AD-A038 347 GENERAL RESEARCH CORP MCLEAN VA OPERATIONS ANALYSIS DIV F/G 15/5
LOGISTIC RESOURCES DATA BASE STRUCTURE.(U)
JAN 77 O J HARRISON, J L BUFFAY, G LEBOVITZ MDA903-76-C-0114

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OAD-CR-177

Logistic Resources Data Base Structure

By

Oscar J. Harrison (Project Director)
Jerry L. Buffay
George Lebovitz

Submitted to:

Program Analysis and Evaluation Directorate
Office of the Chief of Staff, US Army
The Pentagon
Washington, D. C. 20310

Attn: Major William J. Silvey

In response to:

Contract Number: MDA 903-76-C-0114

31 January 1977

GENERAL RESEARCH CORPORATION
WESTGATE RESEARCH PARK, McLEAN, VIRGINIA 22101

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: OAD-CR-177	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Logistic Resources Data Base Structure	5. TYPE OF REPORT & PERIOD COVERED: Final Report. / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Oscar J. Harrison, Jerry L. Buffay, George Lebovitz	8. CONTRACT OR GRANT NUMBER(s): MDA 903-76-C-0114 NEW
9. PERFORMING ORGANIZATION NAME AND ADDRESS: General Research Corporation, Westgate Research Park, McLean, Virginia 22101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: PROBE Steering Committee, Office of the Chief of Staff, U.S. Army, The Pentagon, Washington, D.C. 20310	12. REPORT DATE: January 1977 (12 26?) p. / 13. NUMBER OF PAGES: 527
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): Program Analysis and Evaluation Directorate, Office of the Chief of Staff, U.S. Army, The Pentagon, Washington, D.C. 20310	15. SECURITY CLASS. (of this report): Unclassified / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for open literature.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Approved for open literature.

18. SUPPLEMENTARY NOTES

Appendices A through E published under separate cover, available upon request.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Data Base Structure	Logistic Cost Algorithms
Direct Support Costs	Logistic Resources
Five Year Defense Program (FYDP)	Operating Costs
Indirect Support Costs	Planning, Programming & Budgeting System (PPBS)
Logistic Costs	Support Costs

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Logistic Resources Data Base Structure Study was accomplished by the General Research Corporation (GRC) for the Office of the Chief of Staff, US Army, Program Analysis and Evaluation Directorate (OCSA-PAE).

The objective of the study was to develop an improved Army Logistic Resources Data Base Structure for determining and displaying logistic support resources allocated to, consumed by and projected for units, weapon systems and logistic functions. (continued)

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S/N 0102-014-6601

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. Phase I of the study consisted of the identification of logistic resource information requirements, development of an organization structure for them, initial correlation of the components with the FYDP, and preliminary evaluation of data availability to satisfy information requirements imposed by each structure component. Phase II resulted in the design of a FYDP logistic subsystem, including data aggregation and display requirements and detailed specifications of data element sources and availability.

This report documents both Phase I and II.

CONTENTS

PAGE

FIGURES

TABLES

PAGE

TABLES

SUMMARY

PURPOSE

This report provides a synthesis of the efforts of the Logistic Resources Data Base Structure Study, accomplished by General Research Corporation (GRC) for the Office of the Chief of Staff, US Army, Program Analysis and Evaluation Directorate (OCSA-PAE).

The objective of the study was to develop an improved Army Logistic Resources Data Base Structure for determining and displaying logistic support resources allocated to, consumed by and projected for units, weapon systems and logistic functions.

BACKGROUND AND APPROACH

It is not currently possible to identify all costs being expended for logistic support, nor is it possible to adequately project estimates of these costs for the outyears. The Five Year Defense Program (FYDP) structure does not permit the display of these resources as discrete entities of the total program. Conversely, FYDP program elements (PEs) are not directly relatable to units, weapon systems or logistic functions. This study addressed techniques for circumventing these problems in order to enhance the planning, programming and budgeting process and support rapid response to congressional and other inquiries regarding actual or contemplated resource consumption.

The Logistic Resources Data Base Structure Study was a 13-month effort, begun on 3 November 1975. Phase I, which ended on 15 April 1976, consisted of the identification of logistic resource information requirements, development of a tentative organization structure for them, initial correlation of the components with the FYDP, and preliminary evaluation of data availability to satisfy information requirements

imposed by each component. Phase II, which this report terminates, resulted in the design of a FYDP logistic subsystem, including data aggregation and display requirements and detailed specifications of data element sources and availability.

Relevant Guidance

The study group initially undertook an extensive review of all Department of Defense (DoD) and Department of Army (DA) staff guidance relevant to improving visibility of logistic resources. The documents reviewed proved significantly useful in that they represent the official existing body of thought on what constitutes logistic resources, what the relevant data elements and display requirements are and, in generally theoretical terms, how they should be aggregated.

Related Efforts

The study group also considered related efforts, including the Operating and Support Cost Management Information System (O&SCMIS) and the Ownership Cost Model Study. All major elements of the O&SCMIS structure are relatable to the Logistic Resources Data Base Structure, thereby facilitating the usefulness of both structures to the Army staff. The Ownership Cost Model Study is a supporting effort to O&SCMIS intended to provide weapon system ownership cost projections.

The Logistics Management Institute (LMI) was tasked by OSD to perform a study similar to GRC's for the Air Force and the Institute for Defense Analyses (IDA) is performing a similar study for the Navy.

THE DATA BASE STRUCTURE

Logistics as broadly defined in Army regulation (AR) 700-126[S-1] comprise the five major functions of: supply, maintenance, transportation, services and facilities. These functional divisions have specific but flexible applications at all levels of the Army and provide the framework for worldwide logistic system standardization. The components and subcomponents described in this report were

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[S-1] Dept of Army, "Logistics, Base Functional Structure," AR 700-126, 15 Apr 75.

developed using these logistic functions as a framework for structuring data requirements. Thus, the resulting data base structure permits development of costs for functions in the manner that they are actually performed and for weapon systems in the way which they are supported by the logistics system. See Figs. 2-1 through 2-4 for a graphic portrayal of the data base structure.

Structurally, logistic costs have been divided into three major categories: operating, direct support and indirect support. Operating costs consist of those manpower and material costs directly associated with operating equipment. Direct support costs include any non-operating costs that logically can be directly associated with a specific weapon system, unit or logistic function. Indirect support costs are those non-operating, non-direct support costs not readily allocable to a specific weapon system or unit. These cost categories have varying applications at the organizational, direct support (DS) and general support (GS) level, the installation level and the wholesale (commodity command/depot) level (see Chapter 3).

FYDP Relationships

It is generally accepted that the accomplishment of the DoD mission requires the commitment of substantial logistic resources. Nevertheless, communicating the distribution of logistic resources in FYDP terms is extremely difficult and imprecise because logistic resources:

1. May consist of all three basic types of resources — forces, manpower, and dollars (total obligational authority (TOA)).

2. Are contained in both the investment and operations cost categories as well as several appropriations within these categories.

3. Cut across several major FYDP programs.

This intricate relationship is displayed by Tables 2-3 and 2-4.

In spite of the inadequacies of the FYDP structure in terms of providing visibility of logistic resources, the Logistic Resources Structure is relatable to the FYDP programs. The interrelationship

among the display of logistics in DoD developed by Mr. Charles Groover, OASD (I&L), the FYDP structure and the Logistic Resources Data Base Structure is illustrated by Table 2-7.

STRUCTURE UTILIZATION

The utilization of the structure and the computations required to develop each component is the subject of Chap. 3 of this report. Presented therein are: (1) a discussion of how costs may be aggregated to achieve most meaningful results, (2) a list of representative logical questions which may be addressed via the structure, and (3) the full description of each algorithm used to compute structure components and subcomponents. Illustrative output formats for displaying logistic resource cost aggregations developed using the methodology described in Chapter 3 are found in Appendix A.

Component Aggregations

Once the required components (and subcomponents, if necessary) of operating, direct support and indirect support costs are "filled in" for each level, development of costs for specific weapon systems, units or functions will be possible via judicious selection and aggregation of applicable segments of the total composite structure. In other words, it will be possible to aggregate horizontally (i.e., across units of similar type) or vertically (i.e., across echelons of support for specified weapon systems or logistic functions) over past, current, or future time frames.

Representative Questions

A critical question posed in the determination of logistic resource costs is the relationship between the Logistic Resources Data Base Structure components and candidate methods of aggregating and displaying component-related costs. With but few exceptions (e.g., POL and Training Ammo/Missiles), the components are primarily descriptors of logistic support functions. The question then is one of logically

aggregating costs associated with these functions in such a way as to provide potential users of the Data Base Structure with the capability of addressing a variety of queries concerning logistics resource consumption.

An extensive set of questions that might arise with regard to logistic resource consumption has been framed with the objective of illustrating how logistic cost data could be aggregated to respond to queries regarding logistical costs associated with:

1. Weapon systems (or other end items of equipment).
2. Support of various types of units or activities.
3. Various functions in support of weapon systems and/or units.
4. Any combination of the above.

The questions compiled are based on "annual" costs but, depending on the specific question posed, time may consist of one or more year(s) as noted below:

1. Prior year(s) - Actual expenditures or previously budgeted for resource costs.
2. Current year - Expenditures consumed during the current year or current year budget figure.
3. Future year(s) - Anticipated expenditures or programmed resources.

Admittedly, it is impossible to compile a list of "logical" questions envisioning every permutation and/or combination of weapon system/unit/PE/function. It is the study's intent, rather, to highlight those queries most likely to be asked by the Congress, OSD, or DA authorities.

Resource Component Algorithms

A comprehensive set of logistic resource cost algorithms has been developed by the study to provide potential users with the capability of computing costs for the various components and subcomponents of the structure. Each algorithm (presented in Chapter 3)

is accompanied by a detailed definition of the component along with a description of the related subcomponents and data elements.

Insofar as possible, the algorithms have been designed to provide on an average annual basis: (1) a per equipment (i.e., weapon system) cost, (2) a per unit (i.e., all equipment organic to unit) cost, and (3) wherever appropriate a function cost (i.e., total average annual cost of the logistic function) for operating and direct support components.

Indirect support costs are, for the most part, computed on an average annual basis to provide: (1) a per unit cost and/or a total average annual cost for the logistic function. No attempt has been made to apportion indirect support costs to weapon systems because of the inherent difficulty and impreciseness of such apportionment.

A summary of the logistic resource components, the level at which each is applicable and the kinds of algorithms (i.e., weapon system, unit and/or function) developed by the study for the component is contained in Table 3-2.

User's Guide to the Algorithms

In order to provide users of the Data Base Structure with a working knowledge of the application of the resource components, algorithms, data sources and output displays to actual resource costing situations, this section of Chapter 3 provides the analyst a step-by-step description of the manual use of the system.

Hypothetical Application of Logistic Resource Costing Technique

This section of Chapter 3 is intended to provide a demonstration of how the data base structure and associated algorithms could be utilized by a cost analyst at DA level to answer specific questions concerning the consumption of logistic resources.

For purposes of demonstration, it is assumed that the cost analyst is asked to respond to four specific questions.

The questions cited are examples drawn from the list of representative logical questions previously discussed. They were chosen to illustrate how cost aggregations would be developed for: a weapon system, a unit or group of units, and a logistic function. Each question is answered using a step-by-step approach depicted in Tables 3-4 through 3-7.

DATA AVAILABILITY AND ALTERNATIVES

Concurrent with development of the Data Base Structure, a survey of data availability was initiated. The survey was conducted in a variety of ways, including in-house research, field visits, review of available documentation of existing automated systems, and any other potential known or reported sources. Primary emphasis was placed on potential use of existing automated systems.

Field Visits

A series of visits to field activities was conducted in December 1975 and January 1976, with the purpose of determining availability and character of logistic resources data from local (field) automated and manual systems. These visits were useful not only because of the variety of data sources identified but because the study team's presumptions concerning gaps in data availability were confirmed. Visits were made to the USA Major Item Data Agency (MIDA) and the USA Logistics System Support Agency (LSSA) at Chambersburg, Pa.; the USA Maintenance Management Center (MMC), Lexington, Ky.; the USA Aviation Systems Command (AVSCOM) and the USA Logistics Management Systems Agency (ALMSA) at St. Louis, Mo.; and the 4th Inf Div and installation activities at Ft Carson, Colo.

Automated Systems Survey

Initially, the study team compiled a list of 174 automated and semi-automated logistic and logistic-related data sources for review. This list was examined and a preliminary evaluation made concerning the potential usefulness of each system or other source, based on

review of available system descriptions (e.g., fact sheets, system summaries, etc.) plus the team members' personal knowledge and experience.

Systems that appeared most promising as data sources were given first priority for investigation in detail. Detailed research involved the use of system users' guides and manuals as the basic research tool, plus, in some cases, interviews with DA staff personnel with expert knowledge of the system. Eventually, 65 systems were reviewed in detail.

Another category of 109 systems was screened to confirm the preliminary evaluation of their potential usefulness. The majority of these data sources were, in fact, found to contain or produce data of no direct applicability to the data base requirements. Lists of the data sources examined are contained in Appendix B.

A standardized "data element worksheet" was developed and used to assure uniform system review, documentation and auditability for later analysis (see Appendices C, D and E).

Evaluation of Data Availability

Organization, DS/GS Level. Only a few of the necessary organizational, DS/GS level data elements are furnished by automated systems in forms directly applicable (or easily adaptable) to the cost algorithms. It is evident that partial logistic resource costing by function and unit is possible, that reliable estimates of operating costs can be obtained by weapon system, that maintenance costs related to specific types of weapon systems would be extremely difficult to develop, and that indirect support costs (other than medical) will be extremely difficult (if not impossible) to obtain with any degree of reliability and accuracy.

Installation Level. Operating costs are determinable, although a mixture of actual and average costs is necessary. Installation level direct support costs are primarily available by logistic function, by PE and by AMSCO. However, only limited maintenance costs are available by weapon system although considerable data are available by categories of equipment.

Certain Base Operations transportation costs are obtainable, but other elements of transportation cost are lacking. Indirect support costs for personnel, medical (partially) and real property maintenance are available.

The survey concluded that the major logistic resources costs at installation level are available, assuming the acceptability of a mixture of actual and average cost data and the use of data from a minimum of ten different sources.

Wholesale Level. Direct support costs, with the exception of transportation, are available by logistic function, appropriation, PE and AMSCO. Among indirect support cost components, only investment in logistic facilities and equipment remains completely unfilled. Data in support of medical, real property maintenance, port operations and industrial preparedness are adequate and available functionally by AMSCO and PE. Indirect personnel costs require the application of some arbitrary judgments as to those functions considered indirect, since personnel costs tend to be provided by functions. Civilian personnel costs chargeable to international logistics and reimbursable issues to FMS/MAP are obtainable, however, a source for military personnel costs has yet to be identified. Only marginally useful data related to other indirect logistic services have been identified.

At the wholesale level it is evident that the major logistic resources costs are available, assuming the acceptability of data from, again, at least ten different systems/reports; relating expenditures to TOA is feasible but difficult; and only depot maintenance costs are available by weapon system. Due to the nature of other wholesale level costs, it is impracticable to apportion them to weapon systems.

Alternative Approaches to Meet Data Base Requirements

The preceding discussion of data availability reveals two major considerations regarding the information available to satisfy the Data Base Structure requirements -- first, that applicable data is obtainable from numerous diverse sources and second, that there are

still extant numerous data gaps. The question of data gaps remains to be resolved. Chapter 5 addresses the matter of how best to accommodate existing data and known requirements.

In considering the alternative approaches to satisfying the requirements of the data base structure, certain factors must be kept in mind: (1) the data base must have the capability to handle a large volume of data from many disparate sources, (2) myriad aggregations are required in order for the data base to provide logistic resources cost by weapon system, unit, and logistic functions, which (3) necessitate a flexibility to produce a variety of output displays in addition to the capability of projecting these costs for future requirements.

The study team was asked by the working group to prepare assessments of alternative approaches to develop an operational Logistic Resource Data Base Structure. The various alternatives suggested by the study to the working group at a meeting in September 1976 are as noted below. Chapter 5 discusses and evaluates each of the alternatives.

1. Develop an automated reporting system tailored to Logistic Resources Data Base requirements.

2. Develop a manual reporting system tailored to Logistic Resource Data Base requirements.

3. Utilize Sample Data Collection (SDC) or Intense Sample Data Collection (ISDC) as the primary source of organizational, DS and GS maintenance data.

4. Restructure AMSCOs
    a. Restructure Operations and Maintenance, Army (OMA) programs to identify logistic resources by AMSCO.
    b. Restructure Program 7M to identify depot maintenance by weapon system.

5. Design and implement a logistic resources cost model.

The working group approved the study team's assessment and recommendation that Alternative 1, the automated system, is the most feasible and effective approach to satisfying the data base requirements. Additionally, it was decided that SDC/ISDC be investigated as an adjunct to the automated system as a source of organizational, DS/GS level maintenance data.

CONCEPT OF THE AUTOMATED SYSTEM

The proposed data base system would be comprised of a fully automated collection, computation, and reporting system augmented by certain supplemental data inputs (field reporting, SDC/ISDC data, maintenance/correction transactions, and various input parameters). A control/review group would be responsible for monitoring system inputs and outputs and maintaining the validity of the data base. A conceptual systems flow chart is depicted by Fig. 6-1.

The systems software would be of modular design to satisfy various system functional requirements. The supplementary inputs would consist of semi-automated data coming from field sources or SDC/ISDC, transactions generated against the data base, and those input parameters required to operate the various modules.

Benefits that would accrue from the recommended system include:

1. Automatic collection and collation of a large volume of data from numerous sources.

2. High-speed calculation of complex computational algorithms.

3. The capability to answer questions regarding operating, support and other logistic resources cost by weapon system.

4. Visibility over specific logistic functional costs Army-wide or by unit.

5. Support of the display of logistics to meet OSD FYDP subsystem requirements.

6. Maintenance of a repository of logistic resources data for potential application in other areas.

7. Utilization of state-of-the-art technology in fulfilling a necessary functional requirement within DA and DoD.

CONCLUSIONS

1. The Logistic Resources Data Base Structure encompasses the cost elements required to effectively and logically identify and determine costs associated with the logistical support of weapon systems, units or logistic functions.

2. The "building block" concept of the data base structure provides a flexible means of determining and aggregating weapon system, unit or logistic function costs on a uni-level, bi-level, or tri-level basis as required.

3. Neither the FYDP program elements or the AMSCOs provide a meaningful or useful identification of logistic resources other than in Program 7. The Army should, therefore, initiate (separate and apart from this study) a major effort to restructure the AMSCOs to provide for the identification and reporting of logistic resources in all FYDP programs as well as to improve the serious lack of AMSCO/PE compatability.

4. The Logistic Resources Structure is relatable to the FYDP structure at program element level as well as to the logistic functions output requirements identified by OASD (I&L).

5. Required data elements for which an automated data source is not available (data gaps) may necessitate either additional reporting requirements or satisfaction by other techniques such as factoring or cost estimating.

6. An automated system is the most feasible and effective approach to satisfying the requirements of an Army logistic resources data base.

7. An SDC/ISDC program would be an effective adjunct to the automated system as a source of organizational, DS/GS level maintenance data.

8. The automated collection, computational and reporting system described in Chapter 6 is specifically designed to provide a flexible and realistic means of determining and displaying logistic support resources allocated to, consumed by, and projected for weapon systems, units and logistic functions.

9. A determination of the specific weapon systems to be included in the data base is an essential ingredient for the actual design of the automated system. This decision will directly affect such things as data sources and file composition as well as the scope of an SDC or ISDC program. For design purposes the initial list of weapon systems should contain not more than twelve carefully selected systems which will exercise all the parameters of the data base structure.

10. The merged O&SMIS/Ownership Cost Model efforts have a major requirement which is also central to this study effort. This common requirement is the development of a data collection system capable of reporting or estimating logistic resources expended on existing major weapon systems. The Army should adopt at the earliest possible time a method of insuring the commonality and maximum possible interoperability of the data collection system(s) as well as the supporting SDC program.

RECOMMENDATIONS

1. That an automated collection, computational, and reporting system, as described in Chapter 6, be approved for development as the most feasible and effective approach for satisfying the requirements of a logistic subsystem to the FYDP.

2. That the Army identify the specific weapon systems to be addressed by the automated Logistic Resources Data Base and that the initial list of weapon systems be limited to 10-12 systems for design purposes.

3. That a users committee, consisting of PPBS working level personnel of the Army Staff and its staff support agencies, be established to interact with the study team in the finalization of systems output requirements; i.e., detail data, roll-ups, summaries, breakouts, bridging of data gaps, etc.

4. That an SDC or ISDC program be established as an adjunct to the automated system as a source of organizational, DS/GS level maintenance data.

5. That the Army adopt appropriate coordinative techniques to insure the maximum possible commonality and interoperability of the data collection system(s) of O&SCMIS and the Logistic Resources Data Base Structure in support of weapon system O&S costing.

6. That pending development of an automated system, the structure and methodology described in this report be used as the standard guide for providing required data on logistic resources.

Chapter 1

INTRODUCTION

BACKGROUND AND PROBLEM DESCRIPTION

Logistic support resources represent a significant portion of the total Defense and Army budgets. Central Supply and Maintenance (Program 7), for example, amounts to approximately $3 billion of the Army's annual budget. The Operations and Maintenance, Army (OMA) account, which is projected at about $8 billion per program year, encompasses both mission forces and logistic support resources. Programs normally considered to be force or combat mission-oriented (Programs 1 through 6 and 10) contain substantial resources that could be appropriately described as logistical support. General Purpose Forces (Program 2), for instance, include entire division forces which, by definition, encompass organic logistic functions and resources. Certain units within the division structure, such as the supply and transportation (S&T) battalion, maintenance battalion and division support command (DISCOM), are specifically logistic support units, yet are displayed within the FYDP as part of Program 2.[1-1] In addition, virtually all other battalion-size units within a division have, as an integral part of their organizations, a specifically designated logistic activity whose function is supply, maintenance and transportation in support of the battalion's mission.

The existing programs of the FYDP are structured to contain both mission and mission-support elements so that, via aggregation, it is possible to display all resources assigned to each. These elements may also be aggregated into appropriate Defense Planning and Programming Categories (DPPC). Currently, the DPPCs are Strategic Forces, General Purpose Forces, Auxiliary Forces, Mission Support Forces, Central Support Forces, Individuals and Miscellaneous.

[1-1] Dept of Defense, "FYDP Program Structure," DoD Handbook 7045.7-H, May 76.

Within each FYDP program, resources are denoted by three general categories: forces, manpower and costs. Costs are, in turn, categorized as development, investment and operations. In the context of logistic support, both investment and operations costs may represent logistical expenditures. Procurement of ammunition, missiles, certain replacement components and assemblies and procurement appropriation funded spares constitute investments that can be characterized as logistics. Clearly, operations costs encompass both direct mission-related expenditures and logistic support activities. The three cost categories can be subdivided into numerous appropriations, which cut across various programs and functions. The major ones [OMA, Military Personnel Army (MPA), Military Construction Army (MCA), the Procurement Appropriations (PA), Stock Fund (SF), Industrial Fund (IF), etc.] provide funding for multiple program elements, programs and DPPCs. All of these relationships among the various management languages in use within the Army's Planning, Programming and Budgeting System (PPBS) complicate the problem of isolating any activity, function or set of functions not already defined by the existing code structures.

FYDP programs, DPPCs and appropriations are not structured to facilitate the extraction, segregation and display of total logistic support resources as such, nor will they permit extraction of various other logistic aggregations and alignments desired by OSD, Office of Management and Budget (OMB) and the Congress.

There is, therefore, a clear need to establish a definitive logistic subsystem to the FYDP that has the capacity for identifying logistic support resources expended and projected by specific program, unit, weapon system, and logistic function/subfunction. Such a system would enhance the PPBS by improving the quality and timeliness of logistic management information. It would provide a means for rapid, consistent, and replicable responses to congressional and other inquiries regarding actual or anticipated resource consumption data.

It would also make it possible to generate various logistic cost aggregations while considering alternative force structures. This study has been directed toward the development of such a system.

OBJECTIVES

The objective of the study, as stated in the contract, has been "...to develop an improved Army logistics resources data base structure, which will provide a flexible and realistic means of determining and displaying logistic support resources allocated to, consumed by, and projected for specific combat force units and/or weapon systems."

Further, to the extent possible, the data base structure will be developed to provide the following features:

"1. Isolation of expenditures and anticipated requirements by combat force units and weapon systems.

"2. Aggregation of resource consumption data across all force units and/or weapon system (sic) to permit an overall perspective of each function and subfunction.

"3. Display of resources consumed by an (sic) fundamental logistic support process.

"4. Determination of resources consumed or projected, with reimbursable expenditures so indicated, in support of Security Assistance program requirements." [1-2]

SCOPE

The Logistic Resources Data Base Structure Study was a 13-month effort, begun on 3 November 1975.* Phase I, which ended on 15 April 1976, consisted of the identification of a set of logistic support resource components, development of a tentative organizational structure for them, initial correlation of the components with the FYDP,

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[1-2] Defense Supply Service-Washington, D.C., "Logistic Resources Data Base Structure," Contract Number MDA 903-76-C-0114, 7 Jan 76.

* The negotiated contract contained a pre-contract cost clause covering the period beginning 3 Nov 75.

and preliminary evaluation of data availability to satisfy information requirements imposed by each component. Phase II concentrated on the design of a FYDP logistic subsystem, including data aggregation and display requirements and detailed specifications of data element sources and availability.

In order to assist the delineation of breadth and depth of the study, certain definitions were adopted at the outset of the work as discussed below.

Logistics

Logistics is defined as the sum of the resources and functions required to provide supply, maintenance, transportation, services and facilities support to Army forces. The functions and subfunctions that comprise logistics are defined and described in AR 700-126. Their definitions and relationships are intended for use as a "...baseline for system and subsystem development and evaluation... (and) as DA standards to improve communication, resource management, training, and system design...(and) a fundamental building block, augmented by other standardization actions such as data elements and codes...to gain maximum understanding and commonality."[5-1]

Individual definitions for the functions, subfunctions and tasks comprising logistics are contained in the regulation. Each function and subfunction listed is contained in the Logistic Resources Data Base Structure developed by GRC and presented in Chapter 2 of this report. The ways in which they are organized and aggregated, however, have been chosen to meet the particular needs of the data base structure as specified by the objective of the contract.

OSD AND DA GUIDANCE

An extensive review was conducted of all recent guidance promulgated by DA and OSD pertaining to improving the visibility of logistic resources. This research was of fundamental importance in establishing

a baseline and direction for the study effort. Of the numerous relevant directives, the major ones providing guidance to the study effort are described below:

1. The DoD Programming and Planning Guidance Memorandum (DPPGM) directed the development of a weapon system costing capability.[1-3]

2. The DoD Management by Objectives (MBO) program levies the requirement to develop and implement a cost effective system to identify maintenance and operations costs by weapon system.[1-4] The Army responded to this MBO objective by establishing the O&SCMIS Working Group, which is described later in this report.[1-5]

3. The Army's guide for weapon system costing, DA Pamphlet 11-4, provides a framework for the preparation of cost estimates of the operation and support (O&S) phase of a weapon or support system's life cycle. It establishes criteria, standards and procedures for the review of these cost estimates.[1-6]

4. AR 700-126 establishes the standard functional structure for the Army logistic system as well as standard definitions for logistic functions and subfunctions.[S-1]

[1-3] Dept of Defense, "Defense Programming and Planning Guidance Memorandum" (DPPGM), 17 Feb 75.

[1-4] _____, "Management by Objectives (MBO) Program," Objective 9, Action 2, FY 76.

[1-5] Dept of Army, "Army Plan for a Weapon System Operating and Support Cost Management Information System (O&SCMIS)," Nov 75.

[1-6] _____, "Operating and Support Cost Guide for Army Materiel Systems," DA Pamphlet 11-4, Apr 76.

5. The Army Force Planning Cost Handbook (AFPCH) provides Army planning factors that can be used in estimating resource requirements and costs associated with Army force structures, missions, and activities.[1-7]

6. In a memorandum, Mr. George R. Hall, Deputy Assistant Secretary (Resource Analysis), OASD-PAE, expressed to MG John R. McGiffert, Director of Program Analysis and Evaluation, Office, Chief of Staff, Army (OCSA), OSD's concern over the inability within DoD to summarize information concerning logistics resource consumption by weapon system, organization, or logistic function/subfunction.[1-8] Contractual efforts proposed to deal with this problem are discussed below.

7. The OASD (I&L) display of logistics in the DoD developed by Mr. Charles Groover (Table 1-1) established guidance as to the functional elements constituting logistics in terms of the FYDP.

All of the referenced sources were significantly useful in that they represent the official, existing body of thought on what constitutes logistic resources and operating and support costs, what the relevant data elements are, their broad definitions and, in generally theoretical terms, how they may be aggregated. There are differences, of course, among them. Recognizing this, the GRC study set out to amalgamate the requirements expressed and implied, into what was conceived to be a realistic logistic resources structure within the context of the guidance (sometimes conflicting) and the work statement as contained in the contract. The resulting Logistic Resources Component Structure developed through the study is described in detail in Chapter 3.

[1-7] Dept. of Army, "The Army Force Planning Cost Handbook," Jun 75.

[1-8] Memorandum, "Logistics Resource Visibility in the FYDP," Mr. George R. Hall, Deputy Assistant Secretary (Resource Analysis) OASD-PAE to MG John R. McGiffert, Director of Program Analysis and Evaluation, OCSA, 20 Jun 75.

Table 1-1

LOGISTICS IN THE DEPARTMENT OF DEFENSE

	EQUIPMENT MAINTENANCE/MODIFICATION/ALTERATION
	Depot Maintenance
$: OM	Ship overhauls
$: OM	Overhaul of other major end items, e.g., aircraft, missiles, combat vehicles)
$: OM	Overhaul of major subassemblies (e.g., engines)
$: OM	Overhaul of exchangeable components
$: OM	Other Depot Maintenance
	Depot Mod/Alt
$: OM	Ship alterations
$: OM	Modification of other major end items
$: OM	Modification of major subassemblies
$: OM	Modification of exchangeable components
$: OM	Other Depot Mod/Alt
	Intermediate Level Maint/Mod/Alt
$: OM,MP	Major end items
$: OM,MP	Major subassemblies
$: OM,MP	Exchangeable components
$: OM,MP	Unit/Organizational Level Maint/Mod/Alt
$: OM,MP	SUSTAINING ENGINEERING SUPPORT
	SUPPLY
$: P	Procurement of modification/alteration kits
$: P	Procurement of munitions
	Tactical missiles
	Other munitions
	Procurement of appropriation-funded spares and other secondary items
$: P	Initial
$: P	Replenishment
$: P	War reserve
$: SF	Procurement of stock-funded war reserves (SF)
$: SF (non-add)	Procurement of repair parts and equipment-related materiel for peacetime consumption (stock-funded)
	Procurement of non-equipment-related materiel for peacetime consumption (stock-funded)
$: SF (non-add)	Fuel
	Other commodities
	Supply operations
	ICP OPS, Procurement OPS
$: OM,MP	Depot
$: OM,MP	Below depot
	Receiving, warehousing, issuing
$: OM,MP	Depot
$: OM,MP	Below depot
	TRANSPORTATION
	Second destination transportation
$: OM	Sea
$: OM	Land
$: OM	Air
$: OM	Port operations
$: OM,MP	In-theater/organic/base transportation

Table 1-1 - continued

$: P,MC	INVESTMENT IN LOGISTICS FACILITIES AND EQUIPMENT	
	INDUSTRIAL PREPAREDNESS	
$: OM,P	Munitions production base maintenance and rehabilitation of existing facilities	
$: P,MC	Munitions production base modernization and expansion	
$: OM	Other (e.g., layaway of facilities, planning with industry)	
$: OM,MP	INTERNATIONAL LOGISTICS (MAP, FMS)	
	REAL PROPERTY MAINTENANCE ACTIVITIES (OM, MP, RD), (IF)	
	Logistics facilities, installations	
$: OM,MP,RD	Maintenance and repair of real property	
$: OM,RD	Utilities	
$: OM,RD	Minor construction	
$: OM,RD	Other engineering services	
	Non-logistics facilities	
$: OM,MP,RD	Maintenance and repair of real property	
$: OM,RD	Utilities	
$: OM,RD	Minor construction	
$: OM,RD	Other engineering services	
$: OM,MP	HEADQUARTERS AND COMMAND AT LOGISTICS ACTIVITIES, FACILITIES, BASES	
$: OM,MP	OTHER LOGISTICS ACTIVITIES	
	Laundries	
	Printing plants	
	Etc.	

RELATED EFFORTS

Four independent efforts related to this study are underway. Two of these are DA in-house studies and two are OSD-sponsored contractual studies relating to the Air Force and Navy.

Related DA efforts include the O&SCMIS Working Group and the Ownership Cost Model Study. O&SCMIS is a management information system being designed to provide for the identification, collection and dissemination of O&S costs for existing major weapon systems. The Ownership Cost Model Study, which is being performed by the Army Materiel Systems Analysis Agency (AMSAA), seeks to design a weapon system "ownership" cost model which will include, in addition to the standard definition of logistic support, end item procurement costs. It was recently placed under the direction of the O&SCMIS Working Group as a supporting effort.

The GRC study group has closely coordinated its efforts with both of these DA studies. In fact, all of the data elements of DA Pamphlet 11-4, "Operating and Support Cost Guide for Army Materiel Systems" which is the basis for O&SCMIS, have been incorporated into the weapon system peculiar components of the Logistic Resources Data Base Structure, thus weapon system costs derived from both sources will be compatible. Figure 1-1, extracted from the Cost Guide depicts the standardized elements of weapon system O&S cost.[1-6]

With regard to the other services, OSD has directed two studies comparable to this one. IDA has been tasked to perform a similar study for the Navy; LMI is conducting such a study for the Air Force.[1-9, 1-10] Both involve development of FYDP data base structures for logistic resources. The objectives of both studies as stated in their task orders are almost identical to the work statement contained in the Army's contract for the GRC effort since all three studies seek to satisfy a common OSD requirement.

1-9 Dept of Defense, OASD-PAE, Task Order 94 (Logistic Resources Data Base Structure for the Navy), 4 Aug 75.

1-10 _____, OASD-I&L, Task Order 75-12 (Logistic Resources Data Base Structure for the Air Force).

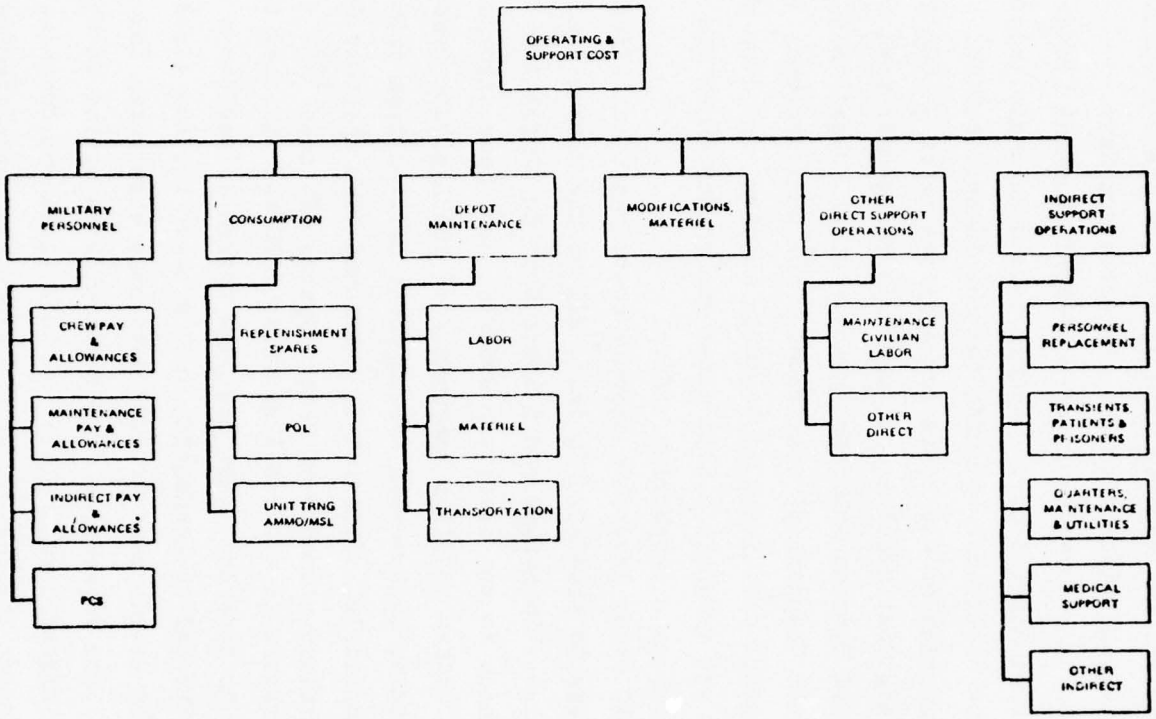

Figure 1-1 Operating and Support Cost Element Structure (DA Pam 11-4)

APPROACH

As indicated previously, a phased approach to the problem of developing a Logistic Resources Data Base Structure was adopted. Phase I entailed the identification of logistic resource information requirements, organization of these information elements into a data requirements structure and an initial assessment of data availability. Phase II consisted of the design of the subsystem functional and procedural methodology and documentation of the study's accomplishments.

Central to the effort of determining data requirements was the documentation of display requirements imposed by OSD, OMB and the Congress, as well as potentially desirable displays for internal use by the Army Staff. Sample output displays intended to meet these various needs are contained in Appendix A.

The task of determining data availability and identifying data sources was one of the most important aspects of the study. An extensive survey of data sources was conducted with the objective of: (1) giving first priority to the use of existing automated systems and reports at all levels, (2) giving second priority to current recurring manual reports in the event that priority data requirements were not available in automated systems, and (3) avoiding, if possible, imposing additional reporting requirements. The survey resulted in the identification of applicable data sources and the delineation of data gaps. The data availability/applicability situation is described in detail in Chapter 4.

To provide potential users of the data base structure with a capability for its interim application to actual logistic resource costing situations, the study has provided in Chapter 3 detailed definitions of each component and subcomponent of the structure along with a comprehensive set of algorithms, so that if desired, the structure may be used manually (assuming adequate data are available to drive the algorithms). However, the great volume of data and the

diversity of data sources necessary to meet the requirements of the data base structure renders a continuing manual approach infeasible for extensive or frequent applications as explained in Chapter 5, and dictated the design of an automated collection, computational and reporting system as described in Chapter 6.

Chapter 2

THE DATA BASE STRUCTURE

THE STRUCTURE

Early in the study effort it became apparent that to effectively and logically identify and determine costs associated with the logistical support of a weapon system, unit or logistic function, a formal organized structure would be necessary.

This chapter addresses the structure developed by the GRC study, along with its components and subcomponents, the levels at which they are applied, and the kinds of aggregations possible through their use.

The structure that evolved is based on the combined knowledge and experience of the study team members, guidance provided by review personnel (both members and non-members of the study's advisory/oversight Working Group) and examination of AR 700-26.

In designing a structure compatible with the logistic functions outlined in the referenced AR, *its purpose is* being served, namely: "It [AR 700-126] will be the baseline for system and subsystem development and evaluation."[S-1]

The structure that evolved has several key features: (1) functionally oriented, (2) a "building block" design, and (3) custom tailored to specific levels of logistic support.

