unique.

[21] "Contractors Bid To Untangle DoD Finances," *The Federal Times*; March 18, 2002; p. 6.

The current process successfully captures data for DoD's organic WCF and non-WCF depot maintenance. But, data collection is not standardized and, in some cases, relies on manual processing. In short, current and planned production systems do not—and are not expected to—offer the prospect of a standard data source for DMCS reporting.

Contract Reporting Systems

Contract production data systems differ by service and by contract category:

- ICS and CLS are not separately visible in most program management systems. For example, the Marine Corps Systems Command's Command Automated Program/Information System (CAPS) maintains milestone schedule status, but it does not discretely record the cost or production status of depot maintenance jobs. In addition, CAPS is typically updated only quarterly or semi-annually.[22]

- DLR production status information is available from such systems as the Commercial Asset Visibility II (CAV II), a system developed by the Naval Supply Systems Command and in use or projected for implementation throughout the services.[23] Nevertheless

  - ➤ although it is widespread, CAV II has not been universally implemented; and

  - ➤ currently CAV II does not link cost data to production status.[24]

- Management of other depot maintenance and repair contracts is generally dispersed throughout service materiel and systems commands with production data systems tailored to each application:

  - ➤ For some contracts, data may not be available to associate costs with the individual items repaired. For example, contracts that are "bundled" by weapon system, technology, vendor, etc. and indefinite delivery, indefinite quantity contracts.

  - ➤ For the Air Force, production and cost data, including the cost of government furnished material, are recorded in the Air Force Materiel Command's G072D Contract Depot Maintenance Production and

[22] Interviews by LMI personnel with military service headquarters and materiel and systems command personnel, including representatives of HQ USMC logistics management and HQ USMC Systems Command Program Analysis and Evaluation.

[23] Interview with Naval Supply Systems Command Fleet Material Support Office project office personnel, April 16, 2002.

[24] "Commercial Asset Visibility II: Benefits and Savings Spell Success," *The Navy Supply Corps Newsletter*, March/April 1998; "Commercial Asset Visibility II," a presentation to the U.S. Army Tank-automotive and Armaments Command's 6th Annual eBusiness Conference, January 2002; and discussions with military service depot maintenance managers.

Cost System. AFMC plans to transition such contracts to the CAV II system in the near future.

50/50 Data

Although 50/50 reporting is comprehensive, especially in the collection of contract depot maintenance data not previously available, the current 50/50 format does not contain all the information essential for DMCS purposes. The 50/50 data represent an obligation of customer funds, not costs incurred. Similarly, reporting is from the "principal," rather than "agent," perspective, meaning the focus is on collecting data from the military services and defense agencies, and work funded by other organizations is not reported. No production-specific data are included. In addition, data collection is unique to each service and type of maintenance, and, in some cases, is based on manual processes. Accordingly, the 50/50 process in its present form cannot serve as an alternative DMCS data source.

SUMMARY

Language in Chapter 14 and related publications encompasses the organic and contract work that constitutes DoD depot maintenance—but only in general terms. Chapter 14 and Chapter 63 guidance appears sufficient for WCF activities that have financial systems that capture the full cost of performing maintenance, but the guidance needs enhancement for contract and organic sources of repair outside the WCF. Including more specific references to non-WCF activities would reduce the potential for differing service interpretations and would clarify the areas subject to reporting.

Changes to the 50/50 reporting requirements in Title 10 have resulted in refinements in guidance as to which activities and costs to classify as depot maintenance and which to exclude. Chapter 14 has not been updated since 1995 and would clearly benefit from application of reporting refinements incorporated into 50/50 reporting.

None of the potential data sources we reviewed offer a feasible alternative as a standard source for DMCS data. Current service-unique processes for collecting data from a combination of production and financial systems are successful and remain the most viable alternative.

Chapter 3
Which Milestone is Most Appropriate?

In this chapter, we address reporting milestones; namely, when should costs be reported?

REPORTING MILESTONES

A cost reporting system can capture cost data at several points, or milestones, during workload execution:

- Obligations—occur on placement of orders and award of contracts.
- Expenses—the value of resources consumed during a period of operations. For example, labor expense for FY 2000 would be for labor actually performed between October 1, 1999 and September 30, 2000.
- Cost of goods sold (CoGS)—the costs associated with completion of a defined portion of a job order. For example, on completion of 50 percent of a particular job order, all expenses incurred to reach that stage of completion would be recorded as the CoGS of that job order, regardless of when the expenses occurred.[1]
- Production complete cost—cost at the time work for a customer or on a job order was completed and the repaired end items or components returned to the customer. For example, naval shipyards record production complete costs in completion reports.
- Financially complete cost—cost at the close of the financial records for a particular customer or job order. Financially complete cost reflects the total cost of completed work. It is similar to production complete cost, with the exception that production complete cost does not include lagging transactions and post-production adjustments.

Each of these financial indicators captures the same resource consumption data at different points in time. For example, a labor-hour cost may appear as an expense in one period, a CoGS in the next, and a financially complete cost in the next.

[1] Also identified as "cost of goods sold and services provided" in Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 11B, Chapter 70, Section IV.

The Financial Completion Milestone

The financial completion milestone offers significant advantages when associating cost with depot maintenance production. Because this milestone falls at the end of both the maintenance and financial processes, cost and production are complete. Unit costs are, therefore, not distorted by

- differing systems for cost and revenue recognition,
- the stages of production at which material costs are incurred,
- requests for equitable adjustment, and
- other contingent liabilities and accounting adjustments.

Yet, using financial completion defers reporting until all job orders and contracts are completed in every respect—a feature that causes DMCS cost data to differ significantly from the financial and production systems used by the services to manage depot maintenance.

Reporting Completed Work

Deferring reporting until all financial transactions are complete results in a percentage of the costs reported to DMCS each year to be for work accomplished 1 or more years prior to the report. Table 3-1 illustrates that 41 percent of all items in the Navy's FY 2000 financially complete records were inducted 1 or more years prior to the reporting year.

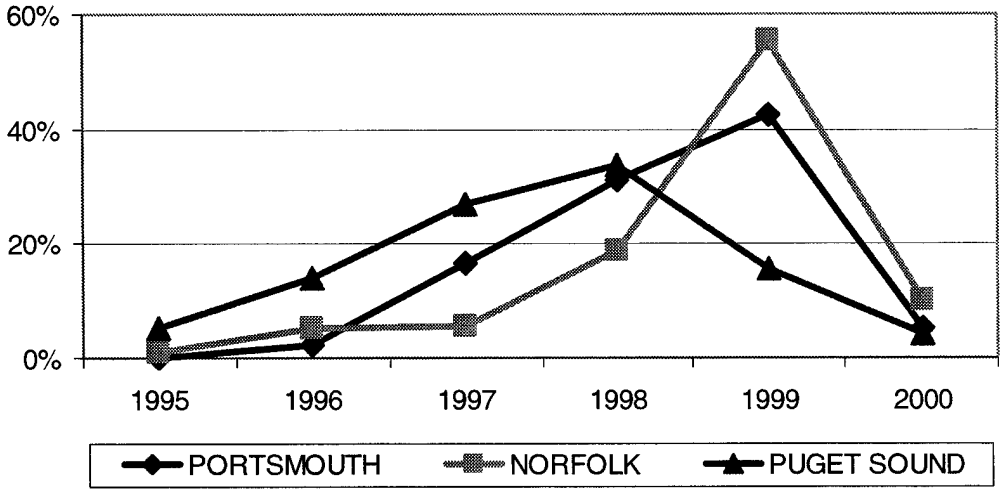
Table 3-1. Percentage of Navy Items Inducted (by Year of Induction)

Year	Percentage
Reporting year	59
First year previous	17
All prior years	24

Source: DMCS financially complete report records for FY 2000.

The time span encompassed in DMCS report records is longest for Naval shipyards. These activities do little DLR work and are primarily engaged in performing ship repair availabilities, which can require up to 2 years to reach production completion. Figure 3-1 shows the year of induction for all records that reached financial completion in FY 2000. As an example, 16 percent of Portsmouth Naval Shipyard's (NSY) FY 2000 records were for work inducted in FY 1997. (This reflects that the Portsmouth NSY workload consists of complex submarine overhauls.)

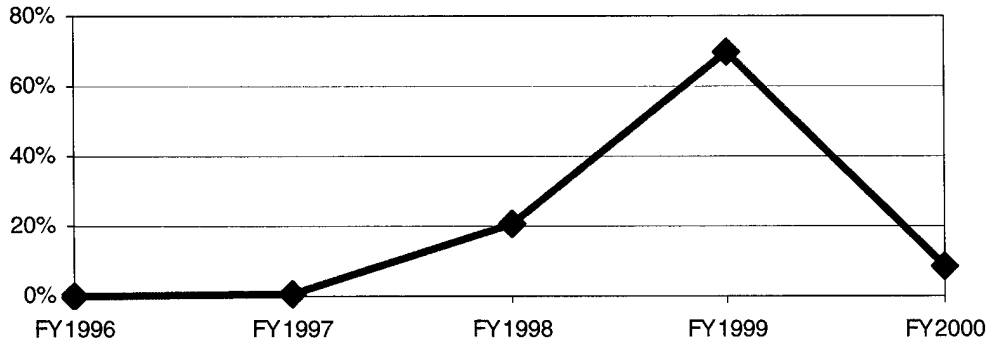
Figure 3-1. Percentage of FY 2000 Completed Report Records (by Start Year)



Data source: FY 2000 DMCS report records of the Naval Sea Systems Command Logistics Center Detachment Atlantic.

A review of data from the Army's FY 2000 submission illustrates a similar pattern. In this data portrayal the dollar value of work inducted is reflected rather than the number of report records.[2] Figure 3-2 depicts that only 9 percent of FY 2000 reported costs were for project orders initiated in that reporting year. FY 1996–1999 costs reflect the same trend, with an average of only 5 percent of costs reflecting financial completion in the year of induction.

Figure 3-2. Percentage of FY 2000 Financially Completed Cost for U.S. Army Organic Depots (by Start Year)



Data source: FY 2000 DMCS report records.

The time lag between induction and financial completion can be attributed to several causes: multiple-item job orders, production flow time, and the closeout of

[2] Army report records contain project order numbers that support tracking of project orders from induction to financial completion.

financial records once production is complete.[3] Timely reporting of financially complete data should be facilitated by Chapter 63 of the FMR:

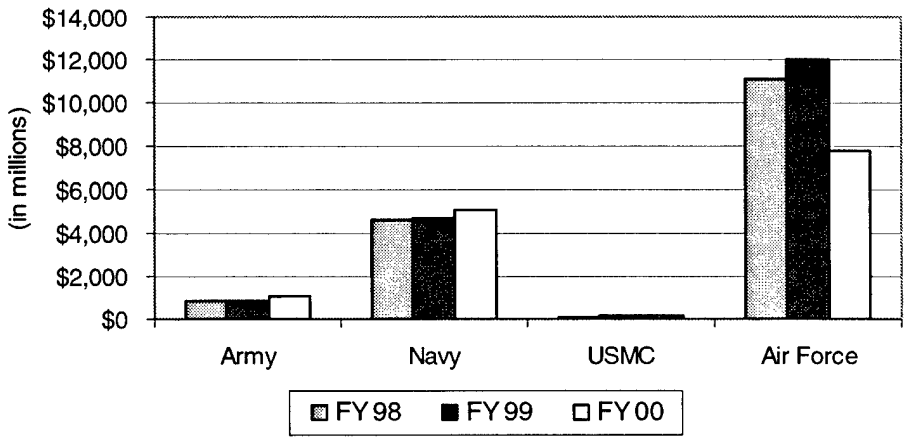
> A job order shall be closed as soon as all direct, indirect, general and administrative costs are determined and assigned to the job order. Normally, all such costs should be determined and posted to the job order within 30 days of the completion of all direct labor chargeable to the job order.[4]

Use of financial completion data for DMCS reporting should not have a significant impact on the report data. The typical DMCS data reporting time lag is more likely a factor of extended depot availabilities, large batch job orders for DLRs, and delays that extend the closeout process beyond the 30-day standard.

