NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

COST MODELS AND THE
CORPORATE INFORMATION MANAGEMENT (CIM)
INITIATIVE

by

David Philip Faulk

March 1991

Thesis Advisor: Joseph G. San Miguel

Approved for public release; distribution is unlimited

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE			
4. PERFORMING ORGANIZATION REPORT NUMBER(S)		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
6a. NAME OF PERFORMING ORGANIZATION Naval Postgraduate School	6b. OFFICE SYMBOL *(If Applicable)* 37	7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School	
6c. ADDRESS *(city, state, and ZIP code)* Monterey, CA 93943-5000		7b. ADDRESS *(city, state, and ZIP code)* Monterey, CA 93943-5000	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL *(If Applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS *(city, state, and ZIP code)*		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
			TASK NO.
			WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*
Cost Models and the Corporate Information Management (CIM) Initiative (UNCLAS)

12. PERSONAL AUTHOR(S)
Faulk, David P.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(year, month, day)*	15. PAGE COUNT
Master's Thesis	FROM TO	1991, March	73

16. SUPPLEMENTARY NOTATION
The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

17. COSATI CODES			18. SUBJECT TERMS *(continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUBGROUP	Cost Systems, Cost Models, Corporate Information Management, CIM

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

This thesis provides a brief history of the Corporate Information Management (CIM) initiative, and includes a summary of the methodology being employed to complete the initiative. The focus of this thesis is on the alternative cost models that are available to the Department of Defense (DoD), and the information requirements for each of them. The cost models reviewed include: actual, normal, standard, variable, cost-volume-profit analysis, and job order. Advantages and disadvantages of each of these models is discussed. In addition, the current DoD implementation of unit costing is also discussed and compared and contrasted to the alternative models that exist.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
[X] UNCLASSIFIED/UNLIMITED [ ] SAME AS RPT. [ ] DTIC USERS	Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Professor Joseph G. San Miguel	22b. TELEPHONE (Include Area Code) (408) 646-2187	22c. OFFICE SYMBOL AS/Sm

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted SECURITY CLASSIFICATION OF THIS PAGE
All other editions are obsolete Unclassified

Approved for public release; distribution is unlimited.

Cost Models and the Corporate
Information Management (CIM) Initiative

by

David Philip Faulk
Lieutenant, United States Navy
B.S., University of Pittsburgh, 1983

Submitted in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

NAVAL POSTGRADUATE SCHOOL
March 1991

Author: _____
David Philip Faulk

Approved by: _____
Joseph G. San Miguel, Thesis Advisor

_____
Robert L. Knight, LCDR, SC, USN, Second Reader

_____
David R. Whipple, Chairman, Department of Admin Sciences

ABSTRACT

This thesis provides a brief history of the Corporate Information Management (CIM) initiative, and includes a summary of the methodology being employed to complete the initiative. The focus of this thesis is on the alternative cost models that are available to the Department of Defense (DoD), and the information requirements for each of them. The cost models reviewed include: actual, normal, standard, variable, cost-volume-profit analysis, and job order. Advantages and disadvantages of each of these models is discussed. In addition, the current DoD implementation of unit costing is also discussed and compared and contrasted to the alternative models that exist.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

Thus far the 1990's introduced great change not only for the world, but more specifically for the Department of Defense (DoD). It appears that the cold war, which had lasted for over forty years, is over and the United States is reducing the defense portion of the federal budget. Since the perceived threat has diminished, many argue that the DoD budget, and troop strength should be reduced accordingly as part of the so-called "peace dividend". This is a drastic change in policy from the 1980's when the DoD's budget was increased almost every year and the military strength of this country was growing. Because the funding was easy to obtain for all of the armed services, waste surely took place due to redundancies in effort. Each service had no motivation to consolidate with other services in order to save money.

Because of this reduction in funding, the DoD is currently reviewing many alternative ways in which it can save money and become more efficient. These alternatives include: Unit Costing, Consolidation, and Corporate Information Management (CIM). This thesis addresses the CIM initiative primarily, but also includes a discussion of the unit costing initiative.

The following discussion focuses on CIM's background, purpose, and direction.

B. WHAT IS CIM?

The Corporate Information Management (CIM) initiative is a DoD program under the direction of the Assistant Secretary of Defense, comptroller (ASD-C). It has three objectives:

- To ensure the standardization, quality, and consistency of data from DoD's multiple management information systems.
- To identify and implement management efficiencies in support of business areas throughout the information life cycle.
- To eliminate duplication of effort in the development of multiple information systems designed to meet a single functional requirement. [Ref. 1]

In a memo from Secretary of Defense Dick Cheney, dated 16 November 1990, direction of the CIM initiative was transferred to the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD-C^3I).

