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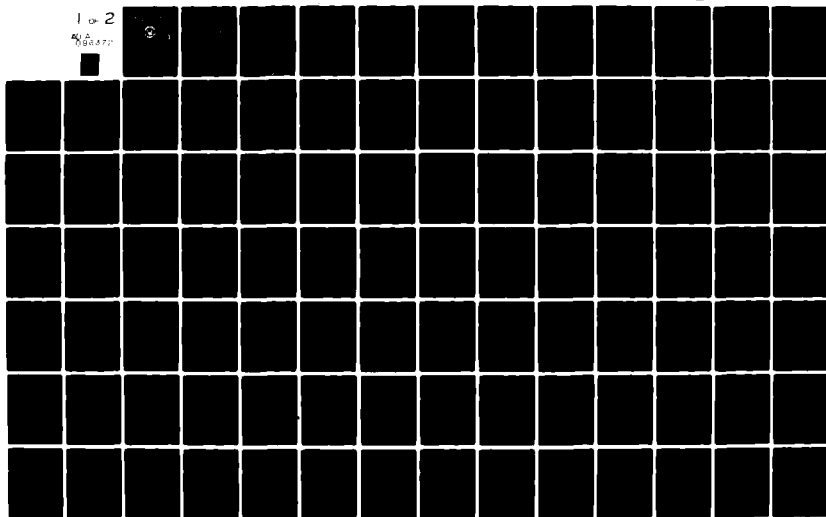
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THESIS

AN OVERVIEW OF INTEGRATED LOGISTIC SUPPORT
IN MEDICAL MATERIAL PROGRAMS

by

Robert Paul Legg

December 1980

Thesis Advisor:

R.A. Bobulinski

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	AD-A096372	
4. TITLE (and Subtitle)	5. TYPE OF REPORT & PERIOD COVERED	
6 An Overview of Integrated Logistic Support in Medical Material Programs.	Master's Thesis, December 1980	
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)	
10 Robert Paul Legg		
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
Naval Postgraduate School Monterey, California 93940		
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE	
Naval Postgraduate School Monterey, California 93940	December 1980	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	13. NUMBER OF PAGES	
12 108	107	
	15. SECURITY CLASS. (of this report)	
	Unclassified	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report)		
Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Integrated Logistic Support Medical Equipment Medical Material Programs Matrix Management Maintenance Support		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
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(20. ABSTRACT Continued)

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An Overview of Integrated Logistic Support
in Medical Material Programs

by

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Lieutenant Commander, Medical Service Corps
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

This thesis addresses the application of integrated logistic support (ILS) principles to Navy medical material programs, describes some of the factors affecting cost and organizational relationships, presents a survey of audit reports and interviews with medical material managers, and makes recommendations for improving the management and maintenance support of medical material and equipment. Conclusions indicate that ILS is both highly essential and viable. The author contends that the employment of matrix project techniques, an adequate management information system, and an administrative support organization coupled with the ILS system advocated by the Department of Defense (DOD) and Department of the Navy (DON) will improve the management and maintenance support of medical material and equipment programs.

TABLE OF CONTENTS

I.	INTRODUCTION -----	7
A.	BACKGROUND AND PERSPECTIVE OF MEDICAL INTEGRATED LOGISTIC SUPPORT -----	7
B.	PROBLEM DEFINITION AND OBJECTIVE -----	9
C.	GENERAL APPROACH AND METHODOLOGY -----	10
D.	THESIS CHAPTER SUMMARY -----	11
II.	INTEGRATED LOGISTIC SUPPORT (ILS) CONCEPT -----	12
A.	ILS SYSTEM GENERATION AND ELEMENTS -----	12
B.	MANAGEMENT SUPPORT -----	24
C.	POLICY -----	27
D.	SUMMARY -----	30
III.	MEDICAL MATERIAL PROGRAMS, RELATIONSHIPS, AND SUPPORTING ORGANIZATIONS -----	31
A.	SOURCES OF REQUIREMENTS -----	31
B.	FACTORS AFFECTING COST, EFFECTIVENESS, AND SUPPORTABILITY OF PRIMARY SYSTEMS AND EQUIPMENT -----	42
C.	RESPONSIVENESS -----	47
D.	SURVEY -----	49
E.	SUMMARY -----	55
IV.	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS -----	57
A.	CHAPTER SUMMARIES -----	57
B.	ANALYSIS OF THE SYSTEM -----	61
C.	GENERAL CONCLUSIONS -----	63
D.	RECOMMENDATIONS -----	73
E.	CONCLUSION -----	74

APPENDIX A: TABLE OF FIGURES -----	97
APPENDIX B: GLOSSARY OF TERMS -----	98
APPENDIX C: SURVEY FORM TABULATION -----	99
APPENDIX D: MISSION AND FUNCTION -----	101
LIST OF REFERENCES -----	103
INITIAL DISTRIBUTION LIST -----	107

I. INTRODUCTION

A. BACKGROUND AND PERSPECTIVE OF MEDICAL INTEGRATED LOGISTIC SUPPORT

In today's environment, health care managers face unprecedented challenges, demands and opportunities. Never before has there been a focus on the management of material resources which requires such a sharply increased emphasis on material readiness [1]. It is the task of the medical material manager to sustain equipment in a state of operational readiness whether the equipment is in hospitals, aboard ships, for use in the field, or prepositioned for contingency operations. Medical and dental life support systems and associated equipment are complex and costly to develop, procure, operate, and maintain. They require maintenance, material support items, test equipment, and personnel.

Military leaders and Congress, with its watch-dog agencies, require that every effort be made to minimize material and personnel costs while continuing to procure and maintain systems and equipment at a high state of readiness. Maximum material readiness may best be accomplished by employing the concept of total integrated logistic support to medical and dental material. The term "integrated logistic support" refers to a planning process designed to provide timely and effective support of systems and individual equipments. Essential to the understanding of this process is acceptance

of the concept that the cost and adequacy of logistic support is a matter equal in importance to the cost and adequacy of the end item itself.

The Integrated Logistic Support (ILS) concept had its Department of Defense (DOD) beginnings in systems acquisition efforts of the 1960's and is defined by the Naval Material Command as:

...a process which identifies, in a systematic and orderly manner the functions which must be performed in support of operation and maintenance, and the resources needed to accomplish those functions. The process also requires that hardware and system design be reviewed with a view toward establishing hardware design and configuration which reduces, to the maximum practicable extent, the logistic burden placed on the operating forces. [2]

Technological advancement has caused major changes in medicine and dentistry in the last several decades. Intensive care units, computerized axial tomography scanners (a diagnostic device that scans the body and simultaneously produces a cathode ray tube image of body processes for evaluation) and many other innovations have been part of the revolution in what the field of medicine can and is expected to provide in support of the military forces. But these changes have been a mixed blessing, since new technology contributes to increased costs and, in many cases, systems and equipment reliability and maintenance support has not paralleled the technology explosion. In fact, some of the newer systems and equipment are less reliable than older, simpler items which required less trained personnel and material support [3].

With the challenges and demands facing the manager, common sense is no longer an adequate guide. In these difficult times, one must reflect upon what is being done and how well the medical systems and equipment are being maintained. ILS by no means provides answers to all the difficult questions and logistic tasks, but it can serve to identify problems and to provide alternative ways to manage the medical systems and equipment, thereby enhancing readiness.

B. PROBLEM DEFINITION AND OBJECTIVE

Why, after years of inspections, analysis, and audit reports, do Navy hospitals, ships, and Fleet Marine Force (FMF) medical units continue to receive inadequate logistics support? For example, the Naval Audit Service, charged with conducting management audits of Naval Medical Activities, cites the need for improved medical equipment maintenance as prescribed by the Navy's Bureau of Medicine and Surgery (BUMED) and the Joint Committee on Accreditation of Hospitals (JCAH) [4,5]. Shipboard medical and dental departments as well as the FMF medical units may be even more susceptible to inadequate logistics because of deployment schedules and a lack of an understanding of the complexity of medical systems and equipment they carry aboard ships or in the field. How can ILS contribute more to resolve some of these logistic problems; and why is the total concept of ILS not employed to satisfy the need of the medical and dental community so as to increase operability and enhance readiness? Does top

management understand ILS enough to provide the guidance and resources necessary for its successful implementation? These are the general problems that this thesis will address.

By contrasting Navy and private sector ILS concepts and actual ILS applications in the Navy medical and dental military health care system, the author's main objective is to determine whether ILS is a viable approach to the present day problem of medical material readiness. A second objective is to generate an understanding of ILS, assess whether there is a need for increased ILS management of medical resources and offer some alternative strategies which could improve the Navy's health care system.

C. GENERAL APPROACH AND METHODOLOGY

Because of the author's experience as a Navy Medical Service Corps officer, the plan of study and research has been directed at the application of ILS within the Navy with some reference to other health care systems.

The research was divided into three areas:

1. literature search
2. correspondence with professional and administrative organizations within the military health care community
3. survey of methods and procedures, and discussions with management personnel assigned material management support functions in Navy hospitals.

This research is supplemented by the author's experience with medical and dental logistic programs incident to ship

construction, advanced bases, foreign military sales, and provisioning of fleet hospitals. Finally, the author will examine the Navy's ILS medical material policy and analyze the study and research results with an emphasis on the potential to expand ILS implementation.

D. THESIS CHAPTER SUMMARY

The first chapter briefly introduces the reader to ILS and its application to medical systems and equipment, and then presents the author's objectives and research methodology.

Chapter II discusses the basic ILS concept, Navy medical management support and planning, and current DOD and Department of the Navy (DON) ILS policy.

Chapter III examines some of the factors that impact on medical material programs and organizational relationships within the Navy medical community. It also presents a survey conducted by the author of medical audits and interviews with medical managers.

Finally, in Chapter IV, the author summarizes the thesis and based on the research findings makes some recommendations for future consideration.

II. INTEGRATED LOGISTIC SUPPORT (ILS) CONCEPT

A. ILS SYSTEM GENERAL AND ELEMENTS

This chapter presents an overview of the systematic developmental process employed in ILS planning with special emphasis on: the major considerations contained in the Department of the Navy (DON) ILS elements; ILS policy directives; and management's role in the ILS process.

The systems approach to material support problems is an outgrowth of the complexity, operability, cost, and supportability of material systems and associated equipments. Within the ILS systems approach, material systems and equipment and related support resources are referred to as primary systems or equipment and associated logistic support [6]. ILS is concerned with the definition, optimization, and integration achieved by the systematic planning, implementation, and management of logistic support resources throughout the systems life-cycle. Blanchard describes the basic system life-cycle as a developmental process with major interfaces between prime equipment and logistic support as illustrated in Figure 2-1 [7].

During the life-cycle formulation phase, it is necessary to arrive at, and to document, the major interfaces that are programmed between the prime mission equipment and logistic support. Briefly, the system developmental process must satisfy a need or mission requirement within a prescribed

operational environment. The systems maintenance concept is applied in terms of logistic support resource requirements. Alternative support configurations are evaluated and selected on the basis of tradeoff studies. During this process, areas such as reliability, maintainability, logistics, personnel, and training are analyzed on the basis of supportability, cost, and system effectiveness. Finally, logistic data is collected throughout the operational life-cycle of the primary system or equipment to assess actual cost, system effectiveness and reprovisioning criteria [8].

Designing a system, however, solely to meet a specific need is not always sufficient. The system must be able to meet the need over a period of time so that the investment in time, funds, and other scarce resources is justified. Thus the system life-cycle originates with a perception of a valid need, fulfills that need, and terminates when the system becomes obsolete and no longer satisfies mission requirements.

In essence, ILS is a management planning discipline. It provides controls that help to ensure that a system or equipment item will meet performance requirements and also that it can be supported throughout its life-cycle. Cleland and King advocate a systems approach for more efficient decision-making and organizing in the day-to-day management of an organization's activities. This approach stresses the use of objective analysis in decision-making problems

which permit consideration of alternatives or choices in the allocation of resources while attempting to achieve organizational objectives [9]. This introduction of systems ideas to the framework of solving complex logistic problems is reflected in the steps illustrated in the developmental process (Figure 2-1) [10].

Planning for the logistical support requirements begins in the primary system or equipment concept stage. Literature indicates that an ILS program or plan should be formalized so that deletions or changes due to inaccurate or missing data are minimized. When the requirement for ILS planning proceeds from the concept stage to the operational stage, the logistic support plan is developed by the ILS program or project manager whose focus of attention is on program goals rather than on any singular element such as training or supply support. Thus, the program manager operates through various functional areas and personnel in directing the allocation of resources which are involved in the process. For example, the acquisition of ten X-ray systems for ships of the same class being built by different shipbuilders calls for program planning which staggers delivery and installation in order that necessary resources are available incident to the installation of the X-ray system. The need for the right test equipment, personnel, and power requirements, to mention a few, necessitates careful planning and coordination on the part of the ILS manager who cuts

across traditional functional lines to bring together the resources required to achieve program objectives [11].

Ideally the ILS planning, programming, and implementation document will address each of the basic logistics elements to the extent required to ensure supportability and capability testing prior to production or acquisition of the end item itself. These elements are displayed by the author as a flow in Figure 2-2 and described more fully herein. Part of the observations made in the following sections are based on the author's personal experiences, interviews, and literature search.

1. The Maintenance Plan

The maintenance plan is a continuing effort which interfaces with all other ILS elements and therefore is given greater emphasis and overshadows the other ILS elements. The plan itself is a description of the requirements and tasks necessary to achieve and maintain the operational capability of the prime system or equipment item. The maintenance capability of existing organizations are analyzed to identify new requirements. These organizations include the user, civilian contractors, and depot level maintenance activities. This is accomplished through the use of maintenance engineering analysis. Various maintenance concepts are reviewed, including supply support, facilities, test and support equipment, personnel, deployment factors, and the operational environment. The concepts should identify

levels and locations of maintenance and prescribed maintenance programs. Technical data files should be considered as to the depth and availability of maintenance at the location under review. The best designed system may fail if the technical data is not available to the maintenance technician. Maintainability (condition status) and reliability (performance probability) require analysis to study the maintenance concept. (See Appendix B for a further explanation of these terms.)

Trade-offs and analysis as an expression of frequency or repair should be considered within the maintainability and reliability parameters. Varied combinations of performance requirements and maintenance capabilities are evaluated to determine the optimum maintenance approaches. In this regard, communication and coordination with the user must be maintained in order to ensure that the maintenance is appropriate for the skill level of the individual performing the maintenance.