Three major categories of cost are addressed: operating costs, direct support costs, and indirect support costs.

Operating Costs

Operating costs are defined as those costs directly associated with the operation of a weapon system or unit. They consist of military personnel (crew) expenses and consumables (ammunition and missiles consumed in annual service practice, and petroleum, oil and lubricants (POL)). Operating costs thus defined become a function of crew size/

composition and usage/consumption factors.

Although it is recognized that "operations" per se are not logistic functions, they have been included in the structure in order that the Army may respond to inquiries received about the "cost to operate and support the XYZ weapon system." The nature and frequency of such questions have caused the elements of "operation" to be considered, de facto, an integral part of the Logistic Resources Data Base structure.

Direct Support Costs

Direct support includes all logistic support functions and costs that are directly attributable to maintaining or otherwise supporting a weapon system, unit or other logistic function.

Direct support functions include (at all levels): supply support, maintenance, and transportation. Procurement is an additional direct support function found only at the wholesale level.

Indirect Support Costs

Indirect support costs are best described as "overhead" expenses. The functions and services provided as indirect support are generally of a nature that prohibits ready identification to specific weapon systems, or even units.

Administrative and overhead personnel costs, medical support, costs for special logistic facilities and equipment, and miscellaneous logistic services are considered at all levels.

At the installation and wholesale levels, real property maintenance is an additional component; at the wholesale level, international logistics, industrial preparedness, and port operations are part of indirect support.

Cost Determination

Weapon system-related costs are based on the data element structure prescribed in the "Operating and Support Cost Guide for Army Materiel Systems" (see Fig. 1-1).[1-6] Incorporation of the Cost Guide structure and use of identical input data will assure compatability of results from both the Logistic Resources Data Base Structure and O&SCMIS.

Determination of costs for the various logistic resource components is discussed in Chapter 3, STRUCTURE UTILIZATION.

"BUILDING BLOCK" CONCEPT

Components

Each of the three separate parts of the structure is designed to be applied at a specific level, i.e., organizational, DS and GS level; installation level; or wholesale (commodity command/depot) level. The components comprising these individual structures are the primary operating, direct and indirect support costs expended for functions performed at each level.

The intent is to provide a means to develop a realistic cost picture for each of the major components. At the same time, common factors are to be used whenever possible, thus minimizing the requirement for detailed and complex cost manipulations. For example, since an acceptable Army-wide military personnel cost is available, it will generally suffice as the standard cost factor for all military personnel and labor-oriented components/subcomponents. This obviates the need for recourse to the lower "subordinate" subcomponents during development of personnel costs for most computations.

Subcomponents

Subcomponents are those elements of cost that are combined to yield a component. At the organizational, DS and GS levels, the component MAINTENANCE, for example, consists of: (1) replenishment spares, (2) labor, and (3) modification materials.

The subcomponents are further borken out by specific categories. Replenishment spares are identified as stock fund or procurement appropriation financed. Labor is either military or civilian. Modification materials are segregated into those installed for improvement of the equipment's performance, safety and/or reliability and maintainability.

Obviously it may not be possible, or in some cases, even desirable to attempt to identify costs in such detail, but the analyst must be aware that such subcomponents of major costs exist and perhaps could be amalgamated to produce the desired cost.

Levels

Because each level possesses certain unique characteristics it was necessary to develop three separate configurations that are similar but not identical in component/subcomponent content.

Organizational, DS/GS. The configuration tailored to the functions found at the organizational, DS and GS level is presented in Fig. 2-1. The detailed subcomponents of LABOR (or personnel) as depicted in Fig. 2-2 are not repeated in the structures to limit repetition.

Installation. A slightly expanded version of the above structure is presented for installation level, Fig. 2-3. The component SUPPLY SUPPORT is substituted for SUPPLY SUPPORT LABOR and the associated installation level functions of administrative operations (management of supplies and local procurement) and storage operations (preservation and storage of materiel and routine receipt, storage and issue of supplies) are added.

The configuration of MAINTENANCE changes from a simple parts, labor and modification materials break-out to a four-way distribution of materiel maintained,* with each assigned a series of subcomponents to collect parts, labor and modification materials cost.

The indirect support function of REAL PROPERTY MAINTENANCE ACTIVITY (RPMA) becomes an expense at this level.

Wholesale. The wholesale level provides support to the entire Army; also, it is responsible for materiel and technical support to other elements of DoD and to foreign governments. Figure 2-4 portrays the wholesale level structure, which adds the function of PROCUREMENT to the direct support cost category. The PROCUREMENT component consists of the subcomponents: (1) procurement of ammunition, (2) appropriation funded spares, and (3) SF war reserves and consumables. Because of the wide-ranging support mission at the wholesale level, several

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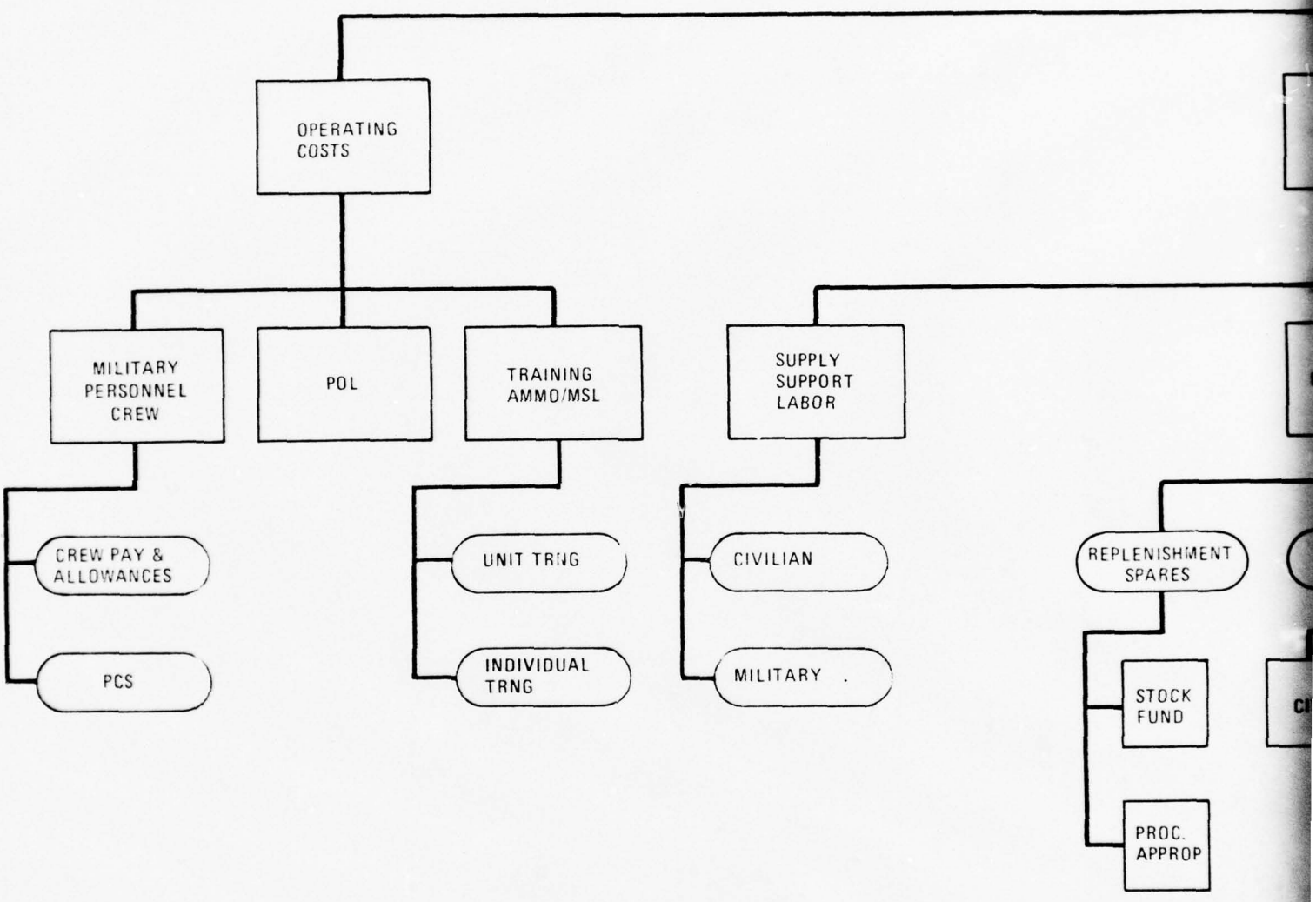
*End item, major assemblies, exchangeable components and other maintenance activities.

LOGISTIC RESOUR

ORGANIZA



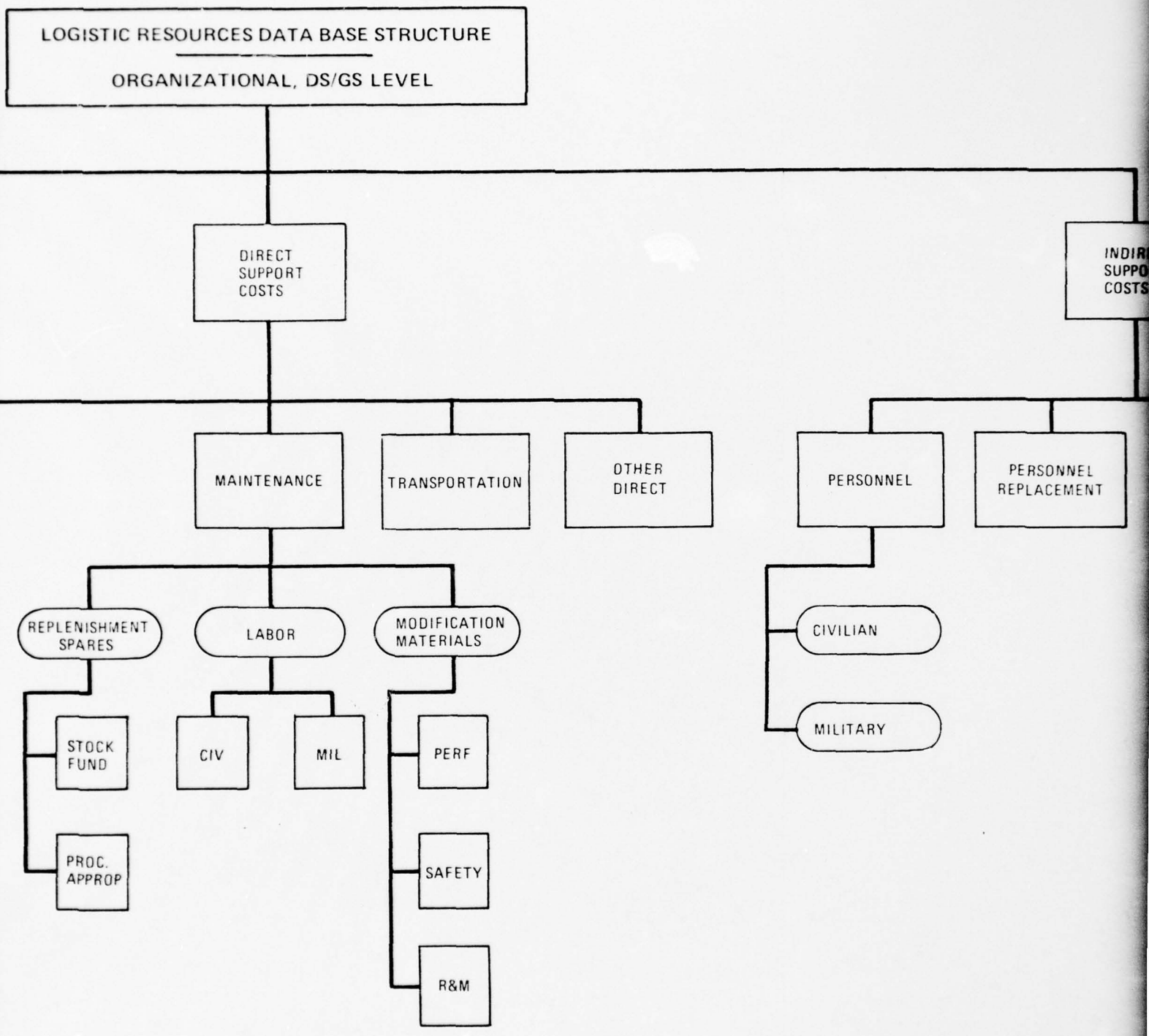
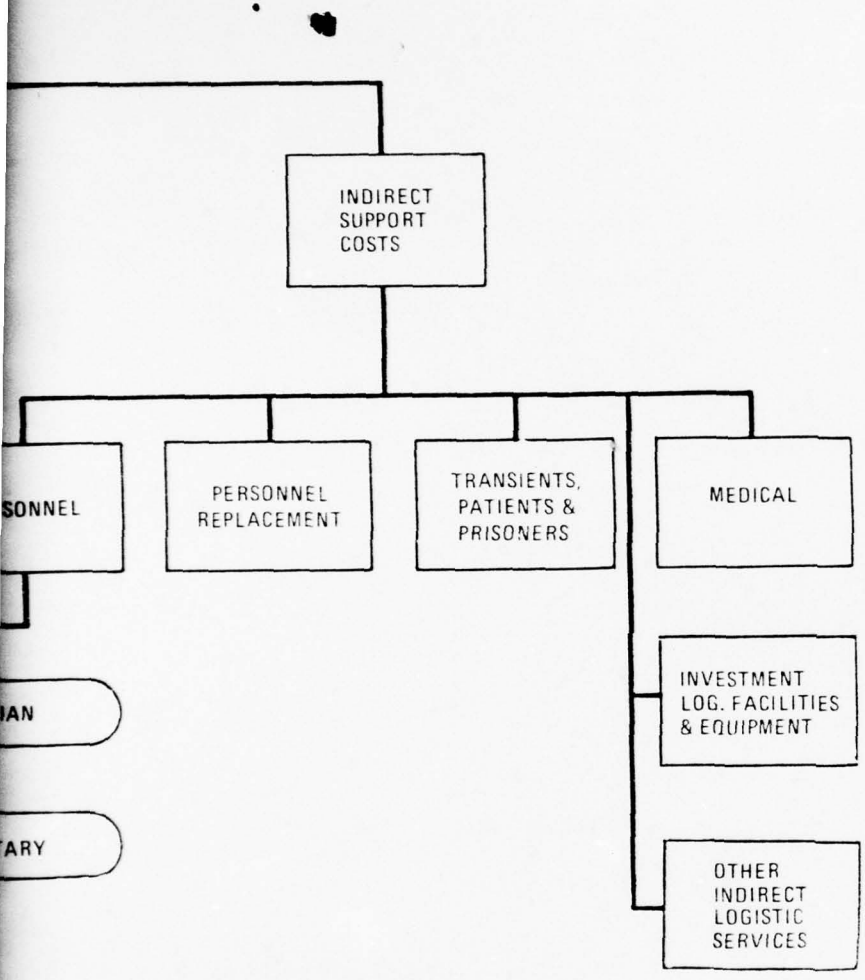

LOGISTIC RESOURCES DATA BASE STRUCTURE
ORGANIZATIONAL, DS/GS LEVEL
DIRECT SUPPORT COSTS
INDIR SUPPO COSTS
MAINTENANCE
TRANSPORTATION
OTHER DIRECT
PERSONNEL
PERSONNEL REPLACEMENT
REPLENISHMENT SPARES
LABOR
MODIFICATION MATERIALS
CIVILIAN
MILITARY
STOCK FUND
PROC. APPROP
CIV
MIL
PERF
SAFETY
R&M

Figure 2-1


INDIRECT SUPPORT COSTS
SONNEL
PERSONNEL REPLACEMENT
TRANSIENTS, PATIENTS & PRISONERS
MEDICAL
INVESTMENT LOG. FACILITIES & EQUIPMENT
OTHER INDIRECT LOGISTIC SERVICES

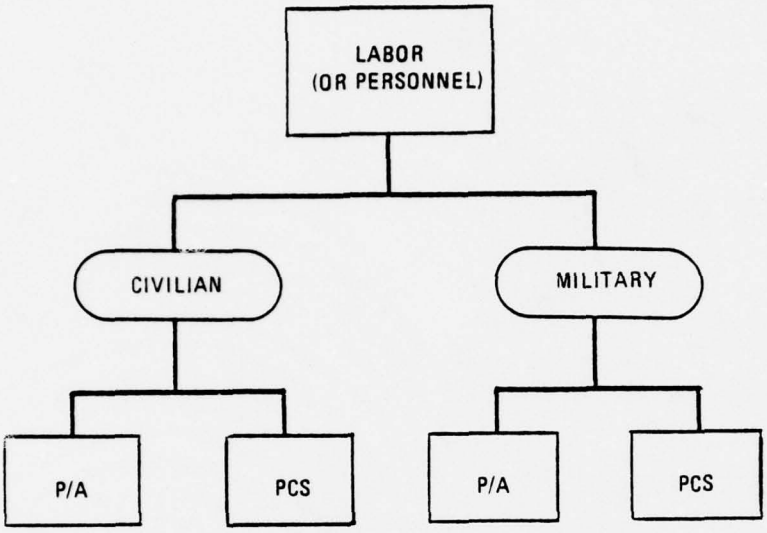
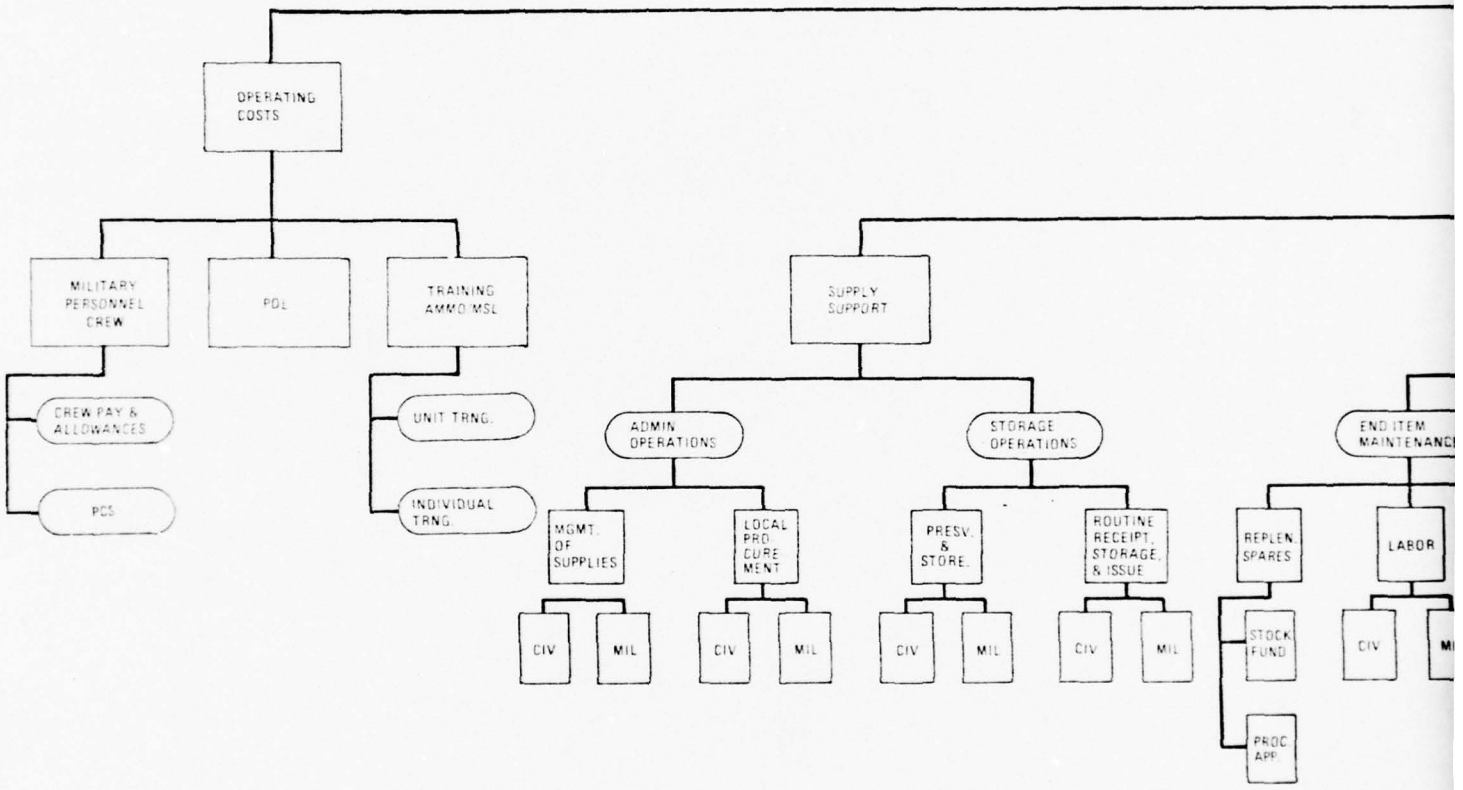


Figure 2-2 Subcomponents of Labor (or Personnel) Cost


OPERATING COSTS
MILITARY PERSONNEL CREW
POL
TRAINING AMMO/MSL
CREW PAY & ALLOWANCES
PCS
UNIT TRNG.
INDIVIDUAL TRNG.
SUPPLY SUPPORT
ADMIN OPERATIONS
STORAGE OPERATIONS
MGMT. OF SUPPLIES
LOCAL PRO CURE MENT
PRESV. & STORE.
ROUTINE RECEIPT, STORAGE, & ISSUE
REPLEN. SPARES
LABOR
STOCK FUND
PROC APP
CIV
MIL
CIV
MIL
CIV
MIL
CIV
MIL
CIV

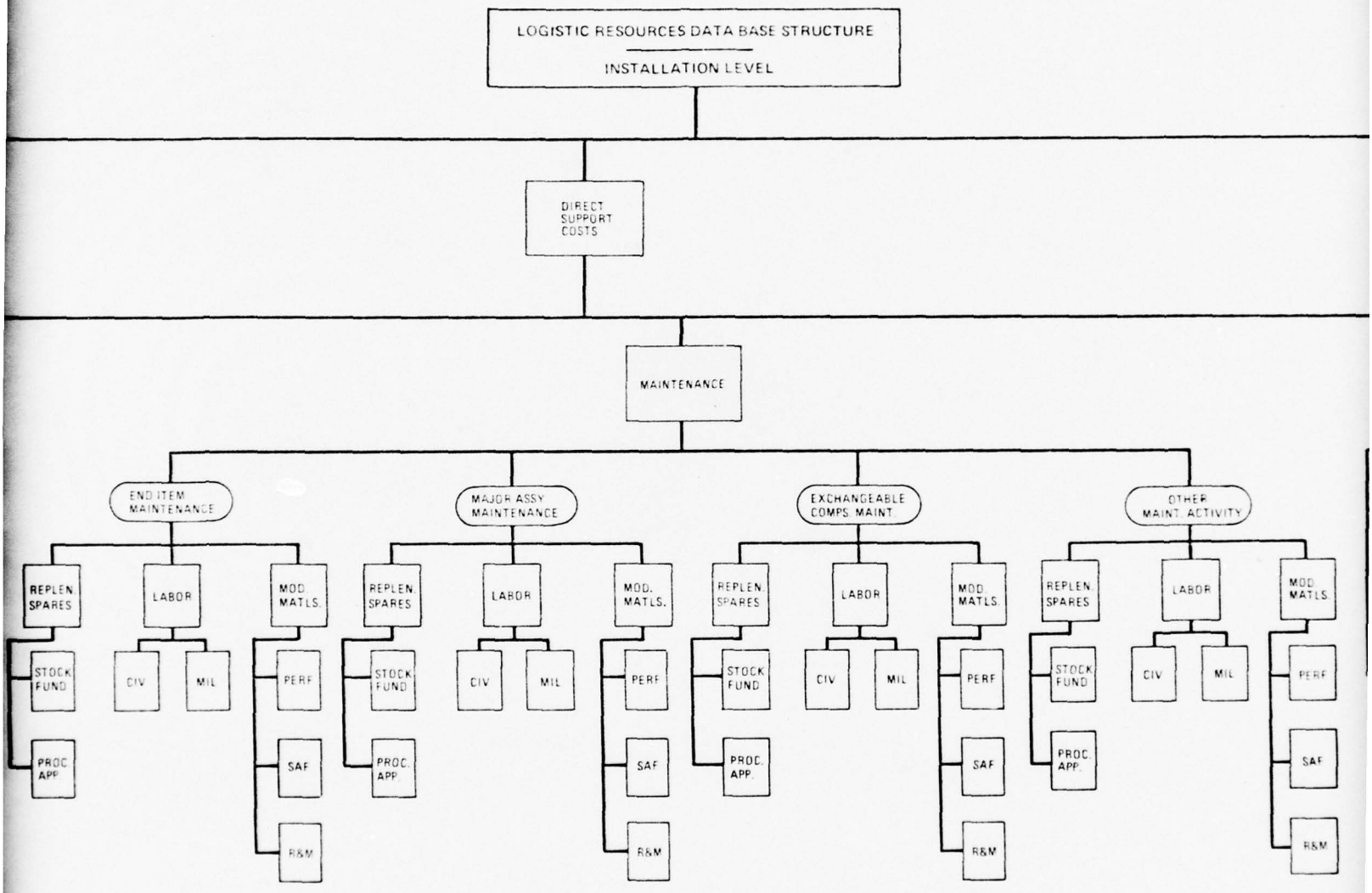
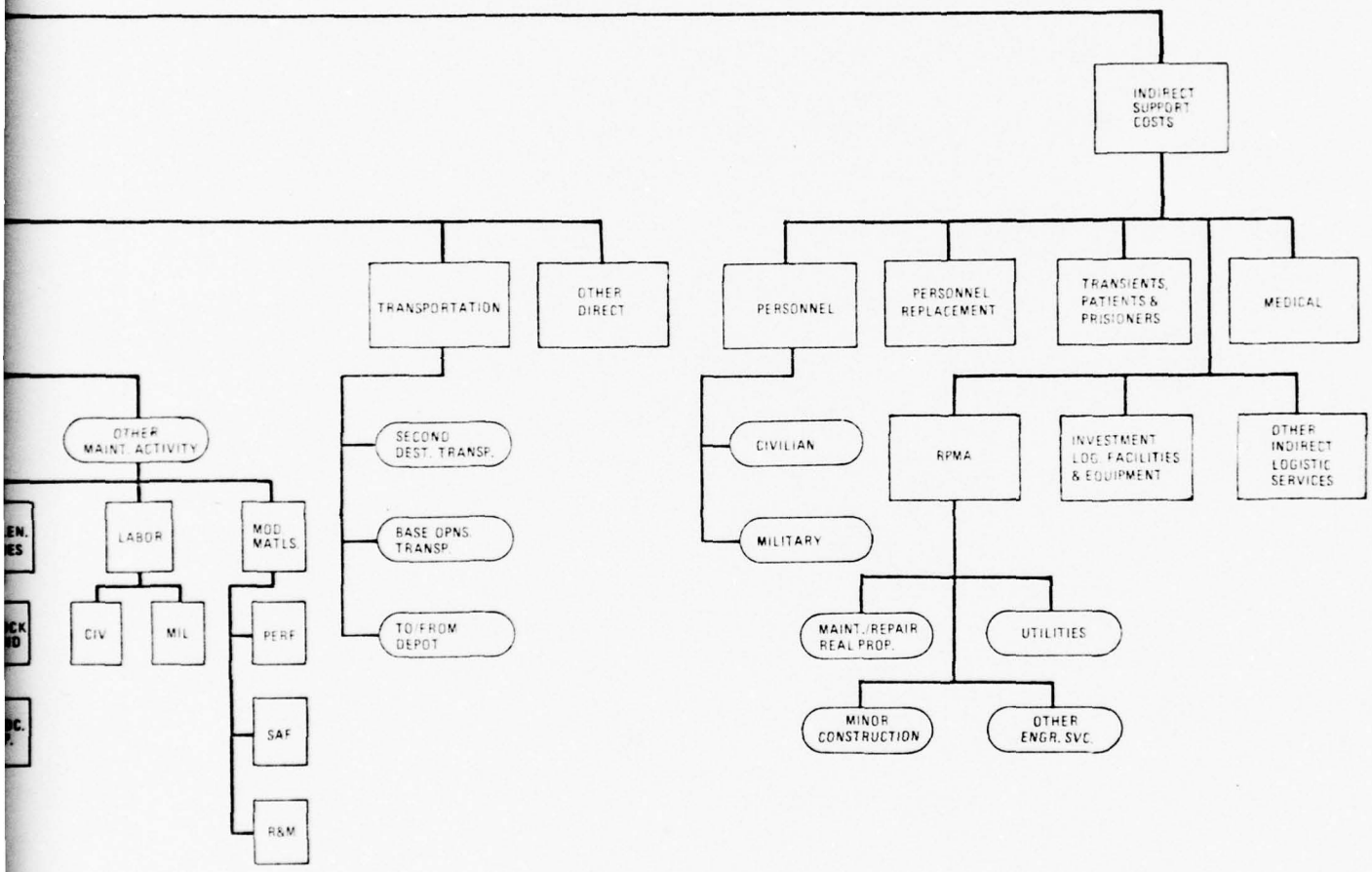
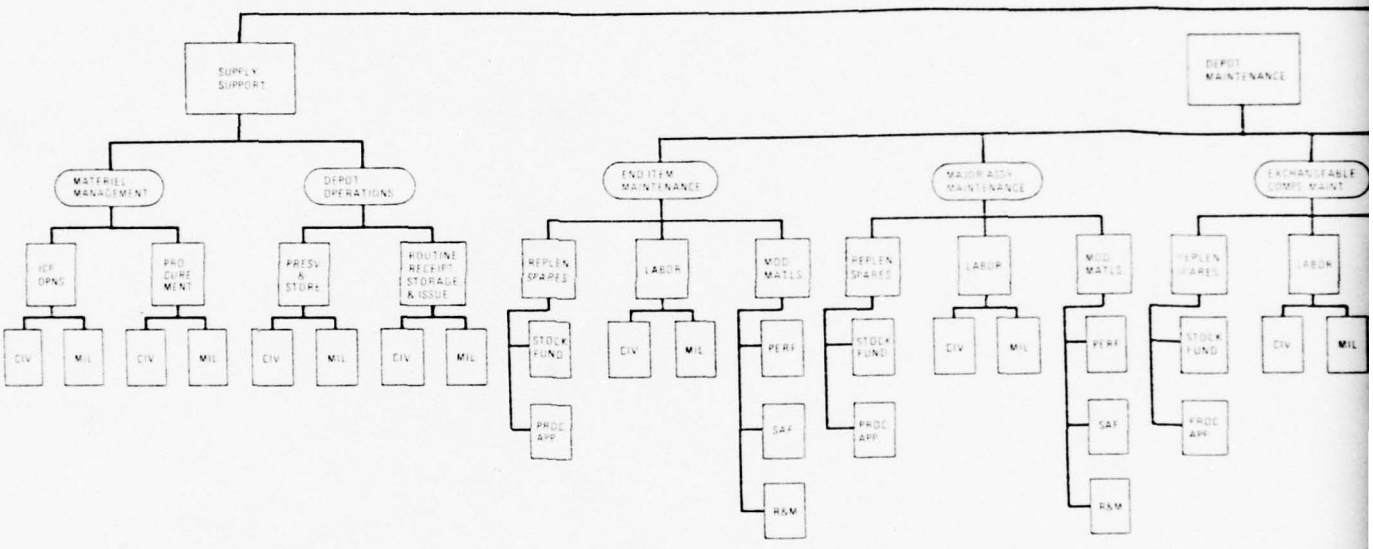

LOGISTIC RESOURCES DATA BASE STRUCTURE
INSTALLATION LEVEL
DIRECT SUPPORT COSTS
MAINTENANCE
END ITEM MAINTENANCE
MAJOR ASSY MAINTENANCE
EXCHANGEABLE COMPS. MAINT.
OTHER MAINT. ACTIVITY
REPLEN. SPARES
LABOR
MOD. MATLS.
STOCK FUND
PROC. APP.
CIV
MIL
PERF
SAF
R&M

Figure 2-3


INDIRECT SUPPORT COSTS
TRANSPORTATION
OTHER DIRECT
PERSONNEL
PERSONNEL REPLACEMENT
TRANSIENTS, PATIENTS & PRISIONERS
MEDICAL
OTHER MAINT. ACTIVITY
LABOR
MOD MATLS.
CIV
MIL
PERF
SAF
R&M
SECOND DEST. TRANSP.
BASE OPNS. TRANSP.
TO/FROM DEPOT
CIVILIAN
MILITARY
RPMA
INVESTMENT LOG. FACILITIES & EQUIPMENT
OTHER INDIRECT LOGISTIC SERVICES
MAINT./REPAIR REAL PROP.
UTILITIES
MINOR CONSTRUCTION
OTHER ENGR. SVC.


SUPPLY SUPPORT
DEPOT MAINTENANCE
MATERIEL MANAGEMENT
DEPOT OPERATIONS
END ITEM MAINTENANCE
MAJOR ASSY MAINTENANCE
EXCHANGEABLE COMPO MAINT
ICP OPNS
PRO CURE MENT
PRESV & STORE
ROUTINE RECEIPT STORAGE & ISSUE
REPLEN SPARES
LABOR
MOD MATLS
STOCK FUND
PROC APP
PERF
SAF
R&M
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MIL

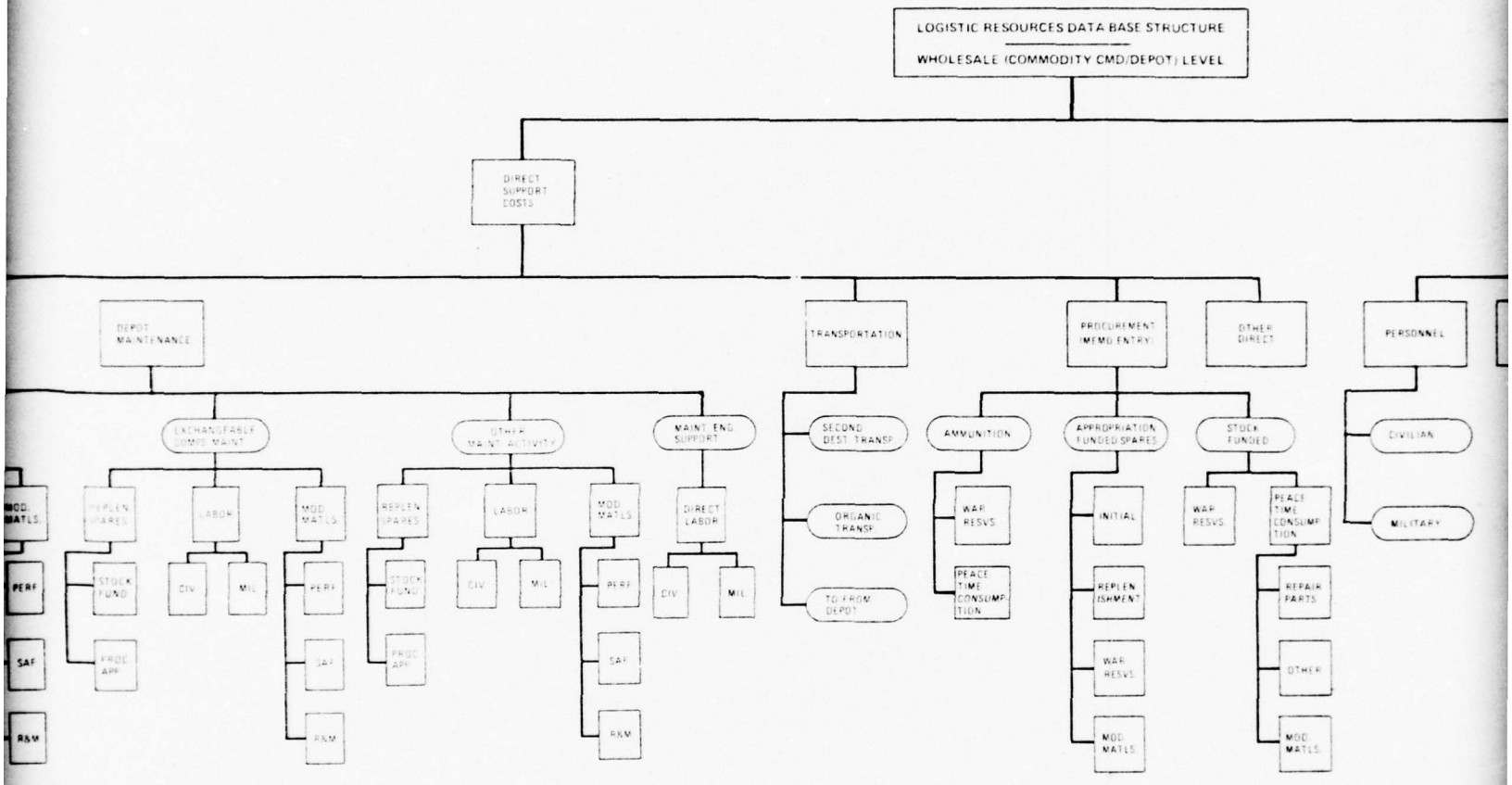
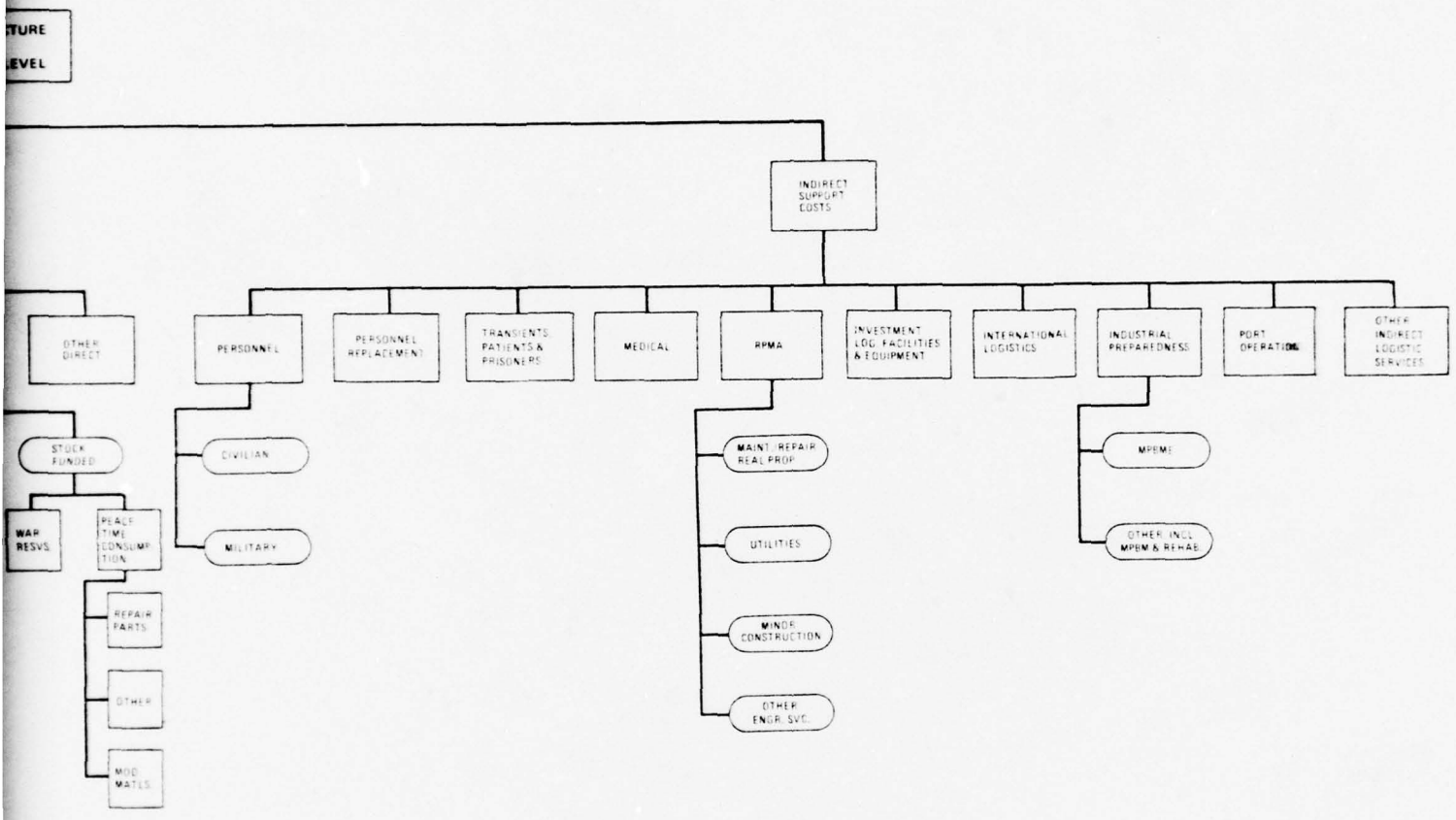

LOGISTIC RESOURCES DATA BASE STRUCTURE
WHOLESALE (COMMODITY CMD/DEPOT) LEVEL
DIRECT SUPPORT COSTS
DEPOT MAINTENANCE
TRANSPORTATION
PROCUREMENT (MEMO ENTRY)
OTHER DIRECT
PERSONNEL
EXCHANGEABLE COMPO MAINT
OTHER MAINT ACTIVITY
MAINT ENG SUPPORT
SECOND DEST TRANSP
ORGANIC TRANSP
TO/FROM DEPOT
AMMUNITION
APPROPRIATION FUNDED SPARES
STOCK FUNDED
CIVILIAN
MILITARY
REPLEN SPARES
LABOR
MOD MATLS
DIRECT LABOR
WAR RESVS
PEACE TIME CONSUMPTION
INITIAL
REPLENISHMENT
REPAIR PARTS
OTHER
CIV
MIL
PERF
SAF
R&M
PROC APP

Figure 2-4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OTHER DIRECT
PERSONNEL
PERSONNEL REPLACEMENT
TRANSIENTS PATIENTS & PRISONERS
MEDICAL
RPMA
INVESTMENT LOG. FACILITIES & EQUIPMENT
INTERNATIONAL LOGISTICS
INDUSTRIAL PREPAREDNESS
PORT OPERATIONS
OTHER INDIRECT LOGISTIC SERVICES
STOCK FUNDED
WAR RESVS.
PEACE TIME CONSUMPTION
REPAIR PARTS
OTHER
MOD MATLS.
CIVILIAN
MILITARY
MAINT. REPAIR REAL PROP.
UTILITIES
MINOR CONSTRUCTION
OTHER ENGR. SVC.
MPEME
OTHER INCL MPEM & REHAB

additional indirect support functions are introduced. In addition to all of the indirect support costs incurred at the lower levels, the wholesale level encompasses the components INTERNATIONAL LOGISTICS, INDUSTRIAL PREPAREDNESS and PORT OPERATIONS, all intended to support the wide scope of wholesale operations.