In conjunction with the above stated objectives, the CIM initiative has a scope which includes:

- DoD wide information management.
- Information management within each business area. [Ref. 1]

C. ESTABLISHMENT OF CIM

The program began officially on October 4, 1989, but events leading up to its spawning began during the early

months of the Bush administration. One of the first events to occur was the Packard Commission reports (June 1986) which criticized the complex acquisition process in addition to other management problems. The outcome of these reports was that the President instructed the Secretary of Defense to overhaul the acquisition and management practices. The Secretary of Defense responded to the President's request in July, 1989 with the *Defense Management Report* (DMR) which

> ...provided a plan to implement fully the Packard Commission recommendations; improve substantially the performance of the defense acquisition system; and manage more effectively the department and its resources. [Ref. 2:p. 8]

In addition to this, the DoD found that there were many redundant areas, in the case of information systems (i.e., each service has its own accounting system). Additional improvements addressed consolidating many of the over 1000 information systems which deal from design through administrative support, and streamlining the services' pay and accounting systems. Through management changes, personnel cuts and enhanced information systems, the Department of Defense anticipates $2.3 billion in savings in 1991, and $39 billion over five years [Ref. 2:p. 13].

In July, 1989, Congress responded to General Accounting Office (GAO) reports citing mismanagement of automated data processing and suggested that no more funding would be available for DoD investments in information systems until the department devised a non-redundant strategy.

In response to these criticisms, Deputy Secretary of Defense Donald J. Atwood established the Corporate Information Management initiative through three actions:

- Established an executive level group of officials, both DoD and outside of DoD, to review the current procedures within the DoD and recommend corrective actions.
- A management plan to be drafted by the Information Resources Management (IRM) staff.
- After completion of the CIM process guide, the functional groups will be established. Officials from the Office of the Secretary of Defense (OSD) will head the groups.

In the interim, the current life-cycle management principles and processes will remain in effect for automated information systems. Also, the Defense Acquisition Board (DAB) will establish the Major Automated Information System Review Council (MAISRC) as a committee, with the chair being filled by the DoD Comptroller. This committee will operate under MAISRC procedures and will provide a review of information systems prior to DAB meetings. [Ref. 3]

D. WHY CIM?

The Deputy Secretary of Defense, Donald J. Atwood, was appointed to office by President Bush early in his administration. He came to government from the private sector where he was an executive for the General Motors Corporation (GMC). While Deputy Secretary Atwood was employed by GMC, they were experiencing the same type of problems that the DoD

is now facing: rivalries, duplication of effort--redundancy, obsolescence, etc. General Motors devised the CIM approach to combat these problems. Because of Deputy Secretary Atwood's prior experience in this area, he was assigned to initiate the CIM initiative for DoD.

E. PURPOSE OF CIM

CIM's broad goals are to reduce and eventually eliminate redundancy between the services. In addition to this, CIM is to establish common data requirements and formats which will reduce the number of information systems that the DoD currently supports. CIM's specific goals are:

- Develop process models that document new and existing business methods.
- Develop standard data definitions available for the Department's business and mission areas.
- Develop a set of common information systems for each function, built upon standard data and business methods.
- Develop an open systems computing and communications infrastructure, transparent to the information systems that stand upon it. [Ref. 4:p. 21]

Reductions in the number of systems supported will lead to monetary savings for the DoD.

F. IMPLEMENTATION

CIM will be implemented through two groups which will manage different levels of the initiative. The Executive Level Group (ELG) will manage DoD-wide information management

strategies. This group will consist of six industry and three DoD executives. They will examine critical elements of DoD CIM, evaluate current oversight practices, and review the procedures of the functional groups. The ELG reports directly to the Deputy Secretary of Defense.

The second group is the Functional Groups which will address the functional areas which include:

- civilian payroll
- civilian personnel
- contract payment
- financial operations
- government furnished material
- material management
- medical
- warehousing

These are the initial groups that have been established in this area. Each group will consist of senior level representatives from each of the DoD components. Each group will examine requirements from a functional point of view. Ultimately, it is hoped that the CIM initiative will include all of the administrative functions within DoD.

C. THESIS OBJECTIVE

The purpose of this thesis is to examine the Corporate Information Management initiative within the DoD, and how

different types of cost models pertain to it. The cost model that is chosen will drive the type of cost data that will be required as input to the system.

H. RESEARCH QUESTIONS

The research in this thesis will answer the following questions:

- What are the alternative cost models that are available for use in the DoD Corporate Information Management initiative?
- What are the information requirements for each model?
- What are the strengths and weaknesses of each of these models?
- How do these models compare or contrast with the Navy's current implementation of Unit Costing?