2. Support and Test Equipment

The purpose of the support and test equipment is to ensure that the required support and test equipment is available to the user and supporting maintenance activities. The ability to perform the scheduled and unscheduled maintenance depends upon the adequacy of the support and test equipment identified or developed concurrently with the primary system or equipment.

Some systems and equipment require as much support and test equipment as the end item itself. For example, the use of disposable products, clinical solutions, calibration and test equipment in medical laboratories might well over time exceed initial investment costs. That is, the number and cost of support and test equipment items may exceed the number and cost of the primary systems or equipment items.

This element of ILS is designed to ensure that all essential items for maintenance are available when required. The system design and existing support and test equipment is analyzed to ensure that standard or common use equipment already developed is used whenever possible. This obviates the necessity of developing additional support and test equipment requirements. The basic design of many complex systems now incorporates built-in test and calibration equipment. Though the initial cost is increased, effective built-in evaluators lower total life-cycle cost.

Testing of the primary system or equipment item with these features by the user in the projected operational environment should be included as part of this ILS element. Systems or equipment items may function very well in a stateside hospital, but when installed aboard ship or moved about in the field, the requirements for supportability may vary. This is particularly true if there has been inadequate or insufficient design analysis. Management receipt of user

data, on-site visits, and feedback reports provide the means for continuous monitoring and evaluation of support equipment throughout the operational phase.

3. Supply Support

Maintaining operational readiness under diverse conditions of use depends directly on the availability of the right supplies at the time and place needed. Supply support is an essential element of the logistics integration effort and is responsible for the timely provisioning, distribution, and inventory replenishment of spares, repair parts and special supplies.

The supply of items to support primary systems and equipment depends upon the design of that system and equipment and how well they are maintained. If an item is designed to be maintained at the user level according to the maintenance concept, adequate repair parts should be allocated and stocked at the user's organizational level. If designed for depot level repair only, the user organization may require less or none. The idea being to allocate the support to the proper level. Again, a contrast could be made here by comparing fleet and field use as opposed to stateside hospital use where access to spares and repair facilities is more likely.

Reliability of a primary system or equipment component is determined prior to forecasting repair parts or spares. Trade-offs between additional costs for design

improvements versus costs of more spares at lower reliability should be evaluated. Throughout the acquisition cycle, supply support functions may change depending upon who provides support of a particular item and where maintenance will be performed. Stockage objectives may migrate from the contractor to the user and the supporting supply system. Review, approval, or readjustment of the contractor's recommended spares, repair parts, and special supplies should be accomplished. This is done in response to the maintenance plan and in consideration of experience with like equipment.

Interface with the ILS technical data element must be established so as to ensure that supply publications reflect the support concept as to level of repair, source of item, or any other management data appropriate to the primary system or equipment. It is especially important to identify long-lead time high-value support items for stockage. This process requires management attention throughout all phases of the equipment life-cycle.

4. Transportation and Handling

As the system to be supported develops, this element will include detailed characteristics, actions, and requirements necessary to ensure that the capability exists to transport, preserve, package, and handle all equipment and support items. An analysis of transportation channels and storage availability as well as the policy governing use is

required. Further, containers for costly complex components are considered. The design of these containers should consider protection, weight, reusability, and quantity.

5. Technical Data

The element of technical data deals with a systematic process for developing, printing, and distributing primary system and equipment publications. Technical data provides the link between personnel and equipment. The publications provide the necessary information on installation, operation, maintenance, supply, and repair. It has long been recognized that complex materials cannot be employed effectively without adequate equipment publications. A detailed schedule must be developed to ensure the availability of appropriate instructions on a timely basis. Manuals should be designed so as to be understood at the skill and intelligence level of desired performance. Complicated engineering schematics and repair manuals are useless if the operator or maintenance technician cannot read or interpret them correctly. This element is becoming even more acute as systems and equipment designs become increasingly complex.

Review by the user is important and should include verification of actual performance of the operational and maintenance procedures set forth in the publications. In addition, this review should be coordinated and planned before technical publications are approved and accepted. Disregard of a reviewer's comments due to time constraints can lead to unsatisfactory publication support.

6. Facilities

The purpose of the facilities element is to ensure that required facilities are available to the users and supporting activities. If not, action is taken to modify the existing facilities or to construct new ones.

Facilities planning is limited to an analysis of support requirements for all categories of maintenance to ascertain the need for standard, new, or unique types of maintenance facilities arising from new requirements. It is based upon equipment design, locations, space needs, environment, personnel interfaces, and frequency of use. Also, some primary systems or equipment items may require special power sources for equipment operation, temperature and humidity control, and communications. Each of these considerations must be weighed in conjunction with the design parameters, maintenance concept, and operating support requirements. Evaluation of equipment, maintenance level, and locations, should provide many answers to facility requirements. Facility planning requires support management attention throughout the life-cycle to provide positive coordination with other ILS elements.

7. Personnel and Training

This support element includes identification of the requirements for personnel to operate, maintain and to otherwise support the end item or system. As with any of the elements, even the best designed system can malfunction

without appropriate support. The maintenance concept of the primary system or equipment will dictate the number and skill level required at varying locations. If contracted maintenance is called for at a particular level, requirements for specific training is reduced. However, assurance must be given that support services are adequately provided during contracted maintenance periods. As an aid to equipment introduction, planning for new equipment training teams in the field is desirable.

8. Logistic Support Resource Funds

The cost of logistic support has been growing each year, although the control and estimate of projected costs is difficult to ascertain [12]. As such, inaccurate estimates, or new or unfunded requirements, can result in tardy requests for additional funds or changes in schedules, which may indicate poor program management. Further, the political framework generally impacts on program management and funding support, affecting all ILS elements and program completion. Better control of support funds, more realistic forecasts, and a thorough understanding of the political process, i.e., the availability of financial resources, is essential for program success.

9. Logistic Support and Management Information

Material support is dependent upon the management information process for data with which the manager analyzes and evaluates equipment performance with respect to support

implications. Logistic management information is valid if it can track or indicate potential problems of cost, scheduling, or performance. Many reports show operating hours, periodic maintenance performed, failure rates, time to repair, and test results. Any combination of report criteria or feedback may be designed, but planners must not simply duplicate other known information systems. They should be specific and definite and continuously review report data requirements. Information must be available in meaningful, readily accessible form, or too much time and effort will be expended in interpretation and review.

10. Other ILS Elements

Department of Defense (DOD) Directive 5000.39 of January 1980 titled ILS Program indicates that there are now 15 ILS elements. The new additions are: computer resources support, energy management, survivability, and test and evaluation. Personnel and training, and training support now are two elements, and transportation and handling has expanded to include packaging [13]. Managers responsible for the development of a new system should consider, identify, and incorporate the appropriate ILS elements into the design and development of the ILS plan.

11. ILS Contribution

The purpose of describing the ILS elements is to show that the concepts are applicable to any primary system or equipment developmental process. Within the medical

community, ILS planning could provide improved visibility to support requirements essential for improved life-cycle costing and systems analysis trade-offs. In essence, this means that both the primary system or equipment item and the logistic support system are considered together during planning and development, acquisition, and operation.

No ILS element can stand by itself or provide answers to all questions concerning primary systems and equipment support. The more complex the items, the more detailed the support, and the greater the interface required between the elements and care taken in the maintenance engineering analysis phase. Overall the ILS management system provides a framework for organizational integration which fosters total system contributions in terms of life-cycle costs relevant to performance and mission requirements.

B. MANAGEMENT SUPPORT

The organizational integration discussed in the previous section can best be accomplished by the early assignment of an ILS manager to a designated program or project office [14]. This manager would be responsible for assembling various logistic element managers into an ILS matrix organization and for the coordination of the respective activities with overall systems requirements.

An ILS program or project manager's role is to work across functional lines so that tasks may be interrelated. Cleland and King advocate the use of matrix management as

an aid to the manager to pull functionally separated activities together to attain goals and to resolve problems in large complex organizations [15]. Matrix management as an organizing force within project management is no panacea, but it does provide a means for controlling various undertakings. For example, Gannon describes the matrix organization as an organization design that combines departmentation by product and function: Functional managers exercise technical authority over projects, while product managers have responsibility for budgets and the final completion of projects. The functional managers lend staff members to product managers as needed [16].

Merging logistics with the matrix design could help organizations meet the dynamic logistical challenges of the health care community. Until recently, the aerospace industry was characterized by a rapidly expanding technology, the demands of which necessitated logistics considerations and matrix organizational modifications [17].

A matrix organization can establish a flexible system of resources and procedures to accomplish a variety of programs and project objectives. Figure 2-3 is an author-developed conceptual framework for a matrix type of ILS organization, illustrating the coordinated or matrix system of relationships among functions. A matrix organization is built around specific projects. As projects are completed or cancelled, they are deleted from the organization. The

program manager is given the authority, responsibility, and accountability for completion of the project. The manager is assigned personnel with requisite qualifications from functional areas for completion of the project. Thus, the project organization is composed of the manager and functional personnel groups.

Other circumstances in which project or program management matrix techniques may be employed are:

1. Special projects within a segment of the organization,
2. Non-routine or unfamiliar organizational endeavors,
3. Feasibility and developmental studies,
4. Integration of functional elements and outside organizations,
5. Changes to plans requiring organizational flexibility, and
6. Objectives involving many people and independent organizations [18].

The matrix organization provides a framework for incorporating ILS elements and projects into a traditional functional organization. It permits the organization to develop and implement a number of projects while enhancing management control. Project management may not be adaptable to all situations and depends on the magnitude of the effort, complexity, familiarity, interrelatedness and, above all, organizational policy. Management then must tailor the events and management activities to their particular system by specifying assignments and responsibilities.

Another primary consideration in the implementation of the ILS plan is the organization of the unit or activity responsible for the logistic function. Top management should focus on systems planning, design, and administration. It should facilitate the implementation and control of the plans and policies. Plans should be communicated, controls established, and corrective action taken when necessary.

ILS and the application of matrix management techniques to material support programs offer benefits from several standpoints.

1. It provides management controls that help to ensure that a primary system or equipment item will meet performance requirements and be supported throughout its life-cycle.

2. It establishes a management discipline that fosters integration of requisite functions to achieve project management objectives.

3. It establishes a linkage between the project manager and project personnel which should enhance communications, coordination, and integration of the elements of logistic support.

4. It provides for program direction and control from the top, but allows for program management to be related to the functional matrix on a task-by-task basis [19].

C. POLICY

The ILS system is an integral part of military readiness and capability; recognizing that such readiness or capability

is not achieved solely by procurement of a primary system or equipment. Items must be supported throughout their service life if required operational readiness and capability is to be available to the user. However, provision for such support in accordance with the Department of Defense (DOD) and Department of the Navy (DON) directives has, in this author's opinion, been piecemeal or not observed until after procurement. Another problem is that a lack of ILS application as an integral part of the system developmental process can result in insufficient funds being allocated for logistic support of medical systems and equipment. In fact, DOD and DON are quite clear in their directives that ILS be included in the development of new equipment systems.

Department of Defense Directive 5000.39 "Acquisition and Management of Integrated Logistic Support for Systems and Equipment," establishes policy and assigns responsibility for carrying out the ILS program as an integral part of the acquisition process for the life-cycle support of equipment and systems procured by the Department of Defense [20].

Secretary of the Navy Instruction 4000.29 "Development of Integrated Logistics Support for Systems and Equipment," complements the aforementioned DOD directive and states "that logistics planning will be included in the development, evaluation, and operation of systems and equipment at all stages beginning with concept studies" [21].

OPNAV Instruction 4100.3 "Department of the Navy Integrated Logistic Support (ILS) System" directed the development and implementation of the ILS system concept within the Navy [22].

Naval Materiel Command Instruction 4000.20 "Integrated Logistic Support Planning Policy," establishes policy and procedures for the life-cycle support of systems and equipment and states "that hardware delivered to the fleet without adequate logistic support will not provide the operational capability required by the Chief of Naval Operations" [23].

Bureau of Medicine and Surgery Instruction 4000.2 "Integrated Logistic Support Plan relative to medical and dental equipment," establishes policies and responsibilities for implementation of the Navy ILS planning as applicable to medical and dental equipment [24].

All of these instructions cited require that a systematic planning and management approach be established early in the life-cycle of each system and equipment item in order to ensure consideration of and planning for optimum ILS. According to these directives, planning logistics support requirements should begin in the concept stage. Special problems must be identified early in the program. To achieve reliability, availability, and capability on a cost-effective basis, it is essential that logistics considerations be part of the design, development, test evaluation, production,

and operation during all stages of the primary system and equipment life-cycle.

D. SUMMARY

The preceding sections described some of the major factors in the evaluation of the ILS elements. All elements of logistic support should be evaluated on an integrated basis. The relationships between the various ILS elements heightens the difficulty of life-cycle and trade-off analysis. A matrix structure is an essential component in planning and controlling the ILS organization. Project teams can be organized to achieve prescribed objectives. The functional roles and duties of the various participants should be indicated early, since each affects the other. Once the ILS organization and matrix structure is in place, the project manager is given the authority and responsibility for completion of the project. Such a process is consistent with the relevant DOD and Navy directives.

Chapter III will describe the application of ILS to specific DON medical material programs; discuss factors which affect DON program costs; assess the current DON maintenance planning strategy; and present the author's survey.

III. MEDICAL MATERIAL PROGRAMS, RELATIONSHIPS AND SUPPORTING ORGANIZATIONS

A. SOURCES OF REQUIREMENTS

This chapter examines some of the factors which impact on the selection of medical primary systems and equipment by Navy medical department personnel. The mechanics of equipment selection for inclusion in medical material programs are explained. Some essential points regarding maintenance planning strategy are also considered. In addition, the author's survey results will be presented. This information is discussed to show that the Integrated Logistic Support (ILS) system is at present only partially employed in medical material programs.

Factors such as changes in mission, technology, emphasis, or methodology and assignment of priorities all impact on the requirements and the manner of their fulfillment in the Navy environment. ILS planning and management, however, can help to provide the user with a system or equipment item for which support considerations are based upon operational requirements, mission performance, and the environment in which the system or equipment will be used and supported.

The following discussion will briefly describe three specific programs requiring logistic support within the Navy medical community: ships' construction programs, Advanced Base Functional Components (ABFCs) and the Fleet Marine Force (FMF).

