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AN EXAMINATION OF THE MARINE OPERATING AND SUPPORT INFORMATION SYSTEM (MOSIS) AS A MECHANISM FOR LINKING RESOURCES TO READINESS FOR MARINE OPERATING FORCES

by

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Continued downsizing efforts have imposed increasingly stringent restrictions on Department of Defense budgetary resources. Program and activity managers are expected to justify their budgets based on well-defined quantitative measures of performance, activity level and readiness. This thesis examines the resources-to-readiness issues in DoD, specifically focusing on Marine Corps Operating Forces. Additionally, this thesis evaluates the Visibility and Management of Operating and Support Costs (VAMOSC) program as a mechanism for analyzing detailed operating and support cost data in order to relate resources to readiness.

DoD's VAMOSC program as a whole as well as the individual Service's VAMOSC systems are described. The Marine Operating and Support Information System (MOSIS), which incorporates Marine ground combat systems into Navy VAMOSC, is evaluated with regards to its contribution to cost analysis. Currently, the MOSIS database is limited in the number of weapon systems on which it collects data and the O&S cost categories it covers. In addition, it lacks critical operating tempo data needed to conduct useful cost analysis. This makes it extremely difficult to currently develop cost factors that can be effective in the formulation and justification of budgets. Ongoing efforts to expand MOSIS have the potential to enhance analysis of resources-to-readiness issues.

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ABSTRACT

Continued downsizing efforts have imposed increasingly stringent restrictions on Department of Defense budgetary resources. Program and activity managers are expected to justify their budgets based on well-defined quantitative measures of performance, activity level and readiness. This thesis examines the resources-to-readiness issues in DoD, specifically focusing on Marine Corps Operating Forces. Additionally, this thesis evaluates the Visibility and Management of Operating and Support Costs (VAMOSC) program as a mechanism for analyzing detailed operating and support cost data in order to relate resources to readiness.

DoD's VAMOSC program as a whole as well as the individual Service's VAMOSC systems are described. The Marine Operating and Support Information System (MOSIS), which incorporates Marine ground combat systems into Navy VAMOSC, is evaluated with regards to its contribution to cost analysis. Currently, the MOSIS database is limited in the number of weapon systems on which it collects data and the O&S cost categories it covers. In addition, it lacks critical operating tempo data needed to conduct useful cost analysis. This makes it extremely difficult to currently develop cost factors that can be effective in the formulation and justification of budgets. Ongoing efforts to expand MOSIS have the potential to enhance analysis of resources-to-readiness issues.

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I. INTRODUCTION

A. BACKGROUND

1. Budget Environment

In response to recent downsizing efforts Congress has imposed increasingly stringent restrictions on the Department of Defense (DoD) budgetary resources. Since 1986 there continues to be a real decline in defense spending. In real terms, the FY 98 Budget is 36 percent below that of FY 85, the peak year for DoD budget authority since the Korean War (USMC Concepts and Issues, 1997). Competition for scarce monetary resources within DoD has necessitated that programs and activity managers better justify their budget requests. They will no longer be able to use qualitative measurements as the sole justification for their programs.

Budget analysts at DoD and the Department of the Navy (DoN) prefer to see quantitative performance measures that will help them better understand budget level changes. As an example, the Navy uses steaming days as a performance measure for justification of their budget requests for

Operations and Maintenance (O&M) funding. Currently, the performance measures used by Marine Corps budget analysts to justify O&M funding for Marine Operating Forces are inadequate. A simpler, more accurate quantitative measurement is desired that will assist budget analysts in better explaining budget level changes. (Busick, 1997)

In the past, Marine Corps budget analysts used Battalion Field Training Days (BFTDs) as performance criteria in their budget submissions[1]. BFTDs are collected from the Fleet Marine Force (FMF) by the Training and Education Division, Marine Corps Combat and Development Command (MCCDC) and used in readiness and sustainability formats submitted with the Program Objectives Memorandum (POM). Additionally, the SECDEF is required by law to report to Congress recommendations for the number of field training days for combat arms battalions of the Marine Corps (Jareb, 1994). While BFTDs are a basic measure of a combat arms unit's activity some have attempted to use them as measures of operating tempo (OPTEMPO) and readiness.

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[1] A field training day is a period of time of at least 8 hours and not more than 24 hours where training is conducted in the furtherance of the unit's mission

The Marine Corps states that BFTDs are a measure of activity rather than a measure of unit training readiness. A study conducted by the Center for Naval Analysis (CNA) (Jareb, 1994) on Marine Corps Ground Training Readiness noted three major criticisms of BFTDs:

- They do not account for the quality of training.
- They do not account for the content of training.
- They are reported inconsistently.

As such, BFTDs alone are an incomplete measure or indicator of readiness and therefor are unable to provide a direct relationship to resource expenditures. Furthermore, the CNA study found that increases and decreases in BFTDs reported do not correlate with increases and decreases in unit funding within the Operations and Maintenance account. This may be because O&M funds are not only used to support training and exercise activities but also maintenance and supply activities, and the repair and replacement of individual and unit equipment.

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training program, away from garrison or debarked from Naval shipping (DivO P7110.1).

Another measure used by Marine Corps budget analysts as performance criteria for budget justification has been number of exercises. While this is a valid measure, it is also incomplete. By their very nature exercises differ significantly in size, scope and cost. This makes it difficult to determine an "average exercise" and relate it to specific costs. Additionally, JCS directed and other joint exercises are funded from various sources besides Marine Corps O&M. These factors make it difficult to establish an adequate relationship between number of exercises and O&M expenditures.

In addition to BFTDs and number of exercises the Marine Corps evaluates unit training readiness using the Status of Resources and Training System (SORTS) and the Marine Corps Combat Readiness Evaluation System (MCCRES). Both of these systems are highly subjective in nature and do not provide detailed measures which can be directly related to budgets. While the Marine Corps is beginning to track deployment tempo (DEPTEMPO), it lacks the narrower OPTEMPO data that could better relate to expenditures. A more in-depth

discussion of measuring training readiness is contained in Chapter II of this thesis.

2. Resources to Readiness

As the United States continues to draw down its Armed Forces in response to declining fiscal resources emphasis on readiness and training is increasing in order to avoid creating a "hollow" force. However, the constantly changing global environment has imposed ever-growing demands on our Nation's military. Today's forces are being called upon to not only defend the Nation, but also to support a variety of Military Operations Other Than War (MOOTW) including combating terrorism, counter-drug operations, humanitarian assistance and peacekeeping operations. These missions are, to a great degree, funded at the expense of readiness and training for warfighting capabilities. (Prettol, 1995)

Maintaining acceptable readiness today and in the future will require a delicate balance between funding for current operations, modernization of existing equipment, the procurement of new weapon systems and maintaining an adequate force structure. Achieving such a balance will

rely on a continuous effort to better define resource requirements and link those requirements to readiness.

A finding of this research is that very little progress has been made in the way of linking resources, i.e. funding provided through the Planning, Programming and Budgeting System (PPBS), to readiness for the Marine Corps operating forces. Three major difficulties are noted:

- Determining adequate quantitative measures of readiness for Marine ground combat units.
- Costs associated with readiness are difficult to ascertain from existing databases.
- Limited availability of OPTEMPO data.

A more in-depth analysis of these findings is expressed in Chapter II of this thesis.

One approach the Marine Corps has taken in an attempt to link readiness with budget requirements is the implementation of a Requirements Based Budgeting (RBB) system. The intent of RBB is to standardize the budget process for all three Marine Divisions and link readiness with resource requirements. RBB provides a method to document costs relative to accomplishing specific training

standards required to maintain combat readiness for each Division. While RBB may be used as a tool in the POM process and at mid-year review to justify funding levels, it is not useful for budget formulation and justifications at the HQMC level (Busick, 1997). A more in-depth discussion of RBB is contained in Chapter II of this thesis.

B. OBJECTIVES OF RESEARCH

Initially, the purpose of this thesis was to identify, evaluate and analyze a variety of performance measurements for Marine Corps Operational Forces in an attempt to relate specific measurements to O&M funding requirements. Significant metrics could then be utilized to better explain budget level changes to DoD and DoN budget analysts. The objective was to demonstrate a relationship between readiness/OPTEMPO and resources, namely O&M dollars, as a method for budget justification. However, limited availability of data and the lack of established management information systems (MIS) that adequately and reliably track certain parametric measures of consumption, activity or OPTEMPO make this task extremely difficult.

Instead, this thesis will address, as a long term fundamental question, the contribution of cost analysis to the formulation and justification of budgets. In the course of this research a relatively new database was examined, the Marine Operating and Support Information System (MOSIS), which was developed in conjunction with the Navy Visibility and Management of Operating and Support Cost (VAMOSC) program. The existence of such a database creates an opportunity for providing a connection between measures of OPTEMPO and certain cost factors. Since the database is relatively new, the data collected are limited in content and do not provide all the necessary information. However, they can generate some useful insight that will provide the basis for future analysis of the resources to readiness issue.

In an attempt to answer the research questions below this thesis will: (1) examine the issues facing Marine Corps Operations and Maintenance funding, specifically looking at Marine Operational Forces; (2) discuss research issues relating to Marine Corps ground readiness, noting the difficulties in defining suitable indicators of

readiness/OPTEMPO that can be used as a performance measurement of effectiveness and efficiency for operating forces; (3) describe the DoD VAMOSC Program and the VAMOSC systems used by the different Military Departments; (4) evaluate the progress of incorporating USMC ground combat weapon systems in Navy VAMOSC and the details of the MOSIS database; and (5) provide recommendations for future data collection and areas of research to make the initial objective of this thesis executable.

C. RESEARCH QUESTIONS

1. Primary Research Question

Are there specific quantitative measurements that capture the intensity of Marine Operating Force's operations well enough to explain budget level changes for O&M funding?

2. Secondary Research Questions

1) What quantitative measurements have budget analysts at HQMC used in the past to explain budget level changes?
2) Are these measures inappropriate or inadequate? If so, why?
3) What has been the past trend of O&M funding for Marine Operating Forces?

4) What are the significant cost factors that relate to O&M expenditures for Marine Operating Forces?

5) Can these cost factors be linked to operating tempo (OPTEMPO)?

6) Can measures of readiness or OPTEMPO be linked to O&M funding requirements?

7) How does the MOSIS database and Marine VAMOSC program contribute to cost analysis?

D. SCOPE AND LIMITATIONS

This thesis analyzes the data presented in the U.S. Marine Corps Operating and Support Cost Reports for Ground Combat Systems for FY96. A major question of this thesis is the validity of the data contained in MOSIS and their potential use in providing a linkage between O&M budgets and OPTEMPO/readiness.

The analysis will be limited to Marine Corps ground combat systems selected for inclusion in the MOSIS database by Headquarters Marine Corps, Deputy Chief of Staff for Installations and Logistics (DCS(I&L)). Additional limitations placed on this thesis include the limited data collected on the systems included in MOSIS, the lack of

available OPTEMPO data, limited access to the MOSIS database and the difficulty in defining true measures of readiness.

E. RESEARCH METHODOLOGY

This research was limited to unclassified sources only. Data were gathered from DoD, DoN and USMC documents, books, and various studies and reports. Additionally, the author traveled to Washington, D.C. and met with individuals at Headquarters Marine Corps (HQMC) involved with the formulation and execution of Marine Corps budgets and civilian contractors responsible for development of the Marine VAMOSC program. Through these meetings additional discussions were held and information provided via telephone and email. Since information gathered through these sources was more in the nature of fact finding and not formal interviews, it is cited by general reference to the discussion and the individual's name and position.

F. ORGANIZATION OF THESIS

Chapter I discusses the background and context for this research and defines the objectives, scope, limitations and methodologies of the study. Chapter II provides additional background information on the Marine Corps Operating Forces.