Reporting Work in Process

The accumulated costs for work not yet financially completed are reported separately in the DMCS as work-in-process records.[5] Figure 3-3 shows WIP records reported by the services' organic depots for FY 1998–2000. Total DoD reported WIP increased by 7 percent from FY 1998 to FY 1999, and decreased by 20 percent from FY 1999 to FY 2000. The most significant change over the same time was a decrease of 31 percent in Air Force reported WIP between FY 1999 and FY 2000.

Figure 3-3. Organic WIP for FY 1998 to FY 2000



Data source: DMCS organic WIP report records.

[3] See Appendix A for a definition of "flow time."

[4] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 11A, Chapter 63, paragraph H.2.b.

[5] See Appendix A for a definition of "work in process."

Figure 3-2 and Figure 3-3 demonstrate that DMCS reported costs are primarily for work performed before that reporting year, and the costs accumulate as large WIP balances in the interim.

For FY 2000, the services reported $14.1 billion of WIP and $11.0 billion financially complete, for a total of $25.1 billion. In other words, 44 percent was reported as financially complete and 56 percent (or 1.28 years worth of work) as WIP. This supports the time-lag analysis, which indicated that the majority of financially completed costs were for work completed before the reporting year.

Table 3-2. Service WIP and Financially Complete Data ($M)

Service	WIP	Complete	Total
Army	1,094	1,174	2,268
Navy	5,067	4,476	9,543
USMC	181	196	377
Air Force	7,748	5,123	12,871

Data source: FY 2000 report records.

OTHER MILESTONES

In this section, we consider whether other milestones may be more suitable to the objectives of Chapter 14.

Obligations

The relationship between obligations and production output varies, depending on the type of funding and the kind of resource consumed.

WORKING CAPITAL FUND

In the Working Capital Fund environment, two types of obligation occur: obligation of customer funds to buy a maintenance service and obligation of WCF contract authority to pay for resources to complete the work. We discuss the first case below. In the second case, use of WCF obligations as a basis for reporting cost is not advisable, because obligations often occur well in advance of production output (for example, when materials are obtained for a job order before any work is performed).

APPROPRIATED FUNDS

Obligations are generally used more as the basis for reporting accounts for the activity in need of the maintenance service (namely, the customer funds).

For several reasons, however, the obligation of appropriated funds to purchase depot maintenance services does not appear to be a useful measure of DoD costs:

- *Customers of WCF depot maintenance activities.* Typically, the obligation of customer funds by WCF activities takes place upon induction of the item for repair and is based on a standard fixed price for the work. At this point, no resources have been consumed and the obligation total does not represent the true cost to DoD. The standard price paid by a customer is based on estimated costs. The actual costs incurred as the WCF performs the work will depend on the actual amount of labor and material required.

- *Appropriations-funded contracts.* For contracts funded directly from appropriated funds, obligation typically occurs when the contracts are let or, for requirements or indefinite quantity–type contracts, when end items or components are inducted. Obligation does not reflect the actual cost of the maintenance services performed until contractor bills have been liquidated and the corresponding contract expenses are recorded.

- *Non-WCF organic activities.* For non-WCF organic activities, such as Pearl Harbor, obligation occurs as labor hours and other resources are consumed in the completion of a depot maintenance job order.

In the case of WCF customers, the obligated dollar amount is an inaccurate indicator. For the other two cases—appropriations and non-WCF funding—obligations are not an accurate indicator until expenses are recorded, suggesting that expense is a better indicator. Moreover, buyers of depot maintenance services are often WCF activities, such as a transportation or supply management activities of the DoD Working Capital Fund. In such cases, appropriated funds are not obligated until an appropriation-funded customer of the transportation or supply activity ultimately buys an airlift service or a repaired DLR—events may not occur until some time later.

Expenses

Expenses are a widely used financial measure for both WCF and appropriated fund programs. For a depot or other maintenance enterprise, expenses reflect the value of resources consumed during a period of operations and can be associated with production hours as a measure of output. For individual job orders, however, expenses may not correspond to production output (for example, when material is ordered before any appreciable work is performed).

Cost of Goods Sold

Within the DoD, the cost of goods sold is a financial indicator that is applicable primarily to the working capital funds that sell goods or services through customer-provider relationships. CoGS also applies to activities that sell goods or services through a customer-provider relationship and to organizations that have

implemented activity-based costing.[6] Under the incremental revenue recognition policy in effect for WCF activities, maintenance activities record accumulated costs once production is complete or reaches a defined percentage of completion. Thus, CoGS is a means of associating costs with production output.

Generally, the cost-of-goods-sold concept is not applicable to appropriation-funded activities. Therefore, CoGS would not be useful as a reporting milestone for depot maintenance cost unless non-WCF activities were managed under either activity-based costing or a customer-provider concept.

Production Complete Cost

Production complete associates cost with a completed product, but it is not a viable candidate for application to the DMCS. Production complete cost is not a cost category used by all services, nor is it a milestone in depot maintenance financial systems. Unless production and financial systems change, production complete is not a reasonable indicator for DMCS reporting because adopting it would require the services and the Defense Logistics Agency (DLA) to reengineer their reporting processes.

SUMMARY

The correlation between resource consumption and production output varies for each milestone.

- Obligations exhibit the most tenuous connections, with full obligation of funds often occurring before any resources are used or any work is performed.
- The expenses milestone applies equally to WCF and appropriated-fund programs, but is an inaccurate measure of resource consumption at the job order level.
- Cost of goods sold reflects accumulated expenses at defined stages of production completion, but the milestone is not used outside WCF and related activities.
- Production completion is a production milestone similar to, and more timely than, financial completion, but it is not as commonly used as a financial milestone, even within the WCF. Changing to this standard would require reengineering service reporting processes.
- Financial completion captures total costs for completed production, but is a lagging indicator with respect to when work is performed; therefore, it is an imprecise indicator of actual annual costs.

[6] See Appendix A for a definition of "activity-based costing."

In short, although financial completion results in older cost data than the available alternatives, the milestone captures the most complete job order cost data, is most suited to supporting job order and unit of output cost analyses, and—as the current standard—is the most feasible to employ. Use of the financial completion milestone enables the DMCS to capture the total cost of completing depot maintenance job orders, thereby providing the most accurate and useful data for cost measurement.

Chapter 4
What Are the Uses of DMCS Data?

In this chapter, we consider the intended uses for Depot Maintenance Cost System data and the sequence of analysis needed to satisfy those uses. The remaining chapters identify cost drivers, distinguishing the impact of each and applying that information to meeting the needs of DoD maintenance managers.

STATED USES

Chapters 14 and 63 of the DoD FMR set forth nine uses for DMCS data:

> ...Management should have depot maintenance data available ... to assist in:
>
> (a) Comparison of historical unit cost trends with replacement cost trends.
>
> (b) Oversight of the utilization of depot maintenance resources.
>
> (c) Evaluation of budgets for depot maintenance work programs.
>
> (d) Comparison of cost trends among organic DoD depots or between organic and contract (private sector) sources.
>
> (e) Managerial direction and guidance for depot maintenance programs.
>
> (f) Evaluation of depot maintenance activities for efficient use of resources.
>
> (g) Estimation of depot maintenance requirements.
>
> (h) Monitoring of DoD Component compliance with various Congressionally mandated reporting requirements, including contract/organic shares.
>
> (i) Examination of the behavior of cost drivers over time.[1]

In related language, Paragraph 140102 of Chapter 14 states that DMCS data are needed to document the use of scarce resources, measure productivity and

[1] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 6A, Chapter 14, February 1996, paragraph 140103; and Volume 11B, Chapter 63, paragraph A.2.d.

efficiency, develop and use performance measurement and cost standards, and highlight areas in need of emphasis.

HOW TO USE DMCS DATA

The nine uses may be expressed as a set of interrelated questions to answer through data analysis:

Q1. What drives depot maintenance costs?

Q2. What trends are evident?

Q3. Are the costs reasonable?

Q4. What resources do maintenance activities need to support customer requirements?

Q5. Are depot maintenance budget requests reasonable?

Q6. How do costs compare among sources of repair (SOR)?

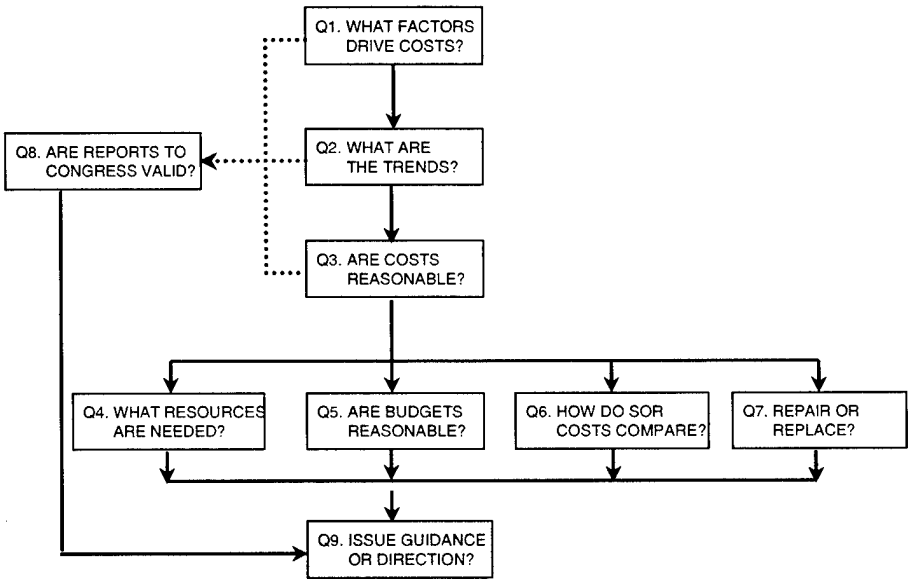
Q7. Would it be cheaper to repair or replace end items or components?

Q8. Are Service cost reports to the Congress valid?

Q9. Is additional guidance or direction needed?

Clearly, answering some of the questions is dependent on first answering others. This logical relationship is depicted in Figure 4-1.

Figure 4-1. Questions to be Answered with DMCS Data



Answering the first three questions is essential for answering the others. An analyst first needs to understand the significant factors that drive reported costs (material price increases, pay raises, etc.) and the control that managers have over each factor (Q1). Based on this information, the analyst can then assess how these factors change over time (Q2).

The third question—Are reported costs reasonable? (Q3)—is more complex and may be addressed in a number of ways. For example, cost-per-hour data may reflect changes in resource management effectiveness, actual costs may vary from performance measures and cost standards, or trends in overhead to direct cost ratios may indicate changes in efficiency. As discussed in the next chapter, assessing reasonableness is about measuring management effectiveness in areas that are subject to management control. This is perhaps the central purpose for collecting and analyzing DMCS data—and it is an essential part of each of the nine uses for DMCS data.

The next four questions are specific applications of answers to the first three. To identify requirements (Q4) or analyze budgets (Q5), an analyst must determine the resources needed to support a given workload and what those resources should cost. Comparing repair sources (Q6) or economic alternatives (Q7) requires an understanding of the factors that determine total cost.

The eighth question requires different information than the others. To validate costs, the services report to Congress (Q8), and an analyst must extract equivalent data from the DMCS (that is, format the data to include the same set of activities and cost categories as specified for the Congressional report). By comparing totals, the analyst can then assess whether the reports are complete and accurate. In addition, an analyst may use information about cost factors, trends, and whether costs are reasonable (in other words, answering the first three questions) to validate narratives accompanying the service reports.

Finally, the answers to the remaining questions provide the information needed to address the final question. When analysis identifies problems in reports to Congress, budget submissions, etc., action to correct problems takes the form of guidance and direction (Q9).

REQUIRED ANALYSIS

We can further reduce the questions to four analytical activities:

- *Assess cost factors* (Q1–Q3). Identify the associated relevant factors that impact total cost, the degree of controllability, and the amount of change over time. Determine an appropriate level or range of effectiveness for each controllable factor. Identify trends and assess performance.