1. Medical Equipment Requirements for Navy Ships

The Chief of Naval Operations (CNO), through the Navy's Ships Characteristics Board (SCB) develops the desired military capabilities and characteristics for new construction ships and major conversion ships. The Naval Sea Systems Command (NAVSEA) is responsible for translating the required military characteristics of ships into plans and specifications. The Bureau of Medicine and Surgery (BUMED), the Navy's medical and dental headquarters command, then reviews each ship's characteristics and design, and develops the required operational capability (ROC) within the projected operational environment (POE) to establish the mission and tasks to be performed by medical and dental departments afloat. The ROC and POE are then translated into functional statements which describe in general terms the medical and dental operational capabilities necessary to support the mission and readiness level for each ship. Some examples are as follows:

Maintain the health and well-being of the crew

Provide routine health care

First Aid

Resuscitation

Medical regulation of personnel casualties

Dental care

Training

From this criteria, the equipment and consumable supplies requirements are developed and an allowance list for

the specific type of ship class is assigned. See Figure 3-1 [25].

Requirements planning based on these functional statements constitutes the rationale for shipboard medical and dental primary systems and support. In addition, such factors as personnel on-board strength, length of employment and personal preference for certain equipment items dictate the final allowance list of equipment and supplies.

The maintenance planning function is usually accomplished through the following process. Items procured through the Defense Logistics Agency (DLA), the medical item commodity manager, may be standard or non-standard stock material. Standard stock items meet the Department of Defense (DOD) prescribed inventory stockage criteria, while non-standard material does not normally qualify for investment and stockage by DOD. The standard items are supported by the DLA through a repair parts manual which enumerates spares and repair parts availability sources by the manufacturer or DLA stockage. The non-standard items are usually accompanied by a manufacturer or vendor recommended list of spares and possibly a few maintenance notes.

The next event in the maintenance support process is accomplished by the material manager who procured and furnished the medical and dental material to the ships. Basically, the manufacturer's literature and maintenance notes are reviewed and a minimal maintenance plan is developed.

The maintenance plan may not provide any formal planning or description of tasks to be performed by operator or maintenance personnel. At present, corrective maintenance is often not available until the equipment item is reported out of commission to the material manager. The point is that the present maintenance plan appears to have only negligible influence on planning for equipment maintainability and reliability. Moreover, the maintenance planning effort too often does not take place until after the user has taken possession of the primary system or equipment item [26].

This section has highlighted some of the current aspects on the way medical and dental material maintenance planning is organized and managed for ships.

2. The Navy Advanced Base Functional Component System

The ABFC system is a quantification of planning, procurement, assembly and shipping of material and personnel needed for the emergency facility support requirements of overseas advance bases. The ABFC is a grouping of personnel, facilities, equipment, and material designed to perform specific functions or to accomplish a particular mission of an advance base. ABFCs are not necessarily complete entities. When an ABFC specifies material only, the operating personnel are provided by another ABFC. For example, housing, food services, medical facilities, communications equipment, power plants, and water supply equipment are not supplied with each component. These service components are

added to the overall base plan as required. Geographic availability of these supporting resources dictates the type and number of ABFC components required.

A detailed Advance Base Initial Outfitting List (ABIOL) is a line item list of the material in each ABFC. Within the context of medical requirements, BUMED is responsible for maintaining a detailed listing of that portion of the ABIOL which contributes the medical support requirements. The medical function is categorized as "Hospital and Medical."

BUMED is technically responsible for and therefore to assure the mission capability of their respective components. Figure 3-2 illustrates the current Hospital and Medical ABFCs of which BUMED is cognizant. BUMED is also assigned the following responsibilities relating to the management of the Hospital and Medical ABFCs.

- a. Review the design and composition of the component to ensure that it meets the requirements of the component's mission statement.
- b. Review listed equipment for which responsible, to ensure that the equipment of the most technically advanced available.
- c. Maintain liaison with other contributing activities to ensure that the latter's contributions are the best available for the purpose of the component.
- d. Coordinate all new components designs and design changes, including personnel.

e. Recommend to CNO the inclusion of new components, the deletion of old components and the revision of mission statements of existing components [27].

It is important to note that ABFCs are intended for planning purposes only and are not preassembled and held in stock for immediate use. When employed, standard ABFCs are designed to meet normal operational requirements. In planning for an advance base, planners tailor personnel and material lists to meet the requirements of the individual base, considering such factors as the base mission and its environment. Some components are technically operational and contain all the necessary personnel, structures, and material necessary to perform their mission.

Upon the activation of an ABFC, as directed by the CNO, schedules for acquisition, assembly and shipment are issued. Materiel procured is held in one of three categories of readiness as follows:

a. Provided Condition. Materiel to be held in system stock and positioned as necessary to facilitate delivery when required.

b. Available Condition. All materiel completely and finally inspected and tested, properly labeled to identify the components packed for overseas shipment and located at depots capable of delivering the materiel to dockside within the readiness time-frame allowed.

c. Assembled Condition. All materiel transferred from the "Available Condition", appropriately marked, and

assembled into functional components at depots specified by the CNO and within a specified date for outloading assigned [28].

Staging of materiel for components at depots or intermediate bases is likely to be held to a minimum because materiel stored for extended periods at intermediate bases is often subject to loss or damage. Also, the complex nature of modern medical materiel has increased the incidence of hazard to patients and operators from:

- a. Deterioration due to unsuitable packaging and storage
- b. Errors in labeling and other identification methods
- c. Errors in manufacture
- d. Equipment component or complete item failure [29].

Medical primary systems, equipment, and consumable supplies are also subject to dated and deteriorative inspection criteria. For example, rubber tubing connectors in dental and anesthesia machines are subject to deterioration from dry-rot.

To better understand the ABFC functions performed by BUMED, it would be appropriate to first briefly review the process of maintaining the Hospital and Medical ABFCs. As directed by BUMED, the Naval Medical Materiel Support Command (NAVMEDMATSUPPCOM) is responsible for assisting in the design of medical and dental spaces and for developing equipment lists of material to outfit spaces for advanced bases.

In essence, this activity continuously reviews the equipment lists. Changes in the listings are made for a variety of reasons, some of which will be described here. An equipment item may be deleted from a DLA supply management catalog because it is no longer available or procurable from commercial sources; because changes in the technology render it obsolete; or because the DLA no longer has sufficient demand for the item to justify stockage or cataloging. A lack of demand occurs when the services no longer procure or levy a requirement on the DLA for item inventory management. It should be noted that there is an abundance of new products from different manufacturers proposed for standardization and stockage by the DLA. Consequently, there are numerous items proposed for deletion or replacement.

NAVMEDMATSUPPCOM coordinates the material actions which add, replace, delete, or change quantities of primary systems or equipment to the ABFCs. A sequence of steps occurs wherein the material action is reviewed by designated individuals responsible for providing input into the decision-making process relative to the item being listed as part of an ABFC. For example, a general surgeon provides professional comments directed toward surgical systems and equipment, an anesthesiologist relative to anesthesia and suction apparatus or an oral surgeon would relate to maxillo-facial equipment and associated surgical instruments. After consolidating all the latter comments, NAVMEDMATSUPPCOM

reviews the proposal and provides comments concerning weight, cube, and if available, cost data. Then a recommendation is made and the final approval is based on the professional and logistic considerations provided.

This section has described BUMED's role in the design of medical and dental spaces and for the development of material lists to outfit medical and dental ABFCs. It is clear that the emphasis of BUMED is upon replacement of material and review of listings. Very little consideration appears to be given to logistics management.

3. Medical Logistic Support for Fleet Marine Forces

Medical logistic support considerations relative to the FMF focus on amphibious operations, and include the provision of medical material and medical peculiar repair parts [30]. Medical and dental material support of the FMF is provided by organizationally allocated field type outfits and resupply blocks. The basic outfits are developed for all organizations to which medical and dental department personnel are assigned. Quantities of items contained in the basic allowances and resupply blocks indicate the minimum amount needed to support the FMF units in their assigned mission. These material requirements must be met by special planning and procurement with particular attention to requirements peculiar to a specific geographic location.

The basic allowances are prepared by the NAVMEDMATSUPPCOM and undergo a review and analysis similar to the review

conducted on ABFCs and ships' allowance lists, except that medical planners assigned to the United States Marine Corps also participate.

There are numerous allowance lists, more properly titled Authorized Medical Allowance Lists (AMALs), assigned to the FMF [31]. One of the more important FMF AMALs is Basic Outfits, Medical (Ground), which is composed of assemblies of medical supplies and equipment functionally packed for convenience in handling. These include surgical trays, equipment sets and burn packs. These basic allowances are designed to provide the durable material and consumable supplies to support the particular unit to which they are assigned. Another important allowance list is the Initial Supply Block (Ground) which contains relatively small amounts of supplies maintained in a continuous state of readiness to augment the medical material of basic outfits. These blocks, in the numbers required to support the personnel involved, and the basic outfits, constitute the initial outfitting supplies and equipment for FMF ground units. There are also additional augmentation and resupply blocks which are listed as AMALs designed for FMF employment. Figure 3-3 depicts several of the current AMALs presently designated as FMF AMALs [32].

As stated above, allowance lists are maintained by the NAVMEDMATSUPPCOM who is responsible to BUMED for the medical support capability available in the allowances. Allowance list reviews are conducted on a continuous basis,

but these reviews may simply be conducted on a line item basis because of an item becoming obsolete or unavailable. The fact that comprehensive FMF AMAL reviews are not being carried out as efficiently as possible suggests that valid primary systems and equipment requirements may not be funded while obsolete and redundant systems and equipment are. For example, the BUMED X-ray professional consultant reviews the radiological benefits and characteristics of a particular field X-ray system and advocates its adoption to an FMF AMAL. This review by the professional consultant sometimes takes up to three months because the consultant performs these reviews on a collateral assignment or part-time basis and has other primary duties which take priority. The proposal is then referred to the NAVMEDMATSUPPCOM for evaluation and is forwarded to the Marine Corps medical planners. These planners conduct their own analysis of the item and provide comments relevant to field use, addressing elements such as packaging, transportation and handling, and training. This part of the review sometimes takes an additional three months. Finally, the NAVMEDMATSUPPCOM reviews all the comments and recommendations provided; if all concerned are not in agreement or if important questions are raised, the proposal may be sent through the entire process again. This is perhaps why a joint services operational workshop emphasized that, in field medicine, the lack of administrative and logistical experience is primarily

responsible for the fact that FMF AMALs have not undergone a substantive review since the Korean War [33].

This brief review of medical material programs dealing with ships, ABFCs and FMF allowance lists shows that there exist shortcomings in the logistic support provided to these programs. From the available information, logistic efforts appear to be fragmented and to be lacking in coordinated organization and management. The major efforts of materials managers are directed toward maintaining or replacing allowance lists, while the kind of continuous functional review that could ensure adequate integrated medical material support is virtually nonexistent.

**B. FACTORS AFFECTING COST, EFFECTIVENESS, AND
SUPPORTABILITY OF PRIMARY SYSTEMS AND EQUIPMENT**

Despite numerous logistic policy directives, the literature indicates that, previously, logistic concepts and elements were misunderstood, ignored, or included only as an afterthought [34]. As a result, equipment may have been declared ready for use, only to discover that it was unsupportable. The reasons for this include, lack of spare parts, lack of technical documentation, or lack of a definite maintenance plan. This has necessitated expenditures of funds to introduce and expand special procedures to keep equipment in an operational ready status. Users also have had difficulty in getting the items repaired or operational and have opted for complete replacement items on an emergency basis. This situation has been exacerbated when a system

or equipment item is carried aboard ship or intended for use in the field. DOD and Navy directives are unambiguous in directing attention to matters such as the requisite amount of personnel for operation and maintenance, complexity of skill level requirements, quantities of spare parts, frequency of maintenance and repair actions, need for support and test equipment, facilities, and data. All of these categories are considered by DOD and the Navy as relevant to cost effectiveness, but are not usually treated as such by medical material managers. Circumstances such as these have caused military logistic costs for operation and maintenance of primary systems and equipment over the life cycle to be often multiples of the initial acquisition cost [35].

One controversial issue relevant to costs occurring in health care is that of acquisition of medical primary systems and equipment without regard to the cost implications [36]. Berki indicates that acquisition of facilities, including equipment, is sometimes used to attract and maintain medical or surgical specialists whose services would otherwise be unavailable [37]. While this practice is undoubtedly effective in maintaining some qualified specialists in the services, it can lead to procurement of expensive, sophisticated equipment despite the existence of other systems or equipment items which could suffice at a lower cost with greater reliability and maintainability.

It is important to note that the professional consultant's or physician's input to the selection of primary systems and equipment should represent only a part, albeit an important one, of the selection process. Much of the equipment, once approved for use, is eventually procured on a mass or bulk basis by the DLA. Furthermore, for those items held in inventory for sale by the DLA, costs are established and published in defense supply management catalogs, which are distributed throughout the Navy and Marine Corps medical activities. Medical activities are expected to use these sources of supply in fulfilling their requirements. Thus, the DLA has equipment in inventory--sterilizers, portable X-ray systems, anesthesia and suction apparatuses--which may not be considered the item of choice by the user or professional consultant. As the author has observed, this situation is further compounded when these users and consultants fail to report to the DLA Medical Directorate or the NAVMEDMATSUPPCOM the circumstances surrounding the lack of acceptance of the primary system or equipment item. Consequently, users sometimes seek other sources of supply to procure items because of personal preferences, even though the items might lack a maintenance planning program. Consequently, equipment held in the DLA inventory does not necessarily reflect the demand rate which was forecast prior to DLA procurement and based upon Navy and Marine Corps requirements. Therefore, inventory and holding costs are increased

for the DLA and may ultimately be passed on to the services. In addition, items may become obsolete over time.

The situations described in this section contribute to increased costs and, perhaps more importantly, dictate a situation which impacts on the process of funding procurement of essential primary systems and equipment and the associated logistic support requirements necessary for mission accomplishment.

At this point, it seems prudent to discuss briefly the budget process for Navy medical and dental activities. A DOD annual appropriation provides funds for the procurement of investment equipment under the appropriation, "Other Procurement, Navy" [38]. Within the DOD, BUMED is responsible for programming and budgeting for the acquisition of equipment for all BUMED command activities. Medical and dental equipment refers to any piece of equipment with a unit cost of over \$1,000, vehicles excepted.

BUMED directs each of its command activities to develop and maintain a formal equipment replacement program. As such, each activity establishes an equipment review committee to assist the commanding officer in the formulation of the program. The equipment committee is made up of the commanding officer, chiefs of professional services, a biomedical equipment technician, and other staff members as may be assigned.