I. METHODOLOGY

The research for this thesis was accomplished through an extensive literature review concerning cost models in both the public and private sectors. Since CIM is so new, there is currently no published data available to perform data analysis or statistical analysis. This thesis was written while the CIM initiative was in progress.

J. OUTLINE OF CHAPTERS

The following is a brief summary of the discussion in each of the remaining chapters.

1. **Chapter II. Corporate Information Management Methodology**

The CIM methodology will be discussed in more detail. This methodology is what will be used by each of the eight functional groups.

2. **Chapter III. Review of Cost Systems**

Will provide a brief review of six of the most common cost systems used in the public and private sectors. These cost systems include: actual, normal, standard, variable, cost-volume-profit analysis, and job order. Advantages and disadvantages of each of the systems will be cited.

3. **Chapter IV. Unit Costing**

This chapter will discuss how the Department of Defense is currently implementing unit costing. Some of the cost systems discussed in Chapter III will be compared and contrasted to this unit costing model.

4. **Chapter V. Conclusion**

This chapter will provide a review of the high points that were covered and provide a summary of the conclusions.

II. CORPORATE INFORMATION MANAGEMENT METHODOLOGY

A. BACKGROUND

The methodology used by each of the eight functional groups must cover the entire planning process, from development of a future mission statement to design detail such as process and data models. At this time, there is no traditional methodology that will provide for this vast range of requirements. In order to proceed, the Executive Level Group (ELG) has developed a Corporate Information Management Process Guide to aid each of the functional groups in their efforts.

The current process guide [Ref. 5], dated August 1990, outlines the three-phase methodology that has been developed for the eight functional groups. Figure 1 shows the flow of this methodology. The three main phases are:

- Phase I--Functional Vision
- Phase II--Functional Business Plan
- Phase III--Information Systems Strategy

The estimated time required to complete these three phases is between 18 and 24 months. However, it will take eight to ten years to fully implement the CIM initiative. Since all of the functional groups are working separately, they are in various