- *Determine requirements* (Q4 & Q5). Identify expected workloads and the costs necessary to perform the work. Determine appropriate cost levels for controllable factors.

- *Perform cost comparisons* (Q6 & Q7). Compute estimated costs for a given workload. Identify the impact of controllable and uncontrollable factors on total cost. For substantive repair-versus-replace decisions, perform economic analyses of each alternative, taking into account the expected reliability and service life of the item and the costs of subsequent repairs.

- *Validate cost reports* (Q8). For cost reports that use financial system (i.e., non-DMCS) data, identify differences in reporting conventions. (For example, the report to be validated may comprise expenses rather than financially complete costs.) Develop methods to adjust for the differences to make the data sets as comparable as possible.

For each analytical activity, the final step is to determine whether guidance or direction is needed (Q9) and to take appropriate action.

Several of the above analytical tasks are difficult to accomplish—but each is essential when achieving the nine DMCS objectives. The feasibility of the objectives will be explored further in the following chapters.

SUMMARY

The nine official objectives of depot maintenance cost and production data are listed in Chapters 14 and 63. The objectives can be viewed as a hierarchy of questions that are answered through data analysis.

The questions can be further reduced to four analytical activities, each requiring different information and methods: assessing cost factors, determining requirements, performing cost comparisons, and validating cost reports.

We will review methods for conducting these analytical activities in the next two chapters. Chapter 5 specifically relates to the first three questions (Q1–Q3), and includes two sections on the all-important question: What drives depot maintenance costs? In answer, we address the following:

- Types of factors

- Determining the impact of individual factors

- Cost trend assessment

- Determination of cost reasonableness.

Chapter 6 then considers how to use information on cost drivers when performing the remaining three analytical activities:

- *Determining requirements*: How to evaluate the costs of depot maintenance as they are reflected in budget and POM submissions and in independent cost analyses.
- *Comparing costs*: How to analyze cost differences among sources of repair and between repair and replace alternatives.
- *Validating cost reports*: How to use DMCS data to assess the accuracy and completeness of reports to the Congress.

Chapter 5
What are the Factors that Drive Cost?

To assess the effectiveness of depot maintenance operations and whether stated requirements are reasonable, it is first necessary to answer a question: What factors determine depot maintenance cost? In this chapter, we review four categories of cost drivers:

- Workload mix—the work performed, expressed as an input variable.
- Resource costs—the prices maintenance activities pay for resources.
- Policy and process factors—the effect of changes in financial policies and industrial processes.
- Resource Management—the effectiveness of resource application.

As part of the review, we also consider the net effect of cost changes and the degree to which factors that influence cost are controllable (i.e., within the scope of maintenance management).

WORKLOAD MIX

Depot-level resource costs are the result of a variety of individual workloads with distinctive characteristics. For example, an aviation depot may perform jet engine overhaul, which is highly material intensive; aircraft overhaul, which incurs much lower material costs; and software maintenance, which requires virtually no material. The depot's use of labor, material, and other resources reflects the mix of these workloads.

Depots experience changes in the volume and type of work performed from year to year, especially if new weapon systems or end items are assigned, a fleet-wide modification is performed, or a maintenance process change occurs. The work added or deleted results in a new workload mix that may significantly alter resource costs. Even when a depot's total costs remain relatively constant, a change in the workload mix may drive significant adjustments in the mix of resources comprising that total.

A notable cause of variance from planned workloads is contingencies. Conflicts and other short-notice operational requirements typically drive short-notice changes to planned production—and to the personnel and resources in place to accomplish the work. Ongoing overhauls are accelerated, new weapon system inductions postponed, and DLR production is transferred to high-priority,

small-quantity inductions. After the engagement, the priority shifts to prompt completion of deferred work and recovery of assets returned from the theater of operations. Throughout, added shifts, premium transportation, and other extraordinary actions typically drive increased costs.

For maintenance managers, such workload changes are a customer-controlled factor and largely uncontrollable. The changes are not a reflection of resource management effectiveness. In any analysis of DMCS costs, the nature of workload changes—and the ensuing changes in resources requirements—must be taken into account to properly understand cost trends.

RESOURCE COSTS

Maintenance activities pay for labor, materials, and other resources at externally determined prices (prices not subject to the control of maintenance managers). Thus, the work inducted, the quantity of resources needed for each job, and the price set for these resources determine the direct proportion of total depot maintenance costs. The following sections review some of the factors that cause prices to change from year-to-year, as well as factors that influence the quantities needed and the costs for indirect support functions.

POLICY AND PROCESS FACTORS

Changes to logistics processes and financial policies often increase or decrease the costs attributed to depot maintenance, independent of any changes to workload or resources consumed. Often these process and policy changes are essentially zero-sum (that is, they redistribute the costs and the funding to pay those costs with little or no *net* change at the military service level, but they do have a differential impact on depot maintenance).

For example, during the mid-1990s the DoD created the Defense Business Operations Fund (DBOF, the predecessor to the Defense Working Capital Fund). A key policy of the new entity was one of "fully loaded prices." Under this new policy, DBOF activities were required to pay for the full cost of goods or services consumed, then recoup the additional costs through increased prices to DBOF customers. In other words, DBOF activities were required to pay for resources (such as DLRs, military personnel, and headquarters management) that were formerly provided by other funding sources at no cost to the activity. This new DoD policy was designed to more fully assign costs to the operational units receiving the support, thereby improving resource budgeting and utilization.

During the same period, DoD implemented two changes to the base support policies under which tenant activities reimburse the costs of support received.[1] The

[1] Department of Defense, Dodo 4000.19, *Inter-service and Intra-governmental Support*, August 9, 1995.

first increased reimbursement rates; the second effectively returned the rates to the original level. Both changes were reflected in WCF costs and prices.

In the mid and late 1990s, the Air Force implemented process and policy changes that produced similar effects:

- The non-job routing initiative required Air Force depots to place demands upon supply management for DLRs previously repaired and reinstalled without a supply transaction. This process change improved inventory control within the depots and distributed a greater share of the cost of Air Force supply management operations to depot maintenance.

- Enhancements to supply pricing procedures allowed the Air Force to recover the costs of replacing DLR condemnations from sales of the individual national stock numbers (NSNs) that generate the costs. (Earlier procedures spread cost recovery over all NSNs, regardless of the rate the items were condemned.) This policy change also increased the share of supply management costs paid by depot maintenance.

The Army is currently implementing an exchange-pricing concept that will remove fixed costs from DLR prices (a departure from the fully loaded prices concept). This policy change will result in reduced material costs for depot maintenance and other DLR consumers.

Each of the above initiatives were zero-sum to the individual military service, but drove an increase or decrease to apparent depot maintenance costs that were unrelated to

- how much work the depots performed,

- how much labor and material they used, or

- how much the services had to pay for those resources.

A process or policy change may occur within a depot maintenance activity, have little or no impact on customers, and still significantly affect cost metrics. For example, in the early 1990s, the Naval Sea Systems Command (NAVSEA) moved shipyard first-line supervision from an overhead to a direct expense. This policy change was zero-sum because it did not change the prices paid by shipyard customers. Workload-related metrics were affected, however. The direct labor costs attributed to each job order increased significantly, while material and other costs per direct labor hour decreased correspondingly. The metrics changes were not the result of changes in the amount of work completed, the actual hours used, or the amount paid by shipyard customers for those hours. Instead, the principal impact was in how NAVSEA accounted for its labor costs.

Some changes do affect the consumption of resources. For example, the Naval Air Systems Command (NAVAIR) is transitioning a number of weapon systems from

Standard Depot Level Maintenance (SDLM) to the Integrated Maintenance Concept (IMC)—in effect changing to reliability-centered maintenance. As this process change is implemented, maintenance intervals, workload packages, and resource consumption patterns for each weapon system will undergo significant changes—and those changes will be reflected in NAVAIR's cost metrics.[2]

For the DMCS, the importance of process and policy changes is significant. From the standpoint of day-to-day maintenance management, the cost-driving changes are uncontrollable[3] and are not a reflection of resource management effectiveness. The changes may significantly affect the comparative costs of depot maintenance, yet may represent no change in resource consumption. These environmental changes must be taken into account in any assessment of productivity and resource consumption trends.

RESOURCE MANAGEMENT

Another, more controllable cost driver is resource management effectiveness. Inefficiencies, or apparent inefficiencies, can be the result of several factors.

Indirect Costs

Indirect costs (which consist of the overhead and general and administrative categories) are those costs that cannot be directly attributed to individual job orders. "Indirect" is commonly viewed as an administrative burden on production activities and the ratio of indirect to direct costs as a measure of depot maintenance efficiency. Nevertheless, indirect costs encompass many functions that are essential to maintenance, such as production planning, financial and information technology services, equipment and facility maintenance, and depreciation of capital assets. Some of the factors affecting indirect costs are:

- *The size and workload of an industrial facility.* A depot or shipyard with low capacity utilization may report a relatively high indirect-to-direct ratio due to idle time and the need to maintain separate administrative, financial, and other functions.

- *Accounting policies.* Costs may transition between indirect and direct due to changes in accounting policies. The NAVSEA change of shipyard supervisors from an indirect to a direct expense did not necessarily represent a change in the shipyard's efficiency; but that the portrayal of costs had changed.

[2] Although IMC will change the scope of work for each aircraft inducted, the process change is expected to be cost-neutral (i.e., zero-sum).

[3] Whether a cost is controllable or uncontrollable is often a factor of time and the level of decision. The manning level in a support function is relatively fixed over the short term, but can be changed over a longer period. A service's logistics policy is an uncontrollable (or "fact-of-life") factor for shop floor personnel, but is ultimately controllable within the service.

- *Relative inflexibility* (or short-term controllability). It takes time to adjust staffing or to close a facility through the Base Realignment and Closure (BRAC) process.

In short, changes in reported indirect costs or in the ratio of indirect to direct may or may not represent a change in resource management efficiency, depending upon individual circumstances. Similarly, a large indirect ratio may represent inefficiency or it may be the result of policy and capability decisions outside the control of production managers.

Direct Costs

Direct costs are those costs that are directly attributable to production. On the whole, direct costs vary directly with the volume of output (For example, repairing five units of an item requires five times the labor and material as repairing one). Direct costs are also affected by a number of other factors:

- *The labor market.* Civilian labor rates vary from area to area and are a factor in cost differences between depots producing similar workloads. Labor markets also vary with respect to hard-to-find skills and workforce attrition rates.

- *Workforce demographics.* Downsizing drives curtailment of hiring, separation of newer employees, and a progressive increase in average salaries. Conversely, increased hiring after a period of downsizing typically results in skills shortfalls as more senior workers retire and newer workers gain experience.

- *Aging weapon systems.* The accumulating effects of corrosion, stress, and wear and tear often cause labor and material costs to increase over time.

- *Resource management effectiveness.* Labor, material and other costs are affected by the efficiency with which the resources are applied. Inefficiencies may occur in material wastage, parts ordering errors, or ineffective workload scheduling and labor application.

From the perspective of the day-to-day performance of depot maintenance, the first three of these factors are relatively uncontrollable and may be considered examples of external conditions. The fourth represents the controllable cost to produce any output.

For both direct and indirect costs, the analytical challenge is to separate the effects of controllable and uncontrollable factors in order to understand the forces that drive cost changes. This understanding is central to achieving all nine DMCS objectives stated in Chapter 14 of the FMR. For example, a comparison of unit cost trends with replacement cost trends requires insight into why costs vary, whether the conditions driving past changes will continue to apply, and whether managers

have appreciable influence over the costs. Similarly, assessing requirements or budget requests requires the same insight.

DETERMINING THE IMPACT OF INDIVIDUAL FACTORS

Our review considered the methods necessary to assess factors that affect total costs. First, we review normalization as a technique to hold constant the effect of one or more variables in order to identify and track the effect of others. Second, we consider the use of metrics as a tool to gain insight into cost drivers. Third, we examine the importance of the analyses provided with the services' annual DMCS data submissions.