The initial submission to the committee is provided by department heads or service chiefs. This input would include

items to be repaired, new items, items requiring immediate replacement, and updated requirements from previous years which were not approved for funding. Further, the hospital or facility plant property records are reviewed for items eligible for replacement during the budget year plus one. The committee develops the activity investment equipment listing and assigns priorities in accordance with the guidelines prescribed by the head of the activity. Each activity then submits its investment equipment requirements for one year plus one with justification to BUMED, which consolidates it with other activity budget submissions for further analysis and assignment of priorities [39]. Figure 3-4 depicts the process that is generally followed.

Primary systems and equipment lists submitted by BUMED activities undergo further review by the professional consultants who support BUMED health care delivery systems. See Figure 3-5 for a list of consultants. Any of these specialists may be called upon to provide comments and recommendations relative to primary systems and equipment selection and eventual funding by BUMED. Maintenance planning actions would be considered subsequent to acquisition.

Programming and acquisition of medical and dental investment equipment requirements for ships is also the responsibility of BUMED [40]. Investment equipment for ships is defined as any piece of equipment with a unit cost of \$3,000 or more which is not included as part of a ship alteration

project. The NAVMEDMATSUPPCOM is the responsible unit for development of the budget for fleet medical and dental investment equipment requirements. These requirements are based upon individual ships which identify their respective requirements and submit their requests in the format shown in Figure 3-6 [41].

The NAVMEDMATSUPPCOM examines the requested items, evaluating its suitability for current medical and dental practices, the availability of spare parts, and coordinating the medical and dental consultants' reviews of each item. Items approved for fleet use are submitted to BUMED for inclusion in the overall BUMED budget for investment equipment. BUMED and NAVMEDMATSUPPCOM emphasize programming and budgeting for funds, but their planning and maintenance analysis is neither systematic nor is it based on an ILS approach. Budget submission appears to be based upon single user initiated requirements with little maintenance support planning considered.

C. RESPONSIVENESS

Based upon the primary system and equipment selection processes described in the previous sections, it seems clear that the user provides the initial input for equipment requirements for the operating environment. As such, the type of equipment budgeted and funded may be based upon obsolescence, personal preference, or perhaps the information of a zealous medical or dental equipment salesman. The key

point is that there seems not to be a clearly defined primary system and equipment program, coupled with maintenance management planning, which is responsive to the user in the operating environment.

Talcott indicates that some critics, both in and out of the health care industry, point to the notion that "physicians and specialists have become overly enamored by the dazzling array of medical electronics equipment which virtually feeds on its own obsolescence" [42]. Clinicians also insist on the absolute necessity of obtaining the latest edition of various items of equipment in the furtherance of providing life-saving care to their patients. Faced with this demand, it may be exceedingly difficult for materials managers to defer the equipment selection and acquisition even though it might not be utilized effectively and economically. Further, the identification of maintenance planning and personnel support and training requirements may take place subsequent to acquisition or if at all.

Although these criticisms are not directed against all physicians and specialists, this author's observations of such incidents corroborate Talcott's assessment. As an example, a cardiac monitoring system which had been previously approved by a professional consultant was being installed as part of an intensive care unit aboard an aircraft carrier. A new physician reported to the medical department on board the ship and expressed his displeasure with the system.

Accordingly, action was initiated and approval granted to replace the system with a system more in line with his personal preferences. Subsequent to that physician's transfer two years later, an anesthesiologist conducted an inquiry to determine why the second system had been installed. In his professional opinion, the original system was the appropriate system for use on board the aircraft carrier. The time, effort and resources expended to make the change in equipment were significant.

Effective selection and utilization of primary systems and equipment for all the Navy's needs is a necessity if the Navy's investment in equipment is to be kept to the minimum for the accomplishment of its mission. The Navy health care community, in competition for investment resources, is no exception. The need for economical systems that will nonetheless operate reliably under varying environmental conditions is no more important than the need for improved logistic support. When logistics is not performed on a carefully planned integrated basis, a primary system or equipment item that operates well in a hospital or dental clinic may prove to be difficult, even impossible, to support when it is introduced into the fleet or field.

D. SURVEY

A survey of data pertaining to medical material programs was conducted in two phases: a study of recent Defense Audit Service and Naval Audit Service reports; and by

correspondence with management and medical repair personnel within the Navy medical community, both by telephone and survey form. The intent of the survey was to assess medical material responsiveness.

Audits of Naval medical activities are conducted on a periodic basis in order to appraise the adequacy of those management functions related to the mission of the activity. This includes an evaluation of the effectiveness and efficiency of management practices in the functional area of medical equipment maintenance [43].

1. The Defense Audit Service, Report on the Review of the DOD Medical Materiel Support Program in May of 1979 stated: "Equipment maintenance and repair programs at medical activities were not always conducted economically." Two medical activities awarded contracts valued at \$381,000 for maintenance support when similar services were available from DOD activities at a savings of \$45,000 [44].

The Defense Audit Service provided the following recommendations to the Surgeons General of the military medical departments: ensure that contracts are not awarded to commercial sources for maintenance and repair of medical equipment that can be accomplished more economically by the government; ensure that medical equipment is properly maintained, and that maintenance and repair efforts are adequately documented; ensure that supply management procedures at health care activities are adequate to provide reliable

inventory records, and require health care activities to requisition centrally managed standard medical items through the supply system unless otherwise authorized by the inventory manager [45].

2. The problem of inadequate maintenance and repair programs at various medical activities was described by the Naval Audit Service in the following manner: medical equipment maintenance and repair programs are deficient in that safety systems are not provided in all instances and inspections and maintenance of life saving/life support records are incomplete; the potential productivity of biomedical equipment technicians is not being realized; the medical equipment maintenance and repair program is deficient in that the programs at one activity did not provide for including equipment at a satellite medical activity; medical equipment maintenance records are incomplete, inspections and maintenance are not accomplished at required intervals; the preventive maintenance program needs improvement in the areas of scheduling, maintenance, and technician staffing, to ensure that life support equipment and other equipment essential for patient care is adequately maintained; about 46 percent of a regional medical center's medical equipment items have not received all required preventive maintenance during the past year (1979).

The Naval Audit Service provided the following recommendations to the medical activities audited: perform required

preventive maintenance actions on all qualifying items of medical equipment; prepare maintenance records of medical equipment; establish a medical equipment maintenance program; establish procedures to be employed by regional medical centers in providing supply support to their satellite activities; improve preventive maintenance for medical equipment; provide the best organizational structure for the medical equipment maintenance and repair program; maintain plant account records; report investment items to BUMED.

The general recommendations of the audit agencies paralleled those elements of an ILS system, calling for the services to: "perform preventive maintenance; establish maintenance programs; provide a materials management organizational structure and procure standard items." Clearly, these agencies charged with investigating military medical and dental activities have found serious deficiencies in the procurement and maintenance of medical equipment.

In the author's survey, 22 activities were solicited by either telephone or direct mailing to the management personnel responsible for maintenance programs. These BUMED managed activities included regional medical centers and hospitals. Fifteen survey forms were completed and returned. A summary of the results tabulated are shown in Appendix C.

Interestingly, the deficiencies reported by the governmental audit agencies were not always corroborated by the

author's survey. Although management personnel (interviewed by telephone) at the 22 medical and dental activities surveyed were largely in agreement that ILS procedures were directly applicable to medical and dental programs, they appeared to have been reluctant to criticize the present conduct of maintenance and repair.

All respondents indicated they were satisfied with contracted maintenance performance. Replies relative to in-house medical repairmen's performance ranged from satisfied to very satisfied; the majority of the respondents were satisfied. Replies concerning depot level maintenance were equally divided between very satisfied and satisfied. Overall, activities indicated that they were generally satisfied with their equipment maintenance programs.

Professional services listed as unproductive because of a constraint on medical or dental equipment indicated a surgical suite inoperative due to an out-of-commission anesthesia apparatus. Lack of spare parts, inadequate maintenance planning and training were the chief causes reported. At another activity, the cardio-pulmonary laboratory was closed due to the lack of a repair manual and schematics, which available maintenance personnel needed to provide remedial maintenance. This activity also cited inadequate operator training as a contributing factor as to the reason that equipment was not operable. Other activities cited the need for an increase in contract maintenance

to increase equipment availability. Inadequate technical data, repair personnel, and a lack of a supply source and supply items were the contributing factors. Because managers are faced with providing similar items of equipment and supporting consumables from various manufacturers, they expressed a desire for uniform or standard equipment selection and maintenance. Too many items of equipment intended to perform the same basic functions are likely to require individualized maintenance planning efforts. Cardiac monitoring units is a typical example found in hospitals. Acquisition of cardiac monitoring units and other equipment items with prescribed maintenance requirements and supply support could enhance hospital equipment maintenance programs.

Despite the fact that respondents indicated that they were generally satisfied with their equipment maintenance programs, there appears to be a contradiction in the degree of adequate maintenance support conducted and what the audit agencies report. The author believes that this contradiction exists because of three factors:

1. Management personnel are reluctant to divulge information that could affect their interpersonal relationships with members of their activity. That is, the way people within an organizational structure will view and evaluate an individual who does not appear to support overall organizational goals and objectives, but who is in fact seeking to motivate others in improving equipment maintenance. The

latter may be a vital issue for management to evaluate, but to open the question would digress into the field of behavior theory.

2. Management personnel are not fully cognizant of their material programs because they lack an information system which could assist them in keeping abreast of the status of their equipment programs. This factor is supported by the audit service reports in that some activities do not have a complete and accurate accounting of their equipment.

3. Management personnel do not have a viable equipment maintenance program. The lack of a systematic approach to planning and scheduling equipment maintenance may have resulted in a repair philosophy of fix it when it breaks or replace the equipment item. That is, management personnel only react to equipment problems when the item is in need of repair.

E. SUMMARY

This chapter has discussed some of the problems facing medical material managers and others involved in the process of selecting and planning for the maintenance of primary systems and equipment. It has also shown that there are deficiencies in the management of medical equipment programs at medical activities. Although there are differences between the audit services and management, the level of effectiveness of maintenance is generally much lower than it could or should be. ILS is essential if these activities

are to be truly planned, controlled, and cost effective. It should be a rational and systematic approach the purpose of which is to provide users with the proper equipment mix and maintenance support plan necessary to support medical mission objectives. Top management has it in its power to improve maintenance effectiveness.

Chapter IV, the final chapter, will discuss the implications brought about by contrasting ILS management depicted in Chapter II with the difficulties portrayed in this chapter. Conclusions will be offered along with recommendations.

IV. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

This chapter reviews some of the concepts and issues presented in this thesis and draws together the conclusions emerging from Chapters I, II, and III. The conclusions are converted into recommendations in order to improve medical material program equipment selection, maintenance, and logistic support.

Chapter I began by linking the concept of integrated logistic support (ILS) to medical material readiness. Further, it pointed out that new technology has fashioned major changes in health care. It was argued, that the the application of ILS to medical material programs can help to better manage medical equipment assets and thereby enhance readiness. The objectives were two-fold. First, to determine if ILS is a viable approach to the problem of medical material readiness. Second, to generate an understanding of ILS in order to assess whether there is a need for increased ILS management of medical resources in the Navy.

As indicated in Chapter II, there is an ILS systems approach available to material managers within the Department of Defense (DOD) and the Department of the Navy (DON). ILS is a system that provides controls that help to ensure that equipment will meet performance requirements, and also that they can be supported throughout their life-cycle. The

systems developmental process coupled with the ILS elements described offers a means for solving complex logistic problems. These concepts are applicable to any primary system or equipment developmental process. Even within the medical community, the author contends that the employment of these ideas and processes could provide improved visibility to equipment selection and maintenance support programs.

An ILS approach provides the manager with an opportunity to evaluate medical equipment and maintenance support alternatives on a co-equal basis. That is, the ILS elements affecting the equipment item are addressed in a systematic fashion which provides improved visibility to the equipment and maintenance support selection process. In essence, this means that both equipment items and the logistic support system are considered together during planning, acquisition, and operation. Further, this approach would consolidate requirements so that equipment items are selected in terms of life-cycle costs relevant to performance and mission and not on a personal preference basis.

Chapter II also discussed the need for an ILS manager who would be responsible for coordinating logistic tasks. A matrix organization built around specific material projects was presented as an aid for the manager to pull functionally separated activities together. Further, the matrix organization would provide a framework for merging together the ILS elements and material projects.

Even within the medical community, an ILS manager could be the focal point that links project personnel together while improving communication, coordination, and integration of the ILS elements into the review of medical allowance lists. If merging logistics with matrix management aided the aerospace industry during a period of rapidly expanding technology, it seems likely that it can meet the logistical challenges of the Navy's health care community.

The final section of Chapter II outlined DOD and DON directives which require a systems approach in the selection and acquisition of systems and equipment. These directives require that equipment must be procured on a cost-effective basis and that logistics considerations are to be a major part of that process. The DOD and DON policy directives are unambiguous in their intent.

Chapter III described the present equipment selection and maintenance processes employed in three medical material programs; ships, Advance Base Functional Components (ABFCs), and Fleet Marine Force (FMF) medical and dental allowance lists. Operational and mission performance factors are stressed as the criteria employed in developing medical and dental allowance lists. Maintenance planning, however, often takes place after acquisition, if at all, and appears to have a negligible influence on equipment maintainability and reliability.

The process for review and update of allowance lists emphasizes replacement of material with little consideration

given to logistics management. The role of the professional consultants providing input into the equipment review and selection process was described. This input appears to be based more on singular personal preference than on systematic analysis, however. ILS might dispose consultants to go along with a decision-making process which supports selection, acquisition, and maintenance of equipment on a systematic basis. This would include written justification which considered the system developmental process and the ILS elements discussed in Chapter II.

The budget process for Bureau of Medicine and Surgery (BUMED) activities and ships was described. Initial input is provided from the user or activity level and reviewed by the BUMED professional consultants. Again, maintenance support appears as a negligible factor in the equipment selection process.

The author conducted a survey pertaining to medical materials program management. Audit agencies' reports were reviewed and a survey of BUMED managed activities was conducted. The intent of the survey was to assess medical material responsiveness. The Defense Audit Service and the Naval Audit Service indicated that there were deficiencies in BUMED's equipment maintenance programs at regional medical centers and naval hospitals. One report cited a potential cost savings of \$45,000, which could have been achieved if maintenance had been performed by DOD facilities rather

than civilian contracted support. Another audit report indicated that 46 percent of a regional medical center's equipment had not received all required maintenance during 1979. The general recommendations provided by the audit agencies were along the lines of an ILS system, calling for improved maintenance programs and a materials management structure.