RELATIONSHIP BETWEEN DATA BASE COMPONENTS AND THE FYDP

The FYDP

The component structure has thus far been described primarily in the language of logistics support functions and subfunctions as applicable to the day-to-day business of maintaining combat-ready units and weapon systems in the field. It is essential, however, to communicate this substantial use of logistic resources in the language of the FYDP, which is the resource management vehicle of OSD.

The FYDP is made up of ten major programs that define the mission and support responsibilities of DoD. Each program/subprogram (i.e., Program 7, Central Supply and Maintenance/Program 7S, Supply, and 7M, Maintenance) is then divided into individual program elements (PEs) to provide visibility of the mission or support functions of the program/subprogram. Within the FYDP structure, the language used to identify specific resources assigned to each PE is termed Resource Identification Code (RIC). Most organizational entities identified in a PE consist of three basic resources, i.e., forces, manpower, and costs (dollars). In some instances all of these resources are used to completely express an element. In other instances only one or two of these resources are involved. The RICs permit recognition of the specific kind of resources included in each PE. The logistic structure components previously described can be associated with all three: forces, manpower, and dollars. The basic resources codes are described below.

Forces Codes

Four digit RICs used to identify certain hardware items by type and model, such as aircraft, missiles, etc., and specific force organizations such as divisions, brigades, and battalions.

Examples:

Army Divisions: 100_ to 109_

Airborne Divisions: 102_

Missile Battalions/Units: 170_ to 199_

Pershing Missile Unit: 186_

Battalions: 120_ to 149_

Tank Battalions: 124_

Manpower Codes

Four-digit RICs used to identify officer, enlisted and civilian manpower in the active, guard and reserve establishments. Separate codes permit the recognition of cadet and Reserve Officers' Training Corps (ROTC) enrollees, and identify civilians as American or foreign and as direct or indirect hire.

Examples:

Active Army officers: 0001

Active Army enlisted service: 0101

Civilians, US direct hire: 0160

Civilians, foreign direct hire: 0161

Appropriation - TOA

A set of four-digit RICs used to identify the three cost categories: development, investment, and operations. For the Army, development consists principally of the research, development, test and evaluation (RDTE) account. The investment category includes the five procurement appropriations, military construction, and family housing. Operations include the OMA, MPA, Reserve and National Guard appropriations, as well as the Industrial and Stock Funds.

Examples:

Development

RDTE, Army: 0300

Investment

Aircraft Procurement, Army: 0425

Missile Procurement, Army: 0426

MCA: 0440

Defense Family Housing Construction: 0453

Operations

O&M, Army Reserve: 0501

O&M, Army: 0510

MPA: 0560

Reserve Personnel, Army: 0564

Army Industrial Funds: 0580

Army Stock Funds: 0597

An example of a FYDP Program 1 PE that includes all three of the basic resources is PE 12212A, Nike Hercules Battalions (Table 2-1). The nature of resources contained in each of the ten FYDP programs is shown in Table 2-2. All ten programs have dollars associated with them. Most also reflect sizable manpower resources with the exception of Program 10, "Support to Other Nations" in which relatively few US personnel are assigned. Forces, on the other hand, are reflected only for TOE* units, i.e., units programmed to be engaged in combat or combat-support missions. Thus, forces generally appear as resources only in the "Strategic," "General Purposes," "Guard and Reserve" categories, i.e., Programs 1, 2, and 5. The format for displaying force-related resources coincides roughly with missions and organizational relationships; forces are reported in units, i.e., numbers of infantry divisions, etc. This is not to imply that there are no organizational structures associated with the other FYDP Programs. For example, Program 7, "Central Supply and Maintenance," includes fundings for the Army's commodity commands and CONUS depots, which represent large TDA** structures, but are not reflected as forces in the FYDP.

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*Tables of organization and equipment

**Tables of distribution and allowances

Table 2-1

ILLUSTRATIVE FYDP PE RESOURCES IDENTIFICATION
NIKE-HERCULES BATTALIONS, PE 12212A

	FY 77	FY 78	FY 79	FY 80
FORCES:				
1920 NIKE-HERCULES Air Def Btrys	3	3	3	3
4001 NIKE-HERC MSLS	50	50	50	50
TOA:				
INVESTMENT				
0429 Other Proc-Army	3000	3000	3000	3000
Total investment	3000	3000	3000	3000
OPERATIONS				
0510 O and M Army BP	5000	5000	5000	5000
0510 O and M Army Total	5000	5000	5000	5000
0560 Mil Pers Army	1000	1000	1000	1000
Total operations	6000	6000	6000	6000
Total TOA	36000	36000	36000	36000
MANPOWER:				
MILITARY MANPOWER				
0001 Act Army Off	500	500	500	500
0101 Act Army Enl	4000	4000	4000	4000
Total military manpower	4500	4500	4500	4500
Total manpower	4500	4500	4500	4500

Table 2-2

FYDP STRUCTURE/RESOURCES

Resources	1 Strategic Forces	2 Gen'l Purpose Forces	3 Commo/Intel	4 Airlift/Sealift	5 Army Reserve and Nat'l Guard	6 RDTE	7 Central Supply & Maint.	8 Training	9 Administration	10 Support to Other Nations
Manpower	X	X	X	X	X	X	X	X	X	(X)
Dollars	X	X	X	X	X	X	X	X	X	X
Forces (TOE)	X	X			X					

(X) Limited manpower

Relationships

It is generally accepted that the accomplishment of the DoD mission requires the commitment of substantial logistic resources. Nevertheless, communicating the distribution of logistic resources in FYDP terms is extremely difficult and imprecise because logistic resources:

1. May consist of all three basic types of resources - forces, manpower, and dollars (TOA).

2. Are contained in both the investment and operations cost categories as well as several appropriations within these categories.

3. Cut across several major FYDP programs.

This intricate relationship is displayed by Tables 2-3 and 2-4.

Although the logistics functions that consume these resources are generally well defined in mission terms, isolating, collecting and aggregating these resources in program and budget terms is largely dependent upon the availability of the required data in existing systems and reports at the appropriate level of detail. This determination was a major thrust of Phase II of the study, the results of which are described in Chapter 4.

The Army Management Structure (AMS) is "the official Army framework for interrelating programming, budgeting, accounting, and manpower control through a standard classification of Army activities and functions," and, to the extent practicable, has been "aligned with the DoD structure of the FYDP to maximize the use of a common language for communicating up and down the hierarchy." [2-1] A comparison of the FYDP program elements and the AMS codes (AMSCOs) was made. In general, AMSCOS in OMA provide a detailed functional breakdown of the same program elements (PEs) appearing in the DoD FYDP. There is a direct relationship between the PE and the AMSCO in all O&M accounts except certain ones in Programs 4 and 5.

[2-1] Dept of Army, "The Army Management Structure (AMS)," AR 37-100-76, 1 Jul 76.

Table 2-3

COMPONENTS OF THE LOGISTIC RESOURCES STRUCTURE BY APPROPRIATION

Logistic resource component	Total Obligational Authority (TOA)								
	Development (RDTE)	Investment (Procure.)	Operations						
			OMA	MPA	OMANG	RPA	OMAR	NGPA	ASF
Operating costs									
Personnel (crew)				P1,P2,P3		P5		P5	
POL			P1,P2,P3,P7,P8		P5		P5		P1,P2,P3,P7
Training ammo/missiles		P1,P2,P5							
Direct support costs									
Supply support			P1,P2,P3,P7,P9		P5		P5		
Materiel management			P1,P2,P3,P7		P5		P5		
Supply depot operations			P1,P2,P3,P7		P5		P5		
Maintenance			P1,P2,P3,P7		P5		P5		
End items			P1,P2,P3,P7		P5		P5		
Major assemblies		P7	P1,P2,P3,P7		P5		P5		
Exchangeable components		P7	P2,P3,P7		P5		P5		P1,P2,P7
Other maint. activities			P3,P7		P5		P5		
Maint. engr. support			P3,P7						
Procurement									
War reserve munitions		P1,P2,P5	P1,P2,P7						
Appro. funded spares		P1,P2,P3,P5	P7		P5		P5		
Stock funded supplies			P1,P2,P3,P7		P5		P5		P1,P2,P3,P5,P7
2nd destination trans.			P2,P7						
Indirect support costs									
Personnel			P1,P2,P3,P7, (P9	P1,P2,P3,P7, (P9	P5		P5		
RPMA			P1,P2,P3,P7,P8		P5		P5		
Medical			P1,P2,P7,P8		P5		P5		
Support systems			P3,P7		P5		P5		
Internat'l logistics	P10	P10	P9,P10	P9,P10					P10
Indust. preparedness		P7	P7						
Port operations			P2,P7						
Other (services)		P7	P7						P7

Table 2-4

COMPONENTS OF THE LOGISTIC RESOURCES STRUCTURE BY FYDP PROGRAM

Logistic resource component	PE code	AMS code	Resource identification					FYDP Programs					
			Forces	Manpower	TOA ($)			1	2	5	7	8	10
					Development	Investment	Operations						
Operating costs													
							X	X	X	X	X		
Personnel (crew)		1000.0000											
		1100.0000	X	X			X	X	X	X		X	
POL			X	X			X	X	X	X	X		
Training ammo/missiles				X		X	X	X	X	X			
Direct support costs													
Supply support		720000.00000	X	X			X	X	X	X	X	X	
Materiel management	711120	721112.00000	X	X			X		X	X	X		
Supply depot operations	71109A	721111.00000	X	X			X		X	X	X		
Maintenance		732207.00000	X	X			X	X	X	X	X	X	
		722896.C0000											
End items			X	X			X	X	X	X	X		
Major assemblies			X	X		X	X		X		X		
Exchangeable components			X	X		X	X		X	X	X		
Other maint. activities				X			X				X		
Maint. engr. support	78017A	738017.000Q0		X			X				X		
Procurement	711130	721113.00000									X		
War reserves munitions				X		X		X	X		X		
Appro. funded spares				X		X		X	X		X		
Stock funded supplies	280320			X			X				X		
2nd destination trans.	780100	728010.00000	X	X			X	X	X	X	X	X	
Indirect support costs													
Personnel		1000.0000											
		1100.0000		X			X	X	X	X	X	X	
RPMA	72894A	722896.J0000											
		722896.K0000		X			X	X	X	X	X	X	
		722896.L0000											
		722896.M0000											
Medical	812110	841211.00000	X	X			X	X	X	X	X	X	
Support systems		.C3000											
		.D8000		X		X	X				X		
Internat'l logistics	020020			X	X	X	X				X	X	X
Indust. preparedness	780110			X		X	X				X		
Port operations	780100		X	X			X		X	X	X		
Other (services)	78012A	728012.00000		X		X	X				X		

PEs in Program 4, "Airlift/Sealift" bear no similarity to the AMSCOs describing these same functions since such activities are predominately industrially funded. In Program 5 the direct relationship between PEs and AMSCOs is limited to the "Depot Maintenance for the Army Reserve" portion of the total program.

The OMA AMSCOs were examined also to determine the degree to which the logistic resources contained within the ten FYDP programs are described. In Program 7, and to a limited degree in Program 5, it is feasible to derive logistic functional costs directly from the AMS coding. This suggests that a similar construct might be possible and desirable for application to the other programs that contain large amounts of logistic resources not currently displayed as such. Finally, the AMS was examined in light of the problem of displaying these resources by weapon system. Only Programs 1, 2, 6, and 7 currently provide for the display of resources by weapon system, and these only to an extremely limited degree.

Since the FYDP Program 7 PEs and their related AMSCOs appear to be the most useful in describing logistic resources, they were given closer attention.

Program 7 is functionally structured in the AMS as illustrated in Figure 2-5. It consists of two subprograms: "Central Supply Activities" and "Depot Materiel Maintenance and Support Activities." The subfunctions of these fall into neat categories as shown, which generally describe the kinds of tasks necessary at commodity commands and depots to accomplish the wholesale level support mission. The PEs that are associated with each of these functions are indicated in parentheses in order to show the direct relationship that exists for Program 7. The AMSCO structure, however, provides for a much finer level of detail than that provided by these PEs. To illustrate, consider two of the major functions of wholesale support: supply depot operations and depot maintenance activities.

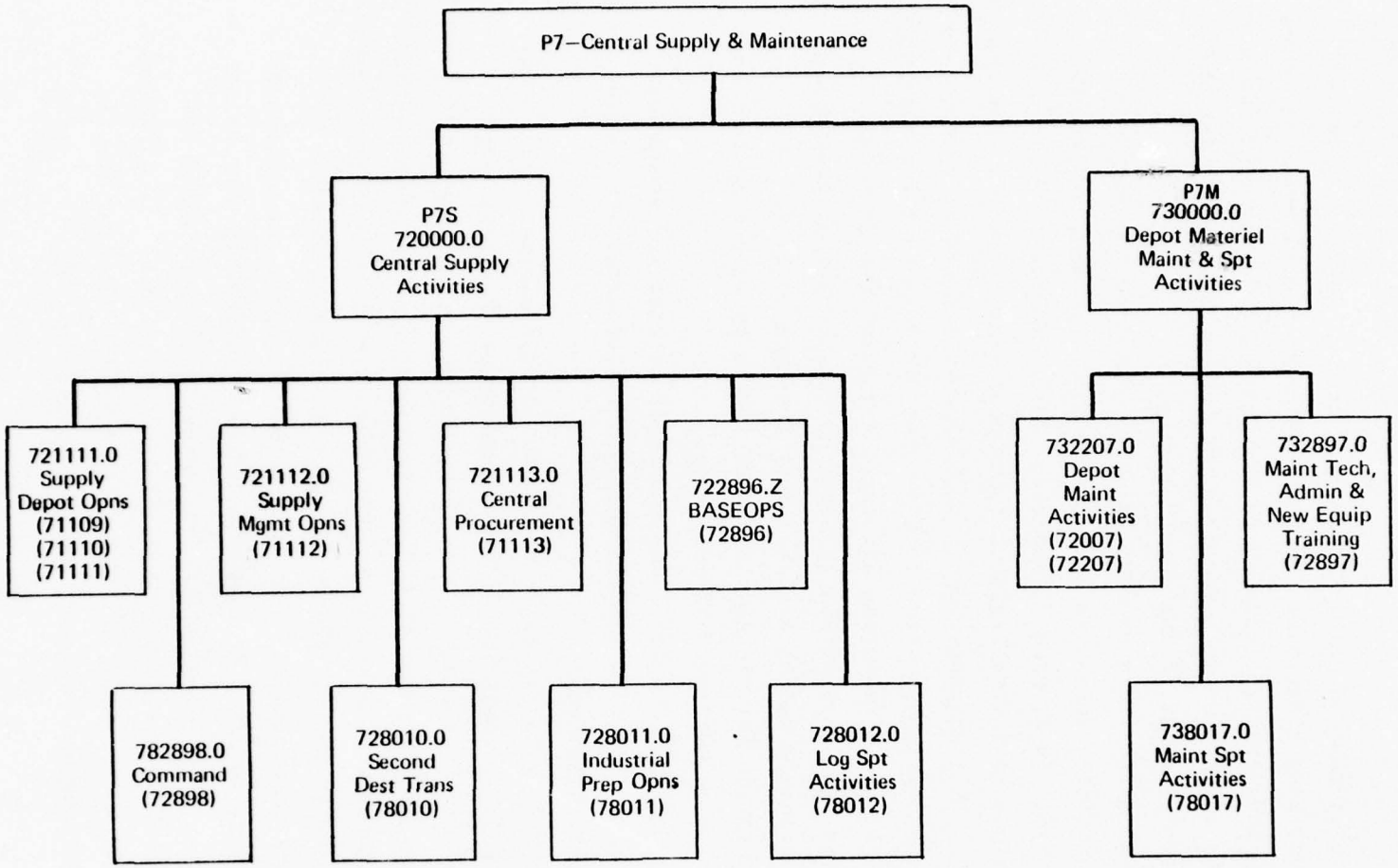


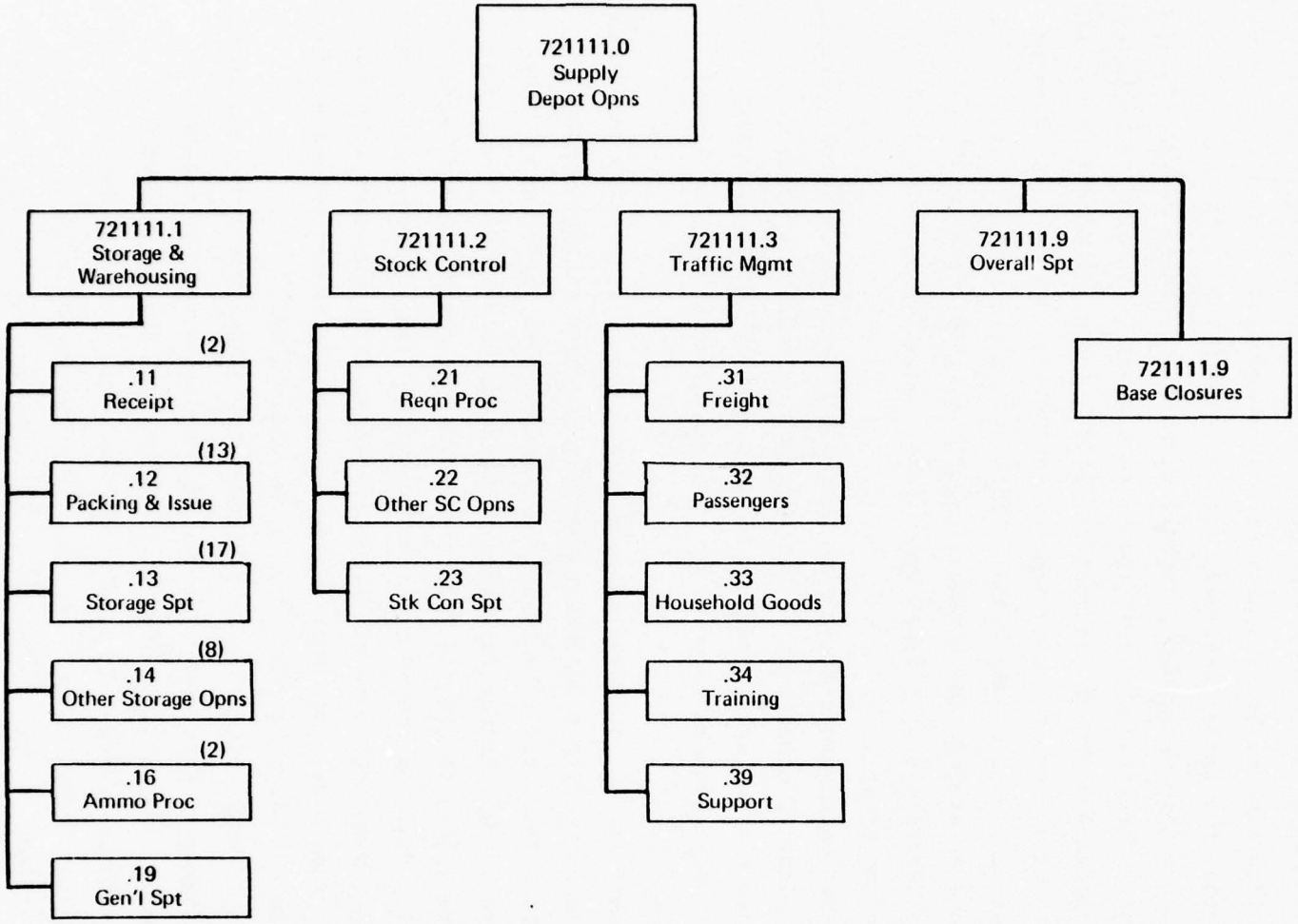
Figure 2-5 P7—Central Supply and Maintenance

The supply depot operations function as shown in Figure 2-6 is broken into five major subfunctions that characterize, in rather precise terms, the tasks performed: storage and warehousing, stock control, traffic management, overall support and base closure/reductions in force. The first three of these are further delineated as indicated. Even this is not the entire picture, which is too voluminous to describe in one table. The bracketed numbers indicate a count of the sub-subsets, as described by additional, individual AMSCOs that relate to the functions of storage and warehousing. In all, 62 separate AMSCOs are used to describe supply depot operations, including individual and summary categories.

Depot maintenance activities presents a somewhat different picture. For purposes of management of the maintenance function, logistic resources therein are segregated by equipment category, end item, assembly or component and type of maintenance performed, as listed in Table 2-5.

There are 12 equipment category codes, up to nine codes describing the component of that equipment category on which the maintenance is to be performed, and 16 work accomplishment codes (WACs) describing the type of maintenance performed. Combined, these codes constitute the five digits to the right of the decimal in the management structure, and fully describe the maintenance functions being costed. For example, the depot maintenance function "modification in conjunction with overhaul or repair of components and accessories for combat vehicles" would have, to the right of the decimal, the code "C03H2."

While this coding scheme is undoubtedly ideal for local assignment and management of personnel, workload scheduling and performance measurement and costing; its utility vis-a-vis the requirements of a logistic resources data base is somewhat restricted. However, with rather minor modification, it would be possible to include, with the existing five digits available, an indication of weapon system. This modification is discussed in Chapter 5.



( ) = Number of AMSCOs comprising each subelement

Figure 2-6 Supply Depot Operations

Table 2-5

MANAGEMENT CODING FOR DEPOT MAINTENANCE
(732207.00000)

Position 1*	Positions 2 and 3 (ACFT)**	Positions 4 and 5
Equipment Category Summary Code (ECSC)	End Item, Assembly or Component Code ("Type Reportable Item")	Work Accomplishment Code (WAC)
A Aircraft	01 Basic End Item or Equip	A1 Cyclic/Normal Overhaul/Rebuild
B Automotive Equipment	02 Engines	A2 Battle/Crash Damage Overhaul
C Combat Vehicles	03 Components & Accessories	B0 Progressive Maintenance
D Construction Equipment	04 Commo-Elect	C1 Conversion (Not in Conjunction with Overhaul/Repair)
E Communications-Electronics	05 Weapons Armament	
F Missile Systems	06 Support Equipment	C2 Conversion (In Conjunction with Overhaul/Repair)
G Ships	07 Missile Armament	
H Munitions Armament	08 TMDE	D0 Activation
I Weapons Armament	09 BII/Plant Equip/Ind Fac	E0 Inactivation
J Rail Equipment		F0 Renovation
K General Equipment		G0 Analytical Rework
L Commodity Groups		H1 Modification (Not in Conjunction with Overhaul/Repair)
		H2 Modification (In Conjunction with Overhaul Repair)
		I0 Repair
		J1 Inspection & Test--Excl Calibration
		J2 Inspection & Test--Calibration
		K0 Manufacture/Fabrication
		L0 Reclamation/Disassembly

*Code "M" is used for TMDE in varying maintenance support activities.

**There are variations in this coding scheme for other ECCs.

EXAMPLES: 732207.A01A1 - Basic ACFT Cyclic/Normal Overhaul/Rebuild
732207.F01C2 - Basic Missile System Conversion (In Construction with Overhaul/Repair)

The application of these five position codes to the subfunctions of depot maintenance results in numerous AMSCOs as illustrated in Figure 2-7. The number of AMSCOs for each subfunction is shown parenthetically.

The first-order breakout of the subfunctions of depot maintenance is shown across the top of the table; i.e., summaries by equipment categories; by equipment categories across end items, components, assemblies and work accomplishment codes; by WAC across equipment category codes (ECCs) and components; for basic issue items; plant equipment; undistributed variable summaries; and nonrecurring costs. The detailed sub-break of the structure for the summary of basic maintenance across weapon systems is shown in the remainder of Figure 2-7. A separate, mutually exclusive AMSCO is used to describe each combination of end item assembly or component and work accomplishment code for each category of equipment. Thus, for aircraft, it spans the codes from .A01A1 (Basic Aircraft Cyclic or Normal Overhaul or Rebuild) through .A08L0 (Aircraft Test, Measurement and Diagnostic Equipment Reclamation or Disassembly). This results in 128 separate codes for aircraft maintenance (not counting Aircraft Basic Issue Items and Plant Equipment), and a total of 1,298 separate AMS Codes to describe the entire Regular Army's depot maintenance activities. But no weapon system coding is available.

This analysis indicates that while the structure of Program 7 PEs and AMSCOs provides a discrete (and perhaps excessively detailed) breakout of logistic resources, all other programs are extremely inadequate in this regard. For example, Table 2-6 indicates 51 force-related PEs that really are "poor stepchildren" in terms of logistic resources identification. None of these can be said to relate only to specific weapon systems, functions, missions, or units, yet all encompass significant amounts of "hidden" logistic resources. The PEs shown in Table 2-6 are only representative, there are many more, the bulk residing in Programs 2 and 5. This situation, among other

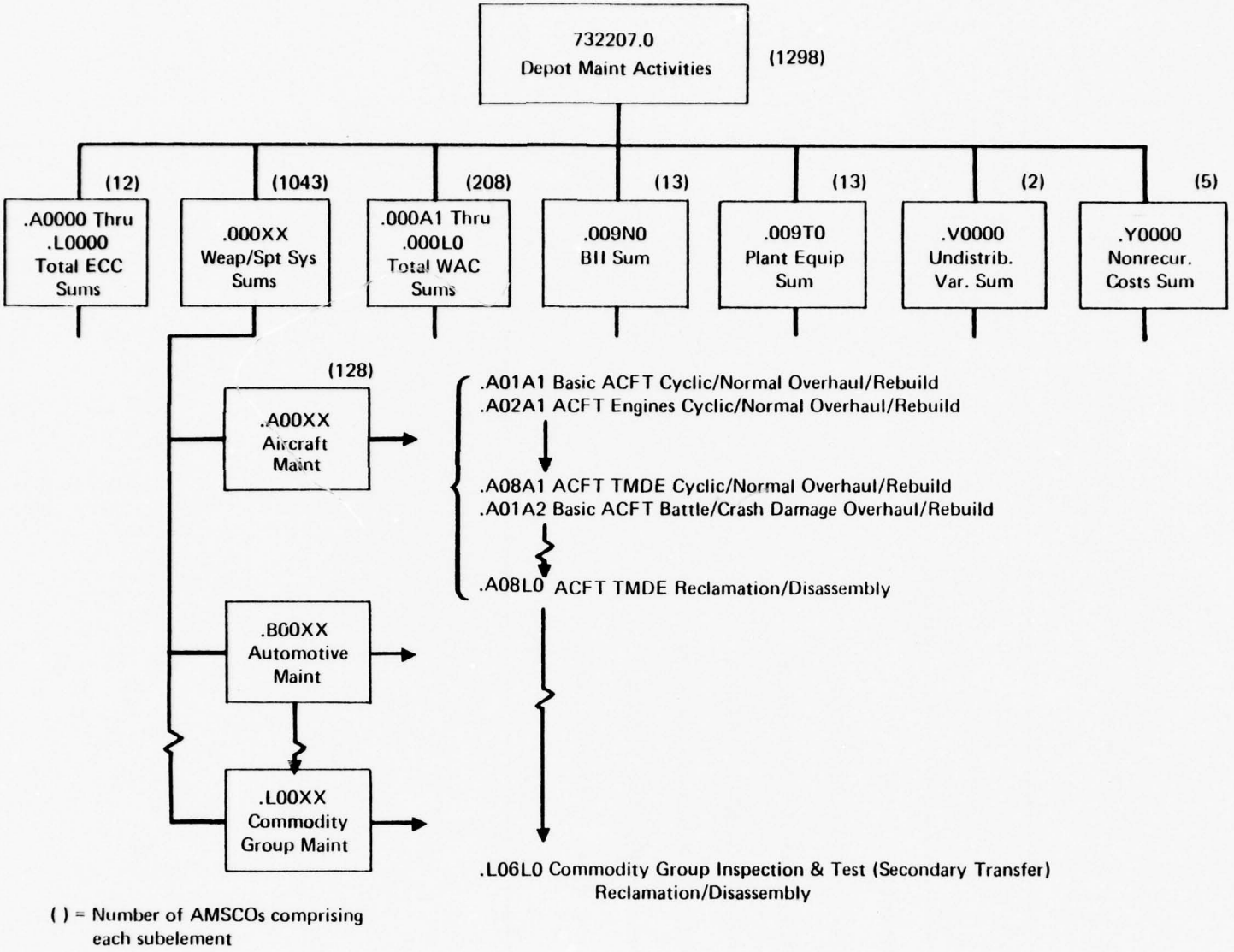


Figure 2-7 Depot Maintenance Activities

Table 2-6

FORCE-RELATED PEs CONTAINING LOGISTIC RESOURCES

Category	Number of PEs by FYDP program				
	1	2	5	10	Total
Division Forces		3	2		5
Non-Div Cmbt Bdes/Regts		3	1		4
Other Non-Div Cmbt Units		2	5		7
Tactical Support Units		4	2		6
Support to Other Services		3	2		5
Defense/Missile Forces	1	5	8		14
Spec Mission/Activities/Spt		6		4	10
Total	1	26	20	4	51

things, prompted consideration of the AMSCO restructuring alternative described in Chapter 5.

In spite of the inadequacies of the FYDP structure in terms of providing visibility of logistic resources, the logistic resources structure is relatable to the FYDP programs. The interrelationship among the display of logistics in DoD developed by Mr. Charles Groover, OASD (I&L) (Table 1-1), the FYDP structure and the Logistic Resource Data Base Structure is illustrated by Table 2-7. Table 2-7 also identifies functional areas of interest for determining the Army staff personnel with whom the GRC study team must work closely in subsequent efforts to bridge the FYDP structural problems described in this chapter.

Table 2-7

INTERRELATIONSHIP AMONG THE DOD, LOGISTIC RESOURCES AND FYDP STRUCTURES

(WHOLESALE LEVEL)

DOD STRUCTURE	LOGISTIC RESOURCES STRUCTURE	FYDP STRUCTURE (PEs)
SUPPLY OPERATIONS ICP Ops, Procurement Ops Depot	SUPPLY SUPPORT Materiel Management ICP Operations Procurement	711120 ICP Operations 711130 Procurement Operations
Receiving, Warehousing, Issuing Depot	Depot Operations Preservation/Storage Receipt/Storage/Issue	71109A Supply Depots (IF) 71110 Supply Depots/Operations (Non-IF)
DEPOT MAINTENANCE Overhaul of major end items Overhaul of major subassemblies Overhaul of exchangeable components Other depot maintenance DEPOT MOD/ALT Modification of major end items Modification of major subassemblies Modification of exchangeable components Other depot mod/alt	DEPOT MAINTENANCE End Items (Includes 1, 2 & 3) Major Assemblies (Includes 1, 2 & 3) Exchangeable Components (Includes 1, 2 & 3) Other Maintenance Activities (Includes 1, 2 & 3) (1) Replenishment Spares Stock Fund Proc Appropriation (2) Labor (Civilian/Military) (3) Mod Materials Performance Safety Reliability and Maintainability	720070 Depot Maintenance (IF) 722070 Depot Maintenance (Non-IF)
SUSTAINING ENGINEERING SUPPORT	Maintenance Engineering Support	780170 Maintenance Spt Activities
Second Destination Transportation Sea Land Air	TRANSPORTATION Second Destination Organic Transportation To/From Depot	780100 Second Destination Trans
WAR RESERVE MUNITIONS PROCUREMENT Tactical Mission Spares Other Munitions	PROCUREMENT Ammunition War Reserves Peacetime Consumption	28030 War Reserve Materiel/Ammo
Procurement of Appropriation funded Spares and other secondary items Initial Replenishment War Reserves	Appropriation Funded spares Initial Replenishment War Reserves Modification Materials	280310 War Reserve Materiel/ Secondary Items
Procurement of modification/alt kits Procurement of Stock Fund War Reserves Procurement of repair parts and equipment-related materiel for peacetime consumption* *(Stock Fund, Non-add) Fuel (Non-add) Other Commodities (Non-add)	Stock Funded War Reserve Peacetime Consumption Repair Parts Non-Equipment Logistics Related Mod Materials	280320 Stock Funded War Reserve Material (Svc Controlled) 280345 Stock Funded War Reserve Materiel (DSA Controlled-Army programs)
N/A	Other Direct	As Applicable

Table 2-7 (continued)

(WHOLESALE LEVEL)

DOD STRUCTURE	LOGISTIC RESOURCES STRUCTURE	FYDP STRUCTURE
HQ AND COMMAND AT LOG BASES	PERSONNEL (INDIRECT)	728980 Command
N/A	PERSONNEL REPLACEMENT	N/A
N/A	TRANSIENTS, PATIENTS & PRISONERS	N/A
N/A	MEDICAL	811130 Professional Training (Med) 812110 Care in Def Facilities 812140 Care in Non-Def Facilities (MEDICARE) 812150 Care in Non-Def Facilities 812160 Other Medical Activities
RPMA Maint/Repair of Real Property Utilities Minor Construction Other Engr Services	RPMA Maint/Repair of Real Property Utilities Minor Construction Other Engr Services	Base Operations (.J0000, .K0000, .L0000 & .M0000)
INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT	INVESTMENT IN LOGISTIC FACILITIES AND AND EQUIPMENT	MCA and Proc Approp
INTERNATIONAL LOGISTICS	INTERNATIONAL LOGISTICS	010090 Service Support to MAP 010010 Misc Spt to Other Nations 020020 Foreign Military Sales Support (Reimbursable) 001000 Support of Allies 002000 Military Assistance Program (Includes FMS Support Personnel) 009999 Reimbursable Sale of Supplies (To Include "off-sets")
INDUSTRIAL PREPAREDNESS Munitions production base maintenance and rehabilitation of existing facilities Munitions Production Base Modernization and Expansion (MPBME) Other	INDUSTRIAL PREPAREDNESS MPBME Other: Reserve Industrial Plants Reserve Industrial Equipment Industrial Prep Planning Emergency Prod Reqmts/Scheduling Prep Planning Measures	780110 Industrial Preparedness MCA and Proc Approp
PORT OPERATIONS	PORT OPERATIONS	780100 Second Destination Trans
OTHER LOGISTIC ACTIVITIES Laundries Printing Plants Etc.	OTHER INDIRECT: Laundries Printing Plants Production Engr (SF/PROC) Defense Standardization Program Disposal Activity Real Estate Admin Etc.	780120 Logistic Support Activities 720330 Printing Plants Selected Baseops Accounts (including .A0000, .E0000, .F0000, .G0000, .H0000, .N0000, .P0000, .Q0000)

Table 2-7 (continued)
(INSTALLATION LEVEL)

DOD STRUCTURE	LOGISTIC RESOURCES STRUCTURE	FYDP STRUCTURE
N/A	MILITARY PERSONNEL (CREW) Crew PCS	All Programs
POL Consumption Peacetime Ammo/Missiles Consumption (Non-add)	POL TRAINING AMMO/MISSILES (Memo Entry) Unit Individual	
SUPPLY OPERATIONS ICP Operations Procurement Operations Receipt/Warehousing/Issues	SUPPLY SUPPORT Admin Operations Supply Management Local Procurement Storage Operations Preservation/Storage Receipt/Storage/Issue	Base Operations (.B0000)
INTERMEDIATE LEVEL MAINT/MOD/ALT Major End Items Major Subassemblies Exchangeable Components	MAINTENANCE End Items (Includes 1, 2 & 3) Major Assemblies (Includes 1, 2 & 3) Exchangeable Components (Includes 1, 2 & 3) Other Maintenance Activities (Includes 1, 2 & 3) (1) Replenishment Spares Stock Fund Proc Appropriation (2) Labor (Civilian/Military) (3) Mod Materials Performance Safety Reliability and Maintainability	Base Operations (.C0000)
In-Theater/Organic/Base Transportation	TRANSPORTATION Second Destination Base Opns Transp To/From Depot	Base Operations (.D0000)
N/A	OTHER DIRECT	As Applicable
INDIRECT LOGISTICS PERSONNEL	PERSONNEL (INDIRECT)	P2, P7, P8 Base Operations
N/A	PERSONNEL REPLACEMENT	N/A
N/A	TRANSIENTS, PATIENTS & PRISONERS	N/A
N/A	MEDICAL	811130 Professional Trng (Med) 812110 Care in Def Facilities 812140 Care in Non Def Facilities (MEDICARE) 812150 Care in Non Def Facilities 812160 Other Medical Facilities
RPMA Maint/Repair of Real Property Utilities Minor Construction Other Engr Services	RPMA Maint/Repair of Real Property Utilities Minor Construction Other Engr Services	Base Operations (.J0000, .K0000, .L0000 & .M0000)
INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT	INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT	MCA and Proc Approp
OTHER LOGISTIC ACTIVITIES Laundries Printing Plants Etc.	OTHER INDIRECT: Laundries Printing Plants Other Base Logistic Services	P2, P7, P8 Base Operations

Table 2-7 (Continued)
(ORGANIZATIONAL, DS/GS LEVEL)

DOD STRUCTURE	LOGISTIC RESOURCES STRUCTURE	FYDP STRUCTURE
N/A	MILITARY PERSONNEL (CREW) Crew Pay and Allowances PCS	All Programs
POL Consumption Peacetime Ammo/Missile Consumption (Non-add)	POL TRAINING AMMO/MISSILES Unit Individual	
Supply Operations	SUPPLY SUPPORT LABOR	P2, P8 Base Operations
INTERMEDIATE LEVEL MAINT/MOD/ALT Major End Items Major Subassemblies Exchangeable Components UNIT/ORGANIZATIONAL LEVEL MAINT/MOD/ALT	MAINTENANCE Replenishment Spares Stock Fund Proc Appropriation Labor Mod Materials Performance Safety Reliability and Maintainability	All Mission and Base Operations Accounts
In-Theater/Organic/Base Trans	TRANSPORTATION	P2, P8 Base Operations
N/A	OTHER DIRECT	As Applicable
INDIRECT LOGISTICS PERSONNEL	PERSONNEL (INDIRECT)	P2, P8 Base Operations
N/A	PERSONNEL REPLACEMENT	N/A
N/A	TRANSIENTS, PATIENTS & PRISONERS	N/A
N/A	MEDICAL	811130 Professional Trng (Med) 812110 Care in Def Facilities 812140 Care in Non-Def Fac (MEDICARE) 812150 Care in Non-Def Facilities 812160 Other Medical Activities
INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT	INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT	MCA and Proc Approp (Non-add)
N/A	OTHER INDIRECT: Laundries Printing Plants Other Logistics Services	P2, P8 Base Operations

Chapter 3
STRUCTURE UTILIZATION

INTRODUCTION

The Logistic Resources Data Base Structure was presented and defined in Chapter 2. This chapter addresses the utilization of the structure and the computations required to develop each component. Presented herein is: (1) a discussion of how costs may be aggregated to achieve most meaningful results, (2) a list of representative logical questions which may be addressed by the structure, and (3) the full description of each algorithm used to compute structure components and subcomponents. Illustrative output formats for displaying logistic resource cost aggregations are found in Appendix A.