Based on this information, we considered the following:

- How cost trends may be identified (Q2 from Chapter 4).
- How to determine whether costs are reasonable (Q3).

In the next chapter, we consider how best to apply the capabilities of the DMCS to accomplishing the uses discussed in Chapter 4, including validation of non-DMCS products.

Normalizing

Process, policy, and workload changes within DoD maintenance depots over the last decade have had a major effect on DMCS costs. Other changes, such as depot consolidations, have also significantly affected costs.

One means to adjust for the effect of such changes, and thus better understand other factors affecting costs, is normalization. Through normalization, offsetting adjustments are made to remove the differential effect of a change on metrics. For example, if a policy change increases material prices by 30 percent, the data may be normalized by either increasing the cost of material in the years before the change or by decreasing it for the years after. The result makes the years before and after equivalent with respect to the variable (in this case material prices), and permits apple-to-apple comparisons over periods spanning the policy change.

For normalization to be effective, the following caveats must be considered:

- *Identifying significant changes.* An industrial activity incurs direct and indirect costs for a wide range of resources. These costs undergo some degree of change over time. Similarly, depot maintenance processes, the amount of work inducted, and the scope of individual job orders all undergo continuous change. Selecting which factors warrant normalization is complex and dependent on the purpose to be achieved.

- *Deciding when to adjust.* The decision of whether to normalize depends upon the intended use of a DMCS metric. For example, a material price change represents a cost change for depot maintenance. The cost change may or may not be the result of a change in net costs incurred by the service. If a DMCS cost metric is used to depict resource consumption, the data should be normalized. If the metric is used to portray cost trends, it should not.

- *Quantifying the impact of a change.* The affect of process and policy changes on depot maintenance costs may not be measurable directly. Modeling or estimating the impact introduces an element of subjectivity.

- *Deciding how long to continue adjusting.* Some changes do not continue to have the same effect year after year. For example, a new material pricing policy will typically be revised in later years. The cost impact on depot maintenance will also change and may eventually be very different from that of the initial policy.

- *Allowing for the impact of unfunded costs.* Chapter 14 is applicable to all DoD depot maintenance costs, regardless of funding source. Costs not directly financed by the maintenance activity are reported as "unfunded." A change to direct depot maintenance funding of any such costs normally should not warrant normalization, because the costs should have been included in DMCS reporting both before and after the change.

- *Maintaining a baseline.* Normalization of any cost metric produces numbers that differ from the actual costs recorded by the services. While this may be useful for a one-time requirement, maintaining a normalized baseline over time is generally not feasible. First, a baseline must be designed for a limited purpose, such as assessing resource consumption. Second, for consistency, historical numbers should not change from year to year. This would lead to an ever-increasing accumulation of adjustments to each year's data and to an ever-greater discontinuity from the real cost data reported by the services. Finally, a normalized baseline would represent a second set of books that are based to a significant degree on subjective estimates and at variance with actual cost data.

In summary, normalization is a valuable tool, but it is best in limited or one-time applications. There are two essential steps to normalization:

- Determine the purpose of the normalization.

- Identify significant changes and quantify the impact of each.

The section on service-provided analyses later in this chapter discusses how to identify and quantify significant changes.

Metrics

In this subsection, we consider the value of leading measures for depicting depot maintenance costs. For a depot maintenance activity, some production data may be presented as of a single point in time, such as assigned personnel as of a certain date. However, cost data will invariably be expressed in terms of the cost for a period of time or unit of production—as a metric.

TYPES OF METRICS

The following are categories of depot maintenance cost metrics:

- Cost per period accumulates total costs for an activity or other cost category over a defined time (a fiscal year for DMCS submissions). Cost per period metrics are used to measure levels of activity and to gauge changes in resource consumption.

- Cost per output reflects the cost per unit produced or per labor hour and are the principal means of assessing performance from DMCS data. There are two kinds of cost per output:

  - Cost per hour produced is computed over either the actual hours incurred or the standard hours to complete defined production tasks. By comparing actual and planned costs per earned hour, managers can determine whether resource costs are above or below target.

  - Cost per unit produced is typically computed at the end item/NSN level or by the type of work accomplished (turbine engine overhaul, DLR repair, etc.). This kind of cost-per-output metric is of significant potential value for assessing resource utilization efficiency independent of any workload volume changes.

- Price change reflects the quantitative effect of the resource cost changes. Price changes are typically expressed as the average cost increase for a category of resource. For example, an average annual pay raise for a depot's workforce is reflected in the price change for that resource.

ADVANTAGES AND DISADVANTAGES OF METRICS

The metrics currently produced from DMCS submissions are of value, but do not entirely support the full range of analysis needed by maintenance management.

Cost per period is the most common metric currently in use, and comprises virtually all of the data depicted in standard DMCS report formats and annual DoD depot maintenance data publications.[4] The metrics provide important information

[4] Department of Defense Depot Maintenance Cost and Production Reporting System, *FY 2000 DoD Depot Highlights*, November 2001.

on the total cost of each maintenance activity, weapon system, etc. The cost-per-period data are useful when identifying requirements and performing cost comparisons and validations. Still, supporting analysis is needed to achieve the objectives of the DMCS because many factors affect the costs of maintenance performance.[5]

Cost-per-unit-produced metrics also require supporting data to be meaningful. For example, costs per weapon system overhaul can be affected by

- changes in the scope of work and materials required for individual job orders;
- end-item configuration differences that require significantly different workload packages;
- the fact that DMCS Work Performance Category A, "Overhaul," encompasses a wide range of rework and rebuild services (that is, one overhaul may not be equivalent to another); and
- the limited use of cost-per-unit-produced metrics in assessing costs for multiple-item, indefinite quantity project orders.

The net result is similar to a process of computing the average cost of a grocery item from a market basket of purchases and then comparing that cost to the average of another market basket from a different time or location. If both the sizes and the mix of the items in the second basket are different, comparing average costs conveys little useful information. This is the case at virtually any level of aggregation of depot maintenance costs. Only at the job order level (for example, repair of a DLR) would unit cost comparisons be meaningful—and only when the factors driving cost changes are well understood.

Cost-per-hour metrics are affected by the same factors, but not to the same degree. Dividing total costs by production hours removes much of the effects of workload changes, especially if the type of work remains the same. The metrics are therefore useful for trend analysis and source-of-repair cost comparisons.

Price-change metrics are generally not feasible when computing below the enterprise level because the mix of supplies and other resources consumed varies over time. The average annual increase in material prices varies depending on the mix of materials purchased for each job order. In addition, materials for a single job order may be purchased over two or more fiscal years. When the type of work performed does not change significantly, price change metrics afford valuable insight into cost behavior and can be an important tool for determining the impact of the factors that affect the cost of performing depot maintenance.

[5] Almost all of Chapter 14's objectives concern evaluating or exercising oversight over resource needs—and resource needs can only be assessed in relation to the controllable and uncontrollable factors that drive total costs.

Cost metrics are, therefore, vital to understanding the relative impact of the factors that affect depot maintenance costs. The measures are of the greatest value in relatively steady conditions, when workloads remain stable and policy and process changes are minimal—otherwise, normalization or more complex analysis of multiple variables is required. Cost per period metrics are especially useful in identifying the relative volume of work and consumption of resources among sources of repair, work performance categories, work breakdown structure categories, etc. The metrics also provide a basis for raising questions about the causes behind significant cost changes. Cost-per-output and cost-per-hour metrics are less affected by workload volume changes and provide insight into how the cost of performing maintenance is changing.

These measures are most valid and useful when workload mix and other changes are minimal or can be quantified. Average price changes are a major cost driver and must be taken into account in determining whether actual costs or budgets are reasonable, what resources are needed, etc. The measures are of greatest use at the enterprise level. (At lower levels, the averages may vary significantly due to differences in the mix of labor skills, types of material, etc.)

Service Analyses

The prerequisite for normalization to be effective, or for metrics to provide meaningful data, is information on the factors driving costs—the information can only come from the activities performing the work.

Current DMCS guidance states that reporting activities shall

- review the accuracy, completeness, and reasonableness of data submitted; and
- provide a narrative analysis of significant developments, information, or trends portrayed in the data submitted.[6]

Service analyses prepared in accordance with this guidance typically provide useful, but limited, information (for example, identifying the net changes in total customer orders for each depot, but not discussing resource price changes or other cost drivers). Clearly, more substantive service narratives are essential to any analyses needed to fulfill the uses of the DMCS. More comprehensive analyses would address the principal cost-driving factors for each depot:

- *Workload.* Identify significant changes in hours and dollars by work performance category.
- *Resource costs.* Identify average pay raise, composite material price change, and average price change for any significant purchases from other

[6] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 6A, Chapter 14, February 1996, paragraph 140210.

WCF activities (not including the supply management activity). Otherwise, assume standard DoD inflation factors.

- *Policy and process.* Identify and quantify impact of all significant changes.
- *Resource management.* Identify significant changes in labor and material efficiency and any notable changes affecting overhead costs.

COST TREND ASSESSMENT

Trend analysis is key to management oversight of depot maintenance. The richness of data available in DMCS reports affords wide opportunity to examine costs by performing activity, resource category, weapon system, or a multitude of other dimensions. Trends identified at aggregate levels (for example, cost increases for a DoD depot or weapon system) inevitably lead to consideration of cost drivers. In other words, are costs changing because of changes in workload, material consumption, or other causes? Trend analyses are, therefore, most useful when they focus on cost drivers.

This can be accomplished by normalization and the selective use of metrics, but it depends on the information available. For example, normalizing will remove the impact of resource price changes, but can only be accomplished if the services have quantified the net impact of those price changes. Similarly, normalizing to offset the effect of a policy or process change requires quantitative information on the extent of that effect.

Significant variations in cost-per-hour or cost-per-output metrics that are not explicit from service-provided analyses or other available information serve as a foundation to request additional information from the services—and will often reveal cost-driving factors not hitherto identified.

DETERMINING COST REASONABLENESS

Determining reasonableness also depends on understanding the factors that drive costs; especially understanding which are controllable and which are not. Judgments must then be with relation to a standard or some other basis of comparison (for example, comparing actual to planned cost, the cost metrics of similar maintenance activities, or recent to past costs through trend analysis). Concerns raised through analysis may, as above, lead to requests for further information.

Adjudging reasonableness is central to many of the analyses that support the uses of the DMCS. Notably, determining requirements and performing cost comparisons:

- *Determining requirements* (Q4 & Q5). To assess budgets or develop statements of requirements, an analyst needs to apply the information learned about cost-drivers and trends to determining whether productivity objectives and total estimated costs are appropriate.

- *Performing cost comparisons* (Q6 & Q7). This type of analysis is performed with respect to an economic alternative, such as a repair or replace decision. In this case, reasonableness is a matter of relative costs. Again, the central issue is understanding the impact of cost drivers on the total cost of delivering depot maintenance services.

SUMMARY

Assessing depot maintenance requirements and performance requires an understanding of the impact of cost drivers. Direct costs are essentially a product of customer-determined workload, the quantities of resources required for each job, and the prices maintenance has to pay for the resources—factors outside the control of maintenance managers. Changes to logistics processes and financial policies may cause significant depot maintenance cost changes that are also uncontrollable from the standpoint of day-to-day maintenance management.

Other cost drivers are more controllable by maintenance managers. Staffing overhead functions, labor and material efficiency, and similar factors determine the relative cost to produce work at each facility, and may warrant OSD inquiry and guidance whenever effectiveness indicators or cost trends are unfavorable. The analytical challenge is to distinguish the controllable and uncontrollable factors that affect costs in order to understand, especially what causes costs to change, how future costs will be affected, and how management can influence controllable factors to improve cost effectiveness.

The effect of individual factors can be distinguished by normalization and the wide range of metrics available in the DMCS. However, both methods are dependent upon the information provided by reporting activities.

Normalization can separate the impact of one cost change factor from others. Offsetting adjustments for known changes affords insight into what costs would have been if the change had not occurred.