The deficiencies cited by the audit reports were not always corroborated by the author's survey of medical activities. Management personnel seemed to be reluctant to criticize existing systems in writing. All respondents indicated that they were satisfied with contracted maintenance support. However, activities did report that some clinical services were inoperative because of lack of spare parts, technical data, and training. They also reflected dissatisfaction for almost all ILS elements, but overall said top management gives a great degree of importance to material readiness and maintenance support. The lack of satisfaction over the byproducts did not equal the satisfaction for the system as a whole. The audit reports indicated that, both the byproducts or elements and overall system were in need of improvement.

B. ANALYSIS OF THE SYSTEM

According to the DOD and DON directives described in Chapter II, there exists a requirement for adequate and timely ILS planning to be provided for primary systems and

equipment. The concepts described in those directives are in accord with the ILS theory advocated by Benjamin S. Blanchard, a noted ILS authority [46].

It appears that detailed attention to ILS has not received its due in the area of medical material programs. Active participation and cooperation by professional, administrative, and logistic personnel in the application of ILS to medical material programs has not been achieved. As indicated in Chapter III, an assessment of the management structure which is presently responsible for these programs indicates that logistic efforts appear fragmented and lack organization and management.

In the civilian sector, top management is charged with overall corporate planning and program objectives. In the Navy's medical community, these functions are the responsibility of BUMED. BUMED is also charged with the responsibility for effective management of existing programs.

An area that merits particular attention is the application of an ILS matrix organization and project management techniques to medical material programs. The dynamics and advantages of a matrix organization, as described in Chapter II, are often the best way to conduct a program. It brings to bear the judgment of professional, administrative, and logistic personnel on the problem of staffing, planning, and operational decision-making. The author notes that herein lies the value of the matrix organization which has a manager

responsible for making decisions between functions and maintaining a constructive set of relationships throughout the organization. By opting for the sophisticated matrix approach to project management, management has at its disposal a decision-making process and concurrent organizational control. Top management then maintains surveillance over the project managers and the interfacing functions to assume that cooperation, effectiveness, and unit exist.

Project management may be viewed by some as a complication in the structure of the BUMED organization. However, it should be remembered, that the basic idea of project management is simplicity itself; to provide a straightforward operational grouping of the people dedicated to accomplishing a specific task, under a single responsible leader. The object is to provide the project team with a direct and simple environment within which to accomplish its task without embroiling it in operations not directly relevant to the designated task. For example, in the BUMED organizational environment, this would mean that the professional consultants would be located at the site of allowance list reviews.

C. GENERAL CONCLUSIONS

The following sections draw together three general conclusions drawn from the previous chapters relevant to providing adequate ILS. They are the need for matrix projects

management, information systems, and an administrative support organization.

1. Matrix Project Management

In a matrix project management organization with strong functional management, the project manager is delegated management authority for the project. Assisted by staff members, he or she develops project tasks and schedules, and assigns them to the appropriate functional member. The phrase "strong functional management" emphasizes the important concept that the manager has the authority to issue direction regarding project matters to all people assigned to the project. The author contends that the advantages of matrix project organizations are as follows:

- a. In many cases it is the least costly form of organization for a project.
- b. The project manager can devote time to the complex issues of the project and to coordinating its tasks and priorities without being distracted by details of execution.
- c. This form of organization retains the expertise and management skills of functional personnel and managers in the execution of project tasks.
- d. Matrix project organization is attractive to managers because it allows them direct contact with the skilled professionals whom they are supervising.
- e. It is easier to accommodate changes in project manpower requirements and to off-load efficiently as a project phases down from its peak workload.

f. The entire management team works together to achieve project objectives, thereby increasing feelings of responsibility, interest, and pride.

g. Management can more readily perceive and resolve conflicts between project requirements and functional organization policies [47].

In establishing a project, BUMED may issue a directive indicating the purpose of the project, providing the general organizational format for the project, appointing the project manager, and stating top management support for the project. BUMED may also include other appointments, policy statements, and guidance. The outline in Figure 4-1 illustrates the author's concept of such a format. In addition, Figures 4-2, 4-3, and 4-4 depict a sample matrix organization which the author posits may be employed by BUMED in the application of the ILS system to the medical programs described in Chapter III.

The Naval Medical Materiel Support Command (NAVMEDMATSUPPCOM) would act as the host in the conduct of these projects. Other projects affecting material programs may also be assigned to NAVMEDMATSUPPCOM. Professional consultants and other participants would be designated by BUMED and other cognizant activities as indicated in Figure 4-1.

Thus it appears that matrix project organizations can be the most appropriate organizational form for a major medical material/equipment project.

2. Information Systems

Project efficiency can be improved by a medical material management information system. Members of ILS project teams must have access to an information system to quickly provide them with the proper data. There is, of course, no way to quantify, record, and project all of the factors affecting the scenarios for which medical programs exist. However, the assessment of performance and effectiveness of the primary system or equipment requires the operational and maintenance histories. Although the Navy employs a number of techniques in its management of maintenance, one technique merits notice. This is the Navy Maintenance and Material Management System, commonly known as the "3-M System." The 3-M System consists of two parts: (1) the planned maintenance system (PMS), and (2) the maintenance data collection system (MDCS). Employing a "work study" approach, it begins with PMS--a system designed to organize and systematize all preventive maintenance actions for ships and aircraft through a more efficient use of scheduling and maintenance personnel. The second aspect of the 3-M system, the maintenance data collection system records, on a one-time basis, the elements of maintenance information that are of value to managers at all levels. This information is reported to a central data processing center, where the data elements are structured into a format suited to the requirements of material managers [48].

Providing information to address such issues as spare parts usages, areas subject to potential malfunctions, areas of personnel hazard, and utilization require a data feedback capability which stresses these categories.

The purpose of the data information feedback system is two-fold:

a. It provides continuous data for evaluation of the performance, effectiveness, operations, maintenance, and logistic support capability for the system. Thus, certain types of information can be made available at designated times.

b. It provides historical data (covering systems in use) applicable to the design and development of new systems and equipment having a similar function. This facilitates the application of experience factors to the design and selection of new systems and equipment as well as logistic support [49].

Blanchard identifies certain ILS data information elements related to the operational and supporting requirements which may provide evaluative and verification information. Some of the data elements advocated for use by Blanchard are:

a. General Operational and Support Factors

- (a) Evaluation of mission requirements (operational scenarios).
- (b) Evaluation of performance factors (range, accuracy, size, weight).
- (c) Verification of system utilization (modes of operation and hours).
- (d) Verification of cost, reliability, maintainability, safety.
- (e) Evaluation of levels and location of maintenance.

- (f) Evaluation of operation and maintenance function.
- (g) Verification of repair policies.
- b. Test and Support Equipment
 - (a) Verification of support equipment type and quantity.
 - (b) Verification of support equipment availability.
 - (c) Verification of support equipment utilization (usage).
 - (d) Evaluation of maintenance requirements for support equipment.
- c. Supply Support (Spares/Repair Parts)
 - (a) Verification of spares and repair parts by type, quantity and location.
 - (b) Evaluation of supply responsiveness (spare available when needed).
 - (c) Evaluation of spare/repair part replacement and inventory policies.
- d. Personnel and Training
 - (a) Verification of personnel quantities and skills at maintenance locations.
 - (b) Evaluation of personnel skill mixes.
 - (c) Evaluation of personnel training policies.
 - (d) Verification of training equipment and data requirements.
- e. Technical Data
 - (a) Verification of data in operating and maintenance manuals [50].

The collection, analysis, and evaluation of data derived from the information system facilitates the application of the ILS concepts described in Chapter II. The point is to have the data available when needed in order to be able to evaluate primary systems, equipment, and associated logistic support alternatives. For example, a spare or repair part may be required as part of a ships' Authorized Medical Allowance List (AMAL) for a class or group of 30 ships. If there is no recorded use of the item in the maintenance history or no demand for supply support the

item may not need to be carried as part of the allowance list. Conversely, items for which there is usage and demand should be evaluated for stockage. Moreover, the level of operator skill and maintenance data to perform the required maintenance service and other ILS issues should be considered along with the possible verification of the need for the parent equipment item. Also the review of spares and repair parts usage data impact on the total life-cycle cost analysis and design characteristics discussed in Chapter II.

In addition to providing the data described above, the information system should provide the means to furnish an AMAL equipment replacement program based on the inventory of primary systems and equipment currently on board ships or in the field. A schedule of the expected life of medical and dental equipment is presented in Figure 4-5. Technological and scientific advances, however, often accelerate obsolescence of medical and dental equipment, necessitating replacement without regard to age or condition. The ILS program information system must be flexible enough to accommodate technological advancements relevant to military medical requirements.

This section has described the need for a simple but specific information system. The system should provide ILS project members with a data base that can be employed to evaluate and assess the performance, maintenance, and logistic support capability of medical material programs.

3. Administrative Support Organization

The focus of this section is upon the organizational framework required for the management of the medical logistics function. First is the establishment of the logistic elements. In this area, the concern is with the interface between the ILS elements and the systems developmental process. Second is the organizational considerations beyond those of the elements. Concern here is with the need for coordination of functional activities outside and inside the organization itself.

During the developmental process, detailed logistic support concepts and resource requirements are developed from equipment and systems design information and analysis of the support environment. This effort helps to define maintenance actions, times, levels, locations, training, training equipment, technical data, tools, test and support equipment. Logistic support personnel participate in reviews, equipment and systems tests and demonstrations to help assure proper consideration of these areas. Changes are evaluated for their impact on support requirements and functions, and support trade-offs are conducted. Management approval based on these trade-offs results in the establishment of the basic systems and equipment configurations with the specifications for and means of demonstrating attainment of operational and readiness goals. This cycle requires close attention by the project manager to identify changes

in training, maintenance planning, reliability and maintainability planning. This is necessary in order that the project manager can assess the data which should represent the minimum needs of the program while recognizing cost.

During the developmental process, emphasis is placed on those support requirements necessary to achieve the operational capability (readiness) within anticipated cost restraints. For example:

- 1) Key mission requirements having most significant impact on the selection of system and equipment features and logistic support concept must be identified.
- 2) Supply, maintenance, personnel, and other major support concepts are addressed as part of the development approach.
- 3) Funding estimates which will be allocated to logistics planning, trade-off analysis, and development are evaluated.
- 4) Potential logistic problems and risks should be articulated and evaluated.

Logistic personnel should work as a team in analyzing basic objectives and in developing strategies to meet those objectives. Figure 4-6 depicts the author's concept of the use of logistic elements in a matrix form which is supported by essential data requirements as a means to select medical primary systems and equipment.

As indicated in Chapter II, inherent in the application of ILS principles, is the fact that there exist

organizations and people responsible for the various elements of ILS. Within the Navy medical community, these organizations, as perceived by the author, do exist. They are as follows.

BUMED

The BUMED professional consultants

NAVMEDMATSUPPCOM

FMF medical personnel

Fleet medical personnel

It appears, however, that there is no single integrating or unifying structure which controls and provides a clearly defined mechanism for the application of ILS to the overall medical system.

The NAVMEDMATSUPPCOM is charged with varying degrees of responsibility each relating to the problem of medical material support. Appendix D lists the NAVMEDMATSUPPCOM mission and functions as approved by BUMED [51]. The basic source of problems and opportunities in the application of ILS principles to medical material programs is that NAVMEDMATSUPPCOM, though responsible, does not appear to assume its role for coordinating and providing consistent direction for these programs. The author believes that the application of the ILS systems approach coupled with an organization which employs matrix project management techniques, discussed earlier, offers NAVMEDMATSUPPCOM an opportunity to integrate, optimize, and assess medical material

programs. Further, it is important that participating organizations be able to view the NAVMEDMATSUPPCOM as the unifying organization responsible for ILS. This is illustrated by the author in Figure 4-7. Moreover, if all participants recognize the true benefits and objectives of ILS, there should be a synthesis of goals and objectives from within and without their organizations [52].

This section has shown that there exists an administrative organization under BUMED, which can act as the control point for ILS management of medical material programs.

D. RECOMMENDATIONS

1. BUMED should issue a charter which mandates AMALs and equipment support reviews on a prescribed cyclic basis. Personnel assigned to these reviews must be aware of the true benefits and objectives of ILS so that there can be a synthesis of goals and objectives from within and without their organizations.

2. A matrix project management approach should be a prerequisite to medical materials management endeavors. It provides an excellent form for dealing with problems of planning and operational decision-making, with particular significance for professional, administrative, and logistics personnel.

3. There is a need for more timely and accurate maintenance management information. A sound system will produce planned maintenance schedules, maintenance backlog reports,

plant equipment records, budget formulation data, and other analytical information for true systems and equipment control.

4. There is a need for increased ILS education for Medical Service Corps officers. Key officers should be identified who are motivated to perform in this important area. Further, formal courses of instruction should be investigated as to availability of quotas.

5. There is a need to review existing DOD and DON ILS policy directives. BUMED should review the operation of certain functions and processes of logistics management to determine whether they are being performed effectively and efficiently in accordance with existing policy directives.

E. CONCLUSION

The review of ILS and its application to medical material programs presented has established the potential for future ILS application. The matrix project management techniques coupled with sound information systems described appear likely to improve logistic organization and control of allowance list reviews. However, many decisions in the federal arena flow more from political consideration rather than from logic, strategic analysis, or mission need. When medical material programs dealing with ships, FMF medical and dental allowance lists, and ABFCs continue to experience recurring problems, it is time for top management to be made aware that medical support capability and the greater part of readiness should

be the product of an ILS system rather than politics. It is incumbent upon BUMED to pursue a plan which brings management of its material programs into focus so that its goals and objectives can be met.