COMPONENT AGGREGATIONS

Once the required components (and subcomponents, if necessary) of operating, direct support and indirect support costs are "filled in" for each level, development of costs for specific weapon systems, units or functions will be possible via judicious selection and aggregation of applicable segments of the total composite structure. Examples of aggregations then possible include, but are not limited to, the following:

- The logistic support cost of a specified weapon system per year or per operating hour.
- The annual support costs (current, past or projected) incurred by a combat battalion pursuant to its mission.
- Support costs per year (current, past or projected) for all units of a particular type, or all units organic to a specified parent organization, such as a division.
- Logistic function costs applied to a specific weapon system, e.g., annual direct support maintenance expenditures for the OH-58A; or, <u>total</u> annual maintenance expenditures for that aircraft system.
- The annual cost (current, past or projected) for a particular logistic support function at a specified level, e.g., annual cost of supply support at Ft. Carson; or, <u>total</u> annual cost of international logistics at the wholesale level.

In other words, it will be possible to aggregate horizontally (i.e., across units for a given weapon system or logistic function, or across units of similar type) or vertically (i.e., across echelons of support for specified weapon systems or logistic functions) over past, current, or future time frames.

The concept of system-wide cost aggregation is illustrated in Fig. 3-1. The methodology to be used considers accumulation of costs incurred at the organizational, DS, and GS level with costs for installation level and wholesale level support. Basically, this is a modular approach, intended to be applicable at any level of support, for any weapon system or set of equipments, for specific units or groups of units, and for selected logistic functions.

When addressing a specific weapon system such as the M60 Tank, the cost for operation and support thereof might be illustrated as has been done in Fig. 3-1. There are identifiable elements of operating cost associated with the tank; similarly, direct support costs can be associated with it (shown collectively as the shaded areas in the figure). In addition, a combat battalion, even though it may be an armored batallion in an armored division, has other equipment besides tanks, and these other equipments also experience operating and direct support costs, as shown by the cross-hatched areas. Finally, those costs that are not directly related or relatable to any specific weapon system (termed indirect costs) are shown in the unshaded sections of the illustration.

Those support cost elements that are directly related to (and directly relatable to) a weapon system being addressed, or to other weapon systems owned by the unit, are such things as organizational maintenance, supply support, and second destination transportation. These elements constitute, by definition, logistic functions. Indirect costs cover such items as facilities, utilities, and overhead personnel (such as the batallion commander and members of his

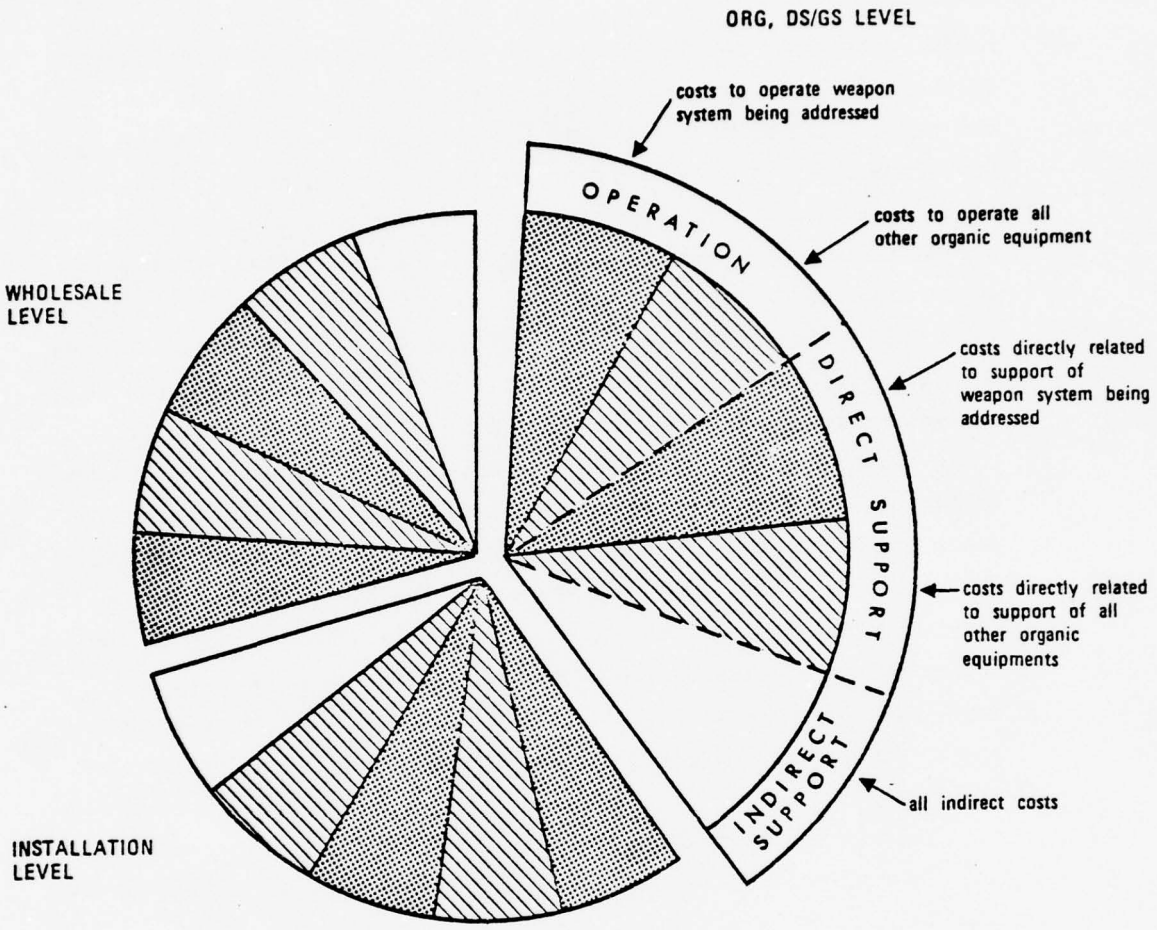


Figure 3-1 Illustration of System-Wide Cost Aggregation

staff). Even though these costs exist only because of the existence of the unit, its mission, and its principal weapon systems, they are not readily allocable to specific weapons. Two options are therefore apparent when costs are aggregated: (1) consider indirect costs as a separate category, never allocable to a specific weapon system or logistic function, but always carried forward during data aggregation as a part of the overall cost for the unit, or (2) apportion indirect costs across weapon systems owned in proportion to end item density, miles traveled, rounds fired, weighted importance of the weapon system to the unit's mission, or some combination of these. There are difficulties inherent in either approach. A third option, in which all costs for other equipments and all indirect costs are simply equally divided among all major equipments (such as M60 tanks) in a battalion, was discarded for two reasons: (1) in some areas it is difficult, if not impossible, to decide which type of equipment constitutes the principal weapon system in a given unit, and (2) this third option would equate unit costs to weapon system costs, which clearly would circumvent the intent of the work statement.

The first option is preferred. However, all costs are intended to be mutually exclusive and, when added, to yield the total support cost for a unit.

REPRESENTATIVE QUESTIONS

A critical question posed in the determination of logistic resource costs is the relationship between the logistic resources data base structure components and candidate methods of aggregating and displaying component-related costs. With but few exceptions (e.g., POL and Training Ammo/Missiles), the data base structure

components are primarily descriptors of logistic support functions. The question then is one of logically aggregating costs associated with these functions in such a way as to provide potential users of the data base structure with the capability of addressing a variety of queries concerning logistics resource consumption.

Table 3-1 portrays the relationship of data base components, i.e., logistic functions or subfunctions to: (1) specific levels of the Army logistical support system, and (2) examples of specific kinds of aggregations potentially available and/or desirable.

An extensive set of questions (referenced by the numbers 1 through 37 shown in the main body of the table) that might arise with regard to logistic resource consumption has been framed with the objective of illustrating how logistic cost data could be aggregated to respond to queries regarding logistical costs associated with:

1. Weapon systems (or other end items of equipment).
2. Support of various types of units or activities.
3. Various functions associated with weapon systems and/or units.
4. Any combination of the above.

For the sake of thoroughness, several questions (e.g., questions 1, 2, and 5) have been included that the GRC study team has defined as "improbable" questions. These are related to identification of logistics resources by specifically identified weapon systems or units, i.e., the level of aggregation is by serial numbered weapon systems or individually designated units (e.g., 3/32d Armored Battalion).

Admittedly it is impossible to compile a list of "logical" questions envisioning every permutation and/or combination of weapon

Table 3-1

REPRESENTATIVE QUESTIONS

FUNCTION	SPECIFIED FUNCTION OR SUBFUNCTION (e.g., MAINTENANCE)														
LEVEL	ORGANIZATIONAL			DS AND/OR GS					ORG+DS+GS	INSTALLATION		ORG+DS+GS+INST	WHOLESALE		ORG+DS+GS+INST+WHS
AGGREGATION DESIRED	Specified ORG	Specified *Group Of* ORGS	All ORGS	Specified Unit	Specific Type of Maint			Total *DS/GS*	Total ORG/DS/GS	Specified Installation	All Installations	Total ORG/DS/GS/INST	Specified *Depot*	All Depot	Total ORG+DS+GS+INST+WSLE
					Aviation	Missile	Other								
EXAMPLE	3/32d Armd Bn	All Armd Bns in 3d Armd Div	Σ ORGS	122d DS Maint Bn	All DS Avn Maint Cos.	All GS Msl Maint Cos.	All GS Avn/Msl Maint Cos	Σ DS/GS	Σ ORG/DS/GS	Ft. Carson	Σ INSTS	Σ ORG/DS/GS/INST	Anniston Army Depot	Σ Depots	Σ ORG/DS/GS/INST/WSLE
Specific Serial Numbered Weapon System	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Specific Type of Weapon System (e.g., M60 Tank)	2	3	4	5	6	6a	6b	6c	7	8	9	10	11	12	13
Unit	14	15	16	17	18	18a	18b	18c	19	20	21	22	23	24	25
Program & PE	26	27	28	29	30	30a	30b	30c	31	32	33	34	35	36	37

system/unit/PE/function. Table 3-1 is intended to highlight those queries most likely to be asked by the Congress, OSD, or DA authorities.

An important facet of logistic resource consumption is the time to be considered for costing purposes. The list of questions compiled by the GRC study team is based on "annual" costs. Depending on the specific question posed, time may consist of one or more year(s) as noted below:

1. Prior year(s) - Actual expenditures or previously budgeted for resource costs.

2. Current year - Expenditures consumed during the current year or the current year budget figure.

3. Future year(s) - Anticipated expenditures or programmed resources.

1. Improbable question. The cost of a specified function or subfunction aggregated for a specific weapon system identified by serial number.

Example: What is the annual organizational maintenance cost to support M60 tank, serial number 123456, assigned to the 3/32d Armored Battalion?

Remarks: It is improbable that logistics resource cost analysts at DA or OSD level would ever require function-related cost data down to this level of detail, i.e., a logistical support cost tied to a specific serial numbered weapon system.

2. Improbable question. The cost of a specified function or subfunction aggregated for a specific type of weapon system assigned to a specifically identified organizational unit.

Example: What is the annual organizational maintenance cost to support all M60 tanks assigned to the 3/32d Armored Battalion?

Remarks: It is improbable that this level of detail would ever be required, i.e., functional cost data tied to a specific

type of equipment assigned to a particular unit. Much more probable would be a requirement to ascertain the "average" cost of a function for an "average" unit possessing a specific type of weapon system.

3. Logical question. The cost of a specified function or subfunction for all weapon systems of a specific type aggregated for a specified group of organizational units.

Example: What is the annual organizational maintenance cost for M60 tanks aggregated for all armored battalions in the 3d Armored Division?

4. Logical question. The cost of a specified function or subfunction for all weapon systems of a specific type aggregated for all organizational units worldwide.

Example: What is the annual organizational maintenance cost for all M60 tanks aggregated for all organizational units worldwide.

5. Improbable question. The cost of a specified function or subfunction for all weapon systems of a specific type aggregated for a specifically identified support unit.

Example: What is the annual direct support maintenance cost aggregated for all M60 tanks supported by the 122d DS Maintenance Battalion?

Remarks: It is improbable that this level of detail would be required, i.e., a functional cost for a particular type of equipment tied to a specifically identified support unit. A more logical requirement would be the determination of a functional cost for a specific type of weapon system based on an "average" of several support units.

6. Logical question. The cost of a specified function or subfunction for all weapon systems of a specific type aggregated for a specific type of support unit worldwide.

Example: What is the annual direct support maintenance cost for AH-1 COBRA helicopters aggregated for all DS aviation maintenance companies worldwide?

6a. Example: What is the annual general support maintenance cost for the IMPROVED HAWK missile system aggregated for all GS missile maintenance companies worldwide?

6b. Example: What is the annual direct or general support maintenance cost for M60 tanks aggregated for all DS or GS maintenance units supporting this weapon system worldwide?

6c. Example: What is the annual direct and general support maintenance cost aggregated for all M60 tanks worldwide?

7. Logical question. The cost of a specified function or subfunction for a specific type of weapon system aggregated for separate levels of the Army logistics system.

Example: What is the annual cost of organizational, DS and GS maintenance aggregated for all M60 tanks worldwide?

8. Logical question. The cost of a specified function or subfunction for a specific type of weapon system aggregated for a specific installation.

Example: What is the annual cost of installation level maintenance for the M60 tank at Ft Carson?

9. Logical question. The cost of a specified function or subfunction for a specific type of weapon system aggregated for all installations worldwide.

Example: What is the annual cost of installation level maintenance for the M60 tank aggregated for all installations worldwide?

10. Logical question. The cost of a specified function or subfunction for a specific type of weapon system aggregated for various levels of the Army logistics system.

Example: What is the annual cost of organizational, DS, GS and installation level maintenance for all M60 tanks worldwide?

11. Logical question. The cost of a specified function or sub-function for a specific type of weapon system aggregated for a specific depot or other wholesale level support activity.

Example: What is the annual cost of depot level maintenance aggregated for M60 tanks processed at Anniston Army Depot?

12. Logical question. The cost of a specified function or sub-function for a specific type of weapon system aggregated for all depots or other wholesale level support activity worldwide.

Example: What is the annual cost of depot level maintenance for M60 tanks aggregated for all depots that support the M60 worldwide?

13. Logical question. The cost of a specified function or sub-function for a specific type of weapon system aggregated for various levels of the Army logistics system.

Example: What is the annual cost of organizational, DS, GS, installation and depot level maintenance aggregated for all M60 tanks worldwide?

14. Improbable question. The cost of a specified function or sub-function aggregated for all equipment organic to a specifically identified organizational unit.

Example: What is the annual cost of organizational maintenance aggregated for all equipment organic to the 3/32d Armored Battalion?

Remarks: It is improbable that this level of detail would ever be required at DA or OSD level. A more logical question would be the "average" annual organizational maintenance cost for an "average" armored battalion.

15. Logical question. The cost of a specified function or sub-function aggregated for all equipment organic to a specified group of organizational units.

Example: What is the annual cost of organizational maintenance aggregated for all armored battalions in the 3d Armored Division?

16. Logical question. The cost of a specified function or sub-function aggregated for all organizational units worldwide.

Example: What is the annual cost of organizational maintenance aggregated for all units worldwide?

17. Improbable question. The cost of a specified function or sub-function aggregated for a specifically identified support unit.

Example: What is the annual cost of direct support maintenance for all equipment supported by the 122d DS Maintenance Battalion?

Remarks: It is improbable that this level of detail would ever be required at DA or OSD level. A more logical question would be the "average" cost of DS maintenance for all equipment supported by an "average" DS maintenance unit.

18. Logical question. The cost of a specified function or sub-function aggregated for all support units of a specified type world wide.

Example: What is the annual cost of direct support maintenance aggregated for all DS aviation maintenance companies worldwide?

18a. Example: What is the annual cost of general support maintenance aggregated for all GS missile maintenance companies worldwide?

18b. Example: What is the annual cost of DS or GS maintenance aggregated for all DS or GS maintenance companies worldwide, excluding aviation and missile support units?

18c. Example: What is the annual cost of DS and GS maintenance aggregated for all DS and GS maintenance activities worldwide?

19. Logical question. The cost of a specified function or sub-function aggregated for all units at separate levels of the Army logistics system.

Example: What is the annual cost of all organizational, DS and GS maintenance aggregated worldwide?

20. Logical question. The cost of a specified function or sub-function aggregated for a specifically identified installation.

Example: What is the annual cost of all installation level maintenance performed at Ft Carson?

21. Logical question. The cost of a specified function or sub-function aggregated for all installations worldwide.

Example: What is the annual cost of all installation level maintenance aggregated for all installations worldwide?

22. Logical question. The cost of a specified function or sub-function aggregated for all units at various levels of the Army logistics system.

Example: What is the annual cost of all organizational, DS, GS, and installation level maintenance aggregated worldwide?

23. Logical question. The cost of a specified function or sub-function aggregated for a specifically identified depot or other wholesale level support activity.

Example: What is the annual cost of all depot level maintenance performed at the Anniston Army Depot?

24. Logical question. The cost of a specified function or sub-function aggregated for all depots or other wholesale level support activities.

Example: What is the annual cost of all depot level maintenance performed at the wholesale level aggregated worldwide?

25. Logical question. The cost of a specified function or sub-function aggregated for all units at various levels of the Army logistics system.

Example: What is the annual cost of all organizational, DS, GS, installation and wholesale level maintenance aggregated worldwide?

26. Improbable question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system assigned to a specifically identified unit, or (2) a specifically identified organizational unit.

Example (1): What is the annual cost of organizational maintenance to support all M60 tanks organic to the 3/32d Armored Battalion; identified by AMSCO?

Example (2): What is the annual cost of organizational maintenance to support all equipment organic to the 3/32d Armored Battalion; identified by AMSCO?

Remarks: It is improbable that this level of detail would ever be required by logistics resource cost analysts at DA or OSD level.

27. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system organic to a specified group of organizational units, or (2) a specified group of organizational units.

Example (1): What is the annual cost of organizational maintenance to support all M60 tanks organic to all armored battalions in the 3d Armored Division; identified by AMSCO?

Example (2): What is the annual cost of organizational maintenance for all armored battalions in the 3d Armored Division; identified by AMSCO?

28. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system organic to all organizational units worldwide, or (2) all organizational units worldwide.

Example (1): What is the annual cost of organizational maintenance for the M60 tank aggregated for all organizational units worldwide; identified by AMSCO?

Example (2): What is the annual cost of organizational maintenance for all organizational units worldwide; identified by AMSCO?

29. Improbable question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system supported by a specifically identified support unit, or (2) a specifically identified support unit.

Example (1): What is the annual direct support maintenance cost for M60 tanks supported by the 122d DS Maintenance Battalion; identified by AMSCO?

Example (2): What is the annual direct support maintenance cost aggregated for all equipment supported by the 122d DS Maintenance Battalion; identified by AMSCO?

Remarks: It is improbable that this level of detail would ever be required. A more logical question would be: what is the "average" DS maintenance cost for the M60 tank or what is the cost of maintenance support provided by the "average" DS maintenance unit?

30. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system supported by all support units of a specified type, or (2) all support units of a specified type.

Example (1): What is the cost of direct support maintenance for the AH-1 COBRA helicopter aggregated for all DS aviation maintenance companies worldwide; identified by AMSCO?

Example (2): What is the cost of direct support maintenance aggregated for all DS aviation maintenance companies worldwide; identified by AMSCO?

30a. Example (1): What is the cost of general support maintenance for the IMPROVED HAWK missile system aggregated for all GS missile maintenance companies worldwide; identified by AMSCO?

Example (2): What is the cost of general support maintenance aggregated for all GS missile maintenance companies worldwide; identified by AMSCO?

30b. Example (1): What is the annual cost of direct or general support maintenance for the M60 tank aggregated worldwide; identified by AMSCO?

Example (2): What is the annual cost of direct or general support maintenance aggregated for all DS or GS maintenance units (excluding aviation and missile units) worldwide; identified by AMSCO?

30c. Example (1): What is the annual cost of direct and general support maintenance for M60 tanks aggregated worldwide; identified by AMSCO?

Example (2): What is the annual cost of direct and general support maintenance aggregated for all DS and GS maintenance units worldwide; identifed by AMSCO?

31. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system supported at various levels of the Army logistics system, or (2) various levels of the Army logistics system.

Example (1): What is the annual cost of organizational, direct and general support maintenance for the M60 tank worldwide; identified by AMSCO?

Example (2): What is the annual cost of organizational, direct and general support maintenance for all equipment supported at these levels worldwide; identified by AMSCO?

32. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system at a specified installation, or (2) a specified installation.

Example (1): What is the annual cost of installation level maintenance for M60 tanks at Ft Carson; identified by AMSCO?

Example (2): What is the annual cost of installation level maintenance for all equipment at Ft Carson; identified by AMSCO?

33. Logical question. The cost of a specified function or subfunction aggregated for: (1) a specific type of weapon system supported at installation level worldwide; or (2) all installations worldwide.

Example (1): What is the annual cost of installation level maintenance to support the M60 tank worldwide: identified by AMSCO?

Example (2): What is the annual cost of installation level maintenance for all equipment worldwide; identified by AMSCO?

34. Logical question. The cost of a specified function or subfunction aggregated for: (1) a specific type of weapon system supported at various levels of the Army logistics system, or (2) various levels of the Army logistics system.

Example (1): What is the annual cost of organizational, direct, general support and installation level maintenance for the M60 tank worldwide; identified by AMSCO?

Example (2): What is the annual cost of organizational, direct and general support and installation level maintenance for all equipment worldwide; identified by AMSCO?

35. Logical question. The cost of specified function or subfunction aggregated for: (1) a specific type of weapon system supported by a specified depot or other wholesale level support activity, or (2) a specified depot or other wholesale level support activity.

Example (1): What is the annual cost of depot level maintenance for the M60 tank at Anniston Army Depot; identified by AMSCO?

Example (2): What is the annual cost of depot level maintenance for all equipment processed by Anniston Army Depot; identified by AMSCO?

36. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system supported by all depots or other wholesale level support activity, or (2) all depots or other wholesale level support activities worldwide.

Example (1): What is the annual cost of depot level maintenance for the M60 tank aggregated for all depots worldwide; identified by AMSCO?

Example (2): What is the annual cost of depot level maintenance aggregated for all Army depots worldwide; identified by AMSCO?

37. Logical question. The cost of a specified function or sub-function aggregated for: (1) a specific type of weapon system supported by various levels of the Army logistics system, or (2) various levels of the Army logistics system.

Example (1): What is the annual cost of organizational, direct and general support, installation and wholesale level maintenance for the M60 tank worldwide; identified by AMSCO?

Example (2): What is the annual cost of all organizational, direct and general support, installation and wholesale level maintenance worldwide; identified by AMSCO?

RESOURCE COMPONENT ALGORITHMS

Introduction

The individual Logistic Resources Data Base Structure components and related algorithms are discussed in this section. In each case, the basic algorithm is described and presented. It is intended that the analyst using the algorithms will apply, where required, the following two elements: population size (equipment density, number of units, etc.) and number of years projected. The equipment population, for example, could range from the entire Army-wide inventory of operational equipments to a specified equipment type within a battalion. The analyst must enter the number of years needed to achieve the desired projection of logistic resource costs.

The algorithms have been segregated into three levels in accord with the data base structures described earlier (see Chapter 2): (1) organizational, DS/GS, (2) installation and (3) wholesale (commodity command/depot). As each level is addressed, the discussion will focus on those components and data elements unique to that level (and higher levels if the component is basically the same) not those already described for a previous level. In a few cases particular data elements may differ; these are discussed where appropriate.

Insofar as possible, the algorithms have been designed to provide on an average annual basis: (1) a per equipment (i.e., weapon system) cost, (2) a per unit (i.e., all equipment organic to unit) cost and (3) wherever appropriate a function cost (i.e., total average annual cost) for operating and direct support components.*

Indirect support costs are, for the most part, computed on an average annual basis to provide: (1) a per unit cost and/or a total average annual cost for the logistic function.* No attempt has been

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*Certain component functions may be costed on a total annual basis when "actual" cost data is available.

made to apportion indirect support costs to weapon systems because of the inherent difficulty and impreciseness of such approtionment.

Table 3-2 lists all of the logistic resource components, the level at which each is applicable and the kinds of algorithms (i.e., weapon system, unit and/or function) developed by the study for the component.

Relationship Between DA PAM 11-4 and the Data Base Structure

Care has been taken to ensure that the cost components and subcomponents comprising the Logistic Resources Data Base Structure are compatible with the cost elements described in the "Operating and Support Cost Guide for Army Materiel Systems," DA PAM 11-4.[1-6] Table 3-3 arrays the cost elements of DA PAM 11-4 against related Logistic Resources Data Base Structure components/subcomponents.

Guide to Use of the Algorithms

It is impossible to attempt to describe in detail the use of the algorithms for all conceivable circumstances. Rather, this general guideline is intended to establish the proper orientation for effective utilization of the structure, its components, and their attendent algorithms.

The potential user must first clearly define the problems. Limits, constraints and scope must be applied. Is the question Army-wide or restricted to a particular level only? Does the question pertain to a functional cost or a horizontal aggregation across functions? Examples of concise, well-defined questions are presented in the preceding section entitled "Representative Questions."

Based on the clear formulation of the question, selection of the applicable configuration of the structure, or components thereof, must then be made. Admittedly, this process is more difficult than implied by the mere statement of its doing. However, each question is a separate case which must be considered individually. The examples presented in the section at the end of this chapter entitled "Hypothetical Application of Logistic Resource Costing Technique" should prove helpful in illustrating how a solution is formulated. Familiarity with the structure components and a logical approach to application of data elements to the issue to be resolved are the best guidelines for establishing the appropriate framework to be used.

Table 3-2

LOGISTIC RESOURCES DATA BASE STRUCTURE
COMPONENTS AND RELATED COST AGGREGATION ALGORITHMS

Structure component/cost aggregation algorithms	Applicable level		
	Org/DS/GS	Instl	Wholesale
MILITARY PERSONNEL (Crew)			
Weapon system	X	X	
Unit	X	X	
POL			
Weapon system	X	X	
Unit	X	X	
TRAINING AMMO/MISSILES			
Weapon system	X	X	
Unit	X	X	
SUPPLY SUPPORT (Labor)			
Weapon system	X	X	
Unit	X	X	
Function	X	X	X
MAINTENANCE			
Weapon system	X	X	X
Unit	X	X	
Function	X	X	X
TRANSPORTATION			
Weapon system	X	X	
Unit	X	X	
Function	X	X	X
PROCUREMENT			
Function			X
OTHER DIRECT			
Weapon system	X	X	
Unit	X	X	
Function	X	X	X
PERSONNEL (INDIRECT)			
Unit	X	X	X
Function			X
PERSONNEL REPLACEMENT			
Weapon system	X	X	
Unit	X	X	
Function			X
TRANSIENTS, PATIENTS & PRISONERS			
Function			X
MEDICAL			
Weapon system	X	X	
Unit	X	X	X
Function			X
INVESTMENT IN LOG FACILITIES/EQUIP			
Unit	X	X	
Function	X	X	X
OTHER INDIRECT LOGISTIC SERVICES			
Unit	X	X	
Function	X	X	X
RPMA			
Unit		X	
Function		X	X
INTERNATIONAL LOGISTICS			
Function			X
INDUSTRIAL PREPAREDNESS			
Function			X
PORT OPERATIONS			
Function			X

Table 3-3

RELATIONSHIP BETWEEN DA PAM 11-4 COST ELEMENTS
AND THE LOGISTIC RESOURCES DATA BASE STRUCTURE

DA PAM 11-4	LOGISTIC RESOURCES DATA BASE STRUCTURE
OPERATING AND SUPPORT COST	OPERATING COST DIRECT SUPPORT COST INDIRECT SUPPORT COST
MILITARY PERSONNEL Crew Pay and Allowances Maintenance Pay and Allowances Indirect Pay and Allowances PCS	MILITARY PERSONNEL Crew Pay and Allowances Maintenance Labor (Military) PERSONNEL (Indirect) PCS*
CONSUMPTION Replenishment Spares POL Unit Training, Ammo/Missiles	Replenishment Spares POL TRAINING AMMO/MISSILES (Unit and Individual)
DEPOT MAINTENANCE Labor Materiel Transportation	DEPOT MAINTENANCE Direct Labor Replenishment Spares TRANSPORTATION (To/From Depot)
MODIFICATION, MATERIEL	Modification Materials
OTHER DIRECT SUPPORT OPERATIONS Maintenance Civilian Labor Other Direct	Maintenance Labor (civilian) OTHER DIRECT SUPPLY SUPPORT PROCUREMENT
INDIRECT SUPPORT OPERATIONS Personnel Replacement Transients, Patients and Prisoners Quarters, Maintenance and Utilities	PERSONNEL REPLACEMENT TRANSIENTS, PATIENTS AND PRISONERS RPMA Maintenance/Repair of Real Property Utilities Minor Construction Other Engineering Services
Medical Support Other Indirect	MEDICAL OTHER INDIRECT LOGISTIC SERVICES INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT INTERNATIONAL LOGISTICS INDUSTRIAL PREPAREDNESS PORT OPERATIONS

*PCS is a subcomponent of all personnel costs, both civilian and military.

Given that the various components from the appropriate level(s) have been established, it is now a straightforward task to select the corresponding algorithms. The sections on algorithms very clearly define the algorithm requirements and relationships and (along with the examples referred to above) are quite self-explanatory.

The analyst must now provide any related parametric data. Depending on the algorithm, parameteric data may be the number of equipments in the population, years costed, personnel served, etc. These factors may be addressed as past, present, or projected, thus developing historic, current, or outyear costs from the same basic algorithm.

Projection of logistic resource consumption costs may be achieved in either of two ways. A simple extrapolation technique may be applied to historical or current year costs (i.e., derived costs multiplied by number of years projected)* or the analyst may substitute projected data for "actual" data (e.g., number of equipments or personnel authorized projected for outyears instead of present distribution or end strength).

The remaining algorithm elements are derived from source data or, in a few cases, other algorithms. If source data is to be used, the system or report containing the information has been identified. Algorithms used as a data source have been cross-referenced for user's convenience. Actual values are then inserted into the algorithm and the indicated computations made to arrive at a cost figure for that particular component/subcomponent.

Once each algorithm has been computed, aggregation of the costs per the structure and scope previously outlined yields the total cost for the logistic resource being costed. The results of these computations might be arrayed in an applicable display shown in Appendix A.

In summary, a step-by-step approach to the development of logistic resource costs using the Logistic Resources Data Base Structure would entail the following procedure.

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*A predetermined inflation or growth factor could be included.

Step 1. Identify the cost(s) to be determined.

a. Component/subcomponent

b. Level(s) of aggregation

c. Orientation (e.g., weapon system)

Step 2. Select appropriate algorithm(s) for computing component costs.

Step 3. Determine data sources.

a. Parametric (furnished by user)

b. Source data from identified system(s) and/or report(s).

c. Computations from other algorithms.

Step 4. Conversion of source data to conform to units of measure required by algorithm (not required in all instances).

Step 5. Perform algorithm computation.

a. Substitute numeric value for algorithm notations.

b. Perform indicated arithmetic operations.

Step 6. Accumulate costs as computed to develop total cost for aggregation identified in Step 1.

Step 7. Select the appropriate format to display computational results. Illustrative examples are provided in Appendix A.

The methodology described is demonstrated both narratively and graphically in the hypothetical costing examples at the end of this chapter. When the automatic system described in Chapter 6 is operational, it will only be necessary for the analyst to accomplish Steps 1 and 3a above.

COMPONENTS OF THE

ORGANIZATIONAL, DS/GS LEVEL

Component: MILITARY PERSONNEL (Crew)
(Organizational, DS/GS, and Installation levels)

Definition: The sum of costs for pay and allowances, theater costs and special pay of military personnel whose primary function is to operate the weapon system. Crew cost may be computed either on an actual or average annual basis.

Description:

Pay and allowances (P/A) includes the per man pay and allowances and theater costs and special pay of military personnel whose primary function is to operate the weapon system being costed (i.e., crew members). Crew special pay and allowances and overhead for additional persons on flight status who are not part of the crew are included in this cost. Special pay includes jump, flight, incentive, hazardous duty and combat pay. Special allowances include station and family separation allowances.

Annual pay and allowances may be computed using one of several alternative methods:

1. Utilize current Army-wide average annual pay and allowances figures for enlisted and officer grades. These figures are available for officers and enlisted personnel and by separate grade/rank.
2. Determine an average annual pay and allowance figure based on the crew's TOE grade structure with an assumed average length of service to attain various grades for longevity pay purposes.
3. Determine actual pay and allowances based on a representative sample of officers and enlisted men actually serving as crew members.

Permanent change of station (PCS) includes the costs associated with replacing personnel overseas and within Continental United States (CONUS). Average PCS costs for officer and enlisted personnel are available by type of move (reason) and to/from areas. PCS costs include dislocation allowance, travel costs of service member and dependents (including per diem), shipment of household goods, trailer allowance and non-temporary storage of household goods. Note that PCS cost used in the algorithm (below), is doubled because each replacement involves a man coming and a man going (two-way PCS costs are considered).

Rotation rate (RR) is defined as the percentage of annual officer and enlisted personnel turnover within specific theaters.

Number of crewmen (N_C) per equipment may be computed on an absolute basis (number of personnel carrying appropriate MOSs actually assigned to crew duties) or extracted from authorizations listed in appropriate unit TOEs and equipment field manuals (FMs).

Algorithm (Weapon System)

(1) Avg annual crew cost per equipment = $\left[(P/A) + (2 \times PCS \times RR)\right] \times N_C$

Where:
- P/A = pay and allowances, theater cost and special pay and allowances
- PCS = permanent change of station cost
- RR = rotation rate
- N_C = number of crewman per equipment

Algorithm (Unit)

(2) Avg annual crew cost per unit = $\sum_{i}^{i} (C_{E_i} \times N_{E_i})$

Where C_E = avg annual crew cost per equipment (of a specific type) as derived from the weapon system algorithm (1)

N_E = number of equipments (of a specific type -- requiring crew) organic to unit

Data Sources

Algorithm notation	Data source
P/A	FCIS(AFPCH) / STANFINS
C_E	Algorithm (1)
N_C	SACS (Pers) / TAADS / Unit TOE / Equipment FM
N_E	SACS (Log) / TAADS / CBS* / Unit TOE
PCS	FCIS(AFPCH)
RR	FCIS(AFPCH)

*Continuing Balance System

Data Limitations:

Pay and allowances displayed in the FCIS(AFPCH) does not include hazardous duty or combat pay.

AD-A038 347 GENERAL RESEARCH CORP MCLEAN VA OPERATIONS ANALYSIS DIV F/G 15/5
LOGISTIC RESOURCES DATA BASE STRUCTURE.(U)
JAN 77 O J HARRISON, J L BUFFAY, G LEBOVITZ MDA903-76-C-0114

UNCLASSIFIED OAD-CR-177 NL

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Component: POL
(Organizational, DS/GS and Installation levels)

Definition: **Petroleum, oils and lubricants (POL) include the costs associated with annual consumption of fuel (MOGAS, diesel fuel, AVGAS, jet fuel, rocket fuel, and missile propellants) and lubricants (oil, grease, brake and hydraulic fluids) by specific weapon/support system(s).**

Description:

Cost per gallon. Fuel is priced by contract according to the installation and number of delivery points at the installation. First destination transportation (and, in some cases, second destination transportation) is included in the pump price. Since the cost varies by installation, the budget price that reflects an Army-wide average should be used. POL cost does not include the personnel and facilities costs involved in its distribution, as these are funded from mission accounts of the distributing organizations/activities.

Average miles per gallon or operating hours per gallon (MPG/OHPG). To compute the average fuel consumption per mile traveled or hour operated, actual consumption data may be used if available. Where empirical consumption data are not available, POL costs could be prorated based upon end item densities or mileage/flying hour/operating hour data. Fuel consumption figures from technical manuals (TMs) and other technical specifications might also be used.

Average usage factor (F). A usage factor must be applied to derive the POL costs for a specified period of time for use in program development. This factor will usually be the annual miles traveled or hours operated per equipment.

Algorithm (Weapon System)

(3) Avg annual POL cost per equipment = [(cost per gallon) ÷ (MPG/OHPG)] x F

Where: MPG/OHPG = avg miles per gallon or operating hours per gallon
F = avg factor, e.g., annual miles traveled or hours operated per equipment.