Included in this chapter are information on the organizational structure of the Marine Operating Forces, the Operations and Maintenance appropriation for the Marine Corps, budgeting for Marine Operating Forces, and a discussion of current OPTEMPO and readiness issues and the indicators of readiness used by Marine ground combat units. Chapter III defines and outlines the VAMOSC program within the Department of Defense. Included is a discussion of Operating and Support (O&S) costs, the history of the VAMOSC program and a brief synopsis of each Service's VAMOSC system. Chapter IV reports on the progress made on incorporating Marine ground systems into Navy VAMOSC. Specifically, this chapter will review the intricacies of the MOSIS database and the FY 96 Cost Report for USMC ground combat systems. Finally, Chapter V provides conclusions, recommendations and defines areas for further research.

II. MARINE CORPS OPERATING FORCES

A. MARINE CORPS ORGANIZATIONAL STRUCTURE

The United States Marine Corps includes Headquarters Marine Corps, the Operating Forces of the Marine Corps, Marine Corps Supporting Establishments and the Marine Corps Reserve. The operating forces consist of the Fleet Marine Forces (FMF), complements on board naval vessels, security forces at Navy shore activities, special activity forces and combat forces not otherwise assigned. (FMFM 1-2)

The FMF consists of the warfighting elements of the Marine Corps. It is designed as a balanced force of ground and air combat arms along with their associated combat and logistical support elements. There are two FMFs in the active Marine Corps, Fleet Marine Force Pacific (FMFPAC) and Fleet Marine Force Atlantic (FMFLANT). The specific missions of the FMF as defined in FMFM 1-2 are:

1) To serve with the fleets in the seizure or defense of advance Naval bases and in the conduct of such land operations as may be essential to the prosecution of a naval operation or campaign.

2) To participate, as directed by the Commandant of the Marine Corps (CMC), in the development of doctrine, tactics, techniques, and equipment used by landing forces in amphibious operations.

3) To train and equip Fleet Marine Forces for amphibious operations, air movement/prepositioned deployment, naval political reinforcement operations, and land operations associated with naval warfare and naval support of continental warfare.

4) To maintain forces in readiness for operational commitment commensurate with the strategic situation, the unified commander's requirements, and training time required to ensure tactical success when committed.

The Marine Operating Forces (MARFORs), are considered the heart of the Marine Corps. They constitute the forward presence, crisis response and fighting power available to the regional Commanders in Chief (CINCs). In FY 1996 Operating Forces were comprised of 106,759 Marines, roughly 60 percent of the active duty force structure (Zinner, 1996).

The MARFORs are organized under two major commands, Marine Forces Pacific (MARFORPAC) and Marine Forces Atlantic (MARFORLANT). MARFORPAC, with headquarters at Camp H. M. Smith, Hawaii, is composed of the 1st Marine Expeditionary Force (I MEF) located in Camp Pendleton, California and the 3rd Marine Expeditionary Force (III MEF) located in Okinawa, Japan. MARFORLANT, with headquarters at Camp Lejeune, North Carolina, is composed of the 2nd Marine Expeditionary Force (II MEF) also located in Camp Lejeune. Figure 2.1 depicts the organizational structure of the Marine Corps.

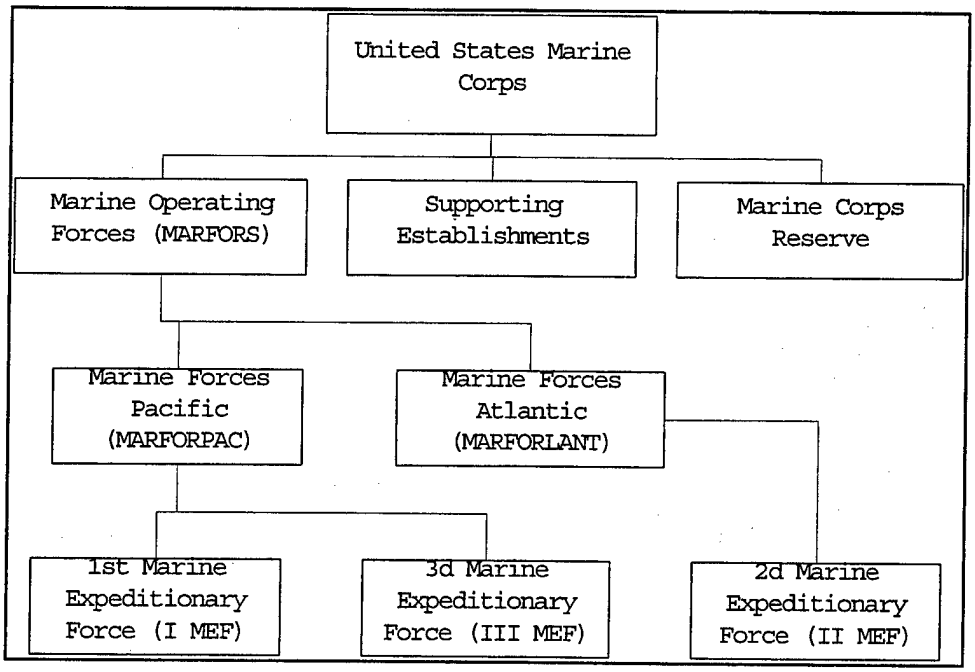

Figure 2.1 Marine Corps Organizational Structure

The MARFORs provide the regional CINCs with a Marine Air Ground Task Force (MAGTF) ready to and capable of rapidly responding to any crises around the globe. Each MAGTF consists of a Command Element (CE), a Ground Combat Element (GCE), an Air Combat Element (ACE) and a Combat Service Support Element (CSSE).

The CE is the headquarters element of the MAGTF. It is responsible for providing effective command and control while organizing, planning and executing operations. The GCE is a task organized ground combat force responsible for conducting ground operations in support of the MAGTF mission. The ACE is a task organized aviation command responsible for providing combat air operations in support of the MAGTF mission. The CSSE is task organized to provide a full range of support functions and capabilities in support of the MAGTF mission to include supply, maintenance, transportation, general engineering, and health services. A MAGTF can vary in size from just over 2,000 Marines to a multiple division sized force.

The Marine Expeditionary Force (MEF) is the largest form of an organized MAGTF and is comprised of one or more

Marine Divisions, one or more Marine Aircraft Wings (MAW), and one or more Force Service Support Groups (FSSG)[2]. There are three standing MEFs in the active Marine Corps; I MEF, comprised of the 1st Marine Division, 1st MAW and 1st FSSG, There are similar organizations for II MEF and III MEF. The MEF is designed to fight in large scale crises and contingencies. It is normally commanded by a lieutenant general and is capable of sustained operations for up to 60 days. Figure 2.2 depicts the MEF organizational structure.

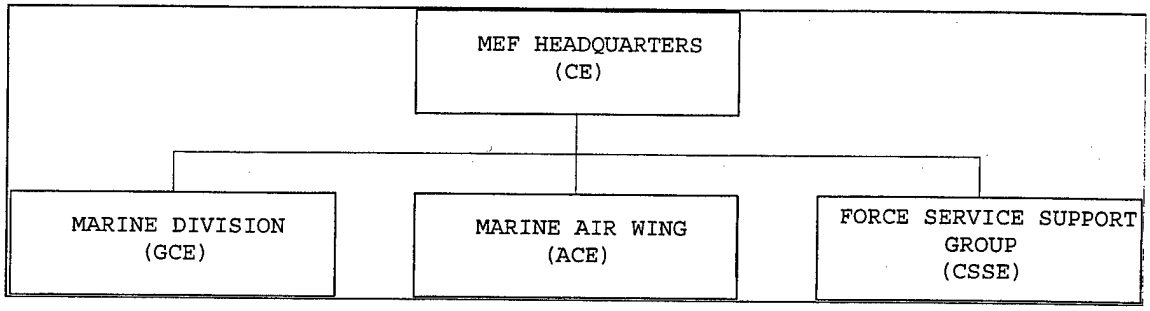

Figure 2.2 MEF Organizational Structure

The Marine Expeditionary Unit (MEU) is the smallest form of a MAGTF and is comprised of a reinforced infantry battalion, composite helicopter squadron, a MEU Service Support Group (MSSG) and a headquarters/command element. Commanded by a colonel, a MEU is organized, equipped and

[2] During peacetime a MEF consists of a single Division, MAW and FSSG. During wartime a MEF may include multiple Divisions, MAWs and FSSGs.

trained to conduct a variety of conventional warfighting missions as well as maritime special purpose missions. Typically, MEUs forward deploy for approximately six months aboard naval amphibious ships as part of an Amphibious Ready Group (ARG). A MEU is capable of conducting independent sustained operations for 15 days. Currently, there are seven MEUs in the active Marine Corps. The 11th, 13th, 15th, and 31st MEUs report to MARFORPAC and the 22nd, 24th, and 26th MEUs report to MARFORLANT.

B. OPERATIONS AND MAINTENANCE MARINE CORPS (O&M,MC)

The Operations and Maintenance Marine Corps (O&M,MC) appropriation provides funding in support of the FMF, equipment and facilities maintenance, civilian employee pay, travel and transportation, training, consumable supplies, recruiting and advertising, base operations and base communications. (USMC Concepts and Issues, 1997).

1. Funding Categories

O&M,MC is divided into various funding categories that provide for the expenses of several activities. It is comprised of three subordinate Budget Activities (BA): (1) BA-1 Operating Forces; (2) BA-3 Training and Recruiting; and

(3) BA-4 Administrative and Service Wide Activities. The budget activity that contributes to the training, readiness and OPTEMPO activities of the combat units within the Marine Corps is mostly contained within BA-1[3].

Each budget activity is further divided into activity groups (AGs) and sub-activity groups (SAGs). BA-1 is divided into AG 1A-Expeditionary Forces, and AG 1B-USMC Prepositioning Forces. The Expeditionary Force AG provides for the operating forces that constitute the MAGTF and Marine Security Forces at naval installations and aboard naval vessels. These funds provide financing for training and routine operations; the maintenance and repair of organic ground equipment; routine supplies, travel, per diem and emergency leave; automatic data processing; and initial purchase as well as replenishment and replacement of both unit and individual equipment. Financing is also provided for travel expenses associated with the operating forces. This includes the movement of troops to and from exercises

[3] The training conducted within BA3 is institutional in nature (formal schools, bootcamp, OCS, etc.,) and therefore doesn't directly relate to OPTEMPO activities.

as well as Temporary Additional Duty (TAD) assignments associated with the mission. (DoN, 1997)

The Expeditionary Forces AG is further divided into the following SAGs: (1) 1A1A-Operational Forces; (2) 1A2A-Field Logistics; (3) 1A3A-Depot Maintenance; and (4) 1A4A-Base Support.

The most prevalent view of ground OPTEMPO budget activities (the variable cost associated with the conduct of unit operations and training) incorporates the annual funding contained in the Operational Forces SAG. The Field Logistics SAG supports the overall weapons systems management and logistics support for the FMF, the Depot Maintenance SAG finances major repair and rebuild of ground equipment and the installation cost of modification kits. The Base Support SAG funds the operation of various Marine Corps Bases and stations. Figure 2.3 depicts the funding categories of O&M,MC.