Likewise, cost metrics are vital to understanding the impact of the individual factors that affect total cost.

- Cost-per-period metrics are useful when tracking total cost changes and raising questions on the reasons for changes—but are of limited utility because the volume of work performed is not taken into account.

- Cost-per-unit and cost-per-hour metrics offer insight into how the costs of maintenance are changing independent of the effect of workload changes; but they are limited by the fact that the units (workload packages) are not alike and vary over time.

- Price-change metrics are most useful at the depot and service levels. Quantifying price changes is essential for understanding why total costs change and the relative impact of other factors.

Although the impact of some changes may be difficult to quantify, normalization and cost metrics are invaluable tools for determining the effect of individual factors on depot maintenance costs—and the degree to which those factors are controllable by maintenance management.

Assessing cost trends and reasonableness rests on an understanding of cost drivers. Trends can best be identified with metrics that focus on the specific area of interest. Determining whether costs are reasonable is the most challenging and perhaps the most worthwhile analytical task. Maintenance managers, by definition, do not have latitude over the uncontrollable elements. Identifying and assessing what is controllable is central to determining reasonableness.

Chapter 6
How Can We Use DMCS Data to Meet the Objectives of Chapter 14?

In this chapter we consider how to use information on cost drivers when performing the remaining three analytical activities:

- Determining requirements
- Comparing costs
- Validating cost reports.

DETERMINING REQUIREMENTS

Applications

There are two principal applications for DMCS analysis: developing independent estimates of maintenance costs and validating the depot maintenance portion of budgets and Program Objective Memorandum (POM) submissions. The estimates and validations will normally apply to service WCF activities, but may be needed for appropriated fund requirements. In the first case, cost data in a WCF budget, POM, or cost estimate will be consistent with that of the DMCS, as both are derived from the same production and financial systems. Evaluating requirements for appropriated funding (such as the O&M depot maintenance cost for a weapon system) is more challenging. The DMCS aggregates weapon system costs differently than in financial products and does not identify unfunded costs by appropriation.

Methodology

For either independent estimates or budget and POM validations, the requirement is similar: assessing future resource needs. It could be 7 years from the time when DMCS costs are incurred and reported to the first year of the next budget—and up to 12 years to the end of next POM (as illustrated later in Figure 6-1). Clearly, too many changes occur over such extended periods to project costs with any precision. Therefore, the most worthwhile analyses will be directed at identifying significant variances between planned and actual efficiency rates, planned workload, etc.

To perform such analyses, one must determine the following:

- Expected workloads in hours or units produced, including the estimated impact of aging systems and weapon system retirements
- Estimated resource price changes
- Planned labor and material efficiency rates
- The estimated impact of any planned policy, process, or infrastructure changes.

Key to the analysis is the identification of controllable costs, including those driven by overhead or service policy and process decisions. Unfavorable trends, may then lead to questions directed at the individual services and may lead to OSD guidance on improving performance.

COMPARING COSTS

Applications

There are two types of cost-comparison applications for this analytical activity: comparisons among sources of repair and comparisons between repair and replacement cost trends. Both may be performed at an end item or aggregate level.

Source-of-repair comparisons are the most practical application of the DMCS, because the comparisons:

- are usually between WCF activities that account for costs in the same manner, and
- are often limited to past performance and do not have to contend with the adjustments associated with projections.

Repair-versus-replace analyses are typically the most difficult, as substantive comparisons require estimation of the full economic costs for both alternatives. This, in turn, requires the estimating of:

- acquisition costs and other costs outside the scope of both the DMCS and the WCF; and
- end-item reliabilities and life cycle costs for both alternatives.

Methodology

Many source-of-repair comparisons entail comparison of similar sets of DMCS data. Others, especially those involving contractor repairs or non-WCF activities,

may require significant projections and adjustments. To make any comparison, we must

- understand the source of cost differences, especially
  - the size and composition of workloads at each facility,
  - differences in labor rates and infrastructure costs, and
  - resource management effectiveness at each facility;
- normalize to account for any policy or process differences and ensure cost-comparability; and
- address costs over time to allow for the impact of workload fluctuations.

Repair-versus-replace trend analyses also require significant projections and adjustments to ensure comparable treatment of the full costs of each alternative considered. Therefore, the most feasible and beneficial analyses are those directed at identifying large disparities. (For example, when aging, reliability, and other factors drive end item or component repair costs to very high levels are compared with a replacement alternative.)

VALIDATING COST REPORTS

Differences Between the DMCS and Non-DMCS Products

Chapter 4 discussed the nine uses for Depot Maintenance Cost System data set forth in Chapter 14. Because several of those questions concern assessing non-DMCS products, such as budget requests, this section will first review data comparability. Three unique features of the DMCS serve to make the data resident in the system different from that of DoD financial systems and specialized products, such as 50/50 reports to the Congress:

- The financial completion milestone
- Reporting of DLR repairs
- Reporting of unfunded costs.

FINANCIAL COMPLETION

Chapter 3 reviewed the characteristics of DMCS data reported under the financial completion standard; notably, that report records include costs incurred 3 or more years before the reporting year. Moreover, although the report format includes fields for quantities inducted by year, the entries in those fields do not indicate

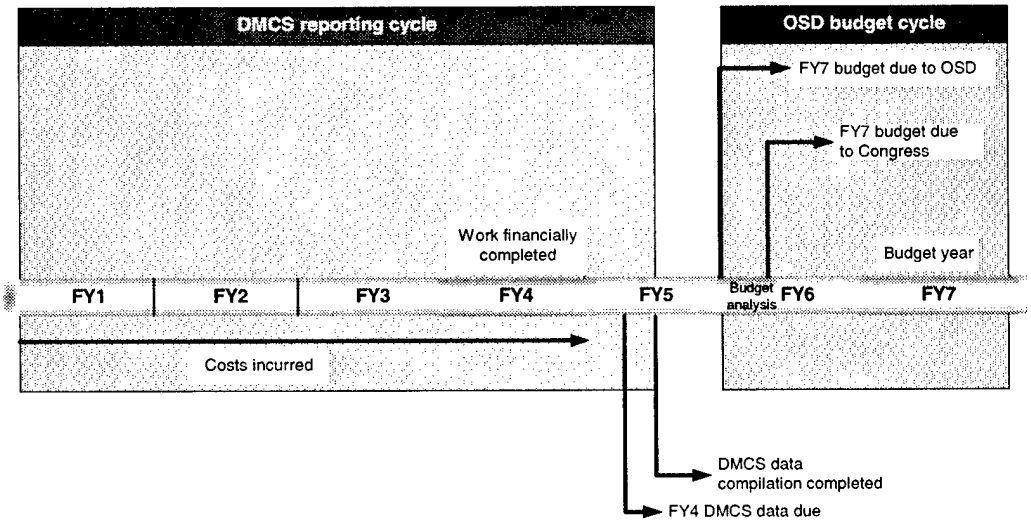
when the costs were incurred. In short, the process in use captures the cost of production—but does *not* track costs by year nor focus on the most recent costs.

Adding data on work that is not financially complete (i.e., from work-in-process records), does not improve the picture. WIP records also accumulate costs over multiple years and do not identify *when* the costs were incurred.

Figure 6-1 and Figure 6-2 illustrate the effect of this feature with respect to using DMCS data to validate budget submissions and 50/50 reports.

In Figure 6-1, the DMCS reporting cycle—from when costs are incurred to when they are reported—spans up to 4 and a half years. The data is then available for assessing the next service budget submissions to the DoD Comptroller (about 6 months later). The budget cycle, including DoD analysis, Congressional enactment, and execution, requires a further 2 years. In total, the maximum is 7 years from when the first costs are incurred (DMCS data) to the end of the budget year (the period to be analyzed).

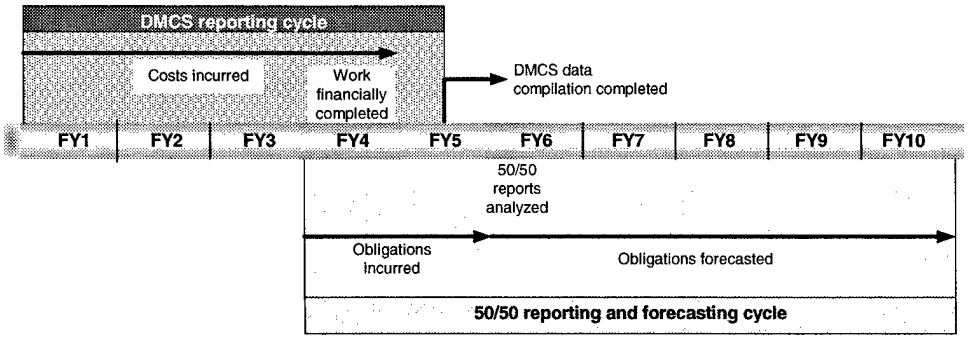
Figure 6-1. DMCS and Budget Time Cycles



In Figure 6-2, there are two time spans:

- More than 5 years for DMCS data used to validate 50/50 reports of actual depot maintenance obligations
- 10 years for validation of the forecast of future obligations.

Figure 6-2. DMCS and 50/50 Time Cycles



Clearly, the age of DMCS data and the fact that costs cannot be tied to a specific year limit its usefulness for analyzing non-DMCS data.

Alternatives to use of the financial completion milestone were reviewed in Chapter 3. The most feasible—production completion—is similar to financial completion in that it would also accumulate costs that could not be tied to a specific year.

Given that neither milestone—production or financial completion—affords visibility of when annual costs are incurred, a second alternative would expand the report record to identify expenses by year. This could be accomplished with either multiple fields in a single record or multiple records. The update would, however,

- require software changes to implement,
- add further complexity to the reporting process, and
- not change the fact that a significant portion of DMCS-reported costs is more than a year old.

DLR Costs

A second unique feature of the Depot Maintenance Cost System is its treatment of DLR repair costs. DMCS report records identify depot maintenance costs in one of ten commodity groups (aircraft, combat vehicles, etc.) that correspond to the major weapon system categories of the work breakdown structure (WBS) specified in Addendum 4 to Chapter 14. Each commodity group is composed of three levels of indenture (For example, WBS A/2/2 represents the commodity/sub-commodity/system of aircraft/bombers/engines).

Within that structure, the DMCS assigns depot-level reparable maintenance costs, to the extent possible, to the weapon systems to which the DLRs apply (For example, by adding the repair cost for F/A-18C components to the aircraft total). Maintenance costs for DLRs that cannot be connected with an end item are assigned to the tenth weapon system category, "All Other Items Not Identified to

Above Categories." This "other" commodity group includes costs for non-DLR end items that cannot be identified to one of the other nine categories. This procedure has the benefit of identifying weapon system costs more fully—but it has drawbacks:

- DLR repair costs cannot readily be determined.[1]
- Weapon system totals differ from those of the budgets and other non-DMCS products to be validated or estimated with DMCS data.
- Weapon system cost totals differ from those tracked and reported by the services.

Thus, the DMCS is limited in its capability to support analysis of service-produced O&M budgets, compare DLR repair and replacement cost trends, and validate service weapon system cost reports.

These constraints may be overcome by providing a capability for DMCS to report DLR repair separate from weapon systems and end item maintenance. To do this, it is necessary to definitively identify a DMCS report record as applicable to a DLR repair. Several of the data fields set forth in Addendum 3 to Chapter 14 may be used for this purpose:

- *The end-item identifier* (a "yes/no" field). This field alone should be sufficient to discriminate DLR repairs from other types of maintenance; however, the validity of end-item identification in service report records is questionable.[2]
- *The third level of indenture of the WBS.* The first and second levels encompass weapon systems and other end items. The third level (in other words, the third position in the WBS data field) usually corresponds to component systems and parts, but may also include test equipment and other end items that directly support a weapon system or major end item. In addition, naval shipyards use the third position to identify the ship system, such as hull structure, electric plant, or outfit and furnishings. For naval shipyards, the third position does not indicate a DLR, because the shipyards do not perform significant amounts of DLR work. The WBS field is, therefore, insufficient as an identifier of DLR repair unless WBS guidance undergoes a major change.
- *The item identification number and associated nomenclature.* For DLR repairs, these fields generally reflect an NSN—or a federal supply

[1] An approximate cost may be developed through research. DMCS report records containing a national stock number in the *Item Identification Number* field are generally for DLR repairs. From this set of records, total DLR repair costs can be estimated by reviewing national stock classes, entries in the *Work Performance Category* field, end item field, etc.