Algorithm (Unit)

(4) Avg annual POL cost per unit = $\sum_{i}^{i} (C_{E_i} \times N_{E_i})$

Where: C_E = avg annual POL cost per equipment as derived from the weapon system algorithm (3)

N_E = number of equipments (using POL) organic to unit

Data Sources

Algorithm notation	Data source
cost per gallon	Defense Fuel Supply Center Price Bulletin
C_E	Algorithm (3)
F	CCSS / SDC / TAMMS
MPG/OHPG	Equipment TM / Technical specifications or empirical data
N_E	SACS(Log) / TAADS / CBS* / Unit TOE

*Continuing Balance System

Data Limitations:

It is recognized that the POL algorithm does not include provision for oil and lubricant costs. This omission is due primarily to the fact that no convenient source of this information is available and secondarily to the fact that these costs are relatively insignificant compared to fuel consumption costs. The terminology POL was retained, in lieu of merely fuel, due to the common usage of POL to signify (primarily) fuel. Oil and lubricant consumptions are commonly factored based on the number of gallons of related fuel consumed, i.e., aviation lubricants are related to aviation fuels and motor oils are related to motor gas consumed (see FM 101-10).

Component: TRAINING AMMUNITION AND MISSILES
(Organizational, DS/GS and Installation levels)

Definition: The costs associated with ammunition and missiles consumed by a specified weapon system during annual unit and individual firing. Costs for missiles consumed during training will not be included in this component if they are costed as additional procurement in the Investment Recurring category of Procurement Appropriations.

Description:

Number of rounds/missiles (N_R) will be based on authorization allowances (per weapon or individual) as prescribed in the Common Table of Allowances (CTA) 23-100-6.

Cost per round/missile will be the most recently published official price, e.g., the current Army Master Data File (AMDF) unit price.

Algorithm (Weapon System)

(5) Avg annual training ammo/missile cost per weapon $= (N_{R_W} \times C_{R_W}) + (N_{R_I} \times C_{R_I}) \times N_C$

Where: N_{R_W} = number of rounds/missiles authorized per weapon

C_{R_W} = cost per round/missile

N_{R_I} = number of rounds authorized per individual

C_{R_I} = cost per round

N_C = number of crewmen per weapon system

Algorithm (Unit)

(6) Avg annual training ammo/missile cost per unit = $\sum_{i}^{i} (C_{W_i} \times N_{W_i})$

Where: C_W = avg annual training ammo/missile cost per weapon as derived from algorithm (5)

N_W = number of weapons organic to unit

Data Sources

Algorithm notation	Data source
C_{R_I}	AMDF
C_{R_W}	AMDF
C_W	Algorithm (5)
N_C	SACS(Log) / TAADS / Unit TOE / Equipment FM
N_{R_I}	CTA 23-100-6
N_{R_W}	CTA 23-100-6
N_W	SACS(Log) / TAADS / CBS* / Unit TOE

*Continuing Balance System

Component: SUPPLY SUPPORT LABOR
(Organizational, DS/GS level)

Definition: Supply support labor costs are defined as the direct labor personnel costs incurred by organizational, direct or general support units in providing supplies and equipment to supported customer units, functional activities or equipment. Supply support functions include requisitioning, receipt, storage and issuance of supplies and equipment.

Description:

Annual salary and benefits for military personnel (ASB_M) includes all elements of military personnel expense as discussed under the component MILITARY PERSONNEL (Crew), including annual pay and allowances and PCS, on a per person basis.

Annual salary and benefits for civilian personnel (ASB_C) includes all elements of civilian labor costs including annual pay and allowances (including overtime) and PCS on a per person basis.

Because of the inherent difficulty of identifying and relating supply support costs to particular weapon systems, it is recognized that some form of cost apportionment may be necessary.

An apportionment factor (F) may be developed using any of several alternative methods:

1. End item density -- the ratio of number of equipments of the type being addressed to total number of equipments of all types comprising the population supported.
2. Reportable major component ratio -- the quantity or dollar value of reportable major components replaced on a specific equipment type versus the quantity or dollar value of reportable major components replaced for all types of equipments.

3. Actual workload factors -- inclusion of a weapon system/end item code on all requisitions (not only high priority) would provide data indicating workload imposed by supply support of each weapon system/end item type. Such factors could be developed via samples and extrapolated to the entire population.
4. Usage -- ratio of annual miles traveled/hours operated/rounds fired, etc. of the weapon system being analyzed versus miles/hours/rounds for all equipments.
5. Dollar value of weapon system -- ratio to total dollar value of all equipments.
6. Direct labor maintenance manhours -- ratio of direct labor maintenance manhours per equipment recorded for weapon system addressed to total manhours per equipment recorded for all equipments.

Algorithm (Weapon System)

(7) Avg annual supply support labor cost per equipment $= [(N_M \times ASB_M) + (N_C \times ASB_C)] \times F \div N_E$

Where:
N_M = number of military direct labor personnel assigned to the supply support function.
ASB_M = annual salary and benefits for military personnel (avg per person)
N_C = number of civilian direct labor personnel assigned to the supply support function
ASB_C = annual salary and benefits for civilian personnel (avg per person)
F = apportionment factor
N_E = number of equipments

Algorithm (Unit)

(8) Avg annual cost of supply support labor per unit = $(N_M \times ASB_M) + (N_C \times ASB_C)$

Where:
- N_M = number of military direct labor personnel assigned to the supply support function
- N_C = number of civilian direct labor personnel assigned to the supply support function
- ASB_M = annual salary and benefits for military personnel (avg per person)
- ASB_C = annual salary and benefits for civilian personnel (avg per person)

Algorithm (Function)

(9) Avg annual cost of supply support = $\sum C_{ss}$ (of all organizational, DS/GS units)

Where: C_{SS} = annual supply support labor cost (see algorithm (8)).

Data Sources

Algorithm notation	Data source
ASB_C	CBS* / STANFINS / CIVPERSINS
ASB_M	FCIS(AFPCH) + MOSB / STANFINS
C_{SS}	Algorithm (8)
F	DSU/GSU system or other factors as appropriate
N_C	TAADS / Unit TDA
N_E	SACS(Log) / TAADS / CBS** / Unit TOE
N_M	SACS(Pers) / TAADS / Unit TOE

*Civilian Budgeting System

**Continuing Balance System

Data Limitations:

The primary problem facing the cost analyst attempting to "cost-out" the supply support function for a weapon system is selection and application of an appropriate apportionment factor (see "Description") from several alternative methods available. Application of a factor based on end item density offers the most convenient approach.

Component: MAINTENANCE
(All levels)

Definition: Maintenance is the function of sustaining materiel in an operational status (including preventive maintenance), restoring it to serviceable condition, or updating/upgrading its functional utility through modifications. Maintenance includes materials cost associated with the installation of replenishment spares, subassemblies, etc. and modification materials, and direct labor costs. Direct labor maintenance personnel are those military and civilian personnel engaged in, assigned to perform, or assigned direct supervisory control of maintenance functions.

Each of the major subcomponents of maintenance will be addressed initially as a separate algorithm, and then as part of the overall MAINTENANCE algorithm. A separate MAINTENANCE algorithm is presented for each level, in order to accomodate those subcomponents and elements peculiar to the level addressed. This necessitates "blocking out" certain non-add elements when developing Army-wide (tri-level) maintenance costs.

Subcomponent: Replenishment Spares
(All levels)

Definition: This subcomponent includes SF and PA funded items used to accomplish maintenance of equipment at the level addressed. Most, but not all, SF items are consumable. The cost implied for a consumable part is the unit price as reflected in the AMDF. Reparable parts cost may be either the unit price or the cost to return an unserviceable item to serviceable condition. If a mix of rebuilt and new components is applied, a factor may be used to reflect the applicable ratio.

Description:

Replenishment spares cost may be determined either by computation of actual cost of parts installed during equipment maintenance or via application of an apportionment factor to total annual parts cost for all equipments. Several methods are described below:

1. Reportable major component ratio -- the dollar value of reportable major components replaced on the specific equipment type being addressed versus the dollar value of reportable major components replaced for all types of equipments.
2. Dollar value of weapon system -- ratio to total dollar value of all equipments.
3. Direct labor maintenance manhours -- ratio of direct labor maintenance manhours per equipment recorded for weapon system being addressed to total manhours per equipment recorded for all equipments.
4. Develop a parts cost per maintenance manhour for all maintenance jobs, and multiply the result by number of direct maintenance manhours expended on the equipment type being addressed.

5. Various other apportionment techniques could be developed via combinations of supply workload, end item densities, usage rates, and all of the apportionment factors listed in 1 through 4 above.

The analyst may apply the average annual parts cost developed using the algorithm noted below to a lesser or greater equipment population (e.g., at another level) by multiplying the parts cost per equipment by the number of equipments to be costed. In some cases a factor may be necessary to accommodate anomalies in the data, e.g., parts issued per equipment to a division-size unit will not necessarily equal the parts issued per equipment to a battalion during the same period.

Number of equipments (N_E) in the population must be based upon an equivalent data base (e.g., parts data from a battalion must consider that battalion's equipment population).

Algorithm (Weapon System)

(10) Avg annual cost of parts per equipment (actual) $= C_{P_E} \div N_E$

Where: C_{P_E} = cost of parts installed on the equipment type being addressed (annual)

N_E = number of equipments supported

(11) Avg annual cost of parts per equipment (estimate) $= C_{P_{ALL}} \times F \div N_E$

Where: $C_{P_{ALL}}$ = cost of parts installed on all equipment types (annual)

F = apportionment factor

Algorithm (Unit)

(12) Avg annual cost of parts per unit $= \sum^{i} C_{P_i}$

Where: C_{P_i} = cost of parts installed on a weapon system (annual)

Data Sources

Algorithm notation	Data source
C_P	Algorithm (10) or (11)
$C_{P_{ALL}}$	SDC / TAMMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS / AMDF
C_{P_E}	SDC / TAMMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS / AMDF
F	See parts cost description
N_E	SACS(Log) / TAADS / CBS* / Unit TOE

*Continuing Balance System

Subcomponent: Maintenance Labor
(All levels)

Definition: Maintenance labor is expressed as the cost of direct military and civilian labor manhours expended or programmed for maintenance support of materiel.

Description:

The elements comprising military labor cost have already been discussed under MILITARY PERSONNEL (Crew). Civilian labor includes similar cost elements: basic pay and allowances (including overtime) and PCS. Hereafter, all elements of labor cost will be referred to collectively as annual salary and benefits (ASB).

Military direct labor cost is defined as the cost of military direct labor manhours expended on maintenance support. This cost is a function of the number of manhours expended and the annual salary/benefits of the personnel engaged in maintenance. Labor costs may be ascertained with reasonable accuracy by review of completed job orders. Since primarily manual records are available at below depot and installation levels, an approximation technique such as sampling may be required.

Civilian direct labor cost results from application of civilian direct labor manhours to provide maintenance support of a specific weapon system/end item. It is a function of the number of manhours expended and the annual salary/benefits of the civilian maintenance employees. Because of the nature of depot and installation level maintenance (the levels at which most civilian maintenance personnel are employed) it is possible to anticipate future labor costs as a result of programmed overhaul rebuild and modification projects. There exist at installation and depot levels various automated management systems from which accurate manhour and labor rate information are obtainable.

Average cost of a direct labor manhour (either military or civilian may be computed as shown in the "Direct Labor Manhour" algorithm.

Number of equipments (N_E) refers to the weapon systems/end items supported by the maintenance activity. This includes all specified equipments in the total supported population, e.g., all M60 Tanks in an armored battalion, not only the ones actually requiring maintenance.

Algorithm (Direct Labor Manhour)

(13) Avg cost of a direct labor manhour (military or civilian) = $ASB \div N_{HA}$

Where: ASB = annual salary and benefits of direct labor personnel (avg per person)

N_{HA} = number of hours available for duty (avg per person per year)*

Algorithm (Weapon System)

(14) Avg annual direct labor cost per equipment = $[(N_{MMH} \times C_{MMH}) + (N_{CMH} \times C_{CMH})] \div N_E$

Where: N_{MMH} = number of military direct labor manhours applied to a specific type of weapon system/end item

C_{MMH} = cost of a military direct labor manhour (avg per person)

N_{CMH} = number of civilian direct labor manhours applied to a specific type of weapon system/end item

C_{CMH} = cost of a civilian direct labor manhour (avg per person)

N_E = number of specific type equipments supported

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*The average work year is generally considered to be 2,080 manhours. MACRIT should be used for military personnel.

Algorithm (Unit)

(15) Avg annual cost of direct labor manhours per unit = $(MMH_{TOT} \times C_{MMH}) + (CMH_{TOT} \times C_{CMH})$

Where:
- MMH_{TOT} = total number of military direct labor manhours
- C_{MMH} = cost of a military direct labor manhour (avg per person)
- CMH_{TOT} = total number of civilian direct labor manhours
- C_{CMH} = cost of a civilian direct labor manhour (avg per person)

Data Sources

Algorithm notation	Data source
ASB (civilian)	CBS* / STANFINS / CIVPERSINS / CSFOR-78
ASB (military)	FCIS(AFPCH) + MOSB / STANFINS / CSFOR-78
C_{CMH}	Algorithm (13)
C_{MMH}	Algorithm (13)
CMH_{TOT}	SDC / TAAMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS
MMH_{TOT}	SDC / TAAMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS
N_{CMH}	SDC / TAMMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS
N_E	SAC(Log) / TAADS / CBS** / Unit TOE
N_{HA}	Empirical data or average of 2,080 hrs per year
N_{MMH}	SDC / TAMMS / TMCS / SMMS / IMMS / SAILS / CS_3 / CCSS

* Civilian Budgeting System
** Continuing Balance System

Subcomponent: Modification Materials
(All levels)

Definition: Parts, components, kits and materials used to accomplish alterations to fielded systems and equipments for the purpose of improving performance, safety, and/or reliability and maintainability. Alterations include modification work orders (MWOs), retrofits, conversions, remanufacture or engineering changes accomplished after acceptance of the equipment by the Army.

It is recognized that modification materials costs are chargeable to the commodity command. However, as is the case with parts and components, the cost of modification materials must be provided for at each level in order to permit development of weapon system and maintenance function costs at any given level.

Description:

Modifications (MODs) may be applied in any of several fashions:

1. At depot level where labor costs are chargeable to the appropriate commodity command.
2. At levels below depot where military labor costs incurred by installing organizations are chargeable to that organization, while any civilian labor changes are assumed by the commodity command.
3. At levels below depot using technical support contact teams. Any additional military labor is charged against the level at which installation is accomplished, while contact team labor and additional civilian labor are paid for by the commodity command.

Data pertaining to each active and completed MOD program are maintained at the Major Item Data Agency (MIDA). It is assumed that "roll-ups" of these data are possible to permit review of accomplished and pending MODs by equipment type.

In order to accurately project future MOD programs and their costs, the analyst must consider two distinct sets of data, i.e., MODs already accomplished and those projected for future years. Additionally, the analyst must remember that use of only the past year's experience, or use of any year or number of years not covering the entire fleet's life, may present a distorted picture of MOD costs. MODs generally tend to accumulate and be performed all at once (or in batches), i.e., one year may see several expensive MODs installed and then very little, if any, MOD work for long periods of time. To accomodate these surges of activity it is recommended that the analyst consider the entire MOD history of the weapon system plus known projected or anticipated MODs.

To display years of high activity and/or high dollar expenditures for MOD materials, the analyst should construct a distribution of MOD materials cost for each year of available historical data and each projected year. This distribution becomes the foundation for the basic algorithm. Table 3-4 illustrates a sample MOD distribution.

Information necessary for development of accurate MOD materials cost includes, on an annual basis:

1. Dollar value of materials cost for each separate MOD program, both projected and accomplished.
2. Number of individual MOD actions accomplished or projected for each program.
3. The cost of materials per MOD accomplished for each program.
4. Number of MODs unaccomplished in each program.
5. Number of equipments in fleet.
6. Total annual cost of MOD materials.
7. Total number of MODs accomplished during year.
8. Average materials cost per MOD accomplished or projected.

As depicted in the example shown in Table 3-4 orderly display of these data provides the analyst with an effective worksheet that

Table 3-4

SAMPLE DISTRIBUTION OF HISTORICAL/PROJECTED MODIFICATIONS
Weapon System "X"

Fiscal year (FY)	MOD	MODs projected		MODs accomplished		(e) Materials cost per MOD accomplished (c ÷ d)	(f) Number of MODs unaccomplished	(g) Number of equipments in fleet (N_{E_Y})	(h) Annual cost of modification materials (C_{MOD_Y}) $\Sigma(c)_Y$	(j) Annual MODs accomplished $\Sigma(d)_Y$	(k) Average materials cost per MOD (h ÷ j)
		(a) Total materials cost	(b) Number of MODs	(c) Total materials cost	(d) Number of MODs						
1972	——	-0-	-0-	-0-	-0-	-0-	-0-	1,000	-0-	-0-	-0-
1973	"A"	$100,000	500	$100,000	500	$200	-0-	1,000	$112,500	625	$180
	"B"	25,000	250	12,500	125	100	125				
1974	"B"	12,500	125	12,500	125	100	-0-	1,200	55,000	1,375	40
	"C"	50,000	1,000	37,500	750	50	250				
	"D"	5,000	500	5,000	500	10	-0-				
1975	"C"	12,500	250	12,500	250	50	-0-	1,400	37,500	1,250	30
	"E"	25,000	1,000	25,000	1,000	25	-0-				
1976	"F"	10,000	1,000	7,500	750	10	250	1,500	7,500	750	10
1977	"F"	2,500	250	2,500*	250*	10	-0-	1,500	2,500*	250*	10*
1978	——	-0-	-0-	-0-	-0-	-0-	-0-	2,000*	-0-	-0-	-0-

*Projected.

permits computation of alternative costs. Using historical/projected MODs, the analyst can provide:

1. Dollar value of materials and number of equipments involved in past MOD programs.
2. Annual and accrued MODs accomplished/projected, and their costs.
3. Actual cost of MOD materials per equipment.
4. Number of unaccomplished MODs and cost to complete them.
5. Carry-over of unaccomplished MODs from one year to another.
6. Projected MOD programs.

Algorithm (Weapon System) (completed MODs only)

(16) Avg annual MOD materials cost per equipment $= \left[\sum_{Y=1}^{N} \left(C_{MMA_Y} \div N_{E_Y}\right)\right] \div N$

Where: C_{MMA_Y} = cost of materials for MODs accomplished (by year)

N_{E_Y} = number of equipments in fleet both modified and not modified (by year)

N = number of years analyzed

Algorithm (Weapon System) (completed plus projected MODs)

(17) Avg annual MOD materials cost per equipment $= \left\{\left[\sum_{Y=1}^{N} \left(C_{MMP_Y} \div N_{E_Y}\right)\right] + \left[\sum_{Y=1}^{M} \left(C_{MMP_Y} \div P_{E_Y}\right)\right]\right\} \div N$

Where: C_{MMP_Y} = cost of materials for MODs projected (by year)

P_{E_Y} = projected number of equipments in fleet (by year)

M = number of years projected.

Algorithm (Unit)

(18) Avg annual MOD materials cost per unit $= \sum^{i} C_{MM_i}$

Where: C_{MM_i} = cost of materials for MODs as developed in algorithm (16) or (17) for a weapon system.

Data Sources

Algorithm notation	Data source
C_{MM}	Algorithm (16) or (17)
C_{MMA_Y}	CS_3 / MIDA / AMDF
C_{MMP_Y}	CS_3 / MIDA / AMDF
M	Furnished by analyst
N	Furnished by analyst
N_{E_Y}	CS_3 / MIDA Data Base*

*Source of status of modification program(s)

Component: MAINTENANCE
(Organizational, DS/GS level)

Definition: The sum of costs associated with replenishment spares, direct labor (military and civilian) and modification materials used to perform the maintenance function.

Algorithm (Weapon System)

(19) Avg annual maintenance cost per equipment $= C_P + C_L + C_{MM}$

Where: C_P = cost of parts per equipment (annual)

C_L = cost of labor (civilian and military) per equipment (annual)

C_{MM} = cost of MOD materials, average per equipment (either completed MODs only or completed plus projected; annual)*

Algorithm (Unit)

(20) Avg annual maintenance cost per unit $= C_{P_{ALL}} + C_{L_{ALL}} + C_{MM_{ALL}}$

Where: (21) $C_{P_{ALL}} = \sum^{i} C_{P_i}$

(22) $C_{L_{ALL}} = \sum^{i} C_{L_i}$

(23) $C_{MM_{ALL}} = \sum^{i} C_{MM_i}$

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*When computing functional cost Army-wide, the cost of MOD materials at commodity command only should be used. This total incorporates the cost of MOD materials applied at all lower levels.

Algorithm (Function)

(24) Avg annual organizational, DS/GS maintenance $= C_{P_{TOT}} + C_{L_{TOT}} + C_{MM_{TOT}}$

Where:

(25) $C_{P_{TOT}} = \sum_{units} C_{P_{ALL}}$

(26) $C_{L_{TOT}} = \sum_{units} C_{L_{ALL}}$

(27) $C_{MM_{TOT}} = \sum_{units} C_{MM_{ALL}}$*

Data Source

Algorithm notation	Data source
C_L	Algorithm (14)
$C_{L_{ALL}}$	Algorithm (22)
$C_{L_{TOT}}$	Algorithm (26)
C_{MM}	Algorithm (16) or (17)
$C_{MM_{ALL}}$	Algorithm (23)
$C_{MM_{TOT}}$	Algorithm (27)
C_P	Algorithm (10) or (11)
$C_{P_{ALL}}$	Algorithm (21)
$C_{P_{TOT}}$	Algorithm (25)

* When computing functional costs Army-wide the cost of MOD materials at commodity command only should be used. This total incorporates the cost of MOD materials applied at all levels.

Component: TRANSPORTATION
(Organizational, DS/GS level)

Definition: Transportation is the cost associated with transporting items to depot maintenance facilities and back to the operational units. Excluded are the costs of first and second destination transportation, which are included in the investment phase. Also excluded is the cost of transportation of equipment to and from training areas, and transportation of repair parts, secondary items, POL and ammo which is included in OTHER INDIRECT.

Description:

Percentage of equipments shipped (%ES) per year includes all movements of weapon systems/end items from a first or second destination location to a repair facility or depot.

Short-ton weight per equipment (W_E) is available from technical specification sheets or appropriate TMs.

Distance shipped (D) will be based on the official table of distances available for CONUS and overseas theaters (ARs 55-60 and 55-61).

Cost per ton-mile (C_{TM}) is available (by commodity group) from reports produced by the Military Traffic Management Command (MTMC). Note that if the distance (D) is expressed in terms other than miles, it will be necessary to convert ton-mile cost to the same unit of measure used for distance.

Algorithm (Weapon System)

(28) Avg annual intracommand transportation cost per equipment = $\%ES \times NE \times W_E \times D \times C_{TM}$

Where:
- $\%ES$ = percentage of equipments shipped per year
- N_E = number of equipments in population
- W_E = short-ton weight per equipment
- D = distance shipped
- C_{TM} = cost per ton-mile

Algorithm (Unit)

(29) Avg annual intracommand transportation cost = $\sum^{i} (C_{E_i} \times N_{E_i})$

Where:
- C_E = avg annual intracommand transportation cost per equipment as derived from algorithm (28)
- N_E = number of equipments organic to unit

Algorithm (Function)

(30) Avg annual cost of intracommand transportation = $\sum C_U$

Where:
- C_U = avg annual intracommand transportation cost as derived from algorithm (29)

Data Sources

Algorithm notation	Data source
C_E	Algorithm (28)
C_{TM}	MTMC Progress Report
C_U	Algorithm (29)
D	ARs 55-60 and 55-61
$\%ES$	Empirical data
N_E	SACS(Log) / TAADS / CBS* / Unit TOE
W_E	Equipment TM / Technical specifications

*Continuing Balance System

Component: OTHER DIRECT
(All levels)

Definition: Other direct costs are defined as any direct operating and support cost not included elsewhere in the data base structure.

Description:

Other direct (OD) is a flexible category used to accumulate direct costs not defined under any other structure cost component/subcomponent. Other direct costs may be a function of a particular weapon system or unit. Geographical location could also be a factor. Examples of other direct costs are civilian contractor maintenance and electric power for a weapon system.

Algorithm (Weapon System)

(31) Avg annual other direct operating/support cost per equipment $= C_{OD_{WS}} \div N_E$

Where: $C_{OD_{WS}}$ = other direct weapon system operating/support cost (annual)

N_E = number of equipments

Algorithm (Unit)

(32) Avg annual other direct operating/support cost per unit $= \sum^{i} C_{OD_{WS}} + \sum C_{OD_U}$

Where: $C_{OD_{WS}}$ = other direct weapon system operating/support cost as derived from algorithm (31)

C_{OD_U} = other direct unit-related operating/support cost (annual)

Algorithm (Function)

(33) Avg annual other direct operating/support cost $= \sum C_{OD}$

Where: C_{OD} = annual other direct operating/support cost for level(s) addressed

Data Sources

Algorithm notation	Data source
C_{OD}	Empirical data
C_{OD_U}	Empirical data
$C_{OD_{WS}}$	Empirical data
N_E	SACS(Log) / TAADS / CBS* / Unit TOE

*Continuing Balance System

Component: PERSONNEL (Indirect)
(All levels)

Definition: Indirect personnel are those military and civilian personnel (at the level of aggregation being considered) whose cost cannot be directly attributed to a specific weapon system or logistic support function (based upon the principle that even if the weapon system or function did not exist, these personnel would be required). Examples of indirect support personnel include administrative, supervisory and certain other indirect support personnel not directly chargeable to the weapon system or function.

Description:

The elements comprising indirect support personnel cost are identical to those included in direct support personnel cost: pay and allowances and PCS. Flight pay for indirect personnel is excluded since the Army-wide overhead for additional persons on flight status is costed in MILITARY PERSONNEL (Crew).

Algorithm (Unit)

(34) Avg annual indirect support personnel cost per unit = $(N_{IM} \times ASB_M) + (N_{IC} \times ASB_C)$

Where:
- N_{IM} = number of indirect support military personnel assigned to unit
- ASB_M = annual salary and benefits for military personnel (avg per person)
- N_{IC} = number of indirect support civilian personnel assigned to unit
- ASB_C = annual salary and benefits for civilian personnel (avg per person)

Algorithm (Function)

(35) Avg annual indirect support personnel cost = $\sum(N_{IM_{TOT}} \times ASB_M) + (N_{IC_{TOT}} \times ASB_C)$

Where: $N_{IM_{TOT}}$ = total number of indirect support military personnel

ASB_M = annual salary and benefits for military personnel (avg per person)

$N_{IC_{TOT}}$ = total number of indirect support civilian personnel

ASB_C = annual salary and benefits for military personnel (avg per person)

Data Sources

Algorithm notation	Data source
ASB_C	CBS* / STANFINS / CIVPERSINS
ASB_M	FCIS(AFPCH) + MOSB / STANFINS
N_{IC}	CBS* / TAADS / Unit TDA
$N_{IC_{TOT}}$	CBS*
N_{IM}	SACS(Pers) / TAADS / Unit TOE
$N_{IM_{TOT}}$	SACS(Pers)

*Civilian Budgeting System

Component: PERSONNEL REPLACEMENT
(All levels)

Definition: Personnel replacement includes the per man cost of training replacements (basic and advanced) for those persons costed under military personnel, including pay and allowances of trainees and instructors. It also includes recruiting costs (enlisted persons only), costs of inprocessing and initial outfitting, and separation costs (for every accession there is a separation).

Description:

Personnel replacement (PR). The data source for this cost element provides a weighted average that includes a factor for on-the-job training (OJT) which is a non-accountable cost. Replacement training costs will be calculated by military occupational specialty (MOS). For a specific weapon system it is possible to select several representative MOSs in order to reduce the amount of calculation. Exclusions: (1) enlistment and reenlistment bonuses (policy decisions not related to the unit or the system); (2) costs of replacing depot maintenance and medical support personnel; and (3) costs of ROTC and the US Military Academy (USMA).

Attrition rate (A) is defined as the percentage of annual Army-wide separations vs. total strength. This data element is available as an Army-wide average for officer and enlisted personnel.

Algorithm (Unit)

(36) Avg annual cost of personnel replacement per unit $= (PR \times A) \times N_P$

Where: PR = personnel replacement cost (per man)

A = attrition rate

N_P = number of personnel in unit*

Algorithm (Function)

(37) Avg annual cost of personnel replacement $= \sum PR$

Where: PR = personnel replacement cost (annual)

Data Sources

Algorithm notation	Data source
A	FCIS(AFPCH)
PR	MOSB
N_P	SACS(Pers) / TAADS / Unit TOE / Unit TDA

*A weapon system-related cost for personnel replacement may be obtained by changing the personnel notation to reflect number of crewmen.

Component: TRANSIENTS, PATIENTS AND PRISONERS
(All levels)

Definition: The pay and allowances of military personnel added to the Army strength over and above TOE/TDA spaces.

Description:

Transients, patients and prisoners (TPP) are those military personnel not currently in a unit performing an assigned job. On PCS between units a soldier is accounted for as a transient. Similar accounting provides for long-term hospital cases and for prisoners committed to the Retraining Brigade or the Disciplinary Barracks. PCS students, including those attending MOS training, are carried in the student account. Trainees, during Basic Combat Training (BCT) and Advanced Individual Training (AIT) are accounted for in the trainee account. The size of the Army is increased above the total of the TOE/TDA spaces by the TTPPS (Trainees, Transients, Patients, Prisoners, Students) account. Trainees and Students are costed under PERSONNEL REPLACEMENT.

Algorithm (Function)

(38) Avg annual cost of transients, patients and prisoners $= \sum TPP$

Where: TPP = cost of transients, patients and prisoners (annual)

Data Sources

Algorithm notation	Data source
TPP	MPA Budget

Component: MEDICAL
(All levels)

Definition: The medical component includes the costs of medical and dental support provided military personnel and their dependents. Medical support includes patient care in Army facilities, care provided at nonmilitary facilities under CHAMPUS, operation of medical service schools and training of medical personnel at civilian institutions.

Description:

Medical care cost per man per year (MC_{MY}) is available as a cost factor in the Army Force Planning Cost Handbook for CONUS and the various overseas areas.

Algorithm (Weapon System)

(39) Avg annual crew medical cost per equipment = $N_C \times MC_{MY}$

Where: N_C = number of crewmen per equipment
MC_{MY} = medical cost per man per year

Algorithm (Unit)

(40) Avg annual medical cost per unit = $N_M \times MC_{MY}$

Where: N_M = number of military personnel assigned to organization
MC_{MY} = medical cost per man per year

Data Sources

Algorithm notation	Data source
MC_{MY}	FCIS(AFPCH)
N_C	SACS(Pers) / TAADS / Unit TOE
N_M	SACS(Pers) / TAADS / Unit TOE

Component: INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT (All levels)

Definition: Investment in logistic facilities and equipment is defined as costs associated with procuring, leasing or constructing special or peculiar equipment, devices, materials, services or facilities in support of a unit or logistic function. Excluded from this cost category are minor construction costs funded under Real Property Maintenance Activity (RPMA).

Algorithm (Unit/Function)

(41) Annual cost of investment in logistic facilities and equipment = $C_{PE} + C_{LE} + C_{CF} + C_{LF}$

Where:
C_{PE} = annual cost of procuring logistic equipment
C_{LE} = annual cost of leasing logistic equipment
C_{CF} = annual cost of constructing logistic facilities
C_{LF} = annual cost of leasing logistic facilities

Data Sources

Algorithm notation	Data source
C_{CF}	MCA Budget
C_{LE}	Base Operations Accounts
C_{LF}	Base Operations Accounts
C_{PE}	Procurement Appropriation Budget / Base Operations Accounts (.C3000, .D8000, .K6400, .M9810)

Component: OTHER INDIRECT LOGISTIC SERVICES
(All levels)

Definition: Other indirect support costs are those costs associated with logistic services not directly chargeable to a specific functional account as outlined below and as pertinent for the level being addressed.

1. At the organizational, DS/GS and installation levels:
   a. Printing plants
   b. Laundry and dry cleaning facilities
   c. Facilities investigation and studies
   d. Property disposal activities
   e. Real estate administration.

2. At the wholesale level:
   a. Printing plants
   b. Laundry and dry cleaning facilities
   c. Provision for central logistic activities and services not directly related to a specific functional budget activity account
   d. Production engineering for Stock Fund items
   e. Defense standardization program
   f. Facilities investigation and studies
   g. DoD production engineering in support of Stock Fund food and food services items
   h. Property disposal activities
   i. Real estate administration
   j. Production engineering for procurement items.

Algorithm (Unit/Function)

(42) Annual other indirect support cost per unit = $(\Sigma C_{OILS} \div P) \times N$

Where: C_{OILS} = cost of other indirect logistic services

P = total population (persons) served

N = number of personnel assigned to the unit or logistic function analyzed

Data Source

Algorithm notation	Data source
C_{OILS}	Empirical data or appropriate AMSCO if functions are so identified, e.g., 780120 "Logistic Support Activities" and various Base Operations accounts
P	TAADS
N	SACS(Pers) / TAADS / Unit TOE / Unit TDA

COMPONENTS OF THE

INSTALLATION LEVEL

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*Already described in the organizational, DS/GS section.

Component: SUPPLY SUPPORT
(Installation level)

Definition: At the installation level supply support is composed of two basic functions: (1) administrative operations, i.e., overall management of the supply support function and (2) storage operations pertaining primarily to the physical handling of equipment and supplies. Civilian and military personnel costs are incurred for supply support.

Description:

Management of supplies includes the administrative and management functions of processing requisitions, establishment of stockage quantities, inventory management, directing release of shipments and supplies to customers, and maintenance of transaction history and other pertinent data files.

Local procurement is defined, in this context, as the labor cost involved in the direct acquisition of supplies and equipment from a local commercial source. The purchase costs for locally procured items will be either: (1) included in the parts cost of the MAINTENANCE component, if the locally procured item is equipment maintenance-related; or (2) included in the INVESTMENT IN LOGISTIC FACILITIES AND EQUIPMENT component of indirect support if the item is not directly relatable to equipment maintenance.

Preservation and storage is the labor cost expended to perserve and store supplies and equipment at the installation level. It includes the labor costs incurred for preservation, represervation and packaging of materiel to be placed in storage or to be shipped, inspection and classification, and deprocessing and preparation of equipment/supplies for shipment. This function is separate from the routine warehousing and storage of supplies discussed below. Materials costs will be included in the MAINTENANCE component.

Routine receipt, storage and issue includes the labor costs resulting from day-to-day operations of the supply point, including the receipt, storage and issuance of supplies and equipment and associated recordkeeping.

Annual salary and benefits (ASB) for civilian and military personnel are as described in the component SUPPLY SUPPORT LABOR in the organizational, DS/GS section.

Algorithm (Weapon System)

(43) Avg annual supply support labor cost per equipment* $= \sum_{\text{function}} \left[(N_M \times ASB_M) + (N_C \times ASB_C) \right] \times F \div N_E$

Where:
- N_M = number of military personnel engaged in the supply support function
- ASB_M = annual salary and benefits of military personnel (avg per person)
- N_C = number of civilian personnel engaged in the supply support function
- ASB_C = annual salary and benefits of civilian personnel (avg per person)
- F = apportionment factor (as described under SUPPLY SUPPORT LABOR for the organizational, DS/GS level)
- N_E = number of equipments

Algorithm (Unit)

(44) Avg annual supply support labor cost per unit* $= \sum_{\text{function}} (N_M \times ASB_M) + (N_C \times ASB_C)$

Where:
- N_M = number of military personnel engaged in the supply support function
- ASB_M = annual salary and benefits of military personnel (avg per person)
- N_C = number of civilian personnel engaged in the supply support function
- ASB_C = annual salary and benefits of civilian personnel (avg per person)

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*Applicable to each of the supply support functions: management of supplies, local procurement, preservation and storage and receipt, storage and issue of supplies.

Algorithm (Function)

(45) Avg annual cost of supply support labor* = $\sum_{\text{function}} C_{SS}$

Where: C_{SS} = annual supply support labor cost (see algorithm (43))

Data Sources

Algorithm notation	Data source
ASB_C	CBS** / STANFINS / CIVPERSINS
ASB_M	FCIS(AFPCH) + MOSB/STANFINS
C_{SS}	Algorithm (43)
F	DSU/GSU system / other factors as appropriate***
N_C	TAADS / Unit TDA
N_E	SACS(Log) / TAADS / CBS**** / Unit TOE
N_M	SACS(Pers) / TAADS / Unit TOE

Data Limitations:

The primary problem facing the cost analyst attempting to "cost-out" a weapon system is selection and application of an appropriate apportionment factor from several alternative methods available.*** Application of a factor based on end item density offers the most convenient approach.

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*Applicable to each of the supply support functions: management of supplies, local procurement, preservation and storage and receipt, storage and issue of supplies.

**Civilian Budgeting System

***See discussion of apportionment factors under SUPPLY SUPPORT LABOR for the organizational, DS/GS level.

****Continuing Balance System

Component: MAINTENANCE
(Installation level)

Definition: Maintenance at the installation level is defined in the same terms as expressed for the organizational, DS and GS levels. The more detailed breakout of the maintenance function by category reflects the elements necessary to accommodate pertinent displays and objectives stated by OSD. Each category is further broken into the subcomponents of parts, labor, and modification materials which are also as previously defined.

Description:

End item maintenance consists of the SF/PA parts, military and civilian labor and modification materials consumed during maintenance or overhaul of major end items. Major end items are defined as PA items reportable under Reportable Items Control Code (RICC).

Major assembly maintenance consists of the SF/PA parts, military and civilian labor and modification materials consumed in repair or rebuilding of major assemblies, e.g., engines, transmissions, etc.

Exchangeable component maintenance consists of the SF/PA parts, military and civilian labor and modification materials consumed for repairing or rebuilding exchangeable components. Exchangeable components are defined as those components coded "reparable" in the AMDF and turned in for repair and reissue through direct exchange (DX) programs, in accordance with locally specified policy and practice.

Other maintenance activities consist of the SF/PA parts, military and civilian labor and modification materials consumed in maintenance support of materiel not identifiable under any of the preceding three categories.