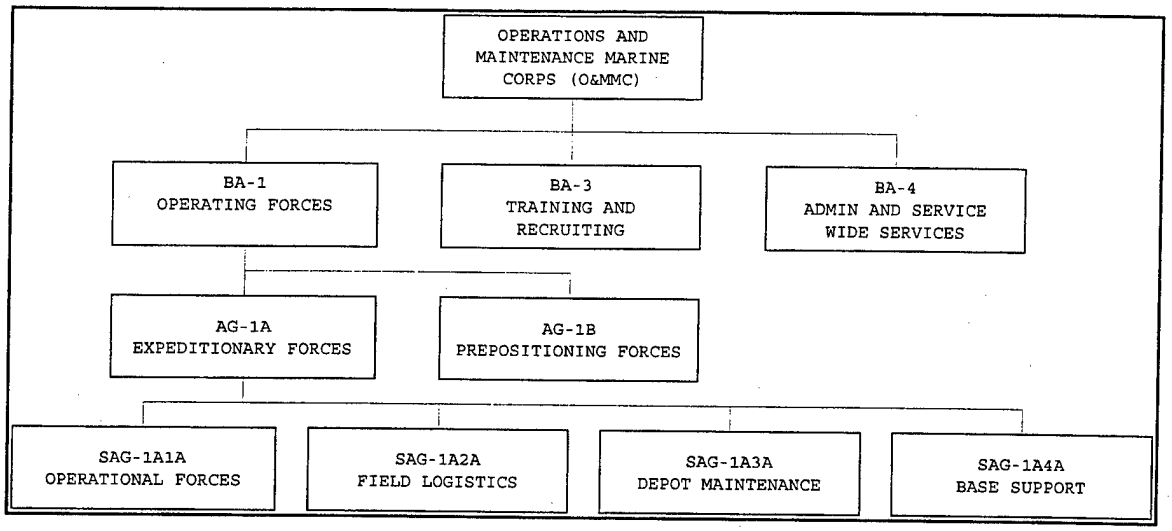

Figure 2.3 Structure of O&M,MC

All Marine aircraft are considered a component of Naval aviation, therefore all flight activity is supported by the Navy's Flying Hour Program (FHP) and funding is furnished through the Operations and Maintenance Navy (O&M,N) appropriation. The distinction between using O&M,MC and O&M,N is commonly referred to as "green dollars" versus "blue dollars". While "blue dollars" pay for fuel, maintenance and other costs associated with aircraft and flight operations, "green dollars" fund all remaining activities not associated with flight operations, to include the fuel and maintenance of ground vehicles and equipment that do not directly support flight operations, supply, administrative expenses, etc.

Blue dollars fund two broad categories, the FHP and the non-Flying Hour Program. Basically, FHP dollars pay for fuel and aviation depot level reparables. Non-FHP dollars pay for all other requirements that support the FHP such as TAD in support of the FHP, Inventory Maintenance List, Table of Basic Allowance, flight equipment (flight suits, helmets, etc.), tools, computers and so on. (Ronning, 1997).

2. Budgeting for Marine Operating Forces

Funding for the MARFORs is provided through the annual O&M,MC appropriation, part of the overall budget for the Department of the Navy. The Marine Corps utilizes a bottom up approach in the POM formulation process whereby subordinate commands submit their budget requests, limited by top line constraints, to HQMC. For the most part these requests are based on historical spending patterns and the previous year's execution data contained in the Standard Accounting, Budgeting and Reporting System (SABRS). Submitting commands identify the priorities for specific functions and organizations within their commands and include full justification for those programs in narrative form. The POM goes through a series of reviews and

revisions and is transformed into the Budget Estimate Submission (BES) which is forwarded through DoN and OSD to Congress for approval.

The POM and BES each contain data regarding OPTEMPO related resources as a means for budget justification. However, these data are limited to BFTDs, equipment utilization data and number of exercises, none of which provide a clear relationship between readiness and fiscal resources. There continues to be a need for a more reliable, quantitative measure of OPTEMPO, readiness or operational activity that will justify Marine Corps O&M budgets to the Navy, OSD and Congress.

3. Requirements Based Budgeting (RBB)

One approach the Marine Corps has taken in an attempt to relate readiness to budgetary requirements is the implementation of a Requirements Based Budgeting (RBB) system. The intent of RBB is to standardize the budget process for all three Marine Divisions and link readiness with resource requirements. RBB provides a method to document costs relative to accomplishing specific training

standards required to maintain combat readiness for each Division.

RBB is a relatively new concept. Initially developed by the 2nd Marine Division in the early 1990's, it has now been implemented throughout all three active Divisions. The goals of this new budgeting systems are to: (1) determine the fiscal requirements to train and maintain a Marine Division; (2) standardize all Division (GCE) budget processes; (3) link readiness with budget requirements; and (4) establish and maintain a higher POM priority (RBB Presentation, 1st MARDIV).

Prior to RBB, budgets were prepared based on historical trends. Each Division was given a control figure (ceiling) from its higher headquarters based on the previous years spending patterns with increments and decrements reflecting new requirements and fiscal constraints. Budgets were prepared in accordance with the constraints imposed by the ceilings with a list of noted deficiencies that required additional funding. The division would attempt to fund the highest priority deficiencies first and petition higher

headquarters for additional funding for the non-funded items.

In an era of declining resources the historical policy of building future budgets on previous spending patterns guarantees the Divisions budget will be reduced on a 'fair share' basis. To ensure budgets are based on requirements we must present data in an objective, factual format, thus the need for a Requirements Based Budget. The RBB is a systematic determination of fiscal actions required to field and maintain a combat ready force and the costing of those actions. This will allow the Division to prepare a budget based on needs and quantifiable costs. Such a document presents a powerful argument in the competition of resources. Implementation of RBB will not be easy, it requires a cultural change in how we have historically Done business. (DivO P7110.1, 1996)

RBB was created as a system that could be used to justify financial requirements by demonstrating a distinct connection between readiness and fiscal resources. This was to provide a basis from which an argument for a specified

funding amount in support of a desired level of readiness could be made.

RBB is accomplished through a uniform set of procedures where costs required to establish and maintain combat readiness within the Division are determined. To establish a requirements based budget, specific funding requirements for the Division must be identified and broken down into appropriate funding centers. A basis for determining the costs associated with each funding center is then incorporated into the budget. These funding centers capture all the costs necessary to train Marines, maintain equipment, and ultimately support readiness. There are eight funding centers associated with a Marine Division: Training; Capitalization; Automated Data Processing (ADP); Administrative Temporary Additional Duty (TAD); Defense Service Supply Center (DSSC) costs; emerging requirements; contracts; and one time un-funded requirements. As a presentation of how RBB attempts to link fiscal resources to readiness this analysis will focus on the procedures used to establish budget estimates for the training funding center.

The purpose of the training funding center is to provide resources in support of the Division's training exercises. The focus of the RBB training funding centers is to identify the resources necessary to support the Division's Mission Essential Task List (METL). The METL is a list of specific training standards that must be accomplished in order to satisfy specific performance guidelines for the Division's readiness. METLs are completed by executing a variety of training events described as Mission Performance Standards (MPS) and Individual Training Standards (ITS). METLs are established down to the Battalion level, MPS are established down to the squad/crew level and ITS are established for individual Marines.

Assigning a cost to each specific standard would be a long, arduous and subjective task. Recognizing this the Commanding Generals of each active Marine Division agreed to use BFTDs as a proxy to standardized METL accomplishment. Each METL is satisfied by the successful execution of specific MPS or ITS relating to that particular METL. A predetermined number of BFTDs required to accomplish each

MPS and ITS is subsequently established. An example of a section of a notional Regimental METL/BFTD matrix was extracted from the 3rd Marine Division Budget Manual and is provided in Figure 2-4.

METL	BFTD	MPS STANDARD
I. Conduct Amphibious Operations	4	MPS 2A.1.1 Conduct Amphibious Staff Planning
	3	MPS 2A.1.2 Develop Landing Plan
	6	MPS 2A.1.3 Conduct Assault Landing
	4	MPS 2A.1.5 Conduct Amphibious Withdrawal

Figure 2-4 Regimental METL

Individual units determine the BFTDs necessary to accomplish their METLs and then identify financial resources required to execute those BFTDs. BFTDs are compared with METLs to ensure funding requirements are identified to meet required training objectives.

Since BFTDs are assigned at the Battalion level and many units conduct training at lower levels (Company, Platoon, Section levels) equivalency factors have been established that weight subordinate units relative to their Table of Organization (T/O) and Table of Equipment (T/E). For example, a rifle company has an equivalency factor of .25. If a rifle company spends four eight-hour days in the

field that is equivalent to 1 BFTD (4X.25=1.0 BFTD). (Budget Manual, 3d MARDIV)

The Unit Training Cost Model is used to determine unit training cost budget estimates associated with planned training events. METL requirements, as defined by BFTDs, are multiplied by specific cost factors to establish a training cost forecast. The cost factors used are based on current usage and pricing data derived primarily from battery, maintenance, and petroleum, oil and lubricant (POL) costs. Data is accumulated through the Maintenance Cost System (MCS), the Logistics Management Information System (LMIS), the Standard Accounting Budgeting and Reporting System (SABRS), and incorporated into the Division Redbook. The Redbook is a manual of cost factors used to "cost out" training events. The cost factors are derived using the information systems listed above and are reviewed and updated on an annual basis. (Budget Manual, 3DMARDIV)

RBB is a process that is applied at a high level of detail and may not prove itself useful at the HQMC level for budget formulation and justification. However, it is a step toward using a method of budgeting other than historical

spending patterns and comptroller judgement. There are some negative aspects to RBB. Most notable is the increased demand on subordinate units to monitor BFTDs and determine unit cost factors.

C. OPERATING TEMPO AND READINESS

1. Measuring Operating Tempo

Operating tempo is a measure of operating activity used to demonstrate the level of operations and training a unit achieves over time. Common measures currently used within DoD include aircraft flying hours, ship steaming days, vehicle miles driven and ammunition expended. In conducting research for this thesis no reliable measures of OPTEMPO used by Marine Operating Forces (ground forces) could be directly related to O&M funding levels. As discussed previously BFTDs are an incomplete measure of activity and are inconsistently reported. Other measures such as vehicle miles driven or ammunition expended aren't readily available nor are they reliably recorded in a manner that make them easily accessible for analysis.

Due to the nature of operations Marines are called on to perform and because of the role the Marine Corps assumes

as the Nation's forward deployed force in readiness, it routinely deploys its forces overseas or aboard naval amphibious ships. The emphasis placed on cyclical unit deployments influenced the Marine Corps to use a measure called deployment tempo (DEPTEMPO) as a way of measuring and recording unit activity.

DEPTEMPO is defined as the percentage of time in a given annual period that a unit, or element of a unit, supports operations or training away from its home base or station for a period greater than or equal to ten consecutive days (Cotto, 1997). DEPTEMPO is tracked through the Marine Corps Training, Exercise and Employment Plan (MCTEEP) system. MCTEEP is relational database developed by the Marine Corps to support planning, execution and visibility of training, exercise and deployment activities throughout the FMF. It contains information on scheduled, current and completed operations, specific units and resource (vehicles, equipment, etc.) requirements. It provides information necessary for Commanders to effectively plan training, exercise and employment activities with the efficient use of available resources. (MCTEEP Web Page)

"Currently implemented throughout the MARFORs, MCTEEP will show the impact of tempo on readiness. Future MCTEEP programs will support predictive readiness." (USMC Concepts and Issues, 1997).

However, DEPTEMPO does not provide a useful tool for budget justification because it merely addresses the rate of deployment related activity and not a level of total activity for the MARFORs. For example, if a unit conducts a training exercise that is less than ten days in duration, it is not included in the DEPTEMPO calculation. Consequently, a unit which may be maintaining a high operating tempo by conducting numerous short term exercises (less than ten days) will not show an increase in DEPTEMPO.

To understand the differences between OPTEMPO and DEPTEMPO it is important to recognize the nature of Marine Corps operations and their deployment schedules. Marines not only deploy in support of military operations and to conduct training exercises, they also deploy on routine six month deployments in fulfillment of the nation's power projection and forward presence missions. There are two deployment programs in which Marine units participate on a

continuous basis, the Unit Deployment Program (UDP) and MEU deployments aboard Naval amphibious ships.