FIGURE 2-1
THE ILS PROCESS
[Ref. 7]

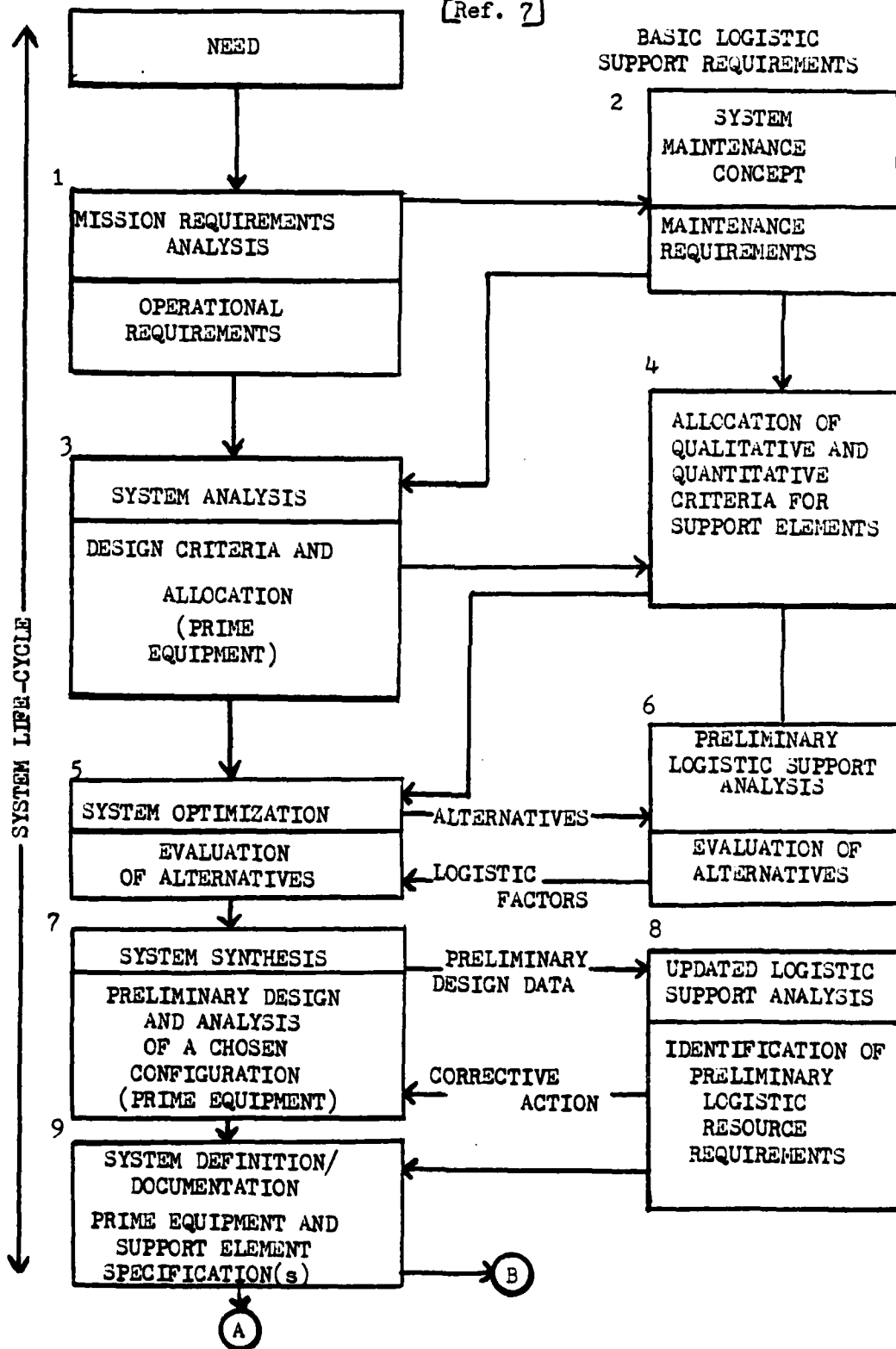


FIGURE 2-1 (continued)

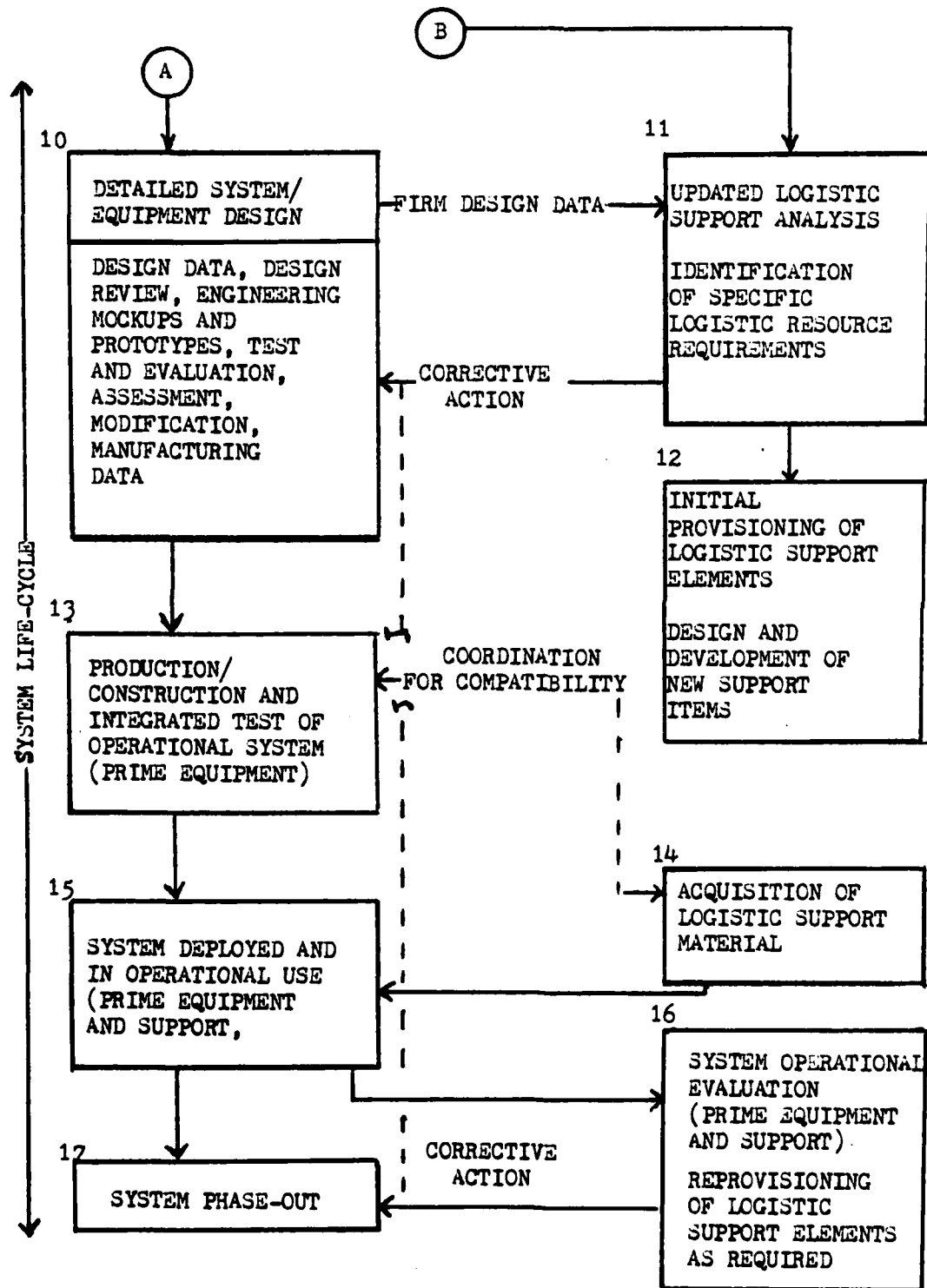
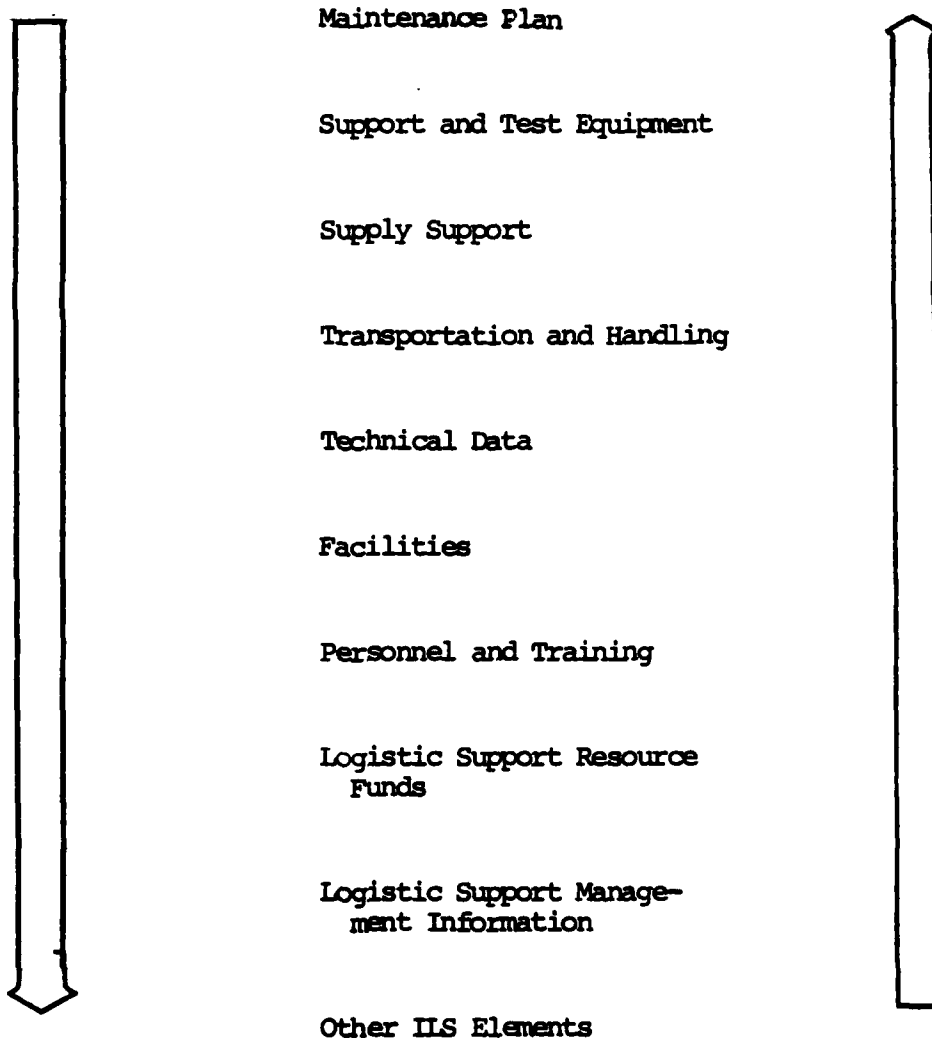


FIGURE 2-2
 INTEGRATED LOGISTIC SUPPORT ELEMENTS
 (author's concept)

Flow of Information

Element

Flow of Material



A		B		C		
Division		Division		Division		
Projects		Consultants	Production	Personnel	Acquisition	Accounting
Fleet Hospitals	Project Manager	Consultant Group	Production Group	Personnel Group	Acquisition Group	Accounting Group
Advanced Bases	Project Manager	Consultant Group	Production Group	Personnel Group	Acquisition Group	Accounting Group
Ships	Project Manager	Consultant Group	Production Group	Personnel Group	Acquisition Group	Accounting Group
Fleet Marine Forces	Project Manager	Consultant Group	Production Group	Personnel Group	Acquisition Group	Accounting Group

Flow of Work Performance



Matrix Organization

Figure 2-3

(author's concept)

SHIPS PLANNING AND DESIGN
[Ref. 25]

<u>FUNCTION</u>	<u>ORGANIZATION</u>
PROPOSED SHIPS MILITARY CAPABILITIES AND CHARACTERISTICS	— CHIEF OF NAVAL OPERATIONS (SHIPS CHARACTERISTICS BOARD)
DEVELOP SHIPS PLANS AND SPECIFICATIONS	— NAVAL SEA SYSTEMS COMMAND
ESTABLISH MISSION AND TASKS FOR MEDICAL AND DENTAL DEPARTMENT PERSONNEL	— BUREAU OF MEDICINE AND SURGERY
PREPARE MEDICAL AND DENTAL ALLOWANCE LIST	— NAVAL MEDICAL MATERIEL SUPPORT COMMAND

Figure 3-1

Hospital and Medical
Advanced Based Functional Components
[Ref. 27]

<u>Nomenclature</u>	<u>Designation</u>
Fleet Hospital, 750-1000 Bed	M-1
Fleet Hospital, 250-500 Bed	M-2
Fleet Hospital, 100 Bed	M-3
Clinic, 25 Bed	M-5
Clinic, First Aid/Outpatient	M-6
Tent Hospital, 60 Bed	-
Surgical Suite Supplement	M-9
Casualty Receiving Unit	M-10
Blood Bank	M-11
Whole Blood Donor Center	M-12
Preventive Medicine Unit	M-13
Ophthalmic Service Unit	M-14
Dispensary, 10 Bed, mobile	-
Casualty Staging Unit	M-16
Dental Mobile	-
Dental Prosthetic Mobile	-
Dental Clinic, small	M-20

Figure 3-2.

Fleet Marine Force
Authorized Medical Allowance List
[Ref. 31]

<u>Unit</u>	<u>AMAL Code</u>
Engineer Battalion, Force Troops	607
Tank Battalion, Force Troops	608
Amphibian Tractor Battalion	609
Communications Battalion	610
Motor Transport Battalion	611
Headquarters Battery, Artillery	612
Engineer Battalion, Marine Division	622
Force Service Regiment	623
Motor Transport Battalion, Division	624
Infantry-Artillery Regiment	625
Military Police Battalion	626
Squadron Medical Section	650
Marine Air Wing Battalion	651
Marine Air Group Headquarters	653
Basic Outfit Dental Company	660
Headquarters and Service Battalion	666
Hospital Company Force Troops	668
Collecting and Clearing Company	670
Infantry Battalion	674
General Support, Artillery Regiment	678
Shore Party Battalion	680
Supply Company, Service Battalion	682

Figure 3-3

Fleet Marine Force
Authorized Medical Allowance List
(continued)

<u>Unit</u>	<u>AMAL Code</u>
Headquarters and Service Company	685
Headquarters Battalion, Division	686
Reconnaissance Battalion	687
Preventive Medicine, Division	690
Mass Evacuation Company	695
Mass Evacuation Casualty Block	696
Hospital Corpsman Independent	697
Initial Supply Block Medical	600
Aviation Supply Block	654
Dental Operative Supply Block	662
Dental Prosthetic Supply Block	664
Mount Out Supply Block	605
Mount Out Augmentation Block	606
Collecting and Clearing Company, Augment	667
Combat Resupply Block Medical	620
Aviation Medical Resupply ALFA	655
Aviation Medical Resupply BRAVO	656

Figure 3-3 (cont.)