Algorithm (Weapon System)

(46) Weighted avg annual maintenance cost per equipment $= \dfrac{[(M_{EI} \times N_{EI})+(M_{MA} \times N_{MA})+(M_{EXC} \times N_{EXC})+(M_O \times N_O)]}{(N_{EI} \times C_{EI})+(N_{MA} \times C_{MA})+(N_{EXC} \times C_{EXC})+(N_O \times C_O)} \times C_{EI}$

Where:

(47) $M_{EI} = (C_P + C_L + C_{MM})_{EI}$

N_{EI} = number of end items supported

(48) $M_{MA} = (C_P + C_L + C_{MM})_{MA}$

N_{MA} = number of major assemblies supported

(49) $M_{EXC} = (C_P + C_L + C_{MM})_{EXC}$

N_{EXC} = number of exchangeable components supported

(50) $M_O = (C_P + C_L + C_{MM})_{OTHER}$

N_O = number of other items of materiel supported

C_{EI} = cost of end items

C_{MA} = cost of major assemblies

C_{EXC} = cost of exchangeable components

C_O = cost of other materiel

Algorithm (Unit)

(51) Avg annual maintenance cost per unit $= C_{P_{ALL}} + C_{L_{ALL}} + C_{MM_{ALL}}$

Where:

(52) $C_{P_{ALL}} = \sum^{i} C_{P_i}$

(53) $C_{L_{ALL}} = \sum^{i} C_{L_i}$

(54) $C_{MM_{ALL}} = \sum^{i} C_{MM_i}$

Algorithm (Function)

(55) Avg annual cost of installation level maintenance = $C_{P_{TOT}} + C_{L_{TOT}} + C_{MM_{TOT}}$

Where:

(56) $C_{P_{TOT}} = \sum_{units} C_{P_{ALL}}$

(57) $C_{L_{TOT}} = \sum_{units} C_{L_{ALL}}$

(58) $C_{MM_{TOT}} = \sum_{units} C_{MM_{ALL}}$*

Data Sources

Algorithm notation	Data source
C_{EI}	AMDF
C_{EXC}	AMDF
$C_{L_{ALL}}$	Algorithm (53)
$C_{L_{TOT}}$	Algorithm (57)
C_{MA}	AMDF
$C_{MM_{ALL}}$	Algorithm (54)
$C_{MM_{TOT}}$	Algorithm (58)
$C_{P_{ALL}}$	Algorithm (52)
$C_{P_{TOT}}$	Algorithm (56)
C_{O}	AMDF
M_{EI}	Algorithm (47)

*When computing functional costs Army-wide the cost of MOD materials at commodity command only should be used. This total incorporates the cost of MOD materials applied at all levels.

Data Sources (continued)

Algorithm notation	Data source
M_{EXC}	Algorithm (49)
M_{MA}	Algorithm (48)
M_{O}	Algorithm (50)
N_{EI}	SAC(Log) / TAADS / CBS* / Unit TOE
N_{EXC}	Empirical data
N_{MA}	Empirical data
N_{O}	Empirical data

*Continuing Balance System

Component: TRANSPORTATION
(Installation level)

Definition: The transportation function at installation level is defined as all second destination movement or shipment of equipment and supplies and transportation funded under the Base Operation account.

Description:

Second destination transportation includes all movement or shipment of equipment and supplies from the point of first destination (i.e., receipt from production) to any other location. Also provides for the movement of Army civilian employees and their dependents on PCS via military airlift/sealift command. All transportation modes are considered. The following kinds of transportation are excluded from this definition:

1. Transportation costs absorbed by the Stock Fund *
2. Cargo transportation and port handling of Military Assistance Program (MAP) materiel.
3. Transportation and CONUS port handling of household goods, baggage and privately owned vehicles of military personnel.

Second destination cost of transporting materiel from one installation to another installation or unit is borne by the shipping installation. Cost of transporting equipment and supplies from a depot or other point of Army acceptance to a user is borne by the commodity command responsible for management of the materiel.

All first destination transportation charges are excluded since these are part of the acquisition cost.

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*Movement of Stock Fund items from CONUS depots to CONUS customers or to CONUS air/sea ports.

Base operations transportation includes cost incurred at the installation level resulting from operation and maintenance of transportation equipment and services. Services include: administrative motor services, local transportation office operations, administrative rail and watercraft services, movement of household goods, administrative aviation serves, etc.

The elements used in the following algorithm have all been described in the TRANSPORTATION component at organizational, DS/GS level.

Algorithm (Weapon System)

(59) Avg annual second destination transportation cost per equipment = $\%ES \times N_E \times W_E \times D \times C_{TM}$

Where:
- $\%ES$ = percentage of equipments shipped per year
- N_E = number of equipments in population
- W_E = short-ton weight per equipment
- D = distance shipped
- C_{TM} = cost per ton mile

Algorithm (Unit)

(60) Avg annual cost of second destination transportation per unit = $\left(\sum^{i} C_{E_i} \times N_{E_i}\right) + PCS_{CIV}$

Where:
- C_{E_i} = avg annual second destination cost per equipment (see algorithm (59))
- N_{E_i} = number of equipments of each type shipped annually
- PCS_{CIV} = PCS costs associated with transportation of civilian personnel

Algorithm (Function)

(61) Avg annual cost of transportation at the installation level = $\sum_{\text{units}} C_{SDT} + \sum C_{BOT_{TOT}}$

Where: C_{SDT} = avg annual cost of unit second destination transportation (see algorithm (60))

$C_{BOT_{TOT}}$ = total annual cost of base operation transportation

Data Sources

Algorithm notation	Data source
$C_{BOT_{TOT}}$	Base Operations ("Z" Accounts)
C_E	Algorithm (59)
C_{TM}	MTMC Progress Report
C_{SDT}	Algorithm (60)
D	ARs 55-60 and 55-61
%ES	Empirical data
N_E	SACS(Log) / TAADS / CBS* / Unit TOE
PCS_{CIV}	No data source identified
W_E	Equipment TM / Technical specifications

*Continuing Balance System

Component: REAL PROPERTY MAINTENANCE ACTIVITIES (RPMA)
(Installation and Wholesale levels)

Definition: Includes the costs of acquisition, construction, rental, alterations to, maintenance and operation of real property facilities; and provision of fire protection, refuse collection, custodial and other services. This cost of maintenance and utilities for personnel living in government owned quarters (family quarters, bachelor officer's quarters/bachelor enlisted quarters (BOQ/BEQ), and barracks) is a part of this cost component.

Description:

Maintenance/repair of real property includes costs associated with the maintenance and repair of real property, less charges made to other functional categories. Costs of minor construction are excluded. Facilities maintenance cost is computed based on the size of facilities maintained (sq. ft.) and the number of employees in the facilities maintenance work force.

Utilities costs include procurement or production and distribution of all utilities except communications. Cost of purchased electrical power, steam, water, sewage service, etc., and the operations of government-owned power generating plants and distribution systems are part of this cost element. Utilities are costed on a "per person served" basis.

Minor construction includes costs incurred for the erection, installation, or assembly of a new real property facility or the addition to, expansion, alteration or replacement of an existing facility.*

Other engineering services include miscellaneous support services such as fire protection, custodial services, refuse collection and disposal, etc.** Services in this category are costed on a "per person served" basis.

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*Excludes projects financed by military construction funds.

**Includes rental of real property, facilities engineering and public works management when not identified elsewhere.

Algorithms (Facilities Maintenance)

(62) Annual cost of facilities maintenance $= \left[(N_{WF} \div A_{TOT}) \times ASB\right] \times A_O$

Where:

N_{WF} = number of facilities maintenance work force employees

A_{TOT} = total area maintained (usually expressed in thousand sq. ft.)

ASB = annual salary and benefits of facilities maintenance employees (avg per person)

A_O = area occupied by unit or logistic function analyzed (expressed in thousnad sq. ft.)

Algorithm (Utilities)

(63) Annual cost of utilities $= (\Sigma C_{U_{TOT}} \div P_{TOT}) \times P_A$

Where:

$C_{U_{TOT}}$ = cost of utilities, total annual

P_{TOT} = total persons served

P_A = number of persons assigned to the unit or logistic function analyzed

Algorithm (Minor Construction - Not Directly Attributable)

(64) Annual cost of minor construction (not directly attributable) $= (\Sigma C_{MC_{TOT}} \div P_{TOT}) \times P_A$

Where:

$C_{MC_{TOT}}$ = cost of minor construction, total annual

P_{TOT} = total persons on installation

P_A = number of persons assigned to unit or logistic function analyzed

Algorithm (Minor Construction - Directly Attributable)

(65) Annual cost of minor construction (directly attributable) $= \sum C_{MCDA}$

Where: C_{MCDA} = annual cost of minor construction directly attributable to the specific unit or logistic function analyzed

Algorithm (Other Engineering Services)

(66) Annual cost of all other engineering services $= (\Sigma C_{ES_{TOT}} \div P_{TOT}) \times P_A$

Where: $C_{ES_{TOT}}$ = cost of all other engineering services, total annual

P_{TOT} = total persons served

P_A = number of persons assigned to the unit of logistic function analyzed

Algorithm (Unit)

(67) Annual cost of all RPMA (Unit) $= C_{FM} + C_U + C_{MC} + C_{OES}$

Where: C_{FM} = cost of facilities maintenance (annual)

C_U = cost of utilities (annual)

C_{MC} = cost of minor construction (annual)

C_{OES} = cost of all other engineering support services (annual)

(RPMA Function)

The costs associated with the RPMA function are available from the RPMA and the Utilities Modules of the Integrated Facilities System, thus no algorithm is required.

Data Sources

Algorithm notation	Data source
ASB	CBS* / STANFINS / CIVPERSINS
A_{TOT}	Empirical data
A_O	Empirical data
$C_{ES_{TOT}}$	RPMA Module (IFS)
C_{FM}	Algorithm (62) / RPMA Module, (IFS), Summary K
C_{MC}	Algorithm (64) or (65) / RPMA Module, (IFS), Summary L
C_{MCDA}	RPMA Module (IFS) / Empirical data
$C_{MC_{TOT}}$	RPMA Module (IFS)
C_{OES}	Algorithm (66) / RPMA Module, (IFS), Summary M
C_U	RPMA Module (IFS), Summary J
$C_{U_{TOT}}$	RPMA Module (IFS), Summary J
N_{WF}	TAADS / Unit TDA
P_A	SACS(Pers) / TAADS / Unit TOE / Unit TDA
P_{TOT}	SACS(Pers) / TAADS / Unit TOE / Unit TDA / Empirical data

*Civilian Budgeting System

COMPONENTS OF THE

WHOLESALE LEVEL

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*Already described in the organizational, DS/GS section.

**Already described in the installation section.

Component: SUPPLY SUPPORT
(Wholesale level)

Definition: Wholesale (commodity command/depot) level supply support includes the primary functions of materiel management and depot operations. Materiel management encompasses the operation of inventory control points (ICPs) and the responsibility for procurement of materiel. Depot operations include the preservation and storage of materiel and the routine receipt, storage and issuance of supplies and equipment. Civilian and military personnel costs are the basis of computation.

Description:

The supply support functions at the wholesale level are similar to those described for SUPPLY SUPPORT at the installation level. The chief difference is the greatly increased magnitude of wholesale level operations. In addition to being Army-wide or DoD-wide, support at the wholesale level may include support to foreign governments.

Materiel management includes processing and review of inventory status reports; determination and forecasting of requirements; directing actions to satisfy requirements by positioning or redistributing stocks, by procurement, overhaul direction or other actions; determination of stock retention limits and excess quantities; disposition of excess material; provisioning of repair parts to support new equipment; coding of items for supply management; research in support of commodity management; determination and recording of standard prices; forecasting of requirement and allied activities performed by commodity management personnel relative to the program/budget process; weapon system materiel management operations; liaison operations with using activities and bases;

provision of technical data required for procurement; determination of preservation, packaging, and packing requirements; development, maintenance, compilation and publication of materiel allowance lists.

ICP operations consist of operation of CONUS National Inventory Control Points (NICPs) and Army class manager agencies, and overseas inventory control points. Functions include inventory control, interservice supply support, mutual security program control, and other logistics support efforts, commodity management, technical support and operation of the US Army Equipment Authorization Review Center.

Procurement operations include actions following the receipt of a procurement request up to but not including preparation and issuance of solicitation for bids and proposals; preparation and issuance of solicitation documents; receipt and evaluation of bids and proposals; performance of pre-award surveys, negotiation and award of basic contractual documents; negotiation and execution of contract modifications and overall management of the procurement function.

Depot operations are defined in identical terms as found in SUPPLY SUPPORT at the installation level, bearing in mind the expanded size of operations.

The following elements are also defined as being identical to terms described in the component SUPPLY SUPPORT (installation level):

1. Preservation and storage
2. Routine receipt, storage and issue
3. Annual salary and benefits (ASB)

Algorithm (Function)

(68) Annual cost of supply support $= C_{ICP} + C_P + C_{PS} + C_{RSI}$

Where:
- C_{ICP} = annual labor cost of ICP operations
- C_P = annual labor cost of procurement
- C_{PS} = annual labor cost of preservation and storage
- C_{RSI} = annual labor cost of receipt, storage and issue

Data Sources

Algorithm notation	Data source
C_{ICP}	AMSCO 721112.00000 / CCSS
C_{P}	AMSCO 721113.00000 / CCSS
C_{PS}	AMSCO 721111.13000 / SPEEDEX / MIDA
C_{RSI}	AMSCO 721111.10000-721111.1290 / SPEEDEX

Component: MAINTENANCE
(Wholesale level)

Definition: The maintenance function at the wholesale level includes all of the components of cost and functions found at the lower levels plus the added function of maintenance engineering support. The cost of parts and MOD materials installed at the wholesale level is a "non-add" when more than the MAINTENANCE component is aggregated since these items are incorporated under PROCUREMENT.

Description:

Maintenance engineering support (MES) is defined as the continuing analysis and evaluation of equipment and maintenance performance data relating to operational equipment to determine need and prescribe changes in equipment configuration, maintenance support structure, or maintenance resource requirements. Engineering consulting service, technical assistance to field commands, and resolution of other maintenance and maintainability related problems are all part of the MES function. MES costs are chargeable under FYDP PE 780170 - Maintenance Support Activities. These costs are allocable as a functional cost only.

Algorithm (End Item)

(69) Avg annual maintenance cost per major end item $(EI)^{*} = (C_P + C_L + C_{MM})_{EI}$

Where:
C_P = cost of parts per equipment (annual)
C_L = cost of labor (civilian and military) per equipment (annual)
C_{MM} = cost of MOD materials, average per equipment (either completed MODs or completed plus projected; annual)

*The algorithm for major assembly (MA) maintenance, exchangeable component (EXC) maintenance and all other (0) categories of maintenance are identical to the algorithm shown for major end item (EI) maintenance.

Algorithm (Weapon System)

(70) Weighted avg annual maintenance cost per equipment

$$= \frac{[(M_{EI} \times N_{EI})+(M_{MA} \times N_{MA})+(M_{EXC} \times N_{EXC})+(M_O + N_O)]}{(N_{EI} \times C_{EI})+(N_{MA} \times C_{MA})+(N_{EXC} \times C_{EXC})+(N_O \times C_O)} \times C_{EI}$$

Where:

M_{EI} = end item maintenance cost (see algorithm (47))

N_{EI} = number of end items supported

M_{MA} = major assembly maintenance cost (see algorithm (48))

N_{MA} = number of major assemblies supported

M_{EXC} = exchangeable component maintenance cost (see algorithm (49))

N_{EXC} = number of exchangeable components supported

M_O = other materiel maintenance cost (see algorithm (50))

N_O = number of other items of materiel supported

C_{EI} = cost of end items

C_{MA} = cost of major assemblies

C_{EXC} = cost of exchangeable components

C_O = cost of other materiel

Algorithm (Function)

(71) Avg annual cost of wholesale level maintenance

$$= C^*_{P_{TOT}} + C_{L_{TOT}} + C^*_{MM_{TOT}} + C_{MES}$$

Where:

$C_{P_{TOT}}$ = total annual cost of parts installed on all equipments

$C_{L_{TOT}}$ = total annual cost of direct labor applied to all equipments

$C_{MM_{TOT}}$ = total annual cost of MOD materials installed on all equipments

C_{MES} = cost of maintenance engineering support

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*Applicable when costing wholesale MAINTENANCE component only.

Data Sources

Algorithm notation	Data source
C_{EI}	AMDF
C_{EXC}	AMDF
C_{L}	CCSS / CSFOR-78 Rpt / CBS*
$C_{L_{TOT}}$	CCSS / CSFOR-78 Rpt / CBS*
C_{MA}	AMDF
C_{MES}	FYDP PE 780170 - "Maint Spt Activities"
C_{MM}	CCSS / AMDF
$C_{MM_{TOT}}$	CCSS / AMDF
C_{P}	CCSS / AMDF
$C_{P_{TOT}}$	CCSS / AMDF
C_{O}	AMDF
M_{EI}	Algorithm (47)
M_{MA}	Algorithm (48)
M_{EXC}	Algorithm (49)
M_{O}	Algorithm (50)
N_{EI}	CCSS / SACS(Log) / TAADS / CBS**
N_{EXC}	Empirical data
N_{MA}	Empirical data
N_{O}	Empirical data

*Civilian Budgeting System

**Continuing Balance System

Component: TRANSPORTATION
(Wholesale Level)

Definition: The transportation function at the wholesale level is defined as all second destination movement or shipment of equipment and supplies and transportation funded under the base operation account plus the cost of operating transportation units organic to the wholesale level.

Description:

Second destination transportation includes all movement or shipment of equipment and supplies from the point of first destination (i.e., receipt from production) to any other location. Also provides for the movement of Army civilian employees and their dependents on PCS via military airlift/sealift command. All transportation modes are considered. The following kinds of transportation are excluded from this definition:

1. Transportation costs absorbed by the Stock Fund.*
2. Cargo transportation and port handling of Military Assistance Program (MAP) materiel.
3. Transportation and CONUS port handling of household goods, baggage and privately-owned vehicles of military personnel.

Second destination cost of transporting materiel from a depot or other point of Army acceptance to a user is borne by the commodity command responsible for management of the materiel.

All first destination transportation charges are excluded since these are part of the acquisition cost.

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*Movement of Stock Fund items from CONUS depots to CONUS customers or to CONUS air/sea ports.

Base operations transportation includes costs incurred resulting from operation and maintenance of transportation equipment and services. Services include: administrative motor services, local transportation office operations, administrative rail and watercraft services, movement of household goods, administrative aviation services, etc.

Organic transportation includes the costs associated with operating transportation units organic to the wholesale level, e.g., line haul transportation units.

Algorithm (Function)

(72) Annual cost of transportation at the wholesale level = $C_{SDT_{TOT}} + C_{BOT_{TOT}} + C_{ORGT_{TOT}}$

Where:
- $C_{SDT_{TOT}}$ = total annual cost of second destination transportation
- $C_{BOT_{TOT}}$ = total annual cost of base operations transportation
- $C_{ORGT_{TOT}}$ = total annual cost of organic transportation

Data Sources

Algorithm notation	Data source
$C_{BOT_{TOT}}$	Base Operations ("Z" Accounts)
$C_{ORGT_{TOT}}$	Mission (P2) Accounts
$C_{SDT_{TOT}}$	AMSCO 728010.00000

Component: PROCUREMENT
(Wholesale level)

Definition: The acquisition of supplies and equipment to provide logistic support to the Army's current inventory of weapon systems and principal items. Munitions and spares for war reserves are also included.

Description:

Ammunition procurement (AP). The procurement, manufacture, reconfiguration and engineering and acceptance testing during production of major ammunition/missiles.

Procurement appropriation funded spares (PAS). Includes the procurement of depot-reparable assemblies and components required to support end items procured under the five Procurement Appropriations: Aircraft, Missiles, Combat Equipments, Ammunition, and Other. Includes the procurement cost of provisioning (initial issue), replenishment and mobilization reserves.

Stock Fund procurement (SFP). Includes the cost of supplies procured by the Army Stock Fund for both peacetime consumption and war reserve requirements. Second destination transportation costs of Stock Fund items shipped from CONUS depots to CONUS users are paid for by the Stock Fund.

Algorithm (Function)

(73) Annual cost of procurement $= C_{AP_{TOT}} + C_{PAS_{TOT}} + C_{SFP_{TOT}}$

Where:
- $C_{AP_{TOT}}$ = total annual cost of ammunition procurement
- $C_{PAS_{TOT}}$ = total annual cost of procurement appropriation funded spares
- $C_{SFP_{TOT}}$ = total annual cost of stock funded procurement

Data Sources

Algorithm notation	Data source
$C_{AP_{TOT}}$	SAAS / SUMS / MIDP / Annual Procurement Appropriation Budget
$C_{PAS_{TOT}}$	Procurement Appropriation Secondary Items Budget
$C_{SFP_{TOT}}$	Army Stock Fund Budget

Component: INTERNATIONAL LOGISTICS
(Wholesale level)

Definition: Includes Army military and civilian manpower directly supporting specific foreign military sales agreements for which DoD is reimbursed fully by the participating foreign customer for all salary, personnel benefits, and support costs, e.g., Technical Assistance Field Teams (TAFT) and related activities covered by sales agreements. Also includes all reimbursable sales of supplies in support of other nations. This component is considered a cost because of the monies obligated until reimbursement.

Description:

Foreign military sales (FMS) support personnel includes all Army military and civilian personnel (and contractor personnel) chargeable to an FMS agreement on a reimbursable basis. Actual or average pay rates may be used.

Reimbursable sale of supplies encompasses all supplies and equipment, to include concurrent spares, provided to a foreign customer on a reimbursable basis.

Algorithm (Function)

(74) Annual cost of international logistics $= (N_M \times ASB_M)+(N_{DAC} \times ASB_{DAC})+(N_{CP} \times ASB_{CP})+C_{RM}$

Where:

N_M = number of military personnel assigned to international logistics operations

ASB_M = annual salary and benefits of military personnel (avg per person)

N_{DAC} = number of DA civilian personnel assigned to international logistics operations

ASB_{DAC} = annual salary and benefits of DA civilian personnel (avg per person)

N_{CP} = number of contractor personnel employed in international logistics operations

ASB_{CP} = annual salary and benefits of contractor personnel (avg per person)

C_{RM} = cost of reimbursable materiel

Data Sources

Algorithm notation	Data source
ASB_{CP}	Empirical data
ASB_{DAC}	CBS* / CIVPERSINS
ASB_M	FCIS(AFPCH) + MOSB
C_{RM}	CCSS(BASS) / AFSI + ASFB**
N_{CP}	Empirical data
N_{DAC}	AMSCO 002002.00000
N_M	AMSCO 002002.00000

*Civilian Budgeting System

**Appropriation Funded Secondary Items and the Army Stock Fund Budgets

Component: INDUSTRIAL PREPAREDNESS
(Wholesale level)

Definition: Industrial preparedness (i.e., maintenance of the industrial mobilization base) is defined as those operations that assure the production capability required to support current and emergency procurement programs, including actions taken by the DoD to augment the production capability of the industrial base, e.g., development of production requirements and mobilization production schedules, maintenance of reserve plants and equipment, etc.

Description:

The munitions production base modernization and expansion (MPBME) program is responsible for modernization, expansion and production engineering measures for Army munitions plants and arsenals and for government equipment in private industry included in the program. Functions solely in support of research and development, including production of items for test (as defined in AR 70-1), are excluded.

Other industrial preparedness activities include all other plans, actions, or measures necessary to establish, maintain, or rehabilitate an industrial base (both government and privately-owned) required to support current, wartime, or other contingency military requirements.

Algorithm (Function)

(75) Annual cost of industrial preparedness $= C_{IP_{AIF}} + C_{IP_{OMA}}$

Where: $C_{IP_{AIF}}$ = cost of industrial preparedness (AIF)* (annual)

$C_{IP_{OMA}}$ = cost of industrial preparedness (OMA) (annual)

*Army Industrial Fund

Data Sources

Algorithm notation	Data source
$C_{IP_{AIF}}$	CSFOR-78 -- AIF AMSCO 3XXX.6600 (Ind Spt)
$C_{IP_{OMA}}$	DoD costs for the Industrial Base (HQ DARCOM, RCS DD-I&L (SA) 784)

Component: PORT OPERATIONS
(Wholesale level)

Definition: The labor costs incurred as a result of the Army's operation of various embarkation and debarkation ports and terminals located in CONUS and overseas.

Description:

Annual cost of port operations is available through the CSFOR-78 Report which provides an AIF total monthly earnings (cumulative and year-to-date (YTD) for military and civilian personnel assigned to port terminal operations. These data are available by command/agency and in summary form showing various totals plus a grand total.

Port Operations (Function)

The costs associated with the function of port operations are available from the CSFOR-78 Report (AIF AMSCO: 3XXX.6100 (Port Tml Op)), thus no algorithm is required.

HYPOTHETICAL APPLICATION OF LOGISTIC RESOURCE COSTING TECHNIQUE

This section is intended to provide a demonstration of how the data base structure and associated algorithms could be utilized by a cost analyst at DA level to answer specific questions concerning the consumption of logistic resources.

For purposes of demonstration, assume that the cost analyst is asked to respond to the following four questions:

1. "What is the annual cost of organizational, DS/GS level maintenance aggregated for all M60 tanks worldwide?" "Provide the answer as a total annual maintenance cost and also as an annual average maintenance cost per tank."
2. "What is the annual cost of supply support (labor) aggregated for all armored battalions in an armored division?"
3. "What is the annual cost of RPMA for all Army depots?"
4. "What is the personnel (crew) cost aggregated for M60 tank battalions stationed in Europe, projected through FY81, assuming a TOE change increasing the number of tanks per battalion from 54 to 60, to be phased in over a three-year period beginning in FY81?

The questions cited are similar to those framed in the list of representative logical questions discussed earlier in this chapter (see Table 3-1). They were chosen to illustrate how cost aggregations would be developed for: (1) a weapon system, (2) a unit or group of units, (3) a logistic function, and (4) a program projection.

The cost analyst must make several basic determinations to effectively utilize the information contained in this chapter. He must determine the logistic function(s) or subfunction(s) to be costed (e.g., maintenance), the level(s) to be aggregated (e.g., organizational, DS/GS) and the level of detail to be aggregated (e.g., weapon system or unit) and the impact of projected changes to any of the variables in the algorithm.

It is assumed in the example cases that the data sources cited would, in fact, provide adequate data (and in appropriate formats) to permit the calculations and aggregations required. The subject of data availability and adequacy is discussed in detail in Chapter 4.

Example 1: Weapon System Maintenance Cost

Table 3-5 presents the technique used to arrive at the total maintenance cost (parts, direct labor and cost of modification materials) for a specific type of weapon system (the M60 tank) at the organizational, DS/GS level of the support system.

Several Logistic Resource Data Base Structure subcomponents (replenishment spares, labor and MOD materials) plus ancillary data element requirements (number of equipments supported and cost of a direct labor manhour) are shown in column 1. The second column lists the algorithm (by number) used to determine the desired cost. Column 3 depicts the logical expression, the terms of which are defined in column 4. Potential data sources (column 5) and hypothetical input data (column 6) are also listed. Columns 7 and 8 depict the computation of the logistic resource cost and the result of that computation. Note that the costs are derived on an average annual basis per tank or may be summed as a total annual maintenance support cost for the fleet.

Example 2: Unit Supply Support Labor Cost

Table 3-6 illustrates the procedures necessary to determine the annual cost of supply support for a specified group of units, in this case, the direct labor (military only) costs consumed by all of the armored battalions in an armored division. Determination of this cost is relatively straightforward: the number of personnel assigned to perform this function used as a multiplier of an average per person annual salary and benefits cost derived from appropriate sources.

Table 3-5

EXAMPLE 1: WEAPON SYSTEM MAINTENANCE COST

Question - "What is the annual cost of organizational, DS and GS maintenance aggregated for all M60 tanks worldwide?"

Structure component/algorithm requirements (1)	Algorithm (No. & title) (2)	Algorithm expression (3)	Definition of terms (4)	Data sources (5)	Hypothetical data (6)	Computation (7)	Result (8)
Parts cost	(10) Avg annual parts cost per equip. (actual)	$C_{P_E} \div N_E$	C_{P_E} = total annual cost of parts installed on M60 tanks at Org/DS/GS level worldwide	SDC/TAMMS/TMCS/ SMMS/CS_3/AMDF	$43.2 million	$43.2M ÷ 3K	$14,400 per year
Number of equip. supported			N_E = number of M60 tanks supported at this level worldwide	SACS(Log)/TAADS/ CBS*/Unit TOEs	3,000 tanks		
Direct labor manhours (military)	(13) Avg cost of a direct labor manhour (military)	$ASB \div N_{HA}$	ASB= annual salary and benefits of direct labor personnel (avg per person)	FCIS(AFPCH) + MOSB	$12,000 per yr	$12K ÷ 2,080 hrs.	$5.77 per hour
			N_{HA} = number of hours avail for duty (avg per person per year)	Empirical data or avg of 2,080 hrs	2,080 hrs.		
Labor cost	(14) Avg annual direct labor cost per equip.	$(N_{MMH} \times C_{MMH}) \div N_E$	N_{MMH} = number of military direct labor manhours applied to M60 tanks	SDC/TAMMS/TMCS/ SMMS/CS_3	800,000 maint manhours per year	(800K x 5.77) ÷3K	$1,539 per tank per yr
			C_{MMH} = cost of a military direct labor manhour (avg per person)	Algorithm (13)	$5.77 per hr		
			N_E = number of M60 tanks supported	SACS(Log)/TAADS/ CBS*/Unit TOEs	3,000 tanks		

*Continuing Balance System

Table 3-5 (continued)

Structure component/algorithm requirements (1)	Algorithm (No. & title) (2)	Algorithm expression (3)	Definition of terms (4)	Data sources (5)	Hypothetical data (6)	Computation (7)	Result (8)
MOD materials cost	(16) Avg annual MOD materials cost per equip (completed MODs only)	$\left[\sum_{Y=1}^{N}(C_{MMAY} \div N_{E_Y})\right] \div N$	C_{MMAY} = cost of materials for MODs accomplished, by year	CS_3/MIDA/AMDF	$5.5 million for yr analyzed	(5.5M ÷ 3K) 1	$1,833 per tank for yr analyzed
			N_{E_Y} = number of equip in fleet both modified and not modified, by year	CS_3/MIDA	3,000 tanks		
			N = number of years analyzed	Furnished by analyst (in this case 1 yr)	1 yr		
MAINTENANCE (Org DS/GS)	(19) Avg annual maintenance cost per equip	$C_P + C_L + C_{MM}$	C_P = cost of parts per equip (annual)	Algorithm (10)	$14,400 ($43.2M total)	$14,400 + $1,539 + $1,833	$17,772 avg annual cost of org/DS/GS maint for M60s worldwide
			C_L = cost of labor per equip (annual)	Algorithm (14)	$1,539 ($4.62M total)	or $43.2M + $4.62M + $5.5M	or
			C_{MM} = cost of MOD materials, avg per equip (completed MODs only)	Algorithm (19)	$1,833 ($5.5M total)		$53.32M total annual maint cost. See display A-12, Appendix A.

Table 3-6

EXAMPLE 2: UNIT SUPPLY SUPPORT LABOR COST

Question - "What is the annual cost of supply support labor aggregated for all armored battalions in an armored division?"

Structure component/algorithm requirements (1)	Algorithm (No. & title) (2)	Algorithm expression (3)	Definition of terms (4)	Data sources (5)	Hypothetical data (6)	Computation (7)	Result (8)
Number of personnel (mil & civ) assigned to function	(8) Avg annual cost of supply support labor per unit	$(N_M \times ASB_M) + (N_C \times ASB_C)$	N_M = number of military direct labor personnel assigned to the supply function	SACS, TAADS (by MOS within UIC) See Data Element worksheet 4.1.2, App C	5 Officers / 16 Enlisted } per Bn pers		
Annual salary and benefits for mil and civ personnel			ASB_M = annual salary and benefits for military personnel (avg per person)	FCIS(AFPCH), STANFINS	Officers= $20,161 / Enlisted= $9,055 } Avg per person	(5 x $20,161)+ (16 x $9,055)	$245,685-Avg annual supply support labor cost per armored bn.
			N_C = number of civilian direct labor personnel assigned to the supply function	TAADS	No civilian personnel assigned	cost of civilian personnel would be computed as above if applicable	
			ASB_C = annual salary and benefits for civilian personnel (avg per person)	Civ Bud Sys (CBS)/ CIVPERSINS See Data element worksheet 4.2.1, App C	No civilian personnel assigned		
	(9) Avg annual cost of supply support	C_{SS} (of all org/DS/GS units)	C_{SS} = annual supply support cost of all org, DS/GS units		Assume five armored battalions per armored division	$245,688 x 5	$1,228,428 = Avg annual cost of supply support labor in an armored division

Example 3: Cost of the RPMA Function

The function of RPMA would be costed as shown in Table 3-7. The subcomponents of RPMA: cost of maintenance and repair of real property, cost of utilities, cost of minor construction and cost of other engineering support services are tallied to provide the overall RPMA cost. RPMA cost data is available from the automated RPMA Module of the Integrated Facilities System (IFS).

Example 4: Program Projection - Military Personnel (Crew) Cost

The steps involved in developing cost, taking into account the impact of a program projection increase, are presented in Table 3-8. In this example, an assumed TOE change would cause the cost addressed to increase annually during the period analyzed. Other program changes resulting from a TOE change such as this one, i.e., maintenance and supply support costs, would be handled in a similar manner.

Table 3-7

EXAMPLE 3: COST OF THE RPMA FUNCTION

Question - "What is the annual cost of RPMA for all Army Depots?"

Structure component/algorithm requirements (1)	Algorithm (No. & title) (2)	Algorithm expression (3)	Definition of terms (4)	Data sources (5)	Hypothetical data (6)	Computation (7)	Result (8)
Annual cost of maint/repair of real property	(60) Annual cost of RPMA	$C_{FM} + C_U + C_{MC} + C_{OES}$	C_{FM} = annual cost of facilities maintenance	RPMA Module, IFS, Summary K & Base Opns "Z" Account .K0000 See Data Element worksheet No. 12.1, App C	$150 million	$150M + $1.4M + $15M + $20M	See Display A-17 Appendix A
Annual cost of utilities	N/A	N/A	C_U = annual cost of utilities	RDMA Module, IFS, Summary J & Base Opns "Z" Account .J0000 See Data Element worksheet No. 12.2, App C	$1.4 million	N/A	"
Annual cost of minor construction	N/A	N/A	C_{MC} = annual cost of minor construction	RPMA Module, IFS, Summary L & Base Opns "Z" Account .L0000 See Data Element worksheet No. 12.3.1, App C	$15 million	N/A	"
Annual cost of other engineering services	N/A	N/A	C_{OES} = annual cost of other engineering support services	RPMA Module, IFS, Summary M & Base Opns "Z" Account .M0000 See Data Element worksheet No. 12.3.2, App C	$20 million	N/A	"

Table 3-8

EXAMPLE 4: PROGRAM PROJECTION - MILITARY PERSONNEL (CREW) COST

Question - "What is the military personnel (crew) cost aggregated for M60 tank battalions stationed in Europe, projected through FY81, assuming a TOE change increasing the number of tanks per battalion from 54 to 60, to be phased in over a three year period beginning in FY81?"

Structure component/algorithm requirements (1)	Algorithm (No. & title) (2)	Algorithm expression (3)	Definition of terms (4)	Data sources (5)	Hypothetical data (6)	Computation (7)	Result (8)
MILITARY PERSONNEL (Crew)	(2) Avg annual crew cost per unit	$\sum_{i} C_{E_i} \times N_{E_i}$	C_E = avg annual crew cost as derived from algorithm(1)	Algorithm (1)	$55.3 per tank per year	FY77=$55.3K x 1080 FY78=$55.3K x 1120 FY79=$55.3K x 1160 FY80=$55.3K x 1200 FY81=$55.3K x 1200	FY77 = $59.7M FY78 = $61.9M FY79 = $64.1M FY80 = $66.4M FY81 = $66.4M
			N_E = number of equipments organic to unit	Unit TOE	FY77 = 1080* FY78 = 1120 FY79 = 1160 FY80 = 1200 FY81 = 1200		
MILITARY PERSONNEL (Crew)	(1) Avg annual crew cost per equip	$(P/A)+(2 \times PCS \times RR) \times N_C$	P/A = pay and allowances	FCIS(AFPCH)	$10.4K per man per year		
			PCS = permanent change of station cost	FCIS(AFPCH)	$1400 per man per year (European theater)		
			RR = rotation rate	FCIS(AFPCH)	20% per year (Army-wide avg)		
			N_C = number of crewmen per equip	Unit TOE	5 crewmen per tank		

*Assumed phase-in of two additional tanks issued to each battalion per FY over a three year period beginning in FY78. Thus, in FY77, (given 54 tanks per battalion and 20 battalion in the theater) the FY77 equipment density is 1080 tanks. The addition of two tanks per battalion in FY78 increases theater density by 40 tanks and similarly in FY79 and FY80.

Chapter 4
DATA AVAILABILITY

INTRODUCTION

Concurrent with determination of the data structure, the study team initiated a survey of data availability. The survey was conducted in a variety of ways, including in-house research, field visits, review of available documentation of existing automated systems, and any other potential known or reported sources.

FIELD VISITS

A series of visits to field activities was conducted in December 1975 and January 1976, with the purpose of determining availability and character of logistic resources data from local (field) automated and manual systems. These visits were useful not only because of the variety of data sources identified, but because they confirmed the study team's presumptions concerning gaps in data availability.

USA Major Item Data Agency (MIDA), Chambersburg, Pa., 18-19 Dec 75.

MIDA maintains worldwide asset data on all standard Army adopted and reportable items of equipment. MIDA produces, inter alia, the Army's Major Item Distribution Plan (MIDP), and is the central workloading agency for all USA Materiel Development and Readiness Command (DARCOM) depot maintenance activities. The MIDA data base, therefore, contains a wealth of logistic resources data relating to:

1. Modification, alternation and conversion of equipment, accomplished and projected, including costs of materials and labor.

2. Annual depot maintenance program costs by weapon/support system commodity groupings, by equipment categories, by customers, by work accomplishment codes, by depot, etc.

3. Asset status of Army major items of equipment, including on-hand quantities by item and current and projected distribution requirements.

USA Logistics Systems Support Agency (LSSA), Chambersburg, Pa., 19 Dec 75.

LSSA is DARCOM's design agency for the automated depot management system called SPEEDEX (System-wide Project for Electronic Equipment at Depots, Extended). SPEEDEX contains internal depot management subsystems, external subsystems to provide management information to Headquarters, DARCOM, and interface with ALPHA (Army Materiel Command Logistics Program Hardcore-Automated), the commodity command automated system for wholesale worldwide supply distribution. Depot performance data generated by SPEEDEX are input directly to MIDA in support of its central workloading mission.

USA Maintenance Management Center (MMC), Lexington, Ky., 19-20 Jan 76.

MMC, a Class II activity of Headquarters, DARCOM, provides maintenance technical assistance to Army commands and installations worldwide. MMC publishes the widely read preventive maintenance magazine called "PS" and is the Army's foremost repository of information and expertise on field maintenance. Its data bank contains substantial maintenance data. MMC's master files are:

1. Equipment History
2. MWO Index
3. MWO Application History
4. Commercial Vehicle Master
5. Central Registration Master
6. Materiel Readiness Control
7. Manpower Authorization Criteria (MACRIT)
8. Sample Data Collection Repository

USA Aviation Systems Command (AVSCOM), St. Louis, Mo., 21-23 Jan 76.

AVSCOM is the NICP and the national maintenance point (NMP) for aviation systems and materiel. AVSCOM was the first DARCOM commodity

command to have the ALPHA system installed and operational. Through ALPHA, a wide variety of NICP/NMP data are available to AVSCOM and the other DARCOM commodity commands. Examples include (by aircraft type):

1. Total operating hours.

2. Total maintenance hours by organizational, DS and GS levels.

3. Average maintenance hours per operating hour for organizational, DS, and GS levels.

4. Depot maintenance parts and labor costs.

5. Procurement costs of Appropriation and Stock Fund spares.

6. Foreign military sales reimbursables.

4th Inf Div (Mech) and Ft Carson, Col., 26-29 Jan 76.

Ft Carson was visited to review the availability and nature of data at the organizational, DS, GS, and installation levels. Divisional and nondivisional units and post supply and maintenance activities were visited. Below division and installation levels, information from automated systems is limited and of questionable quality. Examples of data available from installation and division level systems are:

1. The installation level Support Maintenance Management System (SMMS) which will provide maintenance manhours by job order and by commodity group. When Phase II of SMMS becomes operational, it will interface with the Standard Army Intermediate Level Logistics Subsystem (SAILS) to reflect repair parts costs by job order and commodity group.