Under the Unit Deployment Program infantry battalions and their supporting units deploy from their home bases in the Continental United States (CONUS) or Hawaii to Okinawa, Japan where they become attached to 3D MARDIV for approximately six months. There are four battalions committed to UDP deployments, three from MARFORPAC (two from the west coast and one from Hawaii) and one from MARFORLANT. On average two battalions are deployed to Okinawa at any given time of year.

Under the MEU deployment program one MEU from the west coast (MARFORPAC) and one MEU from the east coast (MARFORLANT) are committed to MEU deployments. Traditionally, MEUs from MARFORPAC deploy to the western Pacific and MEUs from MARFORLANT deploy to the Mediterranean. Deployment schedules are arranged where on average at least one MEU is at sea at any given time of the year.

In preparation for deployments both UDP and MEU battalions go through a rigorous pre-deployment training

program. This normally takes place during the six months prior to the deployment. The focus of training is at the company/battery and battalion levels and usually requires conducting operations at special locations and with other units. An example of this is the Combined Arms Exercise (CAX) conducted at the Marine Corps Air Ground Combat Center in Twenty Nine Palms, California. It is obvious that in this stage of the training cycle OPTEMPO for these units is high. Intuitively one would think that this increase in OPTEMPO would relate to increases in readiness. However, during the course of this research little data were found supporting this view.

2. Readiness Issues

Readiness is "the ability to provide capabilities required by the combatant commanders to execute their assigned missions . . . to deliver the outputs for which (the unit) was designed." (JCS, 1989)

A recent study by the RAND Corporation (Dahlman, 1995) discusses readiness related issues the military is facing in the wake of previous downsizing efforts. Dahlman emphasizes three potential problem areas for readiness related

activities. First, the turbulent political environment lends itself to an unequal distribution of cutbacks. Areas that are easiest to cut, readiness related activities such as force structure, are hit hardest while complex and problematic areas, such as infrastructure, are often left unscathed. Second, unforeseen events (peace keeping missions, contingency operations, etc.) that are usually unplanned and unfunded consume O&M dollars that should have gone towards readiness related training. Third, achieving a balance between different long term goals for the future, most notably the balance between force structure and modernization, is very difficult. The difficulties with measuring readiness only exacerbate these problems.

The Status of Resources and Training System (SORTS) is used by all services to report overall combat readiness to the Chairman of the Joint Chiefs of Staff (CJCS). Based on available resources, a unit commander rates his overall combat readiness in four areas: personnel, training, quantity of equipment and supplies, and condition of equipment. Ratings range from C1 (the unit maintains the necessary resources to meet its wartime mission) to C4 (the

unit is lacking the necessary resources to meet its wartime mission). A rating of C5 is assigned to units that are not ready due to a preplanned activity, for example ships in overhaul or new units being formed.

In addition to C-ratings, Marine Corps ground units use training readiness ratings, or T-ratings, as an assessment of the number of days required for a unit to be fully trained. A unit with a T-rating of 1 requires less than 14 days of additional training to become fully trained. Figure 2.5 outlines the criteria for training readiness ratings.

Training Readiness Rating	Additional Days of Required Training
T-1	<14
T-2	14-28
T-3	29-42
T-4	>42

Figure 2.5 T-Rating Criteria

The use of SORTS ratings as a measure of readiness has been criticized for a variety of reasons. First of all, SORTS scores emphasize tracking resources rather than performance. Second, units may be evaluated in a scenario that does not reflect their actual wartime role. Finally, there is concern over the accuracy and timeliness of the

scores. Some experts speculate that there is the possibility of "gaming" by commanders concerned with protecting or enhancing their reputation. (CBO, 1997)

Betts (1995) points out that using SORTS scores to reflect changes in O&M spending levels for operating forces is difficult because there is little unclassified, comprehensive, or quantitative data available for comparison.

Dahlman (1995) argues that in order to efficiently and effectively distribute resources across units within the services readiness should be viewed as a management process, with decision making at the senior commander level to produce a force capable of meeting wartime requirements, rather than a production process, where unit level commanders apply resources to enable their units to perform certain tasks to standards that may or may not reflect wartime requirements.

During a hearing on force readiness during deliberations on the FY 96 defense budget, the Chairman for the Sub-committee on Military Readiness, Herbert H. Bateman, remarked:

> Readiness is a complex issue. In addition to tank miles, flying hours and steaming days, there are many other factors which impact on overall readiness - personnel tempo, maintenance backlogs, morale, quality of life, base operations support, equipment modernization, recruiting and retention. Add to this the impact of unfunded contingency operations and the funding turbulence associated with such operations. . . . The traditional system for measuring readiness is inadequate. Its focus is narrow, it is too subjective, it is not consistently applied across services, commands or units, and can be misleading. Further, it has no predictive value of future force readiness.

3. Measuring Readiness in the Marine Corps

The definition of readiness, also referred to as operational or current readiness, provided in JCS Pub-1-02 (1994), "Readiness is the ability of forces to deploy quickly and perform initially in war time as they were designed," correlates directly to the Marine Corps' mission.

As outlined in a recent CNA research memorandum (Jareb, 1994) the Marine Corps uses three measures of unit training readiness: BFTDs, SORTS ratings and the Marine Corps Combat Readiness Evaluation System (MCCRES).

Each of these measures requires a certain subjective element of the assessment of readiness. As discussed previously, BFTDs report a level of unit activity not a

level of readiness. Implicitly, one can hypothesize that more BFTDs results in more training thus increased proficiency and readiness. However, this would only be true if BFTDs were efficiently utilized. Unfortunately, there are no established standards for the conduct, content or quality of BFTDs.

As previously discussed, SORTS ratings have many limitations. In addition, a recent study conducted by the Congressional Budget Office (CBO, 1994) found that SORTS ratings for Marine Corps units over a period of 13 years were relatively stable. It is difficult to determine whether the ratings were the result of an abundance of resources, the efficient use of resources or the unwillingness of commanders to report that their units were not ready.

While overall SORTS ratings can be adjusted based on the subjective judgment of unit commanders, T-ratings are the most subjective. One would expect T-ratings to decrease as a unit nears deployment and increase in the months following deployment. However, the CNA study found that T-ratings were insensitive to a unit's position within the

training cycle. In fact, 90 percent of infantry battalion SORTS T-ratings were reported at T-1 over a 14 quarter period. (Jareb, 1994). From this, one could conclude that the subjectivity inherent in SORTS ratings may overstate readiness. Moreover, the CNA study was unable to demonstrate how significantly SORTS ratings impact changes in resources.

A third measure of readiness is the Marine Corps Combat Readiness Evaluation System (MCCRES). The MCCRES is a comprehensive training evaluation program used to evaluate the efficiency and effectiveness of unit training. Its purpose is to provide feedback designed to help unit commanders identify training deficiencies, assess the effectiveness of training programs and revise training programs. The MCCRES consists of a comprehensive list of Mission Performance Standards (MPS) unique to a specific unit type (i.e., infantry, artillery, etc.) that the unit must master. These standards represent the minimum performance necessary to successfully pass the MCCRES. (MCO 3501.1C)

The Commandant of the Marine Corps stated in a 1993 White Paper that:

> Using the MCCRES properly is fundamental in determining training readiness. It is our primary system to assess and evaluate unit training based on approved combat requirements--the mission statement. Correctly executed, it can assess unit capabilities, aid in planning unit training, and serve as an evaluation tool to measure readiness in terms of published combat performance standards.

Even though the MCCRES is based on specified standards and published guidelines, there still remains some degree of subjectivity present in the system. In the past, unit commanders have taken undue liberties in interpreting and executing MCCRES requirements (CMC, 1993). This leads to inconsistency in the conduct of MCCRES throughout the Marine Corps and introduces a degree of bias that detracts from using the MCCRES as a true measure of readiness.

Although subjective, these three measures of readiness provide a qualitative sense of unit readiness. However, the fact remains, demonstrating the link between O&M spending and indicators of readiness is extremely difficult (Betts, 1995).

One would expect that as spending on O&M, readiness related funds, increases or decreases indicators of readiness would follow the same pattern. A CBO study (1997) examined this issue by comparing O&M spending levels with readiness indicators for the Army, Air Force and Navy. They found that SORTs ratings remained remarkable stable over a 15 year period, from 1981 to 1996, and OPTEMPO changed insignificantly while average O&M spending, particularly in the Army and Air Force, increased significantly. In the Navy average spending declined while indicators for readiness remained high. An examination of Marine Corps spending patterns was not included in the study. In summary, they were unable to demonstrate any linkage between resources expended and readiness levels achieved.

D. SUMMARY

This chapter broadly covered the issues relating fiscal resources to readiness for Marine Corps Operating Forces. It began with a description of the MARFORs and the funding categories relating to those forces. Next it described budgeting for Marine Operating Forces. A new approach to budgeting by attempting to link readiness and resources was

also examined. Finally, the issues of measuring and recording OPTEMPO and readiness indicators for Marine ground combat units were discussed.

"Devising the best way to demonstrate a link between the application of resources and the achieved operational readiness is difficult and is likely to be an evolutionary process." (GAO/NSIAD-172, 1989). While there are no notable solutions to the resources-to-readiness issues presented herein, the information presented demonstrates a distinct need to continue efforts to better define and understand this problem. One such effort is the Visibility and Management of Operations and Support Cost Program which is introduced in the next chapter.

III. VISIBILITY AND MANAGEMENT OF OPERATING AND SUPPORT COSTS

A. OPERATING AND SUPPORT COSTS

1. Definition

Operating and Support (O&S) costs, as defined by various DoD directives, are those costs directly related to the operation, maintenance, supply and all other logistical support of a fielded weapon system. Specifically, this includes the cost of personnel; consumable and reparable materials; organizational, intermediate and depot level maintenance; contract support and sustaining investment[4]. O&S costs are incurred from the moment a system is prepared for its initial fielding and continue throughout its entire life cycle. Table 3.1 lists the generic O&S cost elements commonly considered in cost analysis.

O&S costs can be further divided into direct O&S costs and indirect O&S costs. Direct O&S costs are variable cost elements that vary directly with incremental changes in

[4] Procurement costs included in sustaining investment are costs incurred for modification kit procurement and installation, training munitions, support equipment replacement and the recurring procurement costs that result from operating a new system (O&S Cost Estimating Guide).

force structure and OPTEMPO. Indirect O&S costs are those costs that do not vary directly with incremental changes in force structure and OPTEMPO. (Greenburg, 1994).

MISSION PERSONNEL
Operations
Maintenance
Other Mission Personnel
UNIT-LEVEL CONSUMPTION
POL/Energy Consumption
Consumable Material Repair Parts
Depot Level Repairables
Training Munitions/Expended Stores
Other
INTERMEDIATE MAINTENANCE (EXTERNAL TO UNIT)
Maintenance
Consumable Material/Repair Parts
Other
DEPOT MAINTENANCE
Overhaul/Rework
Other
CONTRACTOR SUPPORT
Interim Contractor Support
Contractor Logistics Support
Other
SUSTAINING SUPPORT
Support Equipment Replacement
Modification Kit Procurement/Installation
Other Recurring Investment
Sustaining Engineering Support
Software Maintenance
Simulator Operations
Other
INDIRECT SUPPORT
Personnel Support
Installation Support

Table 3.1 Generic O&S Cost Element Structure
From, Operating and Support Cost Estimating Guide.

In budget terms, O&S costs can be viewed as O&M plus Military Personnel (MilPers), the two primary funding sources for readiness.

O&S costs reflect the commitment of a military establishment to readiness (Hildebrandt, 1990). Readiness, as defined previously, demands that sufficient resources be allocated to the effective operation and support of weapon systems during peacetime. Adequate funding of O&S activities is a key component of readiness. Without these resources, units would fail to meet appropriate standards of equipment and training readiness.