EQUIPMENT REVIEW PROCESS
[Ref. 39]

New or Unfunded
Requirements

Plant Property
Records

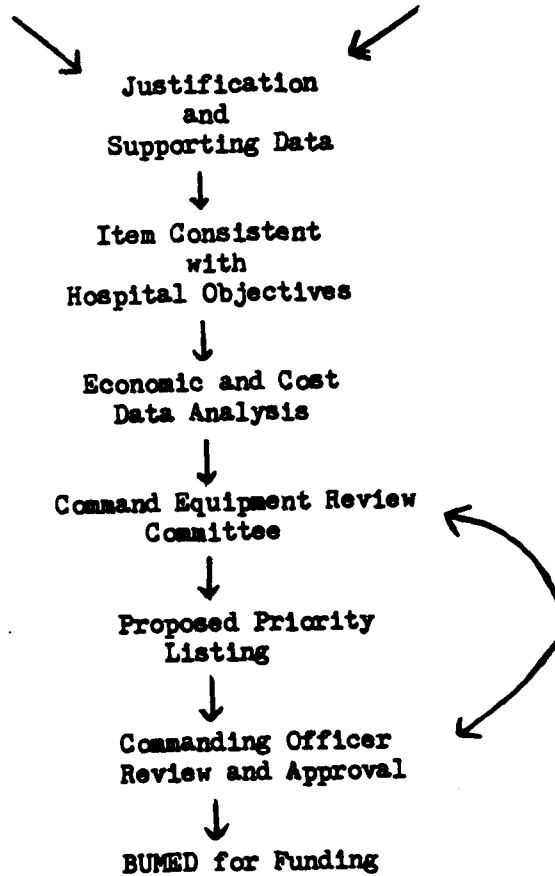


Figure 3-4

SPECIALITY CONSULTANTS
(partial listing)

Anesthesiology	Obstetrics and Gynecology
Cardiology	Ophthalmology
Dental	Optometry
Dermatology	Orthopedics
Food Service	Otorhinolaryngology
Family Practice	Pediatrics
Gastroenterology	Pharmacy
General Surgery	Physcial Medicine
Internal Surgery	Plastic Surgery
Laboratory Medicine	Pulmonary Medicine
Medical Allied Sciences	Psychiatry
Neurology	Radiology
Neurosurgery	Thoracic Surgery
Nursing	Urology

Source; BUMED ltr-21-mg of 3 September 1980

Figure 3-5

MEDICAL/DENTAL INVESTMENT EQUIPMENT BUDGET ITEM JUSTIFICATION WORKSHEET
NAVJED 4235/1 (6-80) [Ref. 40]

REPORT SYMBOL 4235-1

SHIP/UNIT _____

DATE PREPARED _____

BUDGET YEAR: FY _____ SHIP/UNIT PRIORITY SEQUENCE _____

Equipment control number: _____

* (SD + UIC) - (FY) - (Locally assigned serial number)

SECTION I. EQUIPMENT ITEM REQUESTED:

a. Nomenclature/Identification: _____

b. NSN/Stock Number: _____

c. Manufacturer: _____

d. Model/and Accessories: _____

e. Color (if applicable): _____

f. Total/Acquisition Cost, including Accessories \$ _____

g. Power/Utility Requirements: _____

h. Alternate Manufacturer/Model: _____

i. Is item required by current AMAL/ADAL? Yes _____ No _____ If no, is item recommended for AMAL/ADAL inclusion? _____

j. Justification: Brief statement of purpose and function. Also, if requested item is proprietary (sole source) provide a statement indicating why only this item can meet requirements to the exclusion of others; i.e., peculiar characteristics or limiting features such as voltage, dimensions, compatibility with other equipment, etc.

SECTION II. EQUIPMENT ITEM BEING REPLACED

a. Nomenclature/Identification: _____

b. NSN/Stock Number: _____

c. Manufacturer/Model: _____

d. Age: _____

e. Manufacturer/Model: _____

* Service designator (R or V) + UIC (six positions) - fiscal year (one position) - serial (six positions).

Figure 3-6

SECTION III. INSTALLATION INFORMATION

a. Will installation require ship alteration? Yes ___ No ___ If yes, briefly describe _____

b. Can installation be accomplished by ship's company? Yes ___ No ___

c. Has installation been planned for a yard period? Yes ___ No ___

d. Are O&M funds available, if needed, for installation? Yes ___ No ___

e. Has space been evaluated where item is to be installed? Yes ___ No ___ i.e., height of space, size of access door, arrangement.

SECTION IV. IMPACT IF ITEM OF EQUIPMENT IS NOT PROVIDED:

COMMANDING OFFICER SIGNATURE

FIRST ENDORSEMENT

TYPE COMMANDER _____

RECOMMEND APPROVAL _____ FY _____ PRIORITY SEQUENCE _____

RECOMMEND DISAPPROVAL _____

COMMENTS: _____

SIGNATURE

SECOND ENDORSEMENT

FLEET COMMANDER _____

RECOMMEND APPROVAL _____ FY _____ PRIORITY SEQUENCE _____

RECOMMEND DISAPPROVAL _____

COMMENTS: _____

SIGNATURE

Figure 3-6 (continued)

OUTLINE FOR PROJECT CHARTER

Subject: Establishment of Project X

To: Cognizant organizations

Copies to: Staff personnel affected

- I. Charter for the project
 - A. Project goals
 - B. Name of the project
 - C. Estimate of the resources needed
(personnel, materiel and funding for travel,
ADP support etc.)
- II. Organization
 - A. Management responsibility
 - 1. Establishment of project coordinator
 - 2. Directive authority
 - 3. Review authority
 - 4. Executive or officer responsible for completing
the organization phase.
- III. Schedule
 - A. General time frame of the project
 - B. Schedule for completing the organization phase
 - C. Interim reviews, reports to chartering authority
- IV. Statement of top management support for the project

Signed

Chartering Authority

Figure 4-1 (author's concept)

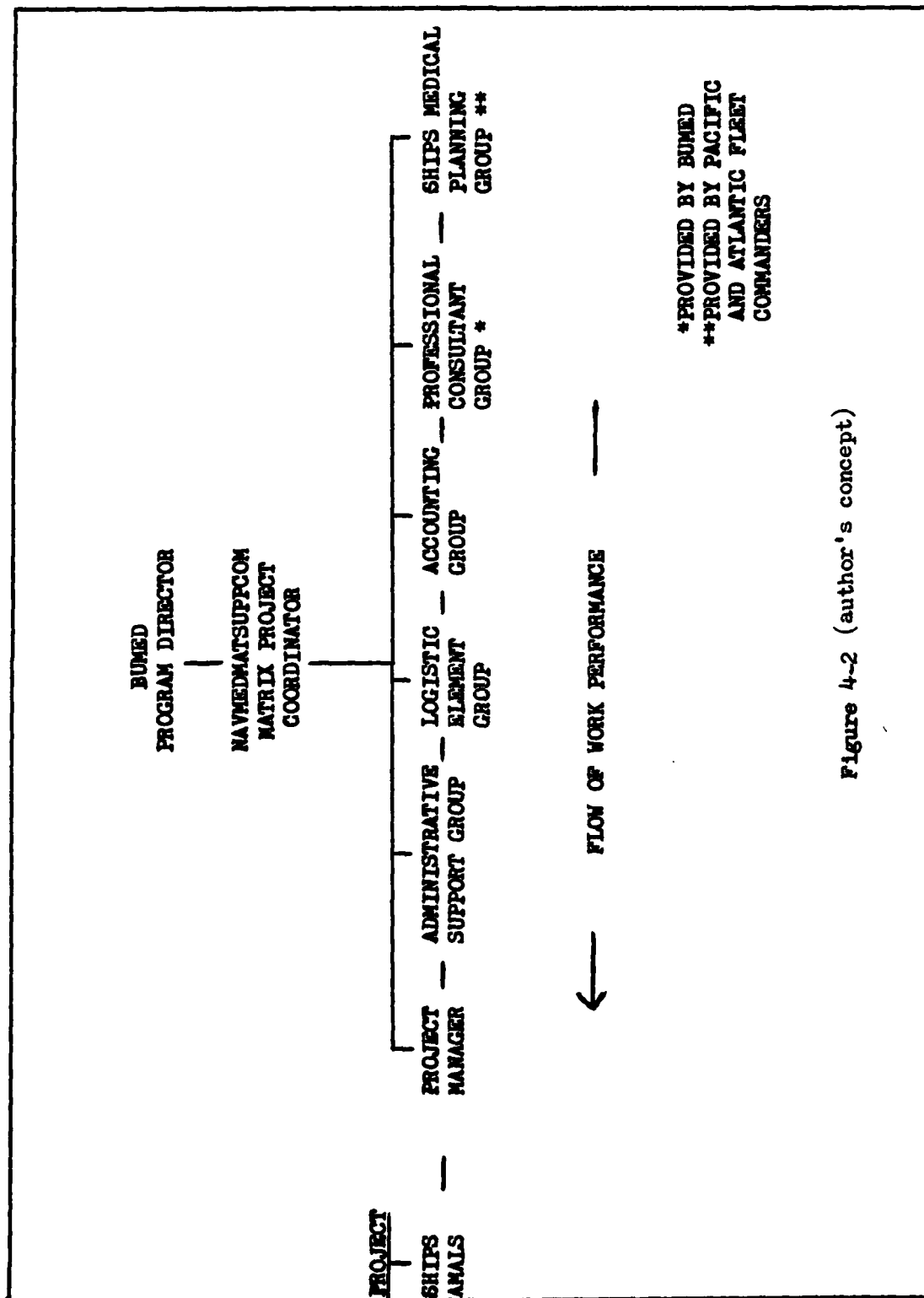


Figure 4-2 (author's concept)

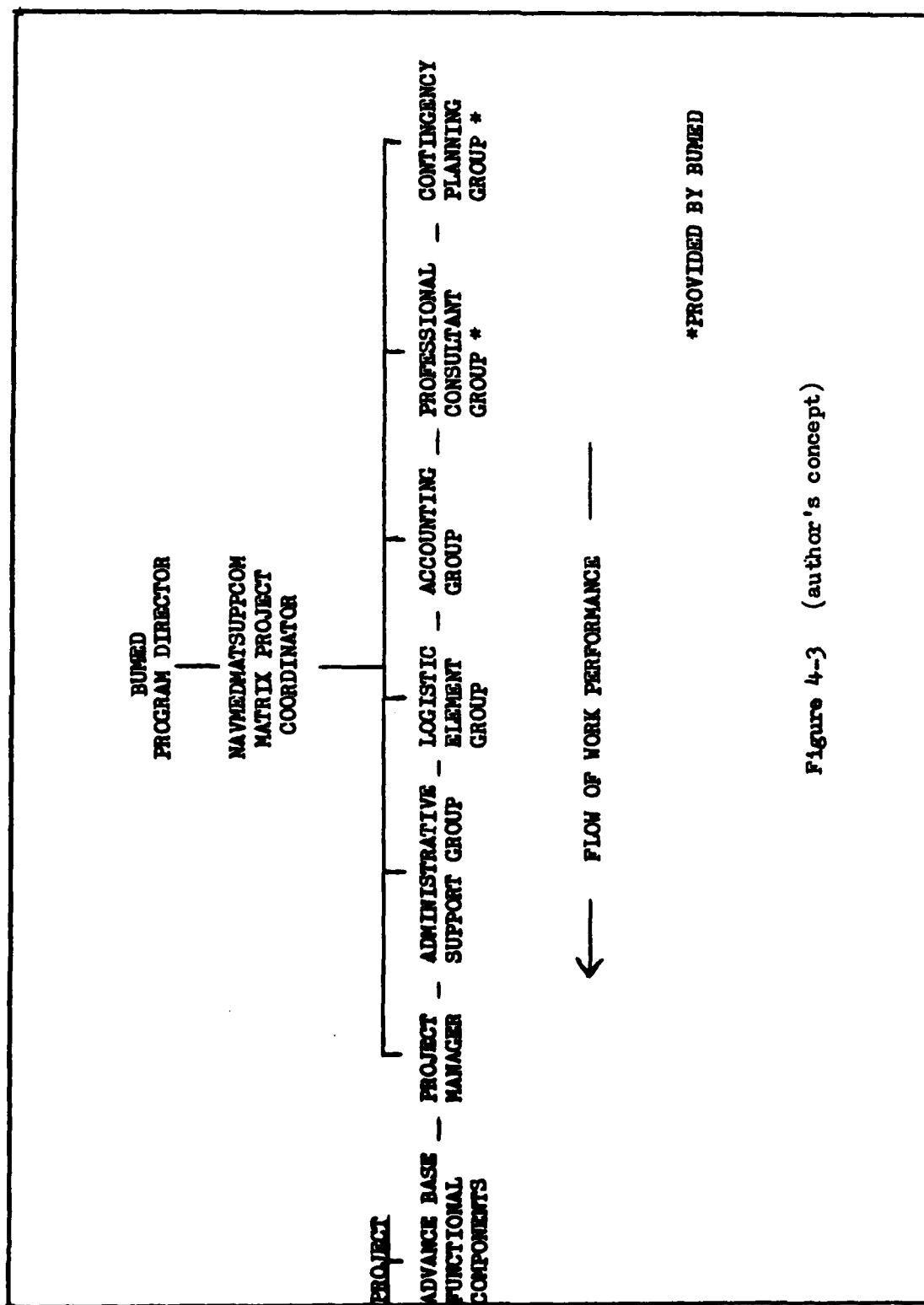


Figure 4-3 (author's concept)

LIFE EXPECTANCY OF MEDICAL EQUIPMENT GUIDE

(Ref. 39)
FSC CLASS 4110

Item	Years	Item	Years
Refrigerator, Blood Bank.	10	Refrigerator, Commercial.	10
FSC CLASS 6515			
Analyzer, cystic fibrosis	8	Infusion pump	10
Analyzer, gas	10	Inhalator	5
Analyzer, oxygen	6	Inhaler unit, gas anesthesia apparatus.	7
Anesthesia apparatus, gas	12	Light, diagnostic, examination.	10
Apparatus, resuscitating.	10	Light, slit, ophthalmological	12
Aspirator, uterine evacuator.	8	Monitor, blood pressure	8
Audiometer.	10	Monitor, cardiac patient.	8
Blood warmer.	10	Nebulizer	10
Booth, audiometric.	12	Operating apparatus, ear, nose, and throat	12
Breathing unit, positive pressure	8	Ophthalmometer.	12
Capsule machine	15	Pacemaker/heart rate monitor.	8
Cardioscope	8	Phoropter	12
Cart emergency.	8	Pipette, automatic.	10
Cautery unit.	10	Projector, ophthalmological acuity test	10
Conductivity tester	10	Pulmonary function equipment.	10
Cryosurgical system	8	Pump, infusion.	8
Cutter, orthopedic cast	10	Resuscitator.	8
Cystoscope.	8	Resuscitator and aspirator.	8
Defibrillator	8	Saw, bone cutting autopsy	8
Dermatome	8	Slit lamp	10
Dialyzer apparatus.	8	Spirometer.	8
Electrocardiograph.	10	Stereoscope, vision testing	8
Electroencephalograph	8	Suction and pressure apparatus, surgical.	6
Electronystagmograph.	8	Suction apparatus, surgical	6
Electrosurgical apparatus	10	Tent, oxygen.	8
Electrosurgical set	10	Test set, audiometer calibration.	8
Fiber optics system, diagnostic	12	Treadmill, electric	5
Heart-Lung system.	8	Ultrasonic cleaner.	10
Hypodermic injection apparatus, jet automatic	8	Vectorscardiograph	8
Hypothermia machine, intragastric	8	Vision test apparatus, color threshold.	10
FSC CLASS 6520			
Casting machine	10	Furnace, dental laboratory, electric.	8
Chair, dental operating	10	Grinding and polishing machine, dental lab	8
Collector unit, dust.	10	Light, dental operating, ceiling.	10
Compressor, reciprocating, power driven	8	Light, dental operating unit.	10
Dental operating unit	10	Mixer-investor, vacuum, dental.	8
Evacuator, oral cavity, dental.	10	Processing unit, dental resins.	12