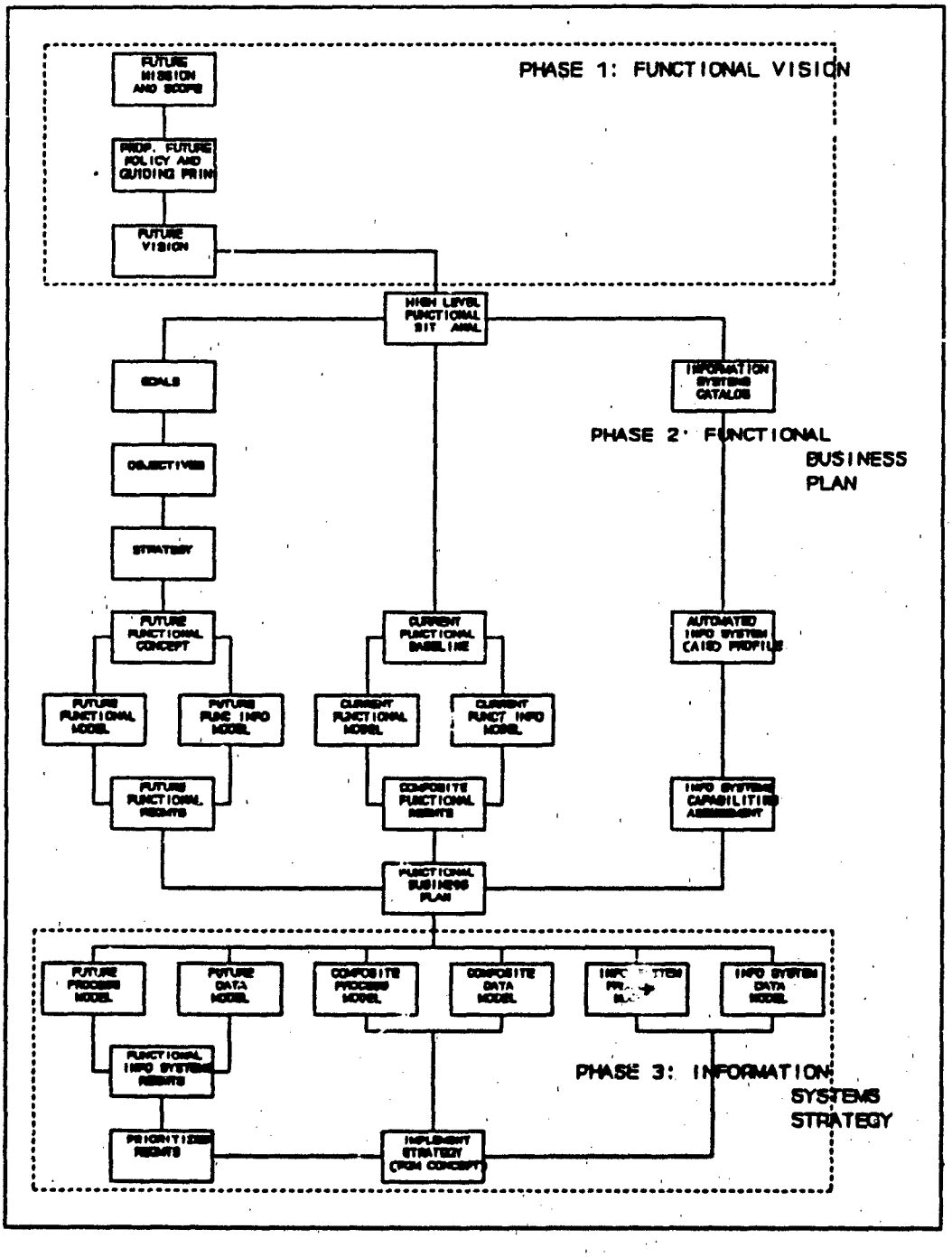

Figure 1. CIM Methodology [Ref. 5]

stages of completion. Figure 2 shows the progress of one of the functional groups, Financial Operations. These were the only specific data available at this time. The status of the other functional groups is unknown.

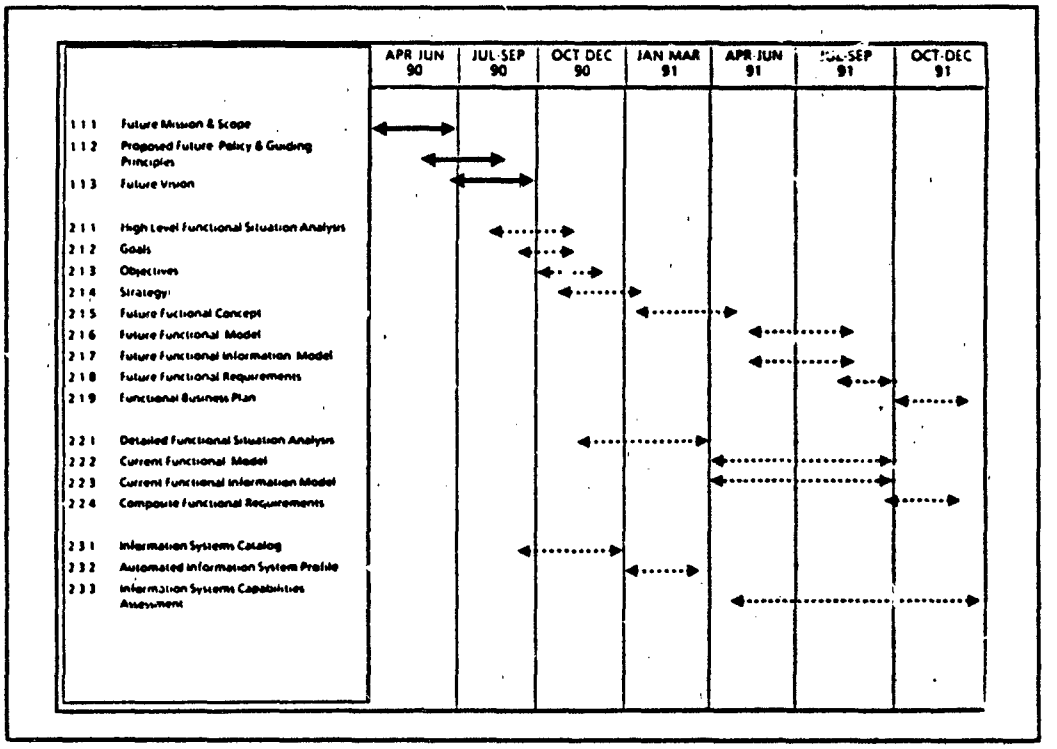

Figure 2. Financial Operations Group Milestones

Recall from the first chapter that there is a functional group for each of the following areas:

- civilian payroll
- civilian personnel
- contract payment
- financial operations
- government furnished material

- material management
- medical
- warehousing

The personnel required for manning each of the eight functional groups is shown in Table I.

The CIM Process Guide is currently over 220 pages. This chapter provides a summary of the Guide. The Process Guide should be referred to for a more detailed discussion.

B. PHASE I: FUNCTIONAL VISION

During this phase, the functional group will develop a future mission statement and scope, proposed future policy and guiding principles, and future vision. Each of these are described in more detail below.

1. Future Mission and Scope

During