2. Historical Trends in O&S Spending

Historically, O&S costs (broadly defined) account for roughly 60 percent of the overall defense budget (Devers, 1993). As reductions in force structure take affect, and in an era of declining budgets, one would expect O&S costs to fall accordingly. However, there is a general consensus throughout DoD that O&S costs have not decreased relative to recent declines in force structure (Horowitz, 1997).

This research determined that O&S costs for DoD, in constant dollars, were higher in 1995 than they were twenty

years earlier. However, after taking into account changes in accounting policy the increase was less than initially thought. Moreover, when only looking at core mission O&S, spending by combat units and other units that deploy during wartime, O&S spending was slightly less in 1995 than in 1975. However, during the same period the decline in force structure was much greater than the reductions seen in direct O&S spending. For example, between 1975 and 1995 military personnel fell by 30 percent, combat divisions by 36 percent, aircraft carriers by 25 percent and bomber aircraft by 72 percent while direct spending on O&S forces increased by 12 percent, when measured comparably in both years (Horowitz, 1997). Once again changes in O&S spending are not congruent with the declining force structure.

In addition, the IDA study found that the growth in O&S was concentrated in the O&M appropriations. This was not surprising. A decrease in force size should see a decrease in the MILPERS appropriations as well as infrastructure spending. While MILPERS has declined in line with force reductions, infrastructure spending has not. Approximately 40 percent of the increases in O&M was directly related to

combat forces while the other 60 percent was related to the support functions. The support O&S expenditures include medical and health services, intelligence and communications, and environmental compliance.

Borga and Horowitz (1997) categorize O&S spending as Mission O&S, Mission Support O&S and Other O&S spending. Mission O&S includes costs most closely related to combat forces, which consist of the costs of operations, direct training and depot maintenance. These are the funds that are likely to have the greatest impact on readiness. Mission Support O&S includes such things as institutional training, base operations and operational headquarters. Other O&S spending includes medical, environmental, administrative, intelligence and communications, etc. These final two categories relate primarily to infrastructure.

Applying the same definitions to O&M spending Figure 3.1 depicts the relationship between Mission O&M and O&M spent on infrastructure related activities (Support O&M plus Other O&M) for DoD as a whole. Notice that over the last 10 years, a period in which force structure declined

significantly, O&M spending relating to infrastructure remained relatively stable while Mission O&M declined.

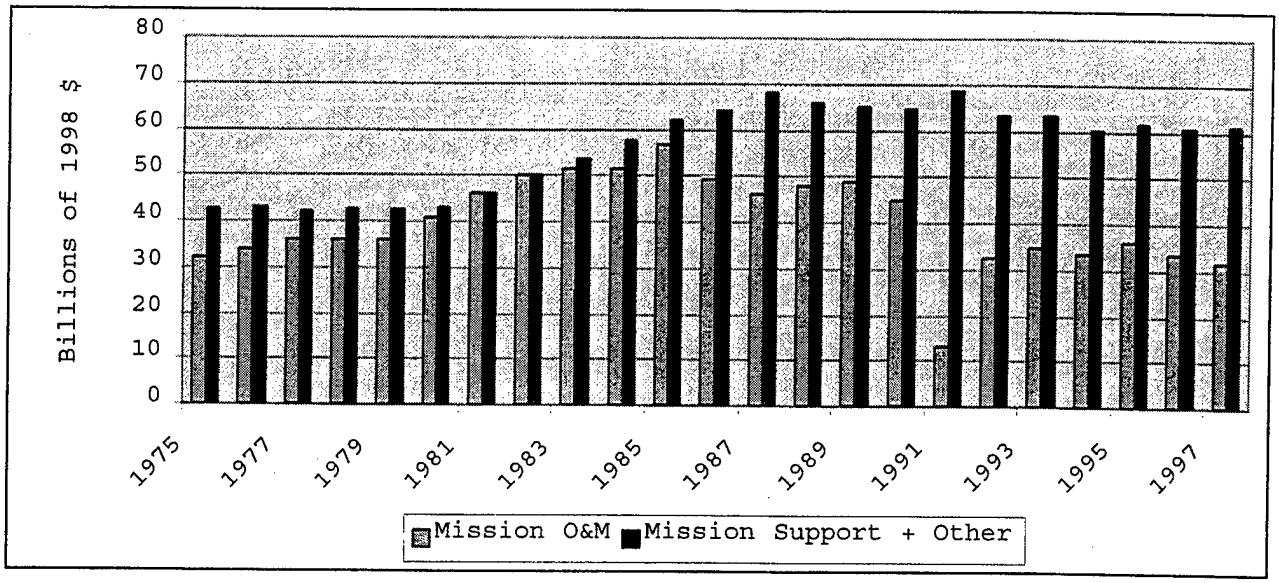

Figure 3.1 Historical O&M Spending for DoD[5]

Figure 3.2 depicts the relationship between Mission O&M and O&M spent on infrastructure related activities for the Marine Corps. In this case there is a direct relationship between changes in Mission O&M and changes in infrastructure related O&M.

[5] Data corrected for contingency spending. Provided by Stan Horowitz, Institute of Defense Analysis. NOTE: Due to corrections made for contingency spending during the Gulf War the 1991 data is artificially low and should be ignored.

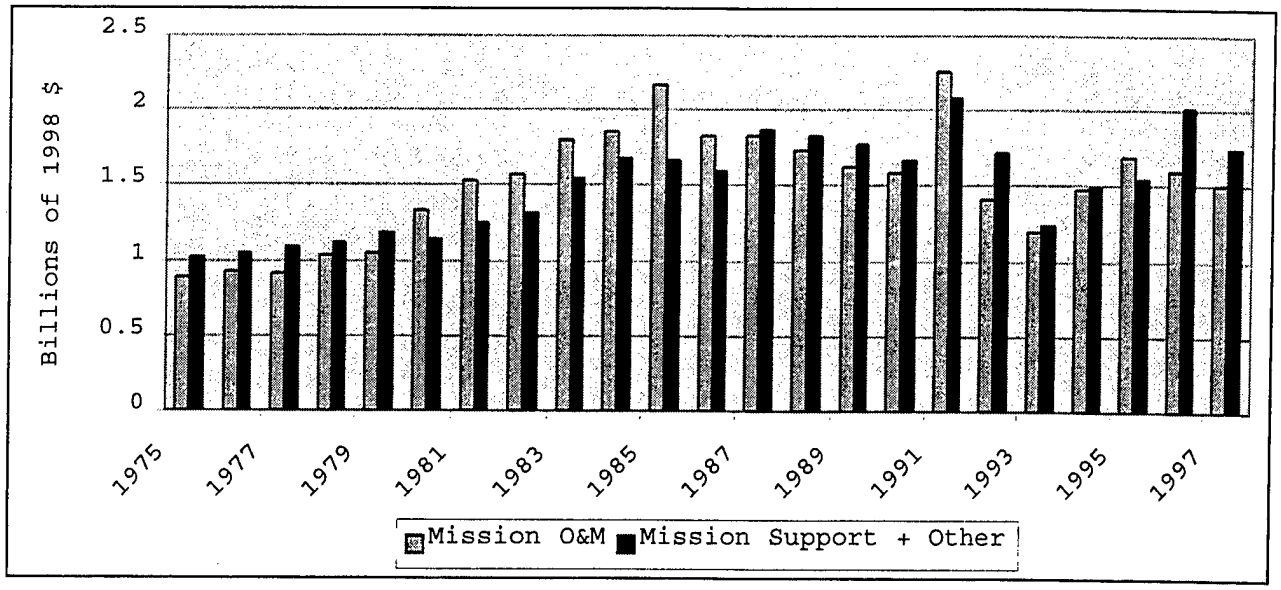

Figure 3.2 Historical O&M Spending for USMC[6]

From the above analysis it is difficult to determine whether the rise in O&S costs has contributed to a rise in capability (readiness). While we have been unable to show any distinct relationship between O&S spending and readiness, one would expect there to be a close association between the two. This relationship may not be easily established on the aggregate level as was concluded by the CBO study (1994) discussed in the previous chapter. However, comparing O&S costs of specific weapon systems to levels of OPTEMPO and readiness may provoke further

[6] Data corrected for contingency spending. Provided by Stan Horowitz, Institute of Defense Analysis.

understanding of the resources-to-readiness relationship. The DoD Visibility and Management of Operating and Support Costs (VAMOSC) program provides one mechanism to do this.

B. VAMOSC PROGRAM

1. History

A need for a better system to manage O&S spending can be traced as far back as the mid 1960's when DoD officials began to recognize a need for a better understanding of where O&S costs are concentrated. They realized that support costs were not accounted for along weapon systems lines. This made it extremely difficult to determine the amount of funding required to support a particular weapon system. Assessing how alternate allocations of budgetary resources would impact readiness was equally as difficult. (CNO, 1974)

Furthermore, it was becoming apparent that an increasing percentage of DoD fiscal resources were being committed to O&S activities. If this were allowed to continue without any intervention, the services would be left without the necessary resources to procure replacement weapon systems. There was a definite need for a system that

would allow managers to track and analyze O&S costs and give them the ability to study the impact that reductions in support costs would have on readiness.

In 1974, in response to General Accounting Office (GAO) recommendations to Congress that DoD accurately determine O&S costs for weapons systems, the Deputy SECDEF requested that each service secretary review his/her individual service's efforts to effectively monitor and manage the support costs associated with major weapon systems. MBO 9-2 (1974), "DoD Requirements for Visibility of Management of Support Costs," directing each Service to develop weapon system and component level O&S cost visibility and standardize O&S cost terminology throughout the Services. (Navy VAMOSC Web Page, 1997)

2. Requirements, Objectives and Uses

Today DoD is congressionally mandated to track O&S costs for all fielded major defense acquisition programs (MDAP)[7]. To meet this requirement DoD established the

[7] A MDAP is an acquisition program that is not a highly sensitive classified program (as determined by the Secretary of Defense) and that is: (1) designated by the Under Secretary of Defense (Acquisition and Technology) (USD(A&T)) as an MDAP, or (2) estimated by the USD(A&T) to require an eventual total expenditure for research, development, test and evaluation of more than $355 million in FY

VAMOSC Program. Under cognizant control of the Office of the Secretary of Defense (OSD) Cost Analysis Improvement Group (CAIG) the VAMOSC program requires each component of DoD to establish its own VAMOSC system. Each VAMOSC system will collect, display, categorize and record historical O&S costs, related data, and associated factors that determine those costs, by MDAP. (DoD 5000.4-M)

DoD Regulation 5000.2 requires independent estimates of O&S costs as part of all Cost and Operational Effectiveness Analysis (COEA) and the CAIG Cost Estimating Guide requires the use of VAMOSC data when predicting O&S costs for acquisition reviews.

The objectives of the VAMOSC system, as listed in DoD Manual 5000.4, are:

- To provide visibility of O&S costs for use in cost analysis of MDAPs and force structure alternatives in support of the PPBS process.
- To provide visibility of critical maintenance and support costs at the subsystem level in sufficient

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1996 constant dollars or an eventual total expenditure for procurement of more than 2.135 billion in FY 1996 constant dollars (DODD 5000.2-R).

detail to promote cost-conscious design and configuration management of new and fielded defense programs.

- To provide visibility of O&S costs so they may be managed to reduce and control program life-cycle costs.
- To improve the validity and credibility of O&S cost estimates by establishing a widely accepted database, thereby reducing the cost and time for collecting these defense program O&S costs for specific applications.