[2] See Appendix A for a definition of "end item."

class—and a corresponding description. In some cases, however, contracts cover a wide range of end items or components, and thus are not identified by a single NSN. In addition, an NSN in the item identification number field may correspond to an item of support equipment rather than a DLR.

Ultimately, the end-item identifier is the most suitable means for unambiguous identification of DLR repairs. In order for this to be successful, Chapter 14 guidance on report record field 43 (the end-item field) must be expanded to differentiate DLR repairs from weapon system maintenance, equipment, and technical assistance as well as other categories of work performance that do not necessarily involve maintenance and repair of an end item. Such a change would require software and data collection changes by every reporting activity.

UNFUNDED COSTS

In Chapter 2, we pointed out that the data reporting requirements of Chapter 14 place all non-WCF costs in a single category: unfunded costs. As a result, the data is of little use for analysis of non-WCF budgets and cost reports. For example, DMCS data could not be used to assess the depot maintenance totals in a service's O&M budget. Several alternatives to address this limitation merit consideration:

- Change the funded and unfunded definitions to correspond with those of Volume 1 of the FMR. For all reporting activities, "funded" would signify costs financed through the appropriation available to the performing activity, and "unfunded" would signify all contributed resources.
- Or, add a "source of funding" field to the report record.
- Or, recognizing that the principal analytical uses of DMCS data are to assess WCF-related costs, budgets, and reports to Congress, revise Chapter 14 to limit the use of data to these applications and change the "funded" and "unfunded" terms to "WCF" and "non-WCF."

The first alternative would be a significant change from the present WCF-centered process, but at the risk of losing the current visibility of WCF-funded costs. Moreover, to specifically identify the principal appropriation, an additional field would be needed. However, these changes would still not identify the appropriation that finances unfunded costs. In short, the first alternative would be difficult to implement and may not result in a net benefit.

The second alternative would require a separate report record for each funding source, thus multiplying the number of records for job orders citing more than one funding source. It would improve visibility of the sources of funding, but would require service and Defense Manpower Data Center (DMDC) software changes implementation. It may also result in large "other" totals for costs not identified to an appropriation.

The third alternative is pragmatic. The terminology change would eliminate differences in Chapter 14 and Volume 1 definitions and clarify the reporting requirement. This alternative also requires no software changes.

Unique Features of the DMCS that Affect Validation of Non-DMCS Products

APPLICATIONS

Below are the principal products that are subject to validation:

- 50/50 reports to the Congress, including reports of actual costs and five-year projections
- Responses to Congressional queries, which may concern weapon system costs, activity levels at particular facilities, or other subjects of interest
- Budget and POM submissions, especially for maintenance activities in the DoD Working Capital Fund.

METHODOLOGY

For 50/50 reporting, the most practical use of the DMCS is to ensure the 50/50 reports do not omit activities or cost categories. As depicted in Figure 6-2, the time between when DMCS costs are incurred and reported and the end of the 50/50 5-year projection is as much as 10 years. In addition, 50/50 reports are limited to service- and defense agency–funded activities, and give an account of obligations rather than expenses or cost of goods sold. Accordingly, validations are most useful at an aggregate level and when they are focused on WCF data. Otherwise, we cannot track DMCS cost data by funding source.

Assessing responses to Congressional inquiries may be more or less difficult, depending on the inquiry. Validating DMCS-sourced reports is straightforward and does not represent a problem. Validating non-DMCS products is, however, a challenge. In each case, there are major issues of data time gap and number consistency. As above, developing projections of DMCS data requires adjustments for expected workload changes, estimated price changes, and planned policy and process changes, among others.

Two factors affect the validation of budgets and POM submissions: the time differential[3] depicted in Figure 6-1 and the fact that DMCS records accumulate costs from multiple years. Nevertheless, the DMCS, budgets, and POM submissions should reflect the same aggregate levels of cost for weapon systems, maintenance activities, etc. In addition, DMCS provides important information for determining whether projected costs are reasonable, notably a view of comparative costs for

[3] Which extends a further 4 years for POM submissions.

alternative sources of repair and insight into cost trends and the reasons for cost changes.

SUMMARY

The DMCS is the only comprehensive source for DoD depot maintenance data, encompassing all costs and all sources of repair. Yet, unique features of the system's data affect—and in some cases, limit—its usefulness to DoD maintenance management.

The key to all DMCS data applications is the "Assess Cost Factors" analytical activity described in Chapter 4: identifying the factors that determine total cost, the trends and level of controllability pertaining to each factor, and whether actual performance is reasonable in terms of standards or forecasts.

Otherwise, the unique features of the DMCS affect the system's ability to support the analysis and validation of non-DMCS data. The following is true for both financially completed and work in process report records:

- Encompass 2 to 4 years of costs. This provides relatively accurate information on cost per output (especially for non-WCF activities), but not on costs by year incurred.

- Combine depot-level reparable costs with weapon system totals. This affords more complete identification of weapon system costs than is available from financial systems, but limits the visibility of DLR repair as a cost category.

- Combine all non-WCF costs into a single category: unfunded. This provides relatively comprehensive information on total costs (especially for non-WCF activities), but does not support identification of unfunded costs by funding source. As a result, DMCS data cannot readily be used to validate O&M budgets and other non-DMCS products.

Identification of DLR repair records may be improved by updating Chapter 14 requirements for the end-item code field. Otherwise, improving cost visibility (by identifying when expenses are incurred or the sources of funding) will require major software changes by DMDC and the services.

In the interim, it may be beneficial to update Chapter 14 with a discussion of the differences between DMCS and non-DMCS products and guidance on how to use DMCS data to validate the products. For example, consider the following:

- In extracting DMCS data for use when reviewing WCF financial products, ensure the DMCS totals include funded costs only.

- When reviewing O&M financial products, take into account that the DMCS includes DLR repairs in its weapon system totals and does not identify funding sources for maintenance performed by non-WCF activities.

The most feasible and productive uses of DMCS data are clearly to

- test the reasonableness of budgets and reports to Congress to ensure the products do not omit or significantly over- or understate costs;
- identify sources of repair;
- compare costs among depot maintenance sources of repair;
- respond to requests for information (for example, perform an analysis to identify DoD-wide depot maintenance costs by category type of weapon system);
- identify significant differences in projected customer orders, the percentages of direct and indirect costs, projected costs per labor hour, etc.; and
- develop requests for additional information to the originating activity to validate the non-DMCS numbers.

Chapter 7
Conclusions and Recommendations

The DMCS is the only source of comprehensive, standardized information on depot maintenance costs that encompass all funding sources and methods of accomplishment. This is especially true for maintenance performed by non-WCF activities and by contract. In these categories, financial system products and other sources capture only partial costs and little or no production data. Thus, the DMCS has the potential of enabling OSD and military managers to exercise oversight—and develop appropriate guidance and direction—for the full range of DoD depot maintenance.

In this study, we reviewed the effectiveness of DMCS procedures, including the suitability of DMCS data for satisfying the management objectives set forth in the DoD *Financial Management Regulation*. We validated that the system's design is appropriate for its purposes, but it could be improved by updating and amplifying current guidance.

CONCLUSIONS

Overall, DMCS procedures and processes are viable in their current state and do not require major revision. However, some areas of potential improvement were identified.

Definitions and Guidance

The definitions of depot maintenance, as well as guidance on the categories of cost to report, continue to be valid, but would benefit from amplification:

- Clarify the two dimensions of depot maintenance (depot-performed and depot-level)
- Incorporate lessons learned from the development of the 50/50 reporting process. For example, additional guidance on reporting ICS, CLS, and similar contracts; intermediate activities performing depot-level tasks; warrantee contracts; and classified and special access programs.

Data Sources

We reviewed five alternatives to the data sources currently used in DMCS reporting and determined that none would improve the ease of reporting, nor would any provide the same scope of data.

Milestones

We assessed four potential alternatives to the financial completion milestone (the as-of date for reporting) and found no compelling case to change. None of the alternatives related production output to production cost and financial completion; one (cost of goods sold) is not in common use outside the WCF; and none could be implemented without reengineering service and DLA reporting processes.

The financial completion milestone has the advantage of capturing complete costs for completed production. Using this milestone, the DMCS accrues costs across the life of each job order, thus providing a basis for assessing trends and comparing costs by maintenance activity, weapon system, and type of maintenance performed. Financial completion provides the most suitable data for cost-per-unit computations. In conjunction with the wealth of cost information in DMCS report records, the milestone provides the ability to analyze cost changes by technology, weapon system, and activity, as well as at multiple levels of indenture.

Following are the chief constraints on the value of using financial completion as a milestone:

- Data collected are older than that of other milestones. Moreover, the DMCS report record format does not provide a means to accurately identify the individual years in which costs were incurred. As a result, DMCS products
  - ➤ are not a precise indicator of costs incurred by year (the products do not directly correspond to depot maintenance budget requests or other products to be validated with DMCS data), and
  - ➤ are of most value when used in conjunction with financial and production information, such as AR(M)1307 reports, for determining requirements and validating budgets and other non-DMCS products.
- The results of cost-per-unit computations are subject to dynamic changes in scope of work, material required, resource prices, end-item or component configuration, and other factors that affect costs. Therefore, the following is true:
  - ➤ Precise apple-to-apple comparisons are not generally feasible, except for the most basic work packages.
  - ➤ Cost comparisons and trend analysis are of greatest value when workloads are relatively stable and changes in resource prices and other factors have been identified.

The effectiveness of Chapter 14 guidance may be improved by adding language on the nature of data collected under the completed cost criterion and use of the data for

- validating or estimating annual cost totals in non-DMCS products, and
- assessing annual costs or activity levels in DoD maintenance facilities.

DLR Repair Costs

The DMCS aggregates weapon system costs differently than service production and financial systems. The services generally identify DLR repair as a separate category of depot maintenance cost, while DMCS does not. As a result, weapon system cost totals do not correspond directly to reports to Congress, O&M budgets, and other products validated by DMCS data.

We reviewed three DMCS data fields and determined none is an absolute indicator that a report record is for a DLR repair. The end-item identifier field could be modified to meet this purpose, but this change would require updates to service and DLA reporting processes.

Unfunded Costs

In Chapter 14 of the FMR, the narrative defines unfunded costs as costs funded by an appropriation other than the one available to the performing activity, while Addendum 3 instructions are to report non-WCF costs as unfunded. The effect of the Addendum 3 report record guidance is that all non-WCF costs are collected in a single category that is not differentiated by appropriation. As a result, the utility of DMCS data for validating appropriation-funded requirements and similar applications is limited.

We reviewed three potential alternative improvements. The most ambitious—adding a source of funding field to the report record—would require significant change to the service and DLA reporting processes, and may not be practical for report records with multiple funding sources. Of the other two alternatives, changing the terminology to "WCF" and "non-WCF" appears the most practical and consistent with current usage. This change would correct the Chapter 14 inconsistency and update obsolete references to the Defense Business Operations Fund.

Cost Drivers

Analysis to support the nine uses of DMCS data stated in Chapter 14 should follow the logical sequence depicted in Figure 4-1 of this report.

All analysis is based upon the identification of principal factors that drive costs (such as workload changes), how the factors change over time, and the degree to which the factors are controllable by the reporting activities. Chapter 14 requires

that each reporting activity submit "a narrative analysis of significant developments, information, or trends portrayed in the data submission report." In practice, these analyses have not consistently provided the information necessary to understand the reasons for cost changes.