2. RPMA costs are available at the installation level. These include utilities, maintenance of real property, minor construction and engineering support services such as fire protection, custodial services, refuse collection and disposal, etc.

3. POL consumption by unit.

4. Because of a unique program in operation within the 4th Inf Div called the "P2 Mission Funding System," data are available at the

battalion and separate company levels on dollars committed for repair parts monthly and annually. A special test was being run in the 1st Brigade to collect Class IX funds commitment by weapon system designator code. This test, "Commitment and Management of Unit Supplies (CAMUS)," proved successful and has been adopted as a FORSCOM command-wide system for management of Class IX supplies.

OTHER SURVEY ACTIVITIES

While examining the question of data availability, the team remained cognizant of the relationship of other Program Optimization and Budget Evaluation system (PROBE)-related GRC studies to the Logistic Resources Data Base Study. Coordination with these studies has been continuously maintained. The PROBE Interface Study is directed toward the documentation and analysis of Army Staff systems and PPBS organizational and functional relationships. PROBE Interface remains the umbrella for coordinating several study efforts pertaining to the PPBS including this study. The other studies are summarized briefly below.

The Defense Planning and Programming Categories (DPPC) Study. This is an OSD (M&RA) project to improve classification structure of DPPCs by improving the connection between DPPCs and units in the field, achieving service consistency in use of DPPCs, and relating locations to DPPCs.

The Program Element/Unit Identification Code (PE/UIC) Study. The study's objective was to associate each UIC with a single PE, thereby improving the accuracy of manpower and logistic reporting.

The Army Management Structure Code (AMSCO) Study. The AMSCO study developed a system to preclude input of invalid AMSCOs into the force file in order to improve the accuracy of the force structure data base.

Force Structure and Manpower Management (FSMM) Study. The objective of this study, monitored by DPAE, is to assist the Office,

Deputy Chief of Staff, Operations (ODCSOPS), in improving force structure and manpower management from an organizational, functional and systems point of view.

The Operating and Support Cost Management Information System for Weapon Systems (O&SCMIS). The objective of O&SCMIS is to provide O&S costs for existing weapon systems, based upon input from the Force Cost Information System (FCIS) and an Intense Sample Data Collection (ISDC) program. Since one of the applications of the Logistic Resources Data Base Structure is to provide logistic costs by weapon system, all of the components of O&SCMIS have been incorporated into the Logistic Resources Data Base Structure (see Figures 2-1 through 2-4) to enhance the utility of both to the Army staff. Wherever O&SCMIS data sources will satisfy the Logistic Resources Data Base requirements they have been used in order to reduce data collection and reporting requirements.

AUTOMATED SYSTEMS SURVEY

A considerable portion of the Phase II effort was devoted to researching the availability of data necessary to support the Logistic Resources Data Base Structure with primary emphasis placed on existing automated systems, files and reports.

Initially, the study team compiled a list of 174 logistic and logistic-related data sources for review. This list was examined and a preliminary evaluation made concerning the potential usefulness of each system or other source. This determination was based on review of available system descriptions (e.g., fact sheets, system summaries, etc.) plus the personal knowledge and experience of study team members.

Systems that appear most promising as data sources were given first priority for investigation in detail. Detailed research involved the use of system users guides and manuals as the basic

research tool plus, in some cases, interviews with DA staff personnel with expert knowledge of the system. Eventually, 65 systems were reviewed in detail.

Another category of systems was screened to confirm the preliminary evaluation of their potential usefulness. The majority of these data sources were in fact found to contain or produce data of no direct applicability to the data base requirements.

The study also identified 23 MIDA products that apparently will provide useful information to support wholesale level data requirements.

Table 4-1 summarizes the data availability survey.

Table 4-1

SURVEY OF AUTOMATED SYSTEMS

Type of review	Number of systems		Total
	Applicable	Not applicable	
Systems/files/reports reviewed in detail	41	24	65
Systems/files/reports screened	23	86	109
Totals	64	110	174

The systems, files and reports examined as part of the survey are listed in Appendix B.

Table 4-2 relates the results of the automated systems survey to specific logistic resource cost components. If the system or report currently produces any data that can be used directly in an algorithm, or supplies other information that may be used to assist in the development of algorithm requirements, it is so noted by an "X" in the appropriate level column.

Table 4-2

SYSTEMS/REPORTS/FILES
REVIEWED FOR LOG RESOURCE DATA APPLICATION

System/Report/File	Applicability to Log Resource Components			
	Level			Not applicable (N/A)
	ORG/DS/GS	INSTL	WSLE	
ADP Mgt Systems				
TRADOC Job Acctg Sys (TRAJAS)				N/A
Facilities				
Integrated FAC Sys (IFS-I)		X	X	
Financial				
COA Data Base				N/A
Data Element Mgt Acct Rpt Sys (DELMARS)				N/A
Force Cost Info Sys (FCIS)	X	X	X	
Std Finance Sys (STANFINS)		X		
Force Planning				
Army Force Program (AFP)				N/A
Basis of Issue Plan (BOIP)				N/A
Force Acct Sys (FAS)				N/A
Force Dev Mgt Info Sys (FDMIS)				N/A
Structure & Composition Sys (SACS)	X	X	X	
The Army Auth Doc Sys (TAADS)	X	X		
TOE File	X	X		
Vertical Force Acct Sys (VFAS)				N/A
Vertical Forces Dev Mgt Info Sys (VFDMIS)				N/A
Vertical Army Auth Doc Sys (VTAADS)	X	X		

Table 4-2 (continued)

System/Report/File	Applicability to Log Resource Components			
	Level			Not applicable N/A
	ORG/DS/GS	INSTL	WSLE	
Industrial Preparedness				
Cost of Maint-Ind Mob Base (137)			X	
Ind Prep Operating Rept (784)			X	
Logistics Systems				
Commodity Commd Std Sys (CCSS)			X	
Major Item Distr Plan (MIDP)			X	
Sys-Wide Project-Elect Equip at Depots Extended (SPEEDEX)			X	
Maintenance				
Combat Serv Spt Sys (CS_3)	X			
Integrated Maint Mgt Sys (IMMS)		X		
Std Army Maint Sys (SAMS)				Develop-mental
Sample Data Collection (SDC)	X	X		
Supt Maint Mgt Sys (SMMS)		X		
The Army Maint Mgt Sys (TAMMS)	X	X		
Tactical Maint Control Sys (TMCS)	X	X		
Personnel				
Active Army Pers Rpt Sys (AAPERS)				N/A
Automated Manpower Util Rpt Sys (CSFOR-78)			X	

Table 4-2 (continued)

System/Report/File	Applicability to Log Resource Components			
	Level			Not applicable
	ORG/DS/GS	INSTL	WSLE	N/A
Personnel (Con't)				
Continental Army and Major Overseas Command System (CARMOCS), USAREUR				N/A
Civilian Budgeting Sys (CBS)	X	X	X	
Civilian Pers Info Sys (CIVPERSINS)	X	X	X	
Civilian Personnel Accounting System (CPAS)				N/A
Military Pers Info Sys (MILPERSINS)				N/A
MOS Training Handbook (MOSB)	X	X		
Std Inst/Div Per Sys (SIDPERS)				N/A
POL				
Def Fuel Supply Ctr Price Bulletin	X	X		
DOD Energy Info Sys (DEIS)		X		
Procurement				
Approp Funded 2d Item Budget			X	
Army Stock Fund Budget			X	
Requirements Priority & Asset Application for 2d Items			X	
System Tech for Acquisition of Resources (STAR)			X	
Supply				
AMDF POS Improvement Prog (APIPS), Formally ALMIDS				N/A
BASOPS Supply Mgt Sys				N/A
Commitment & Mgt of Unit Supplies (CAMUS)	X			
Continuing Balance Sys (CBS)			X	

Table 4-2 (continued)

System/Report/File	Applicability to Log Resource Components			
	Level			Not applicable
	ORG/DS/GS	INSTL	WSLE	N/A
Supply (Con'td)				
Common Table of Allowances 23-100-6 (Ammo, Rkts, Msl)	X	X		
Div Logistics Sys (DLOGS)	X			
DSU/GSU/Sys	X			
COSCOM Fund Commitment Verification Module (FCV)	X			
Standard Army Ammo Sys (SAAS)			X	
Reserve Card Processor Sys (RECAPS)	X			
Std Army Intermediate Level Supply Sys (SAILS)		X		
Std USAREUR Munitions Sys (SUMS)			X	
Transportation				
Automated Sys for Transp Data (AUTOSTRAD)				N/A
Admin Use Veh Mgt Info Sys (AUVMIS)				Developmental
Admin Veh Cost-Pen-Mile (AVC/M)-USAREUR				N/A
European Log Intel Sys (EURLIS)				Developmental
Integrated Trans Mgt Info Sys (ITMIS)				Developmental
Mech of Selected Trans Mvt Rpts (MECHTRAM)		X	X	
Mvt Mgt Sys (MMS) Part of ITMIS				Developmental
Std Port Sys (SPS) Part of ITMIS				N/A

If, after a thorough review, it was determined that no applicable data are currently provided by the system or report, an "N/A" is shown in the "not applicable" column. Of course, this is not to imply that such systems produce no data of value— those labeled "not applicable" simply do not, as determined by the study, contain or produce information suitable for logistic resource costing purposes within the context of this project.

A standardized "data element worksheet" was developed and used to assure uniform system review, documentation and auditability for later analysis. Each worksheet lists the applicable resource component or subcomponent, the level at which it is utilized and other key information such as the name of the data source, producing agency or activity, origin and file locations (where available), frequency of report, period covered, type of report (i.e., historical, status or projection), complete description of the data element(s) furnished and the analyst's evaluation of data adequacy. Additionally, pertinent data formats and output report samples were extracted from the documentation and copies were attached to the worksheets. A complete set of data element worksheets is contained in Appendix C.

EVALUATION OF DATA AVAILABILITY

The following discussion of data availability and applicability presents the study's evaluation of the automated data sources to supply adequate information to permit costing of logistic resources by weapon system, unit and function.

An overview of the data availability picture is shown in Table 4-3. The evaluations to follow will address each of the major cost categories, the components contained therein, and the availability/applicability of the data sources examined to "cost out" these components at the various levels of the logistic system, as noted in the table.

Table 4-3

DATA SOURCE AVAILABILITY

Cost Category	Component	Level		
		ORG/DS/GS	INSTL	WSLE
Operating				
	Military Personnel (Crew)	X	X	
	POL	X	X	
	Training Ammo/Msl		X	
Direct Support				
	Supply Support	P	X	X
	Maintenance	P	X	X
	Transportation	O	P	P
	Procurement			X
	Other Direct	A	A	A
Indirect Support				
	Personnel	P	X	P
	Personnel Replacement	X	X	X
	Transients, Patients & Prisoners	X	X	X
	Medical	P	P	X
	Investment in Logistic Facilities and Equipment	O	O	O
	RPMA		X	X
	International Logistics			P
	Industrial Preparedness			X
	Port Operations			X
	Other Indirect Logistic Services	P	P	P

X - Available

P - Partially Available

O - Not Available

A - As Applicable

Military Personnel (Crew) (Organizational, DS/GS and Installation Levels)

Adequate data are available through the FCIS and MOSB systems to permit development of accurate personnel costs for the crew (these data also are applicable to other military labor categories). The analyst need only identify the grade structure, MOSs and number of personnel to be costed.

Basic Pay and Allowances. Available by grade or by averages across grades from FCIS without need for further manipulation, once specific TOE/TDA is identified. Adequate to meet study requirements.

PCS. The average PCS rates and the annual rotation rate are available from FCIS. The two rates used together will enable PCS costs to be computed provided that the type (officer/EM) and number of personnel and the theater moved to/from are known.

Evaluation: Military personnel costs can be determined with a reasonable degree of accuracy from a combination of automated and manual reporting systems with relative ease.

POL (Organizational, DS/GS and Installation Levels)

Monthly bulk petroleum fuels consumption (barrels) is reported by installation in the DEIS report RCS-DD-I&L (AR)1313. By applying the standard price by product as established in DFSC price bulletins, the monthly cost of POL by installation can be determined. POL costs by unit or logistic function are not available. Usage factors (miles, hours) by equipment are available. By combining usage factors per equipment with the standard product price from DFSC price bulletins, cost of POL consumption per equipment and (by laborious extension) per unit could be computed.

Evaluation: The availability of a DoD-wide POL price list and various usage factors based on CCSS, SDC and TAAMS data indicate that fairly accurate POL costs could be derived for specific weapon systems, units or installations. Little if any

manipulation of the usage factors would be required— given that the equipment to be analyzed is currently, or has recently been, sampled as part of one of the aforementioned programs.

Training Ammunition/Missiles (Organizational, DS/GS and Installation Levels)

No automated data source was found that provided consumption data for training ammunition and missiles. Costs for this component may be derived by using information contained in the Common Table of Allwances (CTA 23-100-6), and price data from the AMDF, plus various asset/allowance files.

Evaluation: Because consumption of training munitions is "programmed," use of the data sources cited above will permit development of representative costs for weapon systems/units.

Supply Support (Organizational, DS/GS and Installation Levels)

Because the supply support function is costed in terms of military and civilian labor, the systems reviewed were primarily personnel reporting systems. The three systems contributing the most useful data were the SACS file, Civilian Budgeting System (CBS), and STANFINS. The SACS file provides "authorized/required" military personnel data that require additional input of military pay/allowances, etc., to be useful. The CBS provides "total" and "average" civilian salary (available by unit, command, AMSCO and numerous other ways). The number of actual or authorized civilian personnel necessary to complete the algorithm must be obtained from other sources.

Military and civilian personnel costs by PE, AMSCO and element of expense (EOE) by installation are provided by STANFINS.

Supply data, primarily in the form of various transaction and management reports, are furnished by DLOGS, the DSU/GSU system and RECAPS at the organizational and DS/GS levels. SAILS provides demand data at the installation level. Unfortunately, at best, the systems cited provide only gross workload measures that would have to be used in conjunction with various personnel data available from other sources to develop usable information.

Evaluation: Supply support costs applied to units or installations may be derived with relative ease. Attempting to apportion these costs to weapon systems would require considerable data manipulation, and even then the results would be questionable.

Supply Support (Wholesale Level)

No effective breakout by materiel management and depot operations has been obtained. However, excellent coverage of actual personnel costs by AMSCO at a higher level of aggregation (supply operations) is available from CSFOR-78 reports for Army Industrial Fund activities. Since AIF encompasses all DARCOM depots and arsenals, this should be acceptable.

Evaluation: The function of supply support can be costed by using AMSCO data. Costs by weapon system are not available at this level.

Maintenance (Organizational, DS/GS Level)

There are several major automated systems that provide a wide range of maintenance management data. The primary problem lies in acquiring this information in a display meaningful for logistic resources costing purposes.

Two systems seem to offer the best sources of useful data — SDC and the Tactical Maintenance Control System (TMCS) (a USAREUR-unique system). The Combat Service Support System (CS_3) system is less useful because it arrays data for maintenance management purposes, e.g., by work center activity, days backlog, etc. Several of the basic CS_3 input records could be used to develop numerous useful displays, but this would entail major changes in the sort routines and output report formats.

Although large quantities of maintenance data exist at the organizational and DS/GS levels, very little of it is easily applicable to logistic resources costing because most reside in non-automated records.

A review of available automated maintenance data indicates that it would be possible to "cost out" a weapon system, unit or function within either of two basic constraints: (1) the weapon system has recently been or is currently an SDC sample equipment, or (2) European data (from the USAEUR TMCS) would be acceptable.

The Standard Army Maintenance System, when it becomes operational, will replace several interim systems and will provide much directly useful resource data. It is shown as "not applicable" only because it has not yet been fielded.

Evaluation: Because of the nature of the maintenance report outputs at this level, it would be extremely difficult to cost out the maintenance component by type of weapon system (i.e., specific models). Weapon system costs could be derived but only by means of massive data manipulation. Unit and function costs are available with moderate manipulation of automated data.

Maintenance (Installation Level)

The Integrated Maintenance Management System (IMMS) and SMMS provide the essential elements of actual manhours and parts costs by type equipment, weapon system support code (WSSC), and, in the case of IMMS, by weapon system and AMSCO. While identification of installation maintenance costs of end items and major assemblies is practicable, further breakout of cost categories such as exchangeable components and modification materials is not possible without extensive effort, the results of which would be imprecise.

Evaluation: Maintenance costs at the installation level are derivable by unit, weapon system and logistic function. Cost distributions by type of maintenance (i.e., exchangeable component, etc.) will probably require special reporting.

Maintenance (Wholesale Level)

Actual and projected costs by maintenance program (end items and major assemblies) are available by AMSCO, PE, and FY. This includes maintenance engineering support costs. While maintenance costs of exchangeable components are not readily available, they are obtained from MIDA by associating national stock numbers (NSNs) or component and accessory codes with depot maintenance procurement request order numbers (PRONs). However, since total program costs are available, this does not appear to be a useful or necessary exercise.

Evaluation: Depot level maintenance data currently produced by existing automated sources are considered adequate for logistic resource costing requirements.

Transportation (All Levels)

Cost of tonnage and passengers moved by Military Airlift Command (MAC), Military Sealift Command (MSC), and MTMC is available by OMA (PE level) and MPA appropriation codes through the MECHTRAM system. While the data are useful, the level of aggregation is very broad.

No source has yet been found that identifies transportation costs by weapon system or specially breaks out "to and from depot" costs.

Evaluation: Transportation cost data presently available are not adequate to meet all study needs.

Procurement (Wholesale Level)

The MIDP, Stock Fund and Appropriation-Funded budgets all provide data useful for deriving adequate procurement costs.

Evaluation: Data available from existing systems are adequate for logistic resources costing purposes.

Other Direct (All Levels)

A flexible category intended to capture all direct operating and support costs not chargeable elsewhere in the structure, these data will surface on a case-by-case basis.

Evaluation: No specific source of other direct costs is identifiable. Cost determination will be made on an empirical basis as required.

Personnel (Indirect— All Levels)

Total civilian salaries by AMSCO and FYDP PE are available from the Civilian Budgeting System. Military and civilian personnel costs by PE, AMSCO and EOE are provided by STANFINS.

Since personnel costs are provided by function and AMSCO rather than direct and indirect, arbitrary judgments must be made.

Evaluation: Data available must be manipulated to obtain indirect personnel costs.

Personnel Replacement (All Levels)

Actual training costs (MOSB) and average loss rate per year (FCIS) are available and useful for determining a portion of personnel replacement costs. Recruiting, cost of inprocessing and initial outfitting and separation costs have not yet been identified in automated systems. All replacement costs, however, are believed to be available from several different sources, some of which will be manual.

Evaluation: Personnel replacement cost data available through identified sources are adequate.

Transients, Patients and Prisoners (All Levels)

Only average annual TPP costs will be used for logistic resource costing purposes.

Evaluation: Adequate cost data are available for each of the separate pieces of TPP from the MPA Budget.

Medical (All Levels)

Actual costs of military medical/dental personnel are available from CSFOR-78 reports for AIF installations.

Evaluation: Data available may be used to derive an average cost of medical support (per crewman) for weapon systems. Unit and installation data are readily available.

RPMA (Installation and Wholesale Levels)

Adequate and comprehensive data are available from the RPMA module of IFS to permit costing of this component by installation and by FY in AMSCO and PE format.

Evaluation: Existing data source is adequate for RPMA costing needs.

Investment in Logistic Facilities and Equipment (All Levels)

Because of the nature of this cost component, it may be necessary to develop costs using empirical data on a case-by-case basis as required.

Evaluation: These data must be extracted from MCA, procurement and OMA budgets.

Other Indirect Logistic Services (All Levels)

Marginally useful "authorized personnel" data are available from TAADS assuming that appropriate UICs can be identified. Cost of logistic support activities (PE 780120) are available at DA level. Costs of operating laundries and printing plants are identified in Base Operations "Z" accounts.

Evaluation: Data generally available and adequate.

International Logistics (Wholesale Level)

Civilian personnel costs chargeable to international logistics (by AMSCO and PE) are available from the Civilian Budgeting System. Costs of all reimbursable issues to this component (FMS/MAP) are available from CCSS and Secondary Item Budgets (Stock Fund and Appropriation Funded). Military personnel costs have not yet been identified.

Evaluation: Partial data are available. Available data are, however, in suitable format.

Industrial Preparedness (Wholesale Level)

Actual cost data are available by AMSCO and PE by FY from the Industrial Preparedness Operations Report, RCS AMCRP-137. Outyear projections are also available.

Evaluation: Available data are considered adequate.

Port Operations (Wholesale Level)

Actual civilian personnel cost data are available by command, AMSCO and PE from the CBS and CSFOR-78. Additionally, CSFOR-78 provides actual military cost data for AIF-funded port operations. Tonnage and passengers moved through such ports are available from MECHTRAM.

Evaluation: Data available are considered adequate.

SUMMARY

The following is a summary of the data availability/applicability situation vis-a-vis the Logistic Resources Data Base Structure and illustrated in Table 4-3.

Organization, DS/GS Level

Only a few of the necessary organizational, DS/GS level data elements are furnished by automated systems in forms directly applicable (or easily adaptable) to the cost algorithms. With the exception of the operating costs of personnel, POL, and training ammo costs, data availability is extremely limited at this level. In the case of supply and maintenance, although numerous elements of data are available, in almost every instance considerable manipulation would be necessary for determining either actual or average costs. No sources have yet been found for intracommand transportation, or investment in logistic facilities and equipment costs. It is doubtful that these data gaps can be readily resolved without a change in current reporting requirements. It is evident that partial logistic resource costing by function and unit is possible, that reliable estimates of operating costs can be obtained by weapon

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system, that maintenance costs related to specific types of weapon systems would be extremely difficult to develop, and that indirect support costs (other than medical) will be extremely difficult (if not impossible) to obtain with any degree of reliability and accuracy.

Available alternative to "costing out" the organizational, DS/GS level of the logistics system would entail using those data elements that are readily available and developing estimated cost factors to complete the structure at this level until such time as empirical data can be obtained through an automated system or a sample data collection program.

Installation Level

The situation is somewhat more encouraging at installation level. Operating costs are determinable, although a mixture of actual and average costs is necessary. Installation level direct support costs are, in the main, available by logistic function, by program element and by AMSCO. However, only maintenance costs are available by weapon system and, at that, only at those installations operating the IMMS (Ft Bliss and Ft Sill). CONUS installations operating the SMMS and USAREUR activities operating TMCS can provide maintenance costs by WSSC, which constitute categories of equipment rather than specific weapon systems.

Certain Base Operations transportation costs are obtainable, but other elements of transportation cost are still missing. Indirect support costs for personnel, medical (partially) and RPMA are available. The RPMA module of the IFS produces particularly useful data in the desired formats by AMSCO and PE.

The survey concluded that the major logistic resources costs at installation level are now available, assuming the acceptability of a mixture of actual and average cost data and the use of data from a minimum of ten different sources.

Available alternatives for the installation level would be: (1) for the near term, accept the less-than-desirable mixture of actual and average cost data from disparate data sources and, meanwhile, emphasize improving the reliability and accuracy of these data sources; (2) for the outyears, ensure that all costs required at DA/OSD levels are originated in field systems and captured via an automated collecting and reporting system.

Wholesale Level

Direct support costs, with the exception of transportation, are available by logistic function, appropriation, PE and AMSCO. Among indirect support cost components, only investment in logistic facilities and equipment remains completely unfilled. Data in support of medical, RPMA, port operations and industrial preparedness are adequate and available functionally by AMSCO and PE. Indirect personnel costs require the application of some arbitrary judgments as to those functions considered indirect, since personnel costs tend to be provided by functions. Civilian personnel costs chargeable to international logistics and reimbursable issues to FMS/MAP are available. However, a source for military personnel costs has not yet been identified. Only marginally useful data related to other indirect logistic services have been indentified.

At the wholesale level: (1) the major logistic resources costs are available, assuming the acceptability of data from, again, at least ten different systems/reports; (2) relating expenditures to TOA is feasible but difficult; and (3) only depot maintenance costs are available by weapon system.

Due to the nature of other wholesale level costs, it is impracticable to apportion them to weapon systems.

Certain likely alternatives emerge for the wholesale level, i.e., that weapon system costing be limited to depot maintenance, and that the collection of other logistic resources costs be attempted by function only. To the extent necessary, AMS coding should be modified to permit identification of significant cost elements desired.

Detailed worksheets describing data elements furnished by the automated systems reviewed by the study are contained in Appendix D, "Data Elements— By Structure Component, By Level," and Appendix E, "Data Elements— By System."

Chapter 5

ALTERNATIVE APPROACHES TO DEVELOPMENT OF AN OPERATIONAL LOGISTIC RESOURCES DATA BASE STRUCTURE

INTRODUCTION

The previous chapter on data availability reveals two major considerations regarding the information available to satisfy the data base structure requirements. First, that applicable data is available from numerous diverse sources and, second, that there are still extant data gaps. The question of data gaps remains to be resolved. The matter of how best to accommodate existing data and known requirements, however, is the subject of this chapter.

The alternatives presented herein are not necessarily mutually exclusive. Conceivably, features of each approach could be incorporated into the final system. They are, however, presented separately since each method represents a different means of accommodating the structure (or a portion thereof).

In considering the alternative approaches to satisfying the requirements of the data base structure, certain factors must be kept in mind. As mentioned above, the data base must have the capability to handle a large volume of data from many disparate sources. Also, the myriad aggregations required in order for the data base to provide logistic resources cost by weapon system, unit, and logistic functions necessitate a flexibility to produce a variety of output displays in addition to the capability of projecting these costs for future requirements.

The alternative approaches to satisfy the requirements of the Logistic Resources Data Base Structure, as were presented to the Logistic Resources Study work group on 17 September 1976 are:

1. Develop an automated reporting system tailored to Logistic Resources Data Base requirements.

2. Develop a manual reporting system tailored to Logistic Resource Data Base requirements.

3. Utilize SDC/ISDC as the primary source of organizational, DS and GS maintenance data.

4. Restructure AMSCOs

   a. Restructure OMA programs to identify logistic resources by AMSCO.

   b. Restructure Program 7M to identify depot maintenance by weapon system.

5. Design and implement a logistic resources cost model.

ALTERNATIVE 1 - DEVELOP AN AUTOMATED REPORTING SYSTEM TAILORED TO LOGISTIC RESOURCES DATA BASE REQUIREMENTS

Discussion

As noted in Chapter 4, the Logistic Resources study team performed intensive research into potential data sources to support the Logistic Resources Data Base Structure. As a result of this survey of existing automated systems, two primary facts must be considered in selection of an alternative to satisfy the Logistic Resources Data Base needs: (1) there is a vast volume of diverse data from multiple sources to be considered, and (2) a considerable effort will be required to manipulate and aggregate these data into logically informative displays.

Given the factors noted above, it follows that a reasonable approach to the collection, analysis and management of requisite structure data is the use of an automated data base system.

An automated system tailored to specific Logistic Resources Data Base Structure requirements would be considerably more efficient in the manipulation of large volumes of data than either a manual (see Alternative 2) or semiautomated method. Additionally, because much data already exists in automated form (or in a format lending itself to automation) the task of capturing these data by means of an automated system would be simplified.

Additional benefits derivable from the use of an automated data base system are its ability to maintain a continuously updated data base and the flexibility to add, delete, or otherwise modify the system in light of logistic resource data requirements/availability.

Implementation of an automated system should logically proceed in two phases: a technical systems design effort, and consideration of organizational and procedural requirements.

Phase I, the technical design effort leading to the development of a general and a detailed functional systems requirement, includes such tasks as:

1. Development of complete system specifications including input data detail, file descriptions and contents, output requirements and the methodology for data base management considerations.

2. A field reporting survey to include analysis of reporting formats, responsibilities, data flows, requirements for local data use, frequency and levels of detail to be reported. This task would determine the course of action to follow in filling data deficiencies, i.e., supplemental reporting or modification of existing reports or formats.

3. System cost determination; an economic analysis to include the cost of data collection, system development, programming, testing and system operation and maintenance.

Phase II, the organizational and procedural specifications effort should include:

1. System correction and validation procedures.
2. Establishment of a supporting organization.
3. Any necessary hardware acquisition.
4. Inter- and intra-agency coordination requirement.
5. Development of data reporting procedures.
6. Imposition of reporting requirements.
7. Implementation authority.
8. Issuance of appropriate guidelines, manuals.

The time to accomplish these two phases would be highly dependent upon the level of effort dedicated to the tasks and the degree to which tasks within the phases could be accomplished concurrently.

Advantages

1. Capability of managing extremely large volumes of data.
2. Rapid processing and analysis resulting in "timely" reports.
3. Ease of continuous data base update and maintenance.
4. High degree of system versatility via programming system and/or data requirement modifications.

5. Capability of assimilating and utilizing source data from already existing automated and/or semiautomated systems.

6. High degree of reliability and accuracy (once system is "debugged").

7. Accessibility to many users via report requests or on-line terminals.

8. May be designed to interface with other systems.

9. Probably most cost-effective alternative, given the magnitude and diversification of input requirements.

10. Capable of producing logistic resource displays by weapon system, unit, logistic function and/or PE (given appropriate input data).

11. System could be designed to provide logistic resource cost projections based on the system's empirical data base.

Disadvantages

1. Comparatively high system developmental costs.

2. Lengthly developmental/implementation time.

3. Need for additional hardware (if required) could be a cost consideration.

ALTERNATIVE 2 - DEVELOP A MANUAL REPORTING SYSTEM TAILORED TO LOGISTIC RESOURCES DATA BASE REQUIREMENTS

Discussion

One alternative to satisfy the data requirements of the logistic resources structure is to develop and implement a manual data reporting/processing system tailored to the specific needs of the Logistic Resources Data Base. It should be noted that in the context of this discussion, "manual" implies extensive use of mechanized card processing equipment (e.g., keypunch equipment, card sorters, listers, etc.) to process and analyze "hard copy" input. In essence, a manual system would be ancillary to the already identified automated system data sources. It would require Department of the Army decisions as to data formats, channels and frequency at each reporting level.

Development and utilization of a manual system is considered a possible alternative, however, cognizance must be taken of the following aspects:

1. Many of the identified data gaps exist at the lower echelons of the Army logistic system where imposition of additional reporting requirements are least desirable.

2. Although a manual system would be less costly to develop and implement vis-a-vis an automated system, ongoing personnel costs would be very high.

3. A manual system of the magnitude required would be extremely difficult to update and maintain in an orderly and easily accessible fashion. This could result in a reduction of the scope of the Logistic Data Base Structure.

The chief advantage of a manual system is the capability to turn it "on" and "off" to sample selected essential data at a few representative units for relatively short reporting durations.

Advantages

1. Less costly to develop and implement than an automated system.
2. Useful for selected sampling for short periods of time.
3. Manual system more readily implemented.

Disadvantages

1. Large staff requirements, numerous data "handlers" and analysts.
2. System would be extremely difficult to maintain in an orderly fashion, i.e., it would be hard to update and retrieve data manually.
3. Difficulty of managing large volumes of data manually may cause scope of the data base structure to be reduced.
4. Each separate data distribution (e.g., by weapon system, by unit, etc.) would require massive data manipulation.
5. Considerable input to the logistic resources structure from existing automated systems would still be necessary.
6. Potentially long "leadtime" to acquire and process/analyze data.

ALTERNATIVE 3 - UTILIZE SDC/ISDC AS PRIMARY SOURCE OF ORGANIZATIONAL, DS AND GS MAINTENANCE DATA

Discussion

The Logistic Resources Data Base Structure Study survey of automated systems revelaed a vast amount of maintenance data existing at the various levels of the Army logistics support system. The major problem with all of the maintenance systems reviewed was their inability to relate detailed labor and/or repair parts costs to specific types of weapon systems and/or units. Some outputs are available in an equipment category code (ECC) format, but this is considered too gross to meet the study's objective of relating logistic resource comsumption to weapon systems and units.

Presently (and in the foreseeable future) only Sample Data Collection (SDC) or its proposed replacement, Intense Sample Data Collection (ISDC), is considered an adequate data source to meet the requirement of relating organizational/DS/GS maintenance data to specific weapon systems and/or units. For this reason, the Logistic Resources Study considers it essential that the Army either continues to present SDC program or adopts the ISDC concept to capture weapon systems/unit maintenance data at the lower echelons of the logistics system.

Sample Data Collection

SDC is defined as "a data collection, processing and analysis program designed to collect selected data for specific equipments for a designated quantity or percentage of the total density to obtain repair and service data. Sample data will be obtained from specific units located in designated geographical areas for a limited period of time. These data will be used by the equipment proponents for evaluation equipment performance effectiveness."5-1

5-1 Dept. of Army, "Sample Data Collection-The Army Maintenance Management System (TAMMS)," AR 750-37, 24 Mar 71.

SDC is part of The Army Maintenance Management System (TAMMS) and is intended to provide equipment reliability, availability and maintainability and selected usage data to the commodity command equipment proponent. Items to be sampled are proposed by the commodity command responsible for the equipment following procedures outlined in AR 750-37 to establish an item as an SDC equipment.

Once an SDC plan is approved, data collection is initiated using various TAMMS forms and records to collect data at the organizational, DS and GS maintenance levels utilizing on-site DARCOM technical representatives as the focal point for SDC field activity. The DARCOM representative forwards the raw data to the US Army Maintenance Management Center (MMC) at Lexington, Kentucky, where it is edited, reduced and processed for analysis. Although MMC serves as the main repository for most of the SDC data base, the equipment proponent may retain its own equipment-peculiar SDC data.

Currently, SDC is not used to collect any aircraft data because of the "total" aircraft maintenance data collection program managed by AVSCOM.

The most important contribution of SDC or the proposed ISDC to the Logistic Resources Data Base Structure and the O&SCMIS is the identification of Class IX repair parts consumed and maintenance labor manhours expended--tied directly to specific weapon systems and units. Less critical, but nonetheless valuable information such as equipment utilization and POL consumption may also be captured. It bears reiteration that at present no other system provides these kinds of data from the organizational/DS/GS maintenance levels.

Intense Sample Data Collection

ISDC is currently being proposed by elements of the Army Staff as a possible alternative to SDC. Under ISDC an on-site "dedicated" data collector would be responsible for maintaining the operational and maintenance history of an individual (i.e., serial numbered) piece of equipment. This one-to-one relationship

is intended to provide more accurate and reliable data.

ISDC would be utilized for new weapon systems only and would be applied as the new equipments enter the system to capture data at the organizational, DS and GS levels.

The primary advantage of ISDC over the current SDC system is the apparent increased accuracy and completeness of data by virtue of a "dedicated" data recorder/evaluator.

Type of Reports

Reports produced as part of the present SDC program are designed by the equipment proponent and do not necessarily follow a standardized format. It is assumed that ISDC would produce similar data analyses. Usually, four basic reports are produced that provide various forms of summary data and analysis.

Part A. Monthly Summary (produced by MMC)

Part B. Quarterly Analysis (produced by MMC)

Part C. Quarterly Materiel Management Summary (produced by MMC)

Part D. Annual Summary (produced by the equipment proponent)

An illustrative table of contents extracted from an SDC Materiel Management Summary is shown in Table 5-1.

Advantages

1. SDC is a demonstrated effective data collection/analysis technique.

2. SDC/ISDC collects data at levels not otherwise reported.

3. Data provided by SDC/ISDC is critical to the Logistic Resources Data Base Structure and the O&SCMIS.

4. SDC/ISDC is capable of providing secondary data considerations of POL consumption and equipment utilization.

5. SDC/ISDC data are tied directly to a specific model of weapon system and specific unit.

6. Relatively minor data manipulation is required to produce "unit" analyses.

7. Because SDC/ISDC may be tailored to specialized requirements, more detailed cost-related analyses could be instituted.

8. Because SDC/ISDC is tailored to specific data needs and is generally run for relatively short durations (12-18 months), both systems must be considered more cost-effective than a general wide-application data collection system.

9. ISDC should provide extremely accurate and reliable data.

10. Field units sampled under the SDC/ISDC program receive regular analytical feedback which should have a positive effect on the acceptability of the program at the user-unit level.

Disadvantages

1. SDC/ISDC data base limited to equipment sampled as part of the program.

2. Long leadtime required to initiate SDC/ISDC program for a new equipment.

3. Lack of continuous data base update once SDC/ISDC for a particular equipment is terminated.

4. Limited to weapon system costs at organizational, DS and GS levels.

Table 5-1

MATERIEL MANAGEMENT SUMMARY TABLE OF CONTENTS

ALTERNATIVE 4 - RESTRUCTURE OMA AMSCOs

Discussion

Restructuring of the OMA AMSCOs is one means of providing visibility to logistic resources residing in the mission-oriented program elements but not currently separately identified. The following discussion describes an analysis made to determine the effects of restructuring the OMA AMSCOs to accomplish this purpose.

Of all the OMA programs in AR 37-100-77, Program 7 (Central Supply and Maintenance) is best structured for logistic resources identification. Program 7 is so structured that the aggregation of data from discrete and logical logistics subfunctions to functions, and from functions to program is greatly facilitated. More significantly, P7M (Depot Maintenance) provides a breakout by equipment category and type reportable item codes that, with minor modifications could provide a means of costing by weapon system. This will be discussed in a later section of this paper.

Alternative 4a - Restructure OMA Mission-Oriented Programs to Identify Logistic Resources by AMSCO.

In considering which restructured program other than P7 would provide the greatest benefit to the Army in the form of logistic resources identification, it was determined that Program 2 (General Purpose Forces) warranted primary consideration because:

1. The bulk of the Army's Active Forces are contained in P2 including the logistics organizations organic to these forces as well as related support units.

2. P2 forces are major consumers of logistic resources, yet this consumption is not separately identifiable.

3. P2 forces are the major beneficiaries of P7 resources.

Before presenting the illustrative restructuring of the P2 AMSCOs, a review of the current P2 structure is necessary. The structure of the 11 digit basic account code for OMA P2 is shown in Fig. 5-1.