Figure 4-5

LIFE EXPECTANCY OF MEDICAL EQUIPMENT GUIDE (CONT'D)

FSC CLASS 6525

Item	Years	Item	Years
Camera, closed circuit television	10	Processing mach., radiographic film, auto	8
Cassette changer.	8	Processing unit, X-ray film	8
Collector, silver, automatic.	10	Rectifier assembly, radiographic and	8
Control unit, X-ray apparatus	8	fluoroscopic, X-ray apparatus	10
Control unit and tube-transformer		Silver recovery unit.	8
head X-ray apparatus.	8	Stereoscope, X-ray film, mounted.	8
Cooler, X-ray film processing unit.	12	Table, field X-ray apparatus.	8
Densitometer.	15	Table, radiographic	8
Developing tank, X-ray.	8	Tank, master, X-ray film processing	6
Drier, photographic film.	8	Transformer, X-ray apparatus.	8
Drier, X-ray film	8	Transformer and control, X-ray apparatus.	8
Image intensifier	8	Tube stand unit	8
Illuminator, X-ray film	12	Viewer, X-ray film.	12
Monitor, closed circuit television.	10	X-ray apparatus, dental	10
Processing machine, photographic film	6	X-ray apparatus, radiographic	8
Processing machine, radiographic film	6	X-ray apparatus, radiographic and fluoro.	8
Processing machine, radiographic paper			
and developer assy.	6		

FSC CLASS 6530

Basinet and dressing table.	8	Sterilizer, health and moisture labile,	12
Basinet, heated	8	medical instruments and supplies.	12
Bath, paraffin	15	Sterilizer, surgical dressing.	12
Bath, whirlpool.	8	Sterilizer, surgical instrument.	12
Bed, hospital.	12	Sterilizer, surgical instrument (portable)	8
Bed, electric.	12	Sterilizer, surgical instrument and dress.	12
Cabinet, solution warming.	12	Sterilizer, surgical instrument and	8
Cart, hospital	12	dressing (portable).	15
Chair, examining and treatment, surgical, motor		Stretcher.	12
Diathermy apparatus.	12	Table, autopsy	12
Filter-mixer-tank unit, pharmaceutical process		Table, examining and treatment	12
Hydrotherapy	15	Table, obstetrical and gynecological	12
Incubator, infant.	10	Table, operating	12
Light, infrared, physical therapy.	10	Table, orthopedic.	12
Light, surgical ceiling.	10	Table, patient examining	12
Light, surgical field	8	Thermoregulator, patient	8
Light, ultraviolet, physical therapy	10	Ultrasonic apparatus, physical therapy	8
Light, surgical stand.	10	Washer, bedpan and urinal.	8
Moist heat apparatus, physical therapy	12	Washer, sterilizer, surgical instrument.	12
Monitor, infant respirator	8		
Respirator, portable	10		
Respirator, mobile	10		

LIFE EXPECTANCY OF MEDICAL EQUIPMENT GUIDE (CONT'D)

FSC CLASS 6540

Item	Years	Item	Years
Blocking unit, ophthalmic lens	12	Generator, ophthalmic lens	8
Cutting machine, ophthalmic lens	10	Measuring unit, ophthalmic lens	8
Cutting machine, ophthalmic lens	10	Lens measuring instrument, ophthalmic	12
Deblocker, lens	10	Surfactant, ophthalmic lens	10
Edging machine, ophthalmic lens	10		

FSC GROUP 66

Item	Years	Item	Years
Analyzer systems, automatic	8	Incubator, bacteriological	10
Balance, analytical	12	Meter, hydrogen ION test	10
Bath, water	15	Microscope	10
Biochemical analysis unit, micro	8	Microtome	10
Blood gas apparatus	6	Microfilm unit	10
Blood chemistry analyzer, auto	8	Oven, laboratory	10
Blood cell counter	10	Photometer, flame	10
Centrifuge, laboratory	12	Refrigerator, blood bank	10
Chromatograph, gas	8	Scanner, isotope	8
Colorimeter, comparative	10	Slide stainer, laboratory	10
Counter, microscopic particle	10	Spectrophotometer	10
Counting apparatus	10	Tissue processor, automatic laboratory	12
Deminerarizer	8	Washing machine, glassware	8
Distilling apparatus, laboratory	8		

Elements Data Requirements	Maintenance Plan	Support and Test Equipment	Supply Support	Transportation and Handling	Technical Data	Facilities	Personnel and Training	Funds	Management Information
Hardware Identification	✓	✓	✓	✓	✓	✓	✓		✓
Maintenance	✓	✓	✓	✓	✓	✓	✓	✓	✓
Operational/Mission Environment	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spares and Repair Parts	✓		✓	✓	✓				✓
Tools	✓		✓				✓		
Support and Test Equipment	✓	✓			✓	✓	✓	✓	✓
Platform or Facility	✓								
Personnel	✓	✓			✓				✓
Maintenance Level	✓	✓			✓		✓	✓	✓

ILS MATRIX LOGISTIC SUPPORT ELEMENTS AS SUPPORTED BY LOGISTICS SUPPORT DATA
 ✓ - Indicates data is used either directly or indirectly in primary systems or equipment associated with the element of logistic support.

Figure 4-6
 (author's concept)

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AN OVERVIEW OF INTEGRATED LOGISTIC SUPPORT IN MEDICAL MATERIAL --ETC(U)
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**INTEGRATED LOGISTIC SUPPORT
UNIFYING STRUCTURE**

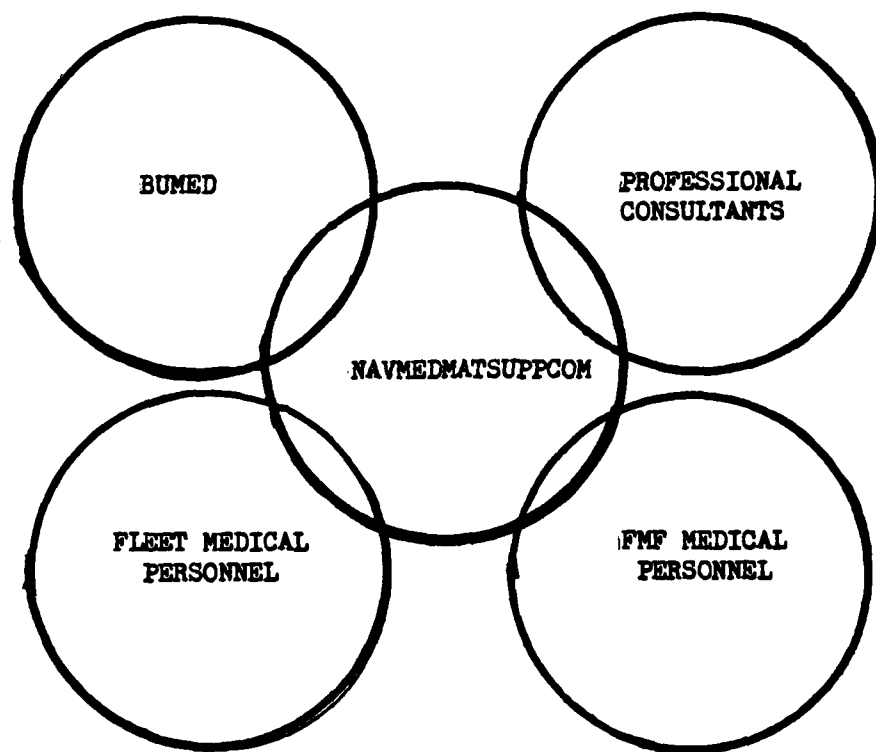


Figure 4-7
(author's concept)

APPENDIX A

TABLE OF FIGURES

Figure 2-1	The ILS Process
Figure 2-2	Integrated Logistic Support Elements
Figure 2-3	Matrix Organization
Figure 3-1	Ships Planning and Design
Figure 3-2	Hospital and Medical ABFCs
Figure 3-3	FMF Authorized Medical Allowance List
Figure 3-4	Equipment Review Process
Figure 3-5	Specialty Consultants
Figure 3-6	Medical and Dental Investment Equipment Budget Item Justification Worksheet
Figure 4-1	Outline for Project Charter
Figure 4-2	Sample Matrix Project Organization for Ships
Figure 4-3	Sample Matrix Project Organization for ABFCs
Figure 4-4	Sample Matrix Project Organization for FMF
Figure 4-5	Life Expectancy of Medical Equipment Guide
Figure 4-6	ILS Matrix
Figure 4-7	ILS Unifying Structure

APPENDIX B

GLOSSARY OF TERMS [Ref. 53]

MAINTAINABILITY

A description of the minimum acceptable maintainability stated in terms of the probability of the system or equipment unit being restored to operating status within an expressed time limit using available test equipment, facilities, personnel, parts, and procedures.

RELIABILITY

A description of the minimum acceptable reliability stated in terms of the probability that the system or unit will perform its intended functions for a specific period.

APPENDIX C

ILS SURVEY TABULATION

Currently, how many hours per week is a service or department unproductive due to the following constraints on a medical or dental equipment item? Department or service

Various

A. Lack of spare parts from:	
1. Stock item	10
2. Supply source	5
B. Lack of support equipment:	
1. Test check	4
2. Consumable supply item	5
C. Inadequate technical data:	
1. Operating manual	8
2. Repair manual or schematics	4
D. Inadequate training:	
1. Repair personnel	8
2. Operator personnel	3
E. Inadequate maintenance:	
1. Operator	10
2. Medical or dental repairman	8
3. Contract maintenance	5
F. Funding:	
1. Budgeted, but not fully funded	8
2. Budgeted and funded, but reprogrammed locally	3
3. Not budgeted	2

APPENDIX C (Cont.)

G. Maintenance planning

1. Plan established	10
2. Corrective actions taken	15
3. Feedback	12

Overall, how satisfied are you with your

a. Contracted maintenance performance

very satisfied	<u>10</u>	somewhat dissatisfied	___
satisfied	<u>5</u>	dissatisfied	___
somewhat satisfied	___	very dissatisfied	___
not used at all	___		

b. Medical or dental repairman's performance

very satisfied	<u>6</u>	somewhat dissatisfied	___
satisfied	<u>9</u>	dissatisfied	___
somewhat satisfied	___	very dissatisfied	___
not used at all	___		

c. Depot level maintenance and repair (Tobyhanna or Tracy)

very satisfied	<u>7</u>	somewhat dissatisfied	___
satisfied	<u>7</u>	dissatisfied	___
somewhat satisfied	<u>1</u>	very dissatisfied	___
not used at all	___		

In your opinion, what importance does top management give to material readiness and maintenance support?

Indicator: great 15 moderate ___ little ___ none ___

APPENDIX D

MISSION AND FUNCTIONS OF THE NAVAL MEDICAL MATERIEL SUPPORT COMMAND PHILADELPHIA, PENNSYLVANIA [Ref. 54]

1. Mission. To provide and coordinate medical and dental materiel support services for naval medical and dental activities on a worldwide basis as directed by the Bureau of Medicine and Surgery and higher authority, and to cooperate with other bureaus, offices, commands, and agencies in matters pertaining to medical materiel support.

2. Functions. As directed by the Chief, Bureau of Medicine and Surgery.

a. Recommend medical materiel policies to the Chief, Bureau of Medicine and Surgery.

b. Evaluate, for Chief, BUMED, the supply effectiveness and the quality control programs of the wholesale military medical supply distribution system operated by the Defense Personnel Support Center (DPSC) and the Navy retail supply system.

c. Promulgate medical/dental material management information to Navy and Marine Corps activities.

d. Serve as a focal point where medical and dental material procurement and supply problems of the operating force may be considered and resolved.

e. Conduct the BUMED portion of the Defense Medical Materiel Standardization Program and serve as Navy point of contact for the Defense Medical Materiel Board.

f. Promulgate procedures for and coordinate reporting of local procurement of nonstandard medical/dental material by BUMED command activities.

g. Develop programs for control and monitor issues of controlled drug substances, alcohol and alcoholic beverages to Navy and Marine Corps activities.

h. Assist in design of medical/dental spaces, and develop equipment lists of material to outfit spaces for new construction and alteration of ships and advanced bases.

APPENDIX D (Cont.)

i. Develop, maintain and promulgate up-to-date authorized medical/dental allowance lists for ships, Fleet Marine Forces, other elements of the operating forces and advanced based functional components.

j. Develop budgetary requirements, direct initial outfitting and administer funds for procurement of medical and dental material for new construction, and alteration of ships and special projects.

k. Serve as program manager for the Chief, BUMED in the development, promulgation, budgeting, requisitioning and provisioning of capital investment medical and dental equipment in the operating forces.

l. Technically review all requisitions/requests for procurement of BUMED controlled equipment, including investment equipment, from operating forces of the Navy and Marine Corps and recommend procurement sources.

m. Administer the medical and dental material excess program for the Navy.

n. Administer redistribution of medical casualty evacuation material for the Navy.

o. Monitor Civil Engineer Support Equipment inventories at BUMED command activities and assist the Naval Facilities Engineering Command in the design, specifications, procurement and allocation of all medical vehicles.

p. Administer the Precious Metals Recovery Program for BUMED command activities.

q. Develop, maintain and collaborate with all commands, the medical and dental material mobilization requirements for the Navy, Marine Corps, Military Sealift Command, and Coast Guard in accordance with policies promulgated by higher authority. Furnish service requirements data to the Defense and Navy Supply Systems, as applicable.

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