Normalization and cost metrics analyses distinguish the impact of one factor from another. Normalization removes the effect of a major change from a cost trend to better evaluate the other factors—but the tool is best used in limited circumstances and on a one-time basis. The richness of data available in the DMCS (identifying costs by performing facility, type resource consumed, type of work performed, type of end item repaired, etc.) provides wide opportunity for cost metrics to identify which costs have changed and by how much. Unfortunately, neither normalization nor the use of metrics can be effective unless the reasons for cost changes have been identified.

The effectiveness of Chapter 14 guidance could be improved by strengthening the requirement for narrative analyses with specific requirements to identify, by performing facility, average resource price changes, the estimated cost impact of any policy or process changes, significant changes in workload, and changes to labor and material efficiency.

Analytical Applications

We identified three analytical activities essential to the application of DMCS data to the uses specified in Chapters 14 and 63. All activities hinge upon understanding the principal cost drivers, trends, and the degree to which costs are controllable (and controlled) by maintenance management.

Determination of maintenance requirements is typically a process of projection from historical (DMCS) data. For WCF activities, DMCS data are relatively compatible. For analyses of non-WCF requirements, such as an O&M budget, DMCS data differences must be taken into account to express the results in comparable terms.

Cost comparisons of more than a superficial nature should ensure all relevant costs are included. Comparisons are often most useful at the cost driver level (for example, comparing labor efficiency at two maintenance facilities).

Similarly, validation of reports to Congress must take into account the unique features of DMCS data, particularly the age differential.

At a minimum, the DMCS provides the basis to accomplish gross analysis to test for the completeness and reasonableness of cost data and as a basis for questions to elicit further information from maintenance activities. Analyses of DMCS data are also more effective when performed using financial and service production system data.

The effectiveness of Chapter 14 guidance may be improved by adding language that deals with uses of DMCS data in specific applications:

- The importance of assessing cost and management effectiveness trends to requirements determination and decisions among economic alternatives.
- The use of DMCS data and analyses as a source of questions.
- The relationship of the DMCS to financial and other supporting products.

RECOMMENDATIONS

In the following subsections, we spell out our recommended changes to the current guidance and definitions available to the DMCS community.

DoDD 4151.18 and JP 1-02 Definitions

Adopt the following definitions in Enclosure 2 of DoD Directive 4151.18 and in Joint Publication 1-02:

> Depot Maintenance—The total of all depot level and depot performed maintenance.
>
> Depot Level Maintenance—Maintenance requiring a high degree of technical capability that may be accomplished only by a depot or a similarly qualified DoD facility or contractor. Includes maintenance performed on materiel requiring major overhaul or a complete rebuild of parts, assemblies, subassemblies, and end-items, including the manufacture of parts, modifications, testing, and reclamation as required. Uses more extensive facilities for repair than are generally available in lower level maintenance activities. Includes all aspects of software maintenance. Examples of non-depot facilities accomplishing depot level maintenance are the Keyport Naval Undersea Warfare Center (computer work) and the Crane Surface Naval Warfare Center (gun systems).
>
> Depot Performed Maintenance—All maintenance accomplished in or by DoD depots, including work performed by DoD depot personnel. Includes support to lower level activities by providing technical assistance and performing maintenance beyond their responsibility. Thus, intermediate and organizational level maintenance accomplished by an organic depot (whether on or off-site) is depot performed maintenance. Depot level work accomplished in non-depot facilities is not.

Reportable Costs

Revise paragraph 140101 to begin subparagraph A at the third sentence ("DoD depot maintenance activities that are funded..."). Add a new subparagraph B,

which states: "Addendum 6 provides a list of maintenance costs to include and those to exclude for reporting purposes."

Add the following new addendum:

Addendum 6
Costs to Include and Exclude for AP-MP(A)1397 Reporting

Include:
Contractor Support. Interim contractor support, contractor logistics support, or any similar contract support to the extent that the support is for the performance of depot maintenance.

To the extent that the detailed data is readily available, report depot maintenance funding as called for specifically in existing and planned contracts. If it is not practical to determine the amount to be reported based on specific contract line items or other direct means, establish appropriate algorithms or estimation formulas to determine the portion of the contracts that is for the performance of depot maintenance. The methodology established shall be consistent with that employed for 10 USC 2466 ("50/50") reporting.

Report only that portion of ICS that occurs after IOC.

Include off-equipment maintenance in support of operational systems and "heavy" or depot-equivalent maintenance tasks.

Do not include shipping, handling, management, engineering, storage, or issue costs or on-equipment maintenance in an operational setting.

Software Maintenance. Include depot level activities after IOC necessary to correct errors in software, add incremental capability improvements or delete unneeded features through software changes, and adapt software to retain compatibility with hardware or with other systems with which the software interfaces.

Modifications. Safety modifications and modifications and upgrades to improve program performance. Include the cost of all materials and modification kits, regardless of the source of funding.

Warrantees. Warrantee costs to the extent that the terms and conditions of a warrantee specify the performance of depot maintenance services. Do not include work that occurs prior to IOC.

Government-furnished materiel. Materiel that is required to perform specified depot maintenance services and has or will be furnished by the government to a contractor for use in performing depot maintenance services.

Public-Private Partnerships. The DoD portion of depot maintenance performed under partnership agreements with industry.[1]

Nuclear Refueling. The nuclear refueling of aircraft carriers.

[1] See Appendix A for a definition of "public-private partnerships."

Exclude:
Classified Programs. Depot maintenance performed in support of classified programs, including the National Foreign Intelligence Program (NFIP) and special access programs, to the extent that the classification of the programs precludes submission of report records in accordance with Addendum 3.

Remanufacturing. Remanufacture wherein hulls, chassis, airframes and other major assemblies are utilized in new production.

Capital Investment. Investments of the DoD Working Capital Program Capital Purchases Program, similar capital purchases for non-WCF activities, and work funded by a Military Construction Program appropriation.

Non-Maintenance Operations. Ammunition and other non-maintenance operations accomplished at Army depots or arsenals and at Naval Warfare and Naval Ordnance Centers.[2]

Milestones and Data Sources

Retain current guidance and processes for the financial completion milestone[3] and DMCS data sources.

Unfunded Costs

Revise paragraph 140104 to replace the current "funded" and "unfunded" terminology and clarify the costs to report in the new categories:

> To ensure that all workloads are accounted for and reported on, regardless of funding source, reporting requirements have been stratified to distinguish between costs funded by depot maintenance activities of the DoD Working Capital Fund and those funded by non-depot maintenance sources.
>
> A. For WCF depot maintenance activities, few costs will be funded by non-depot maintenance sources. The predominate example is the acquisition cost for modification kits, which is normally funded by a procurement appropriation and not recorded in financial records as a depot maintenance cost.
>
> B. For non-WCF maintenance activities, all costs will usually be reported as non-depot maintenance funded.

[2] Derived from the FY 2000 10 USC 2466 Data Call, Deputy Under Secretary of Defense for Logistics and Materiel Readiness memorandum, *Distribution of Depot Maintenance Workloads,* November 20, 2001.

[3] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 6A, Chapter 14, February 1996, paragraph 140207a.

Likewise, revise Addendum 3 data descriptions for fields 17–42 to change "DBOF" to "WCF" and "Non-DBOF" to "Non-WCF." In addition, revise all other references to "DBOF" or "Non-DBOF."

DLR Costs

Revise Addendum 3 end-item instructions for field 43 to state:

> Enter "w" if the item being repaired is a weapon system, "e" if the item is an item of equipment, "d" if the item is a depot level reparable component, and "o" if the report record is for technical assistance or other work.[4]

Service Analyses

Designate the fourth sentence of paragraph 140210 as paragraph 140211 and revise the text to read:

> The hard copy reports shall be accompanied by a narrative analysis of significant developments, information, and/or trends portrayed in the data submission report. As a minimum, this analysis shall identify the policy and/or maintenance process changes since the previous submission that have significantly affected costs and provide a quantitative estimate of the impact of each. The analysis shall also assess significant workload changes for each performing activity, including the impact on material and other resources consumed, and identify the average price increases for material, labor, and other resources since the previous submission.

Designate the fifth sentence and remaining text of the paragraph as paragraph 140212 and renumber paragraphs 140211 to 140213.

Revise the first sentence of paragraph 140103 to read:

> Specifically, management should have available information from the Depot Maintenance Cost System (DMCS) to:

Add a new paragraph 140104:

> Addendum 7 provides guidance on applying Depot Maintenance Cost System cost data to achieving these uses.

Renumber paragraphs 140104 to 140105.

[4] See Appendix A for a definition of "equipment."

Add a new addendum:

Addendum 7
Applying DMCS Data to Analysis

The Depot Maintenance Cost System (DMCS) is the only comprehensive source for DoD depot maintenance data, encompassing all costs, funding sources, and sources of repair. The data available from the system enables portrayal of depot maintenance costs by a great number of categories, including performing facilities and contractors; work breakdown structure; type of maintenance services performed; resources consumed (labor, material, etc.); and whether costs are direct, indirect, or overhead.

In using the DMCS to portray costs or perform analysis, certain characteristics should be taken into account:

A. Report records are of two types, completed work and work in process.

1. Completed work records reflect the total costs for work that is both production-complete and financially complete.

2. Work in process records reflect accumulated costs for work not yet financially completed. These records are not directly associated with units produced.

B. Both completed work and work in process records:

1. Encompass multiple years of costs. The records do provide the complete cost of work produced, but do not indicate annual activity levels (i.e., the costs for the work performed in a particular year).

2. Reflect the standard hours produced for each report record (a measure of output).

C. Costs are identified as either WCF funded (i.e., funded by a depot maintenance activity of the WCF) or non-WCF funded.

D. Costs for repair of depot level reparable components (DLRs) are identified by a "D" in the end item field (field 43) of the report record. DMCS standard reports generally consolidate the costs from these records into weapon system totals.

Because of the DMCS's unique characteristics, the system provides a different and complementary perspective to that of financial and production system reports. It is also the only standard source for depot maintenance performed outside the scope of the WCF, notably work performed by contractors and DoD activities other than depots or shipyards.

In performing analyses with DMCS data:

A. Use financially complete records for determining cost per output.

B. Note that DMCS work in process (WIP) totals are distinct from and should not be confused with WIP totals of the DoD Working Capital Fund (WCF).

C. Note that DMCS financially complete cost data:

1. May be a year or more older than expense data for the same period.

2. May exhibit greater year-to-year variance than financial data as large work orders are completed and reported.

D. Note that some elements of information essential to assessing DMCS data are not in the data itself, but in the narrative analyses accompanying annual data submissions. Particularly important is information pertaining to changes in:

1. The mix and volume of workload.

2. Resource prices (especially for labor and materials).

3. Financial policies and logistics processes.

4. Labor and material efficiency.

5. Infrastructure, such as manning levels and facilities consolidations.

In addition:

A. For reviews of WCF financial products, ensure that only WCF costs are included in DMCS totals.

B. For reviews of O&M financial products, take into account that most DMCS reports include DLR repairs in weapon system totals.

Appendix A
Glossary

10 USC 2460	Title 10, Section 2460, of the United States Code; the provision of public law that defines depot maintenance.
10 USC 2466	Title 10, Section 2466, of the United States Code; the provision of public law limiting depot maintenance contracting to 50 percent of funds made available for that purpose.
AP-MP(A)1397	The DoD reports control symbol for the DMCS.
activity based costing	A cost accounting method that measures the cost and performance of process-related activities and cost objects. It assigns cost-to-cost objects (such as products and customers) based on their use of activities. It recognizes the causal relationship of cost drivers to activities.[1]
cost	The monetary value of resources used or sacrificed, or liabilities incurred to achieve an objective, such as acquire or produce a good or to perform an activity or service.[2] ("Cost" is used in this report to encompass expense, cost of goods sold, etc.)
cost of goods sold (CoGS)	The costs associated with completion of a defined portion of a customer or job order, regardless of when the costs occurred. CoGS is, thus, a cost-per-output measure.
cost per output	A metric expressing the relationship of resources consumed to outputs produced. Cost per output is the cost of providing one unit of service and is determined by dividing the total cost of inputs used to produce outputs by the total quantity of output produced.
cost per period	A metric that accumulates cost for an activity or other cost category over a time period. Two kinds of cost-per-period metrics are "unit cost" (cost per unit produced) and "cost per hour" produced.