VAMOSC data is used as a basis for decisions concerning affordability, budget development, support concepts, cost tradeoffs, modifications, and retention of current systems (DoDD 5000.4). It provides a useful tool to derive and validate O&S costs of defense programs, assists in design tradeoff analysis, supports the development of budgets, and establishes standards for cost estimating. While the majority of VAMOSC data applications relate to the defense acquisition process, expanded collection of accurate and reliable data will extend its capabilities to the

development of cost factors and the development and justification of budgets. In addition, detailed VAMOSC data in the future may be used to relate O&S costs to various measures of OPTEMPO and thus develop a relationship between resources and readiness.

At the present time there are no requirements for VAMOSC to collect and record OPTEMPO data and show their impact on O&S costs. (Freeman, 1997). However, the Air Force, Army and Navy incorporate OPTEMPO into their systems as a determinant of cost per flying hour, vehicle miles driven and steaming hours. OPTEMPO data are also a key factor in developing cost factors for the Army. While the desire to include OPTEMPO data for Marine Corps ground systems is apparent there has been little progress in this area (Lucero, 1997).

C. AIR FORCE VAMOSC SYSTEM

The original VAMOSC system was developed by the Air Force and became operational in 1982. This initial system consisted of three major subsystems and a source data preprocessor: the Weapon System Support Cost (WSSC) Subsystem; the Component Support Cost Subsystem (CSCS); the

Communications Electronics (CE) Subsystem; and the Visibility and Management Overhead (VAMOH) Data Preprocessor Subsystem. These systems were designed to monitor aircraft O&S costs at the Mission Design Series (MDS) level, relate engine component costs to weapon systems, improve the life cycle costing capability for the acquisition of new weapon systems and provide cost information to assist with design trade-off studies, acquisition planning and budgeting.

In 1986 the Air Force started the VAMOSC modernization program to enhance the system's capabilities. This effort emphasized the development of a relational database management system and improvement in the accuracy and reliability of collected data. The result was a modernized WSSC and CSCS and the new VAMOSC Source Data Preprocessor (VSDP) subsystem. These systems were successfully fielded in the early 1990's and data products were made available to the Air Force financial management community in 1995.

The CSSC and the VSDP deliver component O&S cost data configured at the National Stock Number (NSN) and Work Unit Code (WUC) level on a quarterly basis. The WSSC collects data from a variety of financial, logistical and inventory

management systems and provides detailed O&S data configured at the weapon system level, as well as by MDS, command and geographic location. O&S cost and operational data (flying hours, inventory, etc.) are provided in the form of a "DataPack", a pre-defined data set available in spreadsheet or ASCII format. The use of a relational database creates flexibility for users of the system, allowing them to tailor their data requests to meet specific, detailed requirements. Air Force VAMOSC cost reports are available to authorized users via the Internet/World Wide Web (WWW) and can be downloaded and analyzed using spreadsheet software on a personal computer.

In the near future the Air Force will incorporate *Weapon System Briefing Books* into their VAMOSC program. These briefing books will be available on-line and will display weapon system costs, operational statistics, personnel counts, and related trends and metrics (e.g., cost per flying hour). This will enable the end user to break down summary data to greater levels of detail and conduct cost analysis at the micro-level. (Air Force VAMOSC Web Page, 1997)

D. NAVY VAMOSC SYSTEM

In response to OSD direction, the Chief of Naval Operations initiated a system to track O&S costs for Navy and Marine aircraft in FY 1976. A similar system was established in FY 1977 for Navy ships. Throughout the years the Navy's program to assess O&S costs, like similar programs in the other Services, has been criticized by a series of GAO reports for its inability to accurately predict, report or verify O&S costs (Doermann, 1994). In order to provide better guidance and procedures for collecting and reporting O&S data, responsibility for the administration of the VAMOSC program was transferred to the OSD CAIG in 1992. At the same time DoN centralized the management of their VAMOSC system under the Naval Center for Cost Analysis (NCCA).

Currently, Navy VAMOSC tracks historical O&S cost data and provides reports in five major areas: (1) Ships (including Military Sealift Command ships); (2) Aircraft (both Navy and Marine); (3) Missiles and torpedoes; (4) Automated Information Systems (AIS); and (5) Marine Corps

Ground Combat Systems. Each of these reports displays data at various levels of detail and composition.

The Navy VAMOSC system gathers data from existing MIS systems and thus places no additional reporting requirements on the operating forces. The data reflect direct and indirect costs by weapon system, function and cost element as well as providing detailed maintenance cost data. (Navy VAMOSC Web Page, 1997)

The Navy VAMOSC database establishes a centralized source of O&S cost data at the weapon system level. However, it is limited in some respects. It lacks the ability to track infrastructure costs, such as costs associated with Base Operating Support (BOS). There is limited direct access to users and there is no direct link to PPBS. A current effort is underway to re-engineer Navy VAMOSC to capture the total cost of weapon systems. In FY 1997 the VAMOSC database was converted to a relational database to make data available to authorized users on-line and through client software packages. Additionally, NCCA is investigating the possibilities of relating VAMOSC data to the Future Years Defense Plan and PPBS. (NCCA, 1997)

E. ARMY VAMOSC SYSTEM

1. Operating and Support Cost Management Information System

The key to the Army's VAMOSC system is the Operating and Support Cost Management Information System (OSMIS) database. Managed by the Army Cost and Economic Analysis Center (CEAC) OSMIS gathers and records O&S cost information on more that 400 Army Material Systems, including combat vehicles, tactical vehicles, artillery systems, aircraft, electronic systems and miscellaneous engineering systems deployed in tactical units of the Army, National Guard and Reserves. O&S information is made available to numerous users throughout the defense community including Army and DoD analysts, private contractors and other government agencies. Reports are summarized at various levels from the Major Command (MACOM) to the battalion level.

OSMIS was designed to support three communities: the programming/budgeting community, the logistics community and the acquisition community. For the programming/budgeting community, OSMIS assists in the development of OPTEMPO training budgets by providing input into the Army's Training Resource Model and Flying Hour Program. For the Logistics

community, OSMIS provides historical information which can be used to support logistics models, build and validate logistics budget documents, measure system rebuild and parts usage rates, determine demand and costs of reparables, consumables, training ammunition and petroleum, oil and lubricant (POL), and monitor maintenance costs. For the Acquisition community OSMIS is used for various program assessments and analyses such as: Program Office Estimates (POEs), Cost Estimating Relationships (CERs), COEAs, design cost tradeoffs, and cost reduction initiatives.

OSMIS tracks each weapon system by its Weapon Identification Code (WIC). Each system is assigned to a battalion level unit by its Unit Identification Code (UIC) and further identified by the Major Command that unit reports to by a two digit MACOM code. Units may also be grouped into division or non-divisional organizations and identified by Troop Sequence Number (TPSN). Sub-systems or major end items are tracked for each OSMIS Weapon System by the National Item Identification Number (NIIN) in the national supply inventory.

Historical O&S data are reported in Annual Cost Reports produced from the OSMIS database. The cost reports include the information on consumption rates and costs of POL, training ammunition, repair parts and components, depot and intermediate maintenance costs and labor hours and activity/OPTEMPO (miles/flying hours).

The Annual Cost Reports consists of seven volumes: (1) Aviation Systems (rotary and fixed wing); (2) Combat Systems (tanks and combat vehicles); (3) Artillery/Missile Systems (artillery weapons and support vehicles, surface to surface missiles and detection systems); (4) Tactical Systems (wheeled vehicles); (5) Engineer/Construction Systems (engineer, construction, electrical power generators, and floating equipment); (6a) Communications/Electronics Systems (radio receivers, teletypewriters, terminal sets, switches, etc.); and (6b) Communications/Electronics Systems (communications and data processing systems, radar sets, terminals, etc.). Annual Cost Reports for FY 1995 and FY 1996 are available for download as a Portable Document Format (PDF) file and Excel spreadsheets via the WWW. (Army VAMOSC Web Page, 1997)

2. Tracking OPTEMPO

A universally recognized cost driver in the Army is OPTEMPO miles[8]. These figures are critical to defining readiness for the Army and have been used continuously in Congressional Testimony for that very reason (Williams, 1994). OPTEMPO is the pace of unit training activity that the Army believes it needs to conduct in order to maintain prescribed levels of readiness. OPTEMPO funds cover the cost of fuel, reparable spare parts and consumable spare parts. (GAO/NSIAD-97-222).

Tracking OPTEMPO accurately is critical to the effective utilization of resources to meet specified levels of readiness. The OSMIS database records OPTEMPO as well as O&S cost data which allows users of the information to relate O&S costs to executed OPTEMPO (miles driven).

Currently the Army CEAC tracks OPTEMPO mileage for ground combat systems utilizing the Unit Level Logistics System for Ground equipment (ULLS-G). All ground units report their mileage monthly using this system. Senior Army leadership receives quarterly reports of OPTEMPO (Mileage)

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[8] An OPTEMPO mile is defined as every vehicle in the fleet traveling one mile.

totals which are used for budget reviews and computing OPTEMPO costs for the Planning Programming Budgeting Execution System (PPBES). (OPTEMPO Mileage, 1995)

Each time a vehicle is operated its ending mileage is entered into a ULLS computer when it is returned to the motor pool. Not only can this information be rolled up and used at higher echelons for budgeting and planning issues, but it can also be used at the battalion level to determine whether or not they are operating in accordance with their allowable budgets or determine the impact additional training will have on budgetary resources.

Incorporating OPTEMPO data into OSMIS is critical to many applications of OSMIS database. Specifically, it is a major contributing factor to establishing cost factors and developing training budgets. The primary goal of OSMIS is to develop a cost factor for each system it reports on. Cost factors are based on *miles* for ground vehicles equipped with odometers, flight *hours* for aircraft and *number of systems* for most other systems. This enables OSMIS to be linked, although crudely, to readiness. This creates an opportunity to identify the critical cost factors that are

closely associated with readiness. Without OPTEMPO, OSMIS would be severely limited in its ability to relate resources to readiness.

F. SUMMARY

This chapter introduced the reader to the DoD Wide VAMOSC program. It began with the definition of O&S costs followed by a discussion of historical trends and elements of O&S spending. Next, it provided a brief history of DoD's VAMOSC Program followed by a summary of each Service's VAMOSC system. In the next chapter the core of the VAMOSC system for USMC ground combat equipment, the Marine Operating and Support Information System (MOSIS), will be introduced. The focus of that chapter will be an in-depth look at the MOSIS database and the FY 1996 Marine Corps Ground Combat Systems Report.

IV. MARINE OPERATING AND SUPPORT INFORMATION SYSTEM

A. OVERVIEW

Marine aircraft have been included in Navy VAMOSC for twenty years, but until recently ground combat systems have been largely ignored. When the NCCA was made responsible for Navy VAMOSC, they began to expand the program to cover additional areas of interest. During the 1992/1993 CAIG reviews, the Secretary of the Navy directed NCCA to collect USMC O&S information for its ground combat equipment (Freeman, 1997).

In order to integrate USMC ground combat systems into Navy VAMOSC, NCCA, along with support contractors and the Marine Corps, developed the Marine Operating and Support Information System (MOSIS). MOSIS was designed to supplement current MIS used within the Marine Corps. It gathers and records historical O&S cost data for selected ground combat weapon systems. Currently, the MOSIS data base contains data on organizational and intermediate maintenance activities, parts cost, and maintenance labor

hours for both military and civilian personnel. (FY 96 Cost Report, 1997)

Early in FY 1992, Information Spectrum, Inc. (ISI), the prime contractor responsible for the development and operation of Navy VAMOSC, and Calibre Systems, Inc.[9], subcontractor to ISA, were tasked with developing a list of candidate USMC weapon systems for inclusion in Navy VAMOSC. ISI and Calibre compared the similarities and differences of USMC weapon systems to Army and Navy systems currently reported upon by existing VAMOSC systems. Since USMC aircraft and airborne weapon systems have been included in the current Navy VAMOSC system, this analysis focused solely on ground systems. (Flynn, 1992).