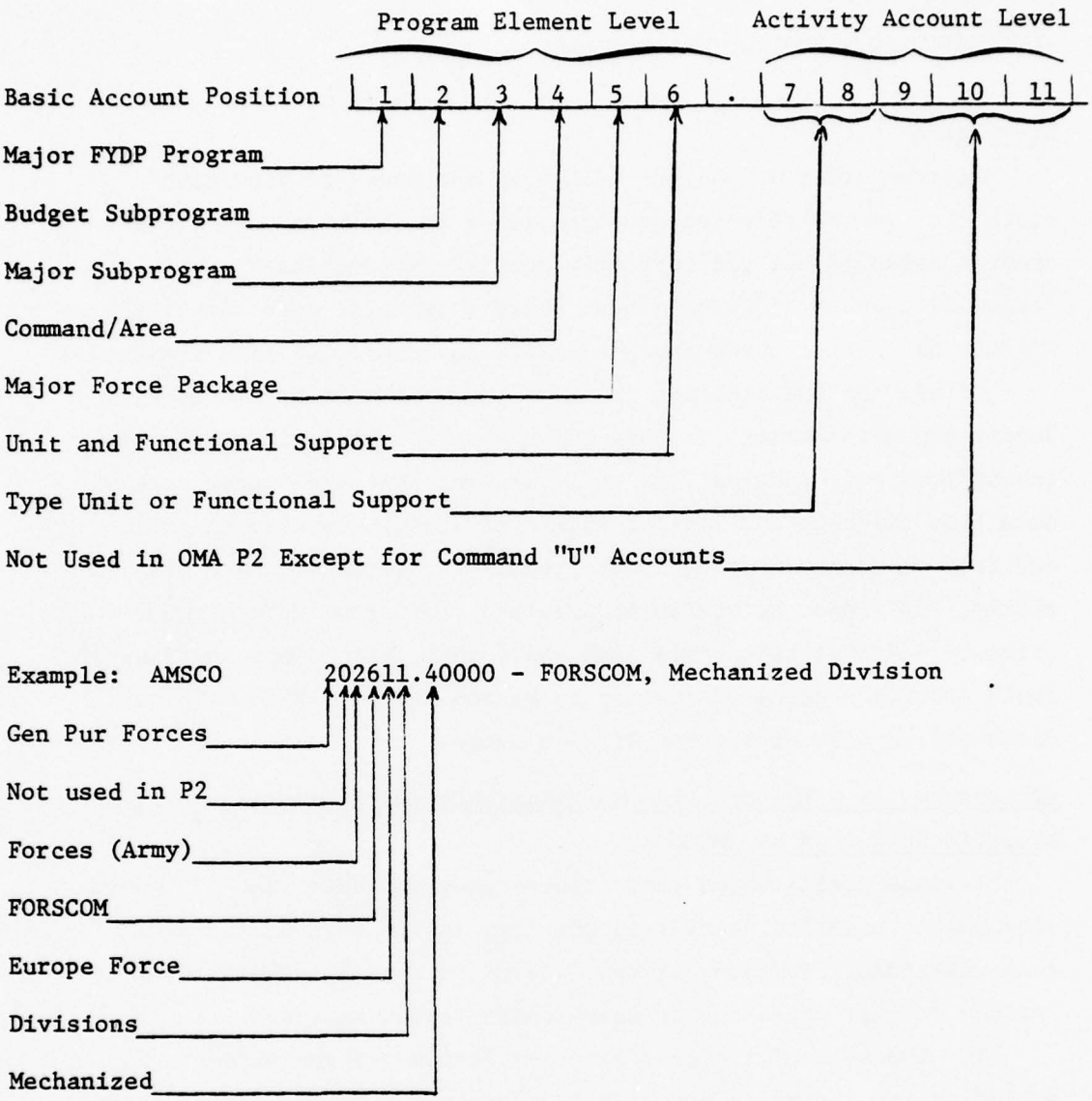


Figure 5-1 Current Army Management Structure Basic Account Code (OMA-Program 2)

Because the first six digits comprising the AMS program element level also encompass the FYDP program element, the restructuring analysis was focused on the activity account level (digits 7 thru 11). The analysis revealed that the technique described below, if applied to Program 2 Forces will provide a discrete display of the logistic resources contained therein. This technique is equally applicable to other mission-oriented programs. It is not applicable to the Base Operations "Z" accounts.

The proposed restructured activity account position of the AMSCO would consist of three codes as shown in Table 5-2.

Parent Unit Code. The seventh and eigth digits are used to uniquely identify each unit within the AMSCO PE (AMSCO PE as used in this paper refers to the complete 11 digit code as shown in Figure 5-1). The use of numerics and alpha-numerics (excluding the number "zero" and letter "0" which would be used for rollups only) made it possible to identify 34 separate units and 34 unit rollups for each AMSCO PE. A more detailed illustration of this coding is shown in Table 5-3.

Subordinate Unit Code. The ninth and tenth digits, in conjunction with the seventh and eighth digits, identify each battalion and separate company in a division, separate brigade or regiment, and each non-division unit in an AMSCO PE. Example: AMSCO 602611.1H020 HHC, 1st Bde, 4th Mech Div.

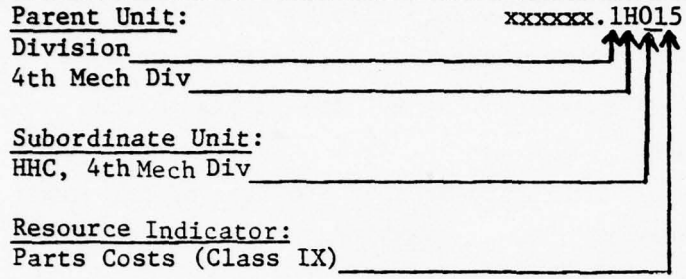
Resource Indicator Code. The eleventh digit identifies discretely the type of logistic-significant resources contained in a unit. This resource indicator is the key element of the technique in that it provides the Army for the first time, within its management structure, logistic resource visibility by unit and logistic function. By keying the appropriate resource indicator, logistic resource costs can be aggregated to display:

1. Logistic function costs by unit within each AMSCO PE, by all units within an AMSCO PE and for all AMSCO PEs in Program 2.

Table 5-2

PROPOSED AMSCO RESTRUCTURING OF OMA-PROGRAM 2

(Activity Account Level Only)



Parent Unit Code	Subordinate Unit Code	Resource Indicator
.1-Divisions	.1H000-4th Mech Div	blank - Rollup of all unit resources
.1A-1st Inf Div	.1H010-HHC, 4th Mech	1-Supply Personnel Resources
.1J-5th Inf Div	.1H020-HHC, 1st Bde 4th Mech	2-Maintenance Personnel Resources
.1K-7th Inf Div	.1H030-1/10 Inf Bn	3-Primary Mission Personnel Costs
.1N-101st Div (AA)	.1H040-1/22 Inf Bn	4-All Other Personnel Costs
.2-Sep Bdes/Regt	.1H050-632d Armd Bn	5-Class IX Parts Costs (Consumption)
.3-Non-Div CBT Units	.1H060-HHC, 2d Bde	6-POL Costs
.4-AVN Units	.1H100-HHC, 3d Bde	7-All Other Materiel Costs
		Supply Units:
.5-Non Div CBT Supt Units (Sig. Cbt Engr, MP)	.1H170-HHC, Div Arty	8-Class II & IV Supplies Issued
		Maint Units:
.6-Mil Intel Units	.1H230-HHC, DISCOM	9-Class IX Supplies Issued
.7-Tac SPT-Med Units	.1H330-4th MP Co	
.8-Tac SPT-Log Units	.81500-HHC, 68th Trans BN	
.9-Admin Units	.83520-40th S&S Co.	
	.90000-56th AG Postal Unit	

Examples:

AMSCO 202611.1H020 - Rollup of all unit resources, HHC, 1st Bde, 4th Mech Div
AMSCO 202611.81515 - Class IX parts cost, HHC, 68th Trans Bn
AMSCO 202611.1A022 - Maint Pers Cost, HHC, 1st Bde, 7th Inf Div

Table 5-3

PROPOSED AMSCO RESTRUCTURING OF OMA-PROGRAM 2

(Parent Unit Code List)

XXXXXX.XXXXX

Proposed Restructuring
.1-Divisions
.1A-1st Inf Div (Mech)
.1B-1st Cav Div
.1C-1st Armd Div
.1D-2nd Inf Div
.1E-2nd Armd Div
.1F-3rd Inf Div
.1G-3rd Armd Div
.1H-4th Inf Div (Mech)
.1J-5th Inf Div
.1K-7th Inf Div
.1L-8th Inf Div (Mech)
.1M-9th Inf Div
.1N-24th Inf Div
.1P-25th Inf Div
.1Q-82nd Abn Div
.1R-101st Air Aslt Div
.2-Sep Bdes/Regts
.3-Non-div Combat Units
.4-Aviation Units
.5-Non-div Cbt Supt Units*
.6-Mil Intel Units
.7-Tac Spt - Med Units
.8-Tac Spt - Log Units
.81-Trans Units
.82-Engr Units**
.83-Sup & Svc / Gen Sup Units
.84-Maint Units
.85-Ord Units
.86-RP Supply Units
.9-Admin Units

*Signal, combat engineer, military police, etc.

**Other than combat engineer units

2. Total logistic resource costs by unit within an AMSCO PE, for all units within an AMSCO PE and for all AMSCO PEs in Program 2.

A detailed illustration of the application of the resource indicator is depicted in Table 5-4.

Regarding the parent and subordinate unit coding described above, this concept addresses the AMSCO as the sole integrater of unit identification and logistic resource indicator. However, since the Force Accounting System (FAS) and The Army Authorization Document System (TAADS), which will be involved in any application of this concept, already contains the unit identification codes (UICs), it might be possible to like the UIC with the resource indicator described above to provide the desired logistic resources visibility. If this variation proves workable, the three positions (8th, 9th, and 10th) now used in this concept for unit coding would be available for application of a weapon system coding scheme functionally harmonious with the resource indicator code.

Advantages

1. Provides a means of meeting the stated objective of OSD and the Army for greater visibility of logistic resources in the FYDP by separately identifying those resources residing in mission-oriented programs.

2. Provides a flexible programmatic means of determining and displaying logistic resources by unit and logistic function.

3. Provides within the basic account portion of the AMS a capability that now only partially exists by use of Accounting Processing Codes (APCs) at installation level. The flexibility that the APC affords the installation commander would not be infringed upon by this technique.

4. Restructuring would redirect the Army's bookkeeping to the collection of data in the format and frequency required.

5. Due to the rollup capability, restructuring does not increase the number of AMSCO PEs for management purposes.

Table 5-4

PROPOSED RESTRUCTURING OF OMA-PROGRAM 2

(Activity Account Level Only)

XXXXXX.XXXXX

4th INFANTRY DIVISION (MECH)

AMSCO 202611.00000	Proposed coding
4th Inf Div (Mech) Cost Rollup	.1H000
Div Supply Personnel Cost Rollup	.1H001
Div Maint Personnel Cost Rollup	.1H002
Div Primary Mission Pers Cost Rollup	.1H003
All other Div Pers Cost Rollup	.1H004
Div Class IX Parts (Consumption) Costs	.1H005
Div POL Costs	.1H006
All Other Div Materiel Costs	.1H007
Div Cl II & IV Supply Costs	.1H008
Div Cl IX Issues Costs	.1H009
HHC, 4th Mech Div Costs Rollup	.1H010
HHC, 4th Mech Div Sup Pers Costs	.1H011
HHC, 4th Mech Div Maint Pers Costs	.1H012
HHC, 4th Mech Div Primary Msn Pers Costs	.1H013
HHC, 4th Mech Div Other Pers Costs	.1H014
HHC, 4th Mech Div Cl IX Costs	.1H015
HHC, 4th Mech Div POL Costs	.1H016
HHC, 4th Mech Div All Other Materiel Costs	.1H017
HHC, 1st Bde	.1H020-.1H027*
1/10 Inf Bn	.1H030-.1H037
1/22 Inf Bn	.1H040-.1H047
6/32 Armd Bn	.1H050-.1H057
HHB, Div Arty	.1H170-.1H177
1/19 Arty Bn	.1H180-.1H187
HHC, DISCOM	.1H230-.1H237
4th S&T Bn	.1H250-.1H257
4th S&T Cl II & IV Issues	.1H258
704th Maint Bn	.1H260-.1H267
704th Mnt Class IX Issues	.1H269
4th Avn Co	.1H290-.1H297
124th Sig Bn	.1H320-.1H327
4th MP Co	.1H330-.1H337

*Resource indicators sequence as for HHC above.

Disadvantages

1. Is not easily implemented. Detailed and careful application of the technique is required to ensure clear definitions and accurate rollups.

2. Does not identify weapon system support costs.

Alternative 4b - Restructure Program 7M to Identify Depot Maintenance by Weapon System

In addition to the illustrative restructuring of OMA P2 as discussed above, this alternative includes, as previously mentioned, a minor modification of Program 7M (Depot Maintenance) to provide a means of costing by weapon system.

The current AMS coding for depot maintenance activities (732207.00000) is displayed in Table 2-5. It consists of three groupings at the activity account level which describe precisely what kind of work is being performed (WAC Code) on an end item or component (Type Reportable Item) of a particular category of equipment (Equipment Category Summary Code (ECSC)). Since the first position of the second digit "Type Reportable Item" code is always zero, it is obvious that one digit will adequately perform this function. The following restructuring is, therefore, possible as depicted in Table 5-5.

1. Reduce the Type Reportable Item code to one position or digit.

2. Expand the Equipment Category Summary Code (ECSC) to two positions and redesignate it as a Weapon System Designator Code (WSDC). Each WSDC category would be structured as follows:

Alpha-numeric AA to AZ (excluding the letter "O") and A1 to A9 (excluding the numeral zero) would be used to identify 34 selected types of aircraft for intensive management.

"A9" would include all other types of aircraft not separately identified.

"A(blank)" would be used to rollup all depot maintenance costs for aircraft.

Table 5-5

MANAGEMENT CODING FOR DEPOT MAINTENANCE
(732207.0000)

Positions 1 and 2*	Position 3 (ACFT)***	Positions 4 and 5
Weapon System Designator Code (WSDC)	End Item, Assembly or Component Code ("Type Reportable Item")	Work Accomplishment Code (WAC)
A** - Aircraft	1 Basic End Item or Equip	A1 Cyclic/Normal Overhaul/ Rebuild
B - Automotive Equipment	2 Engines	A2 Battle/Crash Damage/Overhaul
C - Combat Vehicles	3 Components & Accessories	B0 Progressive Maintenance
D - Construction Equipment	4 Commo-Elect	C1 Conversion (Not in Conjunction with Overhaul/Repair)
E - Communications-Electronics	5 Weapons Armament	C2 Conversion (In Conjunction With Overhaul/Repair)
F - Missile Systems	6 Support Equipment	D0 Activation
G - Ships	7 Missile Armament	E0 Inactivation
H - Munitions Armament	8 TMDE	F0 Renovation
I - Weapons Armament	9 BII for Plt Equip and Indus Facilities	G0 Analytical Rework
J - Rail Equipment		H1 Modification (Not in Conjunction with Overhaul/Repair)
K - General Equipment		H2 Modification (In Conjunction With Overhaul/Repair)
L - Commodity Groups		I0 Repair
		J1 Inspection & Test--Excl Calibration
		J2 Inspection & Test--Calibration
		K0 Manufacture/Fabrication
		L0 Reclamation/Disassembly

*Code M is used for TMDE in managing maintenance support activities.

**AA to AZ, A1 to A9 } excluding letter "O" and numeral "zero" Each two digits identify a designated weapon system--e.g., AA=UH-1. AB=AH1G, "A9"=All other aircraft not separately identified. "A(blank)" = rollup of all aircraft.

***There are variations in this coding scheme for other ECCs.

EXAMPLES: 732207.AA2A1 - Cyclic/Normal Overhaul/Rebuild of a UH1 Engine
732207.AB4B0 - Progressive maint on the Commo-Elect gear of an AH1G

Weapon system categories "B" - "L" would be identically structured.

The technique described is also directly applicable to the Base Operation "Z" accounts for maintenance of materiel (.C0000). The .C1000 support maintenance (DS/GS) account is structured as shown below:

.C0000	MAINTENANCE OF MATERIEL
1000	Support Maintenance (Direct and General Support)
1A##	Aircraft
1B##	Automotive Equipment
1C##	Combat Vehicles
1D##	Construction Equipment
1E##	Electronic and Communications Equipment
1F##	Missile Systems
1G##	Ships
1I##	Weapons Armament
1J##	Rail Equipment
1K##	General Equipment
1L##	Commodity Groups

Note that the Type Reportable Item code common to depot maintenance is not used. However, the ECSC and the WAC code used are basically identical. Therefore, by substituting the proposed WSDC shown in Table 5-5, for the ECSC shown above, base operations maintenance can also be accounted for by weapon system. Examples are:

.CA1B - Progressive maintenance on a UH1

.CF8J1 - Inspection and test of a Basic Hawk Missile

(If Basic Hawk is designated "F8")

In summary, minor modification of the AMSCOs for depot and base operations maintenance will result in: (1) the determination and display of maintenance costs at both levels (depot and installation) by weapon system, and (2) bringing the Army one step closer to the desired visibility of logistic resources by weapon system.

The advantages of this alternative are the same as stated previously (Alternative 4a) for restructuring OMA P2. The chief disadvantage is the time required to implement any change to the AMS.

ALTERNATIVE 5 - DESIGN AND IMPLEMENT A LOGISTIC RESOURCES COST MODEL

Discussion

Collection and manipulation of actual data to provide logistic resources costs is recognized to be a complex and expensive process. A logical alternative to comprehensive data collection and detailed computation is the creation of a numerical modeling technique to approximate/simulate the costs of logistic resources functions. As the state-of-the-art of operations research (OR) advances, so have the tools available to OR becomes more sophisticated and precise. Mathematical models and techniques have been developed to simulate increasingly more complex systems and provide considerably more accurate approximations.

A logistic resources cost model or technique is viable primarily for two reasons: (1) not all actual cost data for logistic functions are available, and (2) models could be utilized as an adjunct to other methodologies, thereby furthering their utility. Some laternative methodologies are presented and discussed below.

Analogous Model

Known costs for a system similar to the one being considered are adjusted by estimating the effects of differences between the two systems. Disadvantages of this technique are that one must first have system costs against which to compare, and there must be a reliable and accurate means of evaluating and representing differences. This technique works well in the case of different models of a similar weapon system, e.g., two different models of tanks or aircraft. Assuming that logistic functions costs were known for the basic model and that the new model represents an increase in capability (e.g., firepower and speed), the process might proceed as follows. The primary differences affect logistic factors such as POL consumption, ammunition requirements, transportation costs, and perhaps maintenance costs. All other cost factors can be considered equivalent. Some percentile differences would then be

established for the new model based on its increased capabilities. This factor (or algorithm) is then applied to the POL, ammunition, transportation, and maintenance costs of the base model to arrive at analogous estimates for the new model.

Mathematical Model

Modeling, per se, can be a very subtle and difficult process. Not only must the system being modeled be completely understood, the parameters of the system must be designated in mathematical terms. This is generally an exacting, challenging task. Models are usually tested against known data and variations either corrected in the technique or accounted for externally. Once verified, the model can be used to generate "what if" type results or fed with empirical data, in addition to estimates, to produce more likely (or accurate) figures. Mathematical models provide the convenience of being readily modifiable to suit corrective actions or changing requirements. However, establishment and validation of the model can be an arduous and difficult task.

Simulation

Simulation is essentially another form of modeling. Generally, simulation is the use and evaluation of a model to study behavior of a system over time. The utility of simulation as a determinant of logistic resources costs is questionable. However, the Monte Carlo simulation (i.e., game) technique might have potential application. Assuming that a weapon system and/or logistic function can be analytically described in terms of probability functions and times, the Monte Carlo technique provides a means for exercising the most probable solution to the functions by utilizing random probability inputs. Each set of inputs is evaluated for the functional set and the results accumulated until insignificant statistical change is recorded by successive iterations. The net result is the most probable solution based on a large number of random (independent) input variables.

Cost Estimating Relationship

A cost estimating relationship (CER) is defined as any estimating relation used to translate physical resources or activity measurement data into costs. CERs usually take the form of derived coefficients applied to the variables. In the case of independent variables, a simple factor may be derived. For instance, depot maintenance cost for a particular weapon system or materiel category may be determined by calculating the ratios:

$$\frac{\text{\$ Value of Materiel Overhauled}}{\text{\$ Value of Materiel Inventory}} \text{ and } \frac{\text{Cost of Annual Maintenance}}{\text{Cost of Materiel Overhauled}}$$

The product of these two ratios represents a factor which could be applied to each materiel category or weapon system to estimate depot maintenance costs. For more complex (independent) functions, a regression technique may be applied to determine appropriate coefficients.

For dependent variables, the CER usually takes the form of an exponential. This is logical, as illustrated by the following example. Assume transportation cost (T), can be represented as some function of weapon system density (D), and weight (W). The linear representation of this functional relationship is:

$$T = a + bD + cW$$

However, this form indicates that a given increment in weight costs a fixed number of dollars regardless of the item density. This is misleading since an increment in weight for a low density item is obviously less significant than for a high density item. However, expressed in exponential form:

$$T = aD^bW^c$$

In order to determine the effect of a change in weight (W), one may differentiate the equation with respect to weight and solve for the change in cost:

$$\frac{dT}{T} = b\,\frac{dW}{W}$$

Thus, for a 1% change in weight, cost is affected by a factor of b.

Similarly, solving for density, we find that cost is factored by c, but only as a percentile, so that each factor is weighted according to impact.

CERs may be developed using a variety of techniques and are extremely useful in approximating costs, assuming a functional relationship between cost and characteristic can be mathematically represented.

Advantages

1. Relatively inexpensive to develop.
2. Readily modifiable.
3. Useful for projection purposes.
4. Can be used to fulfill total requirement, augment other solution(s), or serve as an interim product with continuous phase-out.

Disadvantages

1. Requires detailed algorithms to mathematically represent functions and relationships.
2. Not adaptable to providing the wide variety of displays required by the logistics data base users, i.e., weapon system, unit and logistic functions costs.
3. Validation of models requires actual data which, in most cases, obviates the need for a model.
4. Possibility of erroneous representation of costs due to inability to validate model.
5. While development might be relatively inexpensive, implementation costs would be substantial and probably prohibitive in support of a structure as complex as the Logistic Resources Data Base Structure.

ASSESSMENT OF ALTERNATIVES

The study team's assessment of these alternative approaches to satisfying the data requirements was presented to the Working Group as follows:

1. Either SDC or ISDC has the potential of being a major data source for the Logistic Resources Data Base Structure, O&SCMIS and the Weapon System Ownership Cost Model for collecting maintenance resources consumption data directly related to weapon systems at the organization, direct support and general support level. An SDC/ISDC program should therefore be initiated.

2. A manual system does not provide the requisite capability and flexibility to support the Logistic Resources Data Base Structure.

3. The flexibility and applicability of a model for weapon system costing is currently being evaluated by DARCOM's Army Materiel Systems Analysis Agency (AMSAA). The feasibility of developing such a model has been determined and the project is underway. This study should therefore not devote any further effort to the modeling alternative except to coordinate closely with AMSAA to insure the compatibility of results.

4. While the advantages of the illustrative AMSCO restructuring is the significant improvement of logistic resources visibility on a programmatic basis in the AMS, it has the attendant disadvantage of adding turmoil to an already turbulent area. It is an approach which, therefore, should be pursued as a separate matter and in the light of its total Army implications.

5. Existing automated system data sources do not adequately support the Logistic Resources Data Base Structure, therefore, some additional reporting requirements will be necessary.

6. An automated system is the most effective means of collecting, updating and managing a large volume of data from multiple and diverse sources.

7. The flexibility to produce a variety of output displays along with the capability of projecting these costs for future requirements can best be met by an automated system.

8. Since most of the useful data identified already exists in automated form, an automated system can facilitate the task of capturing this data.

9. An automated system could be developed which would specifically fulfill both the input and output requirements of the Logistic Resources Data Base Structure, that is, a total system tailored to the requirements of the Logistic Resources Data Base Structure.

THE PREFERRED ALTERNATIVE

The working group approved the study team's recommendation that alternative 1, the automated system, is the most feasible and effective approach to satisfying the data base requirements. Additionally, it was decided that SDC/ISDC be investigated as an adjunct to the automated system for a source of organizational, DS, and GS level maintenance data. A description of the GRC recommended full-scale automated system, including the organizational structure to accommodate it, is presented in Chapter 6.

Chapter 6

THE AUTOMATED SYSTEM

GENERAL DESCRIPTION

In Chapter 5, Alternative 1 described in very general terms a concept for an automated reporting system tailored to the requirements of the Logistic Resources Data Base. Of the five alternatives presented it was concluded that an automated system will provide the most effective method of collecting, updating and managing the large volume of data required by the data base. This chapter describes a recommended automated system specifically designed to provide a flexible and realistic means of determining and displaying logistic support resources allocated to, consumed by and projected for units, weapon systems and logistic functions.

The proposed data base system would be comprised of a fully automated collection, computation, and reporting system augmented by certain supplemental data inputs (field reporting, SDC/ISDC data, maintenance/correction transactions, and various input parameters). A control/review group would be responsible for the system to monitor system inputs and outputs and maintain the validity of the data base. The conceptual systems flow chart is presented in Fig. 6-1.

The systems software would be of modular design to satisfy the various system functional requirements. Individual modules, therefore, would be designed and developed to accommodate the update, maintenance, reporting, processing, and other functions. Each module would operate on and with selected data base files and be interactive with (but not necessarily dependent upon) other modules. Since each module would be functionally independent, additional modules may be developed as needed or existing modules modified with minimum impact on the total system.

The supplementary inputs would consist of semi-automated data coming from field sources or SDC/ISDC, transactions generated against

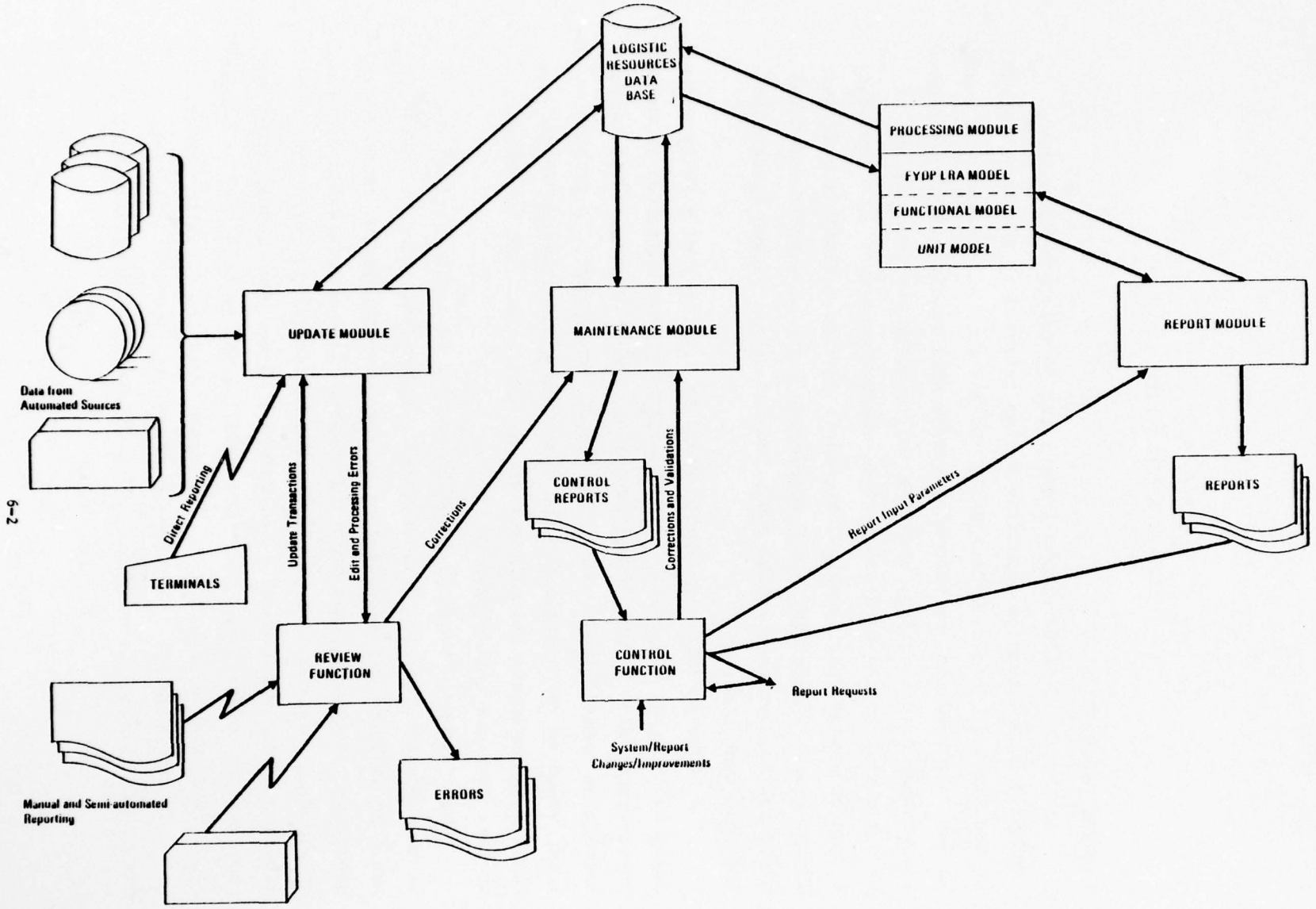


Figure 6-1 Conceptual System Flowchart

the data base, and those input parameters required to operate the various modules.

The control/review group, mentioned earlier, would be the DA level authority responsible for all facets of system operation. The group's duties and responsibilities would consist of (but not necessarily be restricted to):

1. Monitoring of all system inputs/outputs.
2. Generation of certain input (e.g., transactions against the data base).
3. Overall system quality control.
4. Establishment of system run parameters.
5. Validation of all system outputs and system files/ information.
6. Maintenance of an accurate and up-to-date system data base.
7. Conducting necessary liaison between computer operations and the user community.
8. Initiation and coordination of recommendations pertaining to system improvements and/or system changes.

OPERATION

Inputs from automated sources would be provided to the system on a scheduled, periodic basis for automatic update of the various data base files. As each input source is itself updated, it (or an extract from it) would be made available to the automated system in a format suitable for input to the update module of the system. Updates would be accomplished routinely with no manual intervention or monitoring required.

Other inputs such as source data supplementary field reporting or semi-automated information (e.g., pre-punched cards on which additional information is entered) would be submitted to the review group for initial editing and logging, and then forwarded for transcription

prior to input to the update module, along with appropriate run parameters.

The system would initiate processing by editing all inputs. Those inputs not passing editing criteria, and later, those failing processing parameters, would be noted on a control and error report and returned to the control group. The group would either rectify errors directly or initiate corrective action (return to originator) for subsequent re-entry into the system.

Output reports requested through or routinely scheduled by the control group would be routed through the group prior to dissemination to requestors/recipients. Assurance would be made that all reports are valid and complete (e.g., that proper versions of files were used and that a correct or entire report was produced in the appropriate number of copies).

CAPABILITIES

It is intended that the system possess the capability to produce a variety of reports to fulfill the display requirements as presented in other sections of this report. Additionally, the system should be capable of projecting program data, either by an extrapolation scheme or modeling technique.

All inputs to the system would be thoroughly edited and formats validated. When possible, entries would be tested for specific values or codes, otherwise value-within-range or type-of-data checks would be performed. Exhaustive editing should minimize errors introduced into the system.

However, should the need arise, the system would have a built-in capability to modify virtually any data element in the data base. This feature (different and independent from the update capability) would function as the tool by which the control/review group may add, modify or delete data found to be inaccurate, invalid, or incomplete.

The system would also have the capability to handle exclusions of two types: data unavailable and data or computations unwanted. In the first instance, requisite data for a particular computational algorithm is not contained in the data base. The system can be designed to either attempt to operate despite (or around) the missing data, or to merely note the irregularity, pass over the computation, and proceed with the next time to be processed.

Conversely, deliberate exclusions would be a parametrically driven option, specifying that certain data not be considered or computations not performed. This option could be utilized in an exercise such as determining the overall cost of the maintenance function excluding labor costs. Theoretically, this would produce the Army-wide maintenance cost associated with parts and components only. Conceivably, this option would be used to isolate or clarify any portion of the logistics structure costs.

BENEFITS

In summary, the benefits that would accrue from the recommended system include:

1. Automatic collection and collation of large volume data from numerous and diverse sources.
2. High-speed calculation of complex computational algorithms.
3. The capability to answer questions regarding operating, support and other logistic resources cost by weapon system.
4. Visibility over specific logistic functional costs Army-wide or by unit designators.
5. Display of logistic resources to meet OSD FYDP subsystem requirements.
6. Maintenance of a repository of logistic resources data for potential application in other areas.
7. Utilizing state-of-the-art technology in fulfilling a necessary functional requirement within DA and DoD.

Chapter 7
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. The Logistic Resources Data Base Structure encompasses the cost elements required to effectively and logically identify and determine costs associated with the logistical support of weapon systems, units or logistic functions.

2. The "building block" concept of the data base structure provides a flexible means of determining and aggregating weapon system, unit or logistic function costs on a uni-level, bi-level, or tri-level basis as required.

3. Neither the FYDP program elements or the AMSCOs provide a meaningful or useful identification of logistic resources other than in Program 7. The Army should, therefore, initiate (separate and apart from this study) a major effort to restructure the AMSCOs to provide for the identification and reporting of logistic resources in all FYDP programs as well as to improve the serious lack of AMSCO/PE compatability.

4. The Logistic Resources Structure is relatable to the FYDP structure at program element level as well as to the logistic functions output requirements identified by OASD (I&L).

5. Required data elements for which an automated data source is not available (data gaps) may necessitate either additional reporting requirements or satisfaction by other techniques such as factoring or cost estimating.

6. An automated system is the most feasible and effective approach to satisfying the requirements of an Army logistic resources data base.

7. An SDC/ISDC program would be an effective adjunct to the automated system as a source of organizational, DS/GS level maintenance data.

8. The automated collection, computational and reporting system described in Chapter 6 is specifically designed to provide a flexible and realistic means of determining and displaying logistic support resources allocated to, consumed by, and projected for weapon systems, units and logistic functions.

9. A determination of the specific weapon systems to be included in the data base is an essential ingredient for the actual design of the automated system. This decision will directly affect such things as data sources and file composition as well as the scope of an SDC or ISDC program. For design purposes the initial list of weapon systems should contain not more than twelve carefully selected systems which will exercise all the parameters of the data base structure.

10. The merged O&SMIS/Ownership Cost Model efforts have a major requirement which is also central to this study effort. This common requirement is the development of a data collection system capable of reporting or estimating logistic resources expended on existing major weapon systems. The Army should adopt at the earliest possible time a method of insuring the commonality and maximum possible interoperability of the data collection system(s) as well as the supporting SDC program.

RECOMMENDATIONS

1. That an automated collection, computational, and reporting system, as described in Chapter 6, be approved for development as the most feasible and effective approach for satisfying the requirements of a logistic subsystem to the FYDP.

2. That the Army identify the specific weapon systems to be addressed by the automated Logistic Resources Data Base and that the initial list of weapon systems be limited to 10-12 systems for design purposes.

3. That a users committee, consisting of PPBS working level personnel of the Army Staff and its staff support agencies, be established to interact with the study team in the finalization of systems output requirements; i.e., detail data, roll-ups, summaries, breakouts, bridging of data gaps, etc.

4. That an SDC or ISDC program be established as an adjunct to the automated system as a source of organizational, DS/GS level maintenance data.

5. That the Army adopt appropriate coordinative techniques to insure the maximum possible commonality and interoperability of the data collection system(s) of O&SCMIS and the Logistic Resources Data Base Structure in support of weapon system O&S costing.

6. That pending development of an automated system, the structure and methodology described in this report be used as the standard guide for providing required data on logistic resources.

ABBREVIATIONS AND ACRONYMS

AFPCH	Army Force Planning Cost Handbook
AIF	Army Industrial Fund
ALMSA	Army Logistic Management Systems Agency
ALPHA	Army Materiel Command Logistics Program Hardcore-Automated
AMDF	Army Master Data File
AMS	Army Management Structure
AMSAA	Army Materiel System Analysis Agency
AMSCO	Army Management Structure Code
AR	Army regulation
ASB	annual salary and benefits
Avg	average
AVSCOM	Aviation Systems Command
BASS	Budget Backup and Support System
CAMUS	Commitment and Management of Unit Supplies
CBS	Civilian Budgeting System
CBS	Continuing Balance System
CCSS	Commodity Command Standard System
CIVPERSINS	Civilian Personnel Information System
CONUS	Continental United States
CSFOR-78	Automated Manpower Utilization Report
CS_3	Combat Service Support System
CTA	common table of allowances
DA	Department of the Army
DARCOM	USA Materiel Development and Readiness Command
DEIS	Defense Energy Information System
DFSC	Defense Fuel Supply Center
DISCOM	division support command
DLOGS	Division Logistics System
DoD	Department of Defense
DPPC	Defense Planning and Programming Categories
DPPGM	Defense Planning and Programming Guidance Memorandum
DS	direct support
DX	direct exchange
EOE	element of expense
F	factor
FCIS	Force Cost Information System
FM	field manual
FMS	foreign military sales
FORSCOM	Forces Command
FY	fiscal year
FYDP	Five Year Defense Program

GRC	General Research Corporation
GS	general support
ICP	inventory control point
IDA	Institute for Defense Analyses
IF	Industrial Fund
IMMS	Integrated Maintenance Management System
ISDC	Intense Sample Data Collection
LMI	Logistics Management Institute
LSSA	Logistics Systems Support Agency
M&RA	Manpower and Reserve Affairs
MACRIT	TOE Manpower Authroization Standards and Criteria
MAP	Military Assistance Program.
MBO	Management by Objectives
MCA	Military Construction, Army
MECHTRAM	Mechanization of Selected Transportation Movement Reports
MES	maintenance engineering support
MIDA	Major Item Data Agency
MIDP	Major Item Distribution Plan
MILPERSINS	Military Personnel Information System
MMC	Maintenance Management Center
MOD	modification
MOS	military occupational specialty
MOSB	Military Occupational Specialty Training Cost Handbook
MPA	military pay and allowances
MPBME	Munitions Production Base Modernization and Expansion
MPG	miles per gallon
MTMC	Military Traffic Management Command
MWO	modification work order
NICP	national inventory control point
NMP	national maintenance point
NSN	national stock number
O&S	operating and support
O&SCMIS	Operating and Support Cost Management Information System
OASD(I&L)	Office, Assistant Secretary of Defense (Installations and Logistics)
OCSA	Office, Chief of Staff, Army
OCSA-PAE	Office, Chief of Staff, Army-Program Analysis and Evaluation
ODCSLOG	Office of the Deputy Chief of Staff for Logistics
ODCSOPS	Office of the Deputy Chief of Staff for Operations
OHPG	operating hours per gallon
OMA	Operation and Maintenance, Army
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense

P/A	pay and allowances (includes theater costs and special pay)
PA	Procurement Appropriation
PCS	permanent change of station
PE	program element
POL	petroleum, oil and lubricants
PPBS	Planning, Programming and Budgeting System
PR	personnel replacement
PROBE	Program Optimization and Budget Evaluation
PRON	procurement request order number
R&M	reliability and maintainability
RCS	reports control symbol
RDTE	research, development, test and evaluation
RECAPS	Reserve Card Processor System
RIC	Resource Identification Code
RICC	Reportable Items Control Code
ROTC	Reserve Officers' Training Corps
RPMA	Real Property Maintenance Activity
RR	rotation rate
S&T	supply and transportation
SACS	Structure and Composition System
SAILS	Standard Army Intermediate Level Subsystem
SAMS	Standard Army Maintenance System
SDC	Sample Data Collection
SF	Stock Fund
SMMS	Support Maintenance Management System
SPEEDEX	System-wide Project for Electronic Equipment at Depots - Extended
STANFINS	Standard Finance System
SUMS	Standard USAREUR Munitions System
TAADS	The Army Authorization Document System
TAMMS	The Army Maintenance Management System
TDA	tables of distribution and allowances
TM	technical manual
TMCS	Tactical Maintenance Control System
TOA	total obligational authority
TOE	tables of organization and equipment
UIC	Unit Identification Code
USAREUR	US Army, Europe
WAC	work accomplishment code
WSSC	weapon system support code
YTD	year to date

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