[1] U.S. General Accounting Office (GAO) and Office of Management and Budget (OMB), Statement of Federal Financial Accounting Standards No. 4, *Managerial Cost Accounting Concepts and Standards for the Federal Government*, July 31, 1995, Glossary.

[2] Appendix 1, op. cit.

customer order	An order for goods or services from a customer and received and accepted by a Working Capital Fund performing activity.[3] In this report, the term is used in a general sense to include all funded requirements for depot maintenance services, regardless of the funding source.
Defense Working Capital Fund (WCF)	A fund established under the authority of Title 10, United States Code, Section 2208 to provide goods and services, on a reimbursable basis, to other activities within the DoD.[4] WCF activities operate as autonomous business entities within the DoD, selling goods and services at stabilized prices to combat units and other customers. The funds received through sales are then used to defray the cost of labor, materials, and other resources consumed when providing the goods and services. The DoD WCF was formerly designated DBOF. Its major subdivision is into service and agency Working Capital Funds.
depot maintenance	The total of all depot-level and depot-performed maintenance.
depot-level maintenance	Materiel maintenance that requires major overhaul or a complete rebuild of parts, assemblies, subassemblies, and end-items, including the manufacture of parts, modifications, testing, and reclamation as required. Depot-level maintenance provides stocks of serviceable equipment because it has more extensive facilities available for repair than lower maintenance activities. Depot-level maintenance includes all aspects of software maintenance.[5] In short, depot-level maintenance is materiel maintenance that requires a high degree of technical capability, which can be accomplished only by a depot or a similarly qualified DoD facility or contractor. Examples of non-depot facilities accomplishing depot-level maintenance are the Keyport Naval Undersea Warfare Center (computer work) and the Crane Surface Naval Warfare Center (gun systems).

[3] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 1, Definitions, May 1993, p. xiv; and Volume 11B, Chapter 50, December 1994, paragraph A.1.g.

[4] Chapter 50, op. cit., February 1998, Section A1.

[5] Appendix 1 to Joint Publication OPNAVINST 4790.14A/AMC-R 750-10/AFI 21-133(I)/MCO P4790.10B/DLAD 4151.16, Joint Depot Maintenance Program, March 31, 1999.

depot-performed maintenance	All maintenance accomplished in or by DoD depots, including work performed by DoD depot personnel. Includes support to lower level activities by providing technical assistance and performing maintenance beyond their responsibility. Thus, intermediate and organizational-level maintenance accomplished by an organic depot (whether on- or off-site) is depot-performed maintenance. Depot-level work accomplished in non-depot facilities is not.
end item	A final combination of systems, subsystems, components, parts, and other material that is ready for its intended use. An entity of hardware that is not to be installed in another piece of equipment.[6]
equipment	"In logistics, all nonexpendable items needed to outfit or equip an individual or organization..."[7]
expense	A type of cost reflecting the monetary value of resources consumed during a specific accounting period. Expense is a measure of fund status.
financially complete cost	Cost of goods sold as of the closure of the financial records for a particular customer or job order. Thus, financially complete cost represents the total cost per output of completed work.
flow time	"The total number of calendar days from the day an item is inducted by [a] designated repair point until the time the item is completed and ready for issue..."[8]
full cost	The sum of all costs required by an activity, output, or item for which cost is to be measured, including the costs of activities performed by other entities, regardless of funding sources.[9]
government-furnished material	"Material that is required to perform the specified work and has or will be furnished by the government..."[10]

[6] Appendix 1, op. cit.

[7] Department of Defense, Joint Publication 1-02, *Dictionary of Military and Associated Terms*, October 12, 2001 (as amended through October 15, 2001).

[8] Appendix 1, op. cit.

[9] GAO and OMB, op. cit., Glossary.

[10] Appendix 1, op. cit.

Incremental Revenue Recognition	The DoD WCF policy of booking the revenue and costs associated with partial completion of a job order. For example, at the point that 50 percent of the standard hours for an aircraft overhaul have been completed (or "earned"), all of the costs incurred to that point may be recorded as CoGS, and 50 percent of the established price for the overhaul may be recorded as revenue.
Initial Operational Capability (IOC)	"The first attainment of the capability to employ effectively a weapon, item of equipment or system..."[11]
intermediate-level maintenance	"Maintenance that is the responsibility of and performed by designated maintenance activities for direct support of using organizations..."[12] Intermediate-level maintenance is also known as "field" or "back-shop" maintenance.
job order	An order for a specific task, such as an aircraft overhaul or a DLR repair. A job order may be for a quantity greater than one; for example, an order to repair ten F/A-18C altimeters.
maintenance depot	Industrial facility of the Defense Working Capital Fund including Army and Marine Corps multiple commodity maintenance depots, ordnance depots, arsenals, Navy and Air Force aviation depots, shipyards, and DLA industrial plant equipment repair sites.[13]
metric	A standard of measurement, such as cost per year or cost per overhaul.
normalize	To adjust financial data to remove the effect of one or more variables. For example, annual labor costs for a DoD depot may be normalized to offset the impact of pay raises. The result is that each year's labor cost is expressed as if that cost were incurred in a single year (the base year).
obligations	The "amounts of orders placed, contracts awarded, services rendered, and similar transactions during an accounting period that will require payment..."[14] An obligation is created when there is a requirement to pay.

[11] Joint Publication 1-02, op. cit.

[12] Ibid, *Statement of Federal Financial Accounting Standards No. 4.*

[13] Department of Defense, DoD 7000.14-R, *DoD Financial Management Regulation*, Volume 2B, Chapter 9, June 2000, paragraph 090402 B.

[14] Ibid, Volume 1, Definitions, May 1993, p. xxi.

organizational-level maintenance	"Maintenance that is the responsibility of and performed by a using organization on its assigned equipment..."[15 and 16] Organizational-level maintenance is also known as "on-equipment" maintenance.
price change	A metric that expresses the average cost increase for a category of resource; for example, an increase of 5 percent in average DLR cost from one year to the next.
production-complete cost	Cost of goods sold as of the time that work on a customer or job order has been completed and the repaired end item(s) returned to the customer.
program change	A change in the amount of services provided. For depot maintenance, a program change may occur because of an increase or decrease in the scope of work for a particular job order or in the total volume of work. A program change may also occur because of a change in the mix of work ordered by a customer.
public-private partnership	An agreement between an organic depot maintenance activity and one or more private industry or other entities to perform work or utilize facilities and equipment. Program offices, inventory control points, and materiel/systems/logistics commands may also be parties to such agreements, or be designated to act on behalf of organic depot maintenance activities.[17]
unfunded costs	Costs financed by an appropriation, other than the one available, either currently or in the past, to the performing activity.[18] For example, Addendum 3 to Chapter 14 requires the cost of modification kits be included in DMCS reporting. Modification kits are normally funded from procurement appropriations and provided without cost to the depot performing the installation. Accordingly, depot maintenance financial reports reflect only the funded costs of the installation work, while DMCS reports include both funded installation and unfunded kit acquisition costs.

[15] Department of Defense, *Department of Defense Dictionary of Military and Associated Terms*, Joint Publication 1-02, April 12, 2001.

[16] Department of Defense, DoD Directive No. 4151-18, *Maintenance of Military Materiel*, August 12, 1992, Enclosure 2.

[17] Addendum to DUSD for Logistics and Materiel Readiness memorandum, Distribution of Depot Maintenance Workloads, January 10, 2002.

[18] DoD 7000.14-R, DoD Financial Management Regulation, Volume 6, Chapter 14, February 1996, paragraph 140104b.

unit cost	The cost of a selected unit of a good or service. Examples include dollar cost per ton, machine hour, labor hour, or department hour.[19]
work breakdown structure	The stratification of work consistent with the hardware element generating the workload (i.e., weapon or equipment end item, system, subsystem, and component).[20]
work in process (WIP)	Expenses incurred for incomplete work, regardless of when. For DMCS, WIP is the total of all expenses incurred on work that is not yet financially complete. In WCF financial records, WIP is the total of all expenses incurred that have not yet been recorded as CoGS. Because WCF depot maintenance activities recognize revenue and cost incrementally, DMCS WIP totals are typically far larger than those of WCF financial records.
Working Capital Fund	See Defense Working Capital Fund.

[19] GAO and OMB, op. cit., Glossary.

[20] Appendix 1 op. cit.

Appendix B
Abbreviations

ADUSD(MPP&R)	The Assistant Deputy Under Secretary of Defense for Maintenance Policy, Programs and Resources
BRAC	Base Realignment and Closure
CAPS	Command Automated Program/Information System
CAV II	Commercial Asset Visibility
Chapter 14	The chapter of Volume 6A of the FMR that prescribes DMCS reporting requirements
Chapter 63	The chapter of Volume 11B of the FMR that prescribes accounting requirements for depot maintenance activities of the DoD Working Capital Fund
CLS	contractor logistics support
CoGS	cost of goods sold
DBOF	Defense Business Operations Fund, the predecessor to the WCF
DFAS	Defense Finance and Accounting Service
DLA	Defense Logistics Agency
DLR	depot-level repairable
DMCS	DoD Depot Maintenance Cost System
DMDC	Defense Manpower Data Center
FMR	The DoD Financial Management Regulation (DoD 7000 14-R)
FY	fiscal year
ICS	interim contractor support
IMC	Integrated Maintenance Concept, a NAVAIR method of aircraft depot overhaul
IOC	Initial Operational Capability
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NSN	national stock number
NSY	naval shipyard

O&M	operations and maintenance
OSD	Office of the Secretary of Defense
POM	Program Objective Memorandum
SDLM	Standard Depot Level Maintenance, a NAVAIR method of aircraft depot overhaul
SOR	source of repair
UCA	Uniform Cost Accounting and Production Reporting System (superceded by the DMCS)
USC	United States Code
VAMOSC	Visibility and Management of Operating Support Costs
WBS	Work Breakdown Structure
WCF	Working Capital Fund
WIP	work in process

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(MM-YYYY)*
05-2002

2. REPORT TYPE
Final

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE
Improving Depot Maintenance Cost Assessments

Review of the DoD Depot Maintenance Cost System

5a. CONTRACT NUMBER
DASW01-01-F-0462

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Steans, Robert C; Author
Applegate, Harry J; Author

5d. PROJECT NUMBER

5e. TASK NUMBER
LG101.04

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Logistics Management Institute
2000 Corporate Ridge
McLean, VA 22102-7805

8. PERFORMING ORGANIZATION REPORT NUMBER
LG101T1

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of the Assistant Deputy Under Secretary of Defense for Programs, and Resources
Washington, DC 20301-3500

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
A Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES
N/A

14. ABSTRACT

The Depot Maintenance Cost System (DMCS) is designed to collect depot maintenance cost and production data on all depot maintenance services performed by or for the DoD. Its products are used for cost trend analysis, resource oversight, budget evaluation, and responses to Congressional queries. This report assesses the procedures and processes of the DMCS, including whether current guidance sufficiently defines the activities and costs to be reported, whether changing to an alternate data source would streamline data collection, and whether another milestone (the as of date for reporting costs) would streamline the reporting process. The report also examines the requirements of cost analysis with respect to meeting management's needs with DMCS data. The report concludes with a number of recommendations to strengthen reporting procedures, including guidance on using the data to identify cost drivers, assess performance, and validate budgets and other non-DMCS products.

15. SUBJECT TERMS
Depot Maintenance Cost System, financially complete, production complete, unfunded, work in process, production reporting, financial reporting, cost accounting, cost per hour, cost factors,10 USC 2460; depot-level, depot-performed.

16. SECURITY CLASSIFICATION OF: UNCLAS			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**	Unclassified Unlimited	82	Nancy E. Handy
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED			**19b. TELEPHONE NUMBER** *(include area code)* 703-917-7249