The following criteria were established to determine whether or not a specific weapon system should be included in MOSIS:

- The weapon system is considered combat essential equipment.

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[9] Calibre Systems, Inc. played a key role in the development and operation of the Army's VAMOSC system, OSMIS.

- The weapon system qualifies as a reportable item and is in current use in operational units.
- The weapon system is of substantial value (generally defined as meeting DoD requirements for ACAT I or II programs)[10].
- The weapon system is fielded in such quantities that its O&S costs are of interest to operational and fiscal agencies.

The 5 Ton Series Truck, all variants of the Amphibious Assault Vehicle (AAV), all variants of the Light Armored Vehicle (LAV), the M101A1 and M198 artillery systems, the M1A1 and M60 Tanks and the tank recovery vehicle met at least one of the above requirements. In addition, 72 other communications, electronic and ordnance systems were identified for possible consideration. (Flynn, 1992)

The Deputy Chief of Staff of Installations and Logistics (DCS(I&L)), in close coordination with ISI and

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[10] Acquisition Category I (ACAT I) programs are MDAPs that require eventual expenditure for research, development, test, and evaluation of more than $355 million (FY 1996 constant dollars) or procurement of more than $2.135 Billion (in FY 1996 constant dollars). ACAT II programs are major systems that require eventual expenditure for research, development, test, and evaluation of more than $140M (in FY 1996 constant dollars) or procurement of more that $645 million (in FY 1996 constant dollars). (DOD 5000.2-R).

Calibre, selected the 5 Ton Truck series and the LAVs for a pilot program to develop MOSIS. The result of this program was the development of the Marine Corps Operating and Support FY 1994 Cost Report. Included in this report were information on 5 Ton Trucks and LAVs associated parts costs, maintenance labor hours and cumulative fiscal data from FY 1992 through FY 1994. The pilot program was limited to organizational and intermediate maintenance costs because of funding constraints. The final Cost Report was submitted to NCCA and incorporated into Navy VAMOSC.

Following the successful completion of this pilot program, DCS(I&L) directed the expansion of the MOSIS process. He mandated that the FY 1995 Cost Report include O&S data on the artillery systems, the AAVs and the M1A1 tank. In addition, he encouraged increased distribution of future cost reports to field commanders. (FY 96 Cost Report, 1997)

B. CAPABILITIES AND BENEFITS

MOSIS and the Fiscal Year Cost Reports provide DoN, HQMC, Marine Corps Field Commanders, other managers, private contractors and government agencies with a useful tool for

monitoring historical O&S costs and related maintenance information for major weapon systems. The data contained within these reports will contribute to developing and justifying annual budgets for field commanders, provide independent cost estimates to acquisition program managers to help justify development of a replacement weapon system, provide a mechanism to analyze maintenance structures, identify various consumption rates and assess funding of a new weapon system versus the continued support of current systems.

The MOSIS database can be accessed to customize data to meet a variety of needs relating to specific weapon systems or groups of systems, fiscal year(s) or organize information by unit from the Battalion to the MEF level.

C. DATA COLLECTION

By design, MOSIS uses Marine Corps standard MIS. There are no additional hardware or software requirements, nor special field programming needs (NCCA, 1996). This eliminates the possibility of hindering the operating forces with any additional reporting requirements. To further alleviate reporting responsibility from the MARFORs, MOSIS

collects its data from the highest possible organizational level. The majority of the collection effort is focused on standard USMC information systems located at the Marine Corps Logistics Base (MCLB) in Albany, Georgia.

The preponderance of the information incorporated into the MOSIS database is drawn from historical records maintained within the Asset Tracking for Logistics and Supply Systems II (ATLASS II). Simply defined, ATLASS II is an integrated MIS that provides the interface of maintenance management, readiness reporting, additional classes of supply and appropriate MAGTF Logistics Automated Information Systems (UM-4400-71).

The Marine Corps Integrated Maintenance Management System (MIMMS), a subsystem of ATLASS II, is an automated information system that provides for the effective maintenance production and practices through the management of resources, training procedures and technical documentation (UM-P4790-5). MIMMS provides MOSIS with material consumption data by National Stock Number (NSN) and level of maintenance activity (depot, intermediate,

organizational), labor hours and information on Equipment Repair Orders (ERO).

D. FY 1996 COST REPORT

The MOSIS FY 1996 Cost Report contains individual reports on the series of 5 ton trucks, towed artillery pieces, the family of AAVs, the family of LAVs and the M1A1 tank. Each weapon system is accounted for by Table of Authorized Material Control Number (TAMCN) which identifies the type and technical category of the system, its assigned item number and its major classification and sub-classification of supply. The Cost Report is organized in TAMCN sequence where each variant of a weapon system is identified by a specific TAMCN and reported on individually. Table 4.1 contains a list of the weapon systems selected for inclusion in the FY 1996 Cost Report.

Five Ton Trucks

TAMCN	NSN	Model	Nomenclature
D1059 VIIK	2320000508913	M813A1	Truck, Cargo, Dropside, W/out Winch
	2320000508905	M813A1	Truck, Cargo, Dropside, With Winch
	2320010502084	M923A1	Truck, Cargo, Dropside, W/out Winch
	2320010478769	M925	Truck, Cargo, Dropside, With Winch
D1061 VIIK	2320000508987	M814	Truck, Cargo, Dropside, XLWB, With Winch
	2320010478771	M927	Truck, Cargo, Dropside, XLWB, W/out Winch
	2320010478770	M928	Truck, Cargo, Dropside, XLWB, With Winch
D1072 VIIK	2320000510589	M817	Truck, Dump, With Winch
	2320010478576	M929	Truck, Dump, With Winch
	2320010478755	M930	Truck, Dump, W/out Winch
D1134 VIIK	2320000508984	M818	Truck, Tractor, With Winch, With Equipment
	2320010478753	M931	Truck, Tractor, W/out Winch
D1212 VIIK	2320000510489	M816	Truck, Wrecker, With Winch, With Equipment
	2320010478574	M936	Truck, Wrecker, With Winch, With Equipment

Artillery

TAMCN	NSN	Model	Nomenclature
E0640 VIIM	1015003229752	M101A1	Howitzer, Light, Towed, 105MM
E0665 VIIM	1025010266648	M198	Howitzer, Medium, Towed, 155MM

Assault Amphibious Vehicles (AAVs)

TAMCN	NSN	Model	Nomenclature
E0796 VIIK	2350010809087	AAVC7A1	Assault Amphibious Vehicle, Command
E0846 VIIK	2350010818138	AAVPPA1	Assault Amphibious Vehicle, Personnel
E0856 VIIK	2350010809088	AAVR7A1	Assault Amphibious Vehicle, Recovery

Light Armored Vehicles (LAVs)

TAMCN	NSN	Model	Nomenclature
E0942 VIIM	2300011231609	LAV-AT	Light Armored Vehicle, Anti-tank
E0946 VIIB	2300011231606	LAV-C2	Light Armored Vehicle, Command and Control
E0947 VIIM	2300011231602	LAV-25	Light Armored Vehicle, Light Assault, 25MM
E0948 VIIB	2300011231612	LAV-L	Light Armored Vehicle, Logistics
E0949 VIIM	2300011231607	LAV-M	Light Armored Vehicle, Mortar
E0950 VIIB	23000011231608	LAV-R	Light Armored Vehicle, Maintenance/Recovery

Tank

TAMCN	NSN	Model	Nomenclature
E1888 VIIK	2350010871095	M1A1	Tank, Combat, Full Tracked, 120MM Gun

Table 4.1 Selected Ground Combat Systems
From Appendix B, FY 1996 Cost Report

Each individual system report begins with a narrative description of the system and a weapon system models and

components list[11]. Following the system description are eight separate reports. Each report displays Marine Corps wide totals, Command totals (I MEF, II MEF, III MEF, Reserves and Prepositioning Forces) and Major Subordinate Command (MSC) totals (CE, MEU, GCE, ACE, CSSE). Each of the eight reports is described briefly.

FY 96 Summary Data Report. This report gives an overview of O&S costs and other pertinent information about the weapon system. It includes information extracted from the other seven reports.

FY 96 Parts Cost Per System Report. This report displays the average annual parts cost per system at the organizational and intermediate maintenance levels as well as total parts cost for each Command and MSC[12].

Average Annual Parts Cost Report. This report displays the total parts cost for each Command and MSC for a five year period. The average annual parts costs are determined

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[11] Multiple models of a particular weapon system may be included under a single TAMCN.

[12] Parts costs are calculated by multiplying NSN parts quantities recorded on completed maintenance EROs, as reported in MIMMS, by corresponding standard unit prices for consumables or by exchange or special unit prices for reparables. The sums provided are in "then year dollars".

by dividing total parts cost by the number of years data were collected[13].

FY 96 Maintenance Labor Hours Report. This report displays organizational and intermediate level maintenance labor hours and total labor hours for each Command and MSC. Average annual labor hours per weapon system are computed by dividing total labor hours by the number of weapon systems within a particular Command or MSC.

Average Annual Labor Hours Report. This report displays total maintenance labor hours for each Command and MSC for a five year period. Average annual labor hours are determined by dividing the sum total of labor hours by the number of years data were collected.

FY 96 Equipment Repair Order Costs Report. This report displays organizational and intermediate maintenance level ERO parts costs[14] and total ERO parts cost for each Command and MSC. The average annual parts cost per ERO is calculated by dividing the total ERO parts cost (includes

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[13] For some systems data may not have been available for the full five years.

[14] The Cost Report provides no distinction between parts costs and ERO parts costs.

both organizational and intermediate ERO parts cost) by the number of EROs submitted by a particular Command or MSC.

Average Equipment Repair Order Costs Report. This report displays ERO parts cost for each Command and MSC for a five year period. Average ERO costs are calculated by dividing the total ERO parts costs (the summation of parts costs for the number of years data were collected) by the number of years data was collected.

Top 100 National Stock Number Cost Drivers Report. This report lists the top 100 repair parts, both reparable and consumable, used by a particular weapon system. Items are displayed by NSN and listed in descending order by extended cost (quantity used multiplied by the unit price).

E. LIMITATIONS

MOSIS is not nearly as elaborate or complete as the systems used by the other Services and is limited in many respects. Most notable are the limited number of systems MOSIS tracks, the limited data presented in the Fiscal Year Cost Reports, the inability to track OPTEMPO measurements, limited user accessibility and the inability to track indirect support cost elements.

Currently, MOSIS reports on 26 different models and types of ground combat systems. Compared to the Army's OSMIS system which tracks approximately 400 different tactical systems, MOSIS is not nearly as well developed. In addition, data in the most recent cost report are limited to organizational and intermediate level maintenance parts cost and labor hours. In contrast to OSMIS there are no data on depot level maintenance, including depot level reparables (replenishment spares), and unit level consumption of training ammunition and POL. Table 4.2 summarizes the O&S Cost Elements and other categories included in the OSMIS and MOSIS Cost Reports.

MOSIS does not track OPTEMPO or other measures of unit activity. This, in part, is because the individuals responsible for collecting and recording MOSIS data are not authorized to impose reporting requirements on the MARFORs (Freeman, 1997) (Lucero, 1997) and in part because current Marine Corps MIS do not accurately track or record specific measures of OPTEMPO (e.g., miles driven) (Carroll, 1997).

O&S COST ELEMENT	OSMIS	MOSIS
MISSION PERSONNEL		
Operations		
Organizational Maintenance Labor Hours		✓
UNIT LEVEL CONSUMPTION		
POL Consumption/Cost	✓	
Training Ammunition Consumption/Cost	✓	
Consumable Material/Repair Parts Cost	✓	✓
Depot Level Reparables	✓	
INTERMEDIATE MAINTENANCE		
Maintenance Labor Costs	✓	
Maintenance Labor Hours	✓	✓
Consumable Materials/Repair Parts Cost	✓	✓
DEPOT MAINTENANCE		
Rebuild/Overhaul	✓	
Maintenance Labor Costs	✓	
Maintenance Labor Hours	✓	
Material Cost	✓	
Overhead Cost	✓	
Contract Cost	✓	
Rebuild/Overhaul Cost Drivers	✓	
Repair Cost Drivers	✓	
OTHER CATEGORIES		
OPTEMPO Miles	✓	
Top Consumable Cost Drivers	✓	✓
Top Reparable Cost Drivers	✓	✓

Table 4.2 Comparison of OSMIS and MOSIS O&S Cost Elements

Finally, neither MOSIS nor OSMIS collects data on BOS, installation support or other indirect support costs elements. This research was unable to confirm any significant efforts to include such information in MOSIS or OSMIS in the near future.

F. FUTURE OUTLOOK

1. Future Data Collection Plan

According to the FY 1996 Cost Report MOSIS is capable of expanding to accommodate an ever increasing number of cost elements associated with the utilization of fielded major end items. The future data collection plan will concentrate on gathering data on ammunition costs, depot level maintenance costs, maintenance personnel labor costs and POL costs. Each of these costs elements will be drawn from Marine Corps standard data systems where the information is relatable to specific TAMCNs.

There are also plans to incorporate additional systems into MOSIS and future Cost Reports. The MOSIS team has started collecting information and data for the M220A2 Tube-launched, Optically guided, Wire command linked (TOW) anti-armor missile system, the Armored Vehicle Launched Bridge (AVLB), the High Mobility Multipurpose Wheeled Vehicle (HMMWV), the Commercial Utility Cargo Vehicle (CUCV) and miscellaneous engineering and communications assets. (Freeman, 1997)

We were unable to confirm any significant progress in or future plans to begin collecting and incorporating OPTEMPO data into the MOSIS database. Additionally, neither MOSIS nor OSMIS

2. User Accessibility

Currently, Fiscal Year Cost Reports are available through NCCA. However, direct access to MOSIS, the ability to obtain data in electronic format or specifically structure data to meet special end user needs are limited. The NCCA converted Navy VAMOSC (which includes MOSIS) to relational database format in FY 1997 and is in the process of making the data available to authorized users on line and through the use of client software.

Navy VAMOSC data are maintained in Oracle Relational Database Management System (RDBMS) in a database warehouse. Data may be retrieved using a Commercial-of-the-Shelf (COTS) software package called Business Objects. Business Objects is a Windows based, Graphical User Interface (GUI) on-line analysis process tool from which reports can be created that contain up to date data from the VAMOSC data warehouse. (Lucero, 1997)

G. SUMMARY

This chapter introduced the reader to the Marine Operating and Support Information System. It began with a discussion of the development of MOSIS followed by a brief description of its capabilities, benefits and data sources. Next it described the main output of MOSIS, the FY 1996 Cost Report and compared MOSIS O&S Cost Elements with the Army's OSMIS Cost Elements. The chapter concluded with a discussion of the limitations of MOSIS in its current state and future plans for expanding its capability. The next chapter concludes this thesis with recommendations and areas for further research.

V. CONCLUSION AND RECOMMENDATIONS

A. DISCUSSION

This thesis focused on presenting the resources-to-readiness issues for DoD in general and the Marine Corps in particular. The previous chapters describe the Marine Corps Operating Forces, budgeting for those forces, the ways in which the Marine Corps currently monitors readiness for those forces and the difficulties associated with their methodology. Finally, a cost analysis tool for DoD, the VAMOSC Program, was introduced as a possible mechanism for analyzing O&S cost data to relate resources to readiness.

Relating budgetary resources to readiness continues to be a perplexing problem throughout DoD. Coupled with the recent downsizing efforts and increased fiscal constraints, Marine Corps activity managers continue to struggle in their efforts to formulate and justify O&M budgets based on quantitative measures of performance or indicators of readiness. Currently the Marine Corps evaluates readiness using a variety of methods, but there still continues to be a need for a good indicator of activity, OPTEMPO or

readiness that can define a distinct relationship to O&M budgets.

The RBB system has been described as one effort to link readiness to budgeting. It justifies financial requirements by demonstrating a distinct connection between readiness and fiscal resources. While this system has worked well for the Marine Divisions, it is too narrowly focused to be applied to the Marine Corps as a whole.

DoD's VAMOSC Program is one mechanism that provides detailed cost data that may be useful in examining the resources-to-readiness problem. The Army, Navy and Air Force VAMOSC systems collect and record O&S cost data and relate it to specific measures of OPTEMPO, e.g., cost per mile driven, cost per steaming hour and cost per flying hour. The Army's OSMIS system in particular has been extremely useful in developing cost factors that are applied to the planning, programming, and budgeting process.

Marine Corps ground combat systems have been incorporated into the Navy VAMOSC system using the MOSIS database. MOSIS is still in the early stage of development and is limited in the data it collects and their

accessibility to end users. Also, little effort has been made to incorporate OPTEMPO data into the system. This makes it extremely difficult to define cost factors that can be effective in the formulation and justification of budgets. However, as MOSIS matures, and data on more weapon systems and more O&S cost elements become available, its capacity for cost analysis will increase greatly.

B. RECOMMENDATIONS

The single most limiting factor of MOSIS as an analytical tool for better understanding the resources-to-readiness problem is the lack of accurate and reliable measures of OPTEMPO. To enhance the usefulness of the MOSIS database and its contribution to cost analysis OPTEMPO data must be incorporated into the system. It is recommended that the Marine Corps utilize existing MIS to record OPTEMPO data for systems currently reported on in MOSIS. Additionally, steps need to be taken to ensure that as new systems are incorporated into MOSIS techniques for recording levels of activity are developed. This includes recording miles driven or operating hours and POL consumption for

vehicles, ammunition consumption for weapons, battery usage for communications equipment, and so on.

Another limiting factor for using MOSIS in cost analysis is the relatively few combat systems and O&S cost elements it reports on. It is further recommended that the developers of MOSIS continue to include additional systems and cost elements in MOSIS. Particularly, unit level consumption and depot level maintenance data should be collected.

C. AREAS FOR FUTURE RESEARCH

1. Broad Level Analysis

An analytical approach to predicting readiness based on deployment patterns, SORTS ratings, personnel issues, etc., may provide a means to better understand the relationship between readiness and resources, exercise and deployments in the Marine Corps. A good starting point for this research would be CNA Research Memorandum 97-51, *Measuring and Predicting Readiness: Final Report*, June 1997.

2. Micro-level Analysis

In the near future the MOSIS database will be accessible through the use of client software available at

the Naval Postgraduate School computer laboratories. This will allow researchers to structure data to their particular analytical requirements.

Once OPTEMPO data becomes available it would be possible to use MOSIS data to: (1) predict consumption rates (maintenance labor hours, parts usage, fuel consumption, etc.) based on OPTEMPO; and (2) determine the operational cost per mile/hour of a particular weapon system and develop cost factors that could be used to cost out exercises, develop budgets and justify budget level changes.

Currently, efforts are underway to collect OPTEMPO mileage data on all Light Armored Infantry Battalions in the Marine Corps. This creates an opportunity to conduct the above analysis for the LAV and relate it to specific Marine Corps units. This will also provide a means to demonstrate the potential of the MOSIS database.

LIST OF ACRONYMS

AAV	Assault Amphibious Vehicle
ACAT	Acquisition Category
ACE	Aviation Combat Element
ADP	Automated Data Processing
AG	Activity Group
AIS	Automated Information System
ARG	Amphibious Ready Group
ATLASS II	Asset Tracking for Logistics and Supply System
AVLB	Armored Vehicle Launched Bridge
BA	Budget Activity
BES	Budget Estimate Submission
BFTD	Battalion Field Training Day
BOS	Base Operating Support
CAIG	Cost Analysis Improvement Group
CAX	Combined Arms Exercise
CBO	Congressional Budget Office
CE	Command Element
CEAC	Cost and Economic Analysis Center
CER	Cost Estimating Relationships

CINC	Commander in Chief
CJCS	Commander Joint Chiefs of Staff
CMC	Commandant of the Marine Corps
CNA	Center for Naval Analysis
CNO	Chief of Naval Operations
COEA	Cost and Operational Effectiveness Analysis
CONUS	Continental United States
COTS	Commercial Off The Shelf
CSCS	Component Support Cost Sub-system
CSSE	Combat Service Support Element
CUCV	Commercial Utility Cargo Vehicle
DCS(I&L)	Deputy Chief of Staff for Installations and Logistics
DEPTEMPO	Deployment Tempo
DoD	Department of Defense
DoN	Department of the Navy
DSSC	Defense Service Supply Center
ERO	Equipment Repair Order
FHP	Flying Hour Program
FMF	Fleet Marine Force
FY	Fiscal Year

GAO	General Accounting Office
GCE	Ground Combat Element
GUI	Graphical User Interface
HMMWV	Highly Mobile Multipurpose Wheeled Vehicle
HQMC	Headquarters United States Marine Corps
IDA	Institute for Defense Analysis
ISI	Information Spectrum, Inc.
ITS	Individual Training Standards
JCS	Joint Chiefs of Staff
LAV	Light Armored Vehicle
MACOM	Major Command
MAGTF	Marine Air Ground Task Force
MARDIV	Marine Division
MARFORs	Marine Operating Forces
MAW	Marine Air Wing
MBO	Management By Objectives
MCCDC	Marine Corps Combat Development Command
MCCRES	Marine Corps Combat Readiness Evaluation System
MCLB	Marine Corps Logistics Base
MCS	Maintenance Cost System
MCTEEP	Marine Corps Training Exercise and Employment Plan

MDAP	Major Defense Acquisition Program
MDS	Mission Design Series
MEF	Marine Expeditionary Force
METL	Mission Essential Task List
MEU	Marine Expeditionary Unit
MIMMS	Marine Corps Integrated Maintenance Management System
MIS	Management Information System
MPS	Mission Performance Standards
MOSIS	Marine Operating and Support Cost Information System
MSC	Major Subordinate Command
MSSG	MEU Service Support Group
M1A1	Abrams Tank
NCCA	Naval Center for Cost Analysis
NIIN	National Item Identification Number
NSN	National Stock Number
OMB	Office of Management and Budget
O&M,MC	Operations and Maintenance, Marine Corps
O&M,N	Operations and Maintenance, Navy
O&S	Operating and Support

OSD	Office of the Secretary of Defense
OSMIS	Operating and Support Cost Management Information System
OPTEMPO	Operating Tempo
PDF	Portable Document Format
POE	Program Office Estimate
POL	Petroleum, Oil and Lubricant
POM	Program Objectives Memorandum
PBBES	Planning Programming Budgeting and Execution System
PPBS	Planning Programming and Budgeting System
RBB	Requirements Based Budgeting
RDBMS	Relational Database Management System
SABRS	Standard Accounting Budgeting and Reporting System
SAG	Sub-activity Group
SECDEF	Secretary of Defesne
SORTS	Status of Resources and Training Systems
TAD	Temporary Additional Duty
TAMCN	Table of Authorized Material Control Number
T/E	Table of Equipment
T/O	Table of Organization
TPSN	Troop Sequence Number

UDP	Unit Deployment Program
UIC	Unit Identification Number
ULLS	Unit Level Logistics System
ULLS-G	Unit Level Logistics System Ground
USD(A&T)	Under Secretary of Defense For Acquisition and Technology
USMC	United States Marine Corps
VAMOH	Visibility and Management Overhead
VAMOSC	Visibility and Management of Operating and Support Costs
WIC	Weapon Identification Code
WUC	Work Unit Code
WSSC	Weapon System Support Cost
WWW	World Wide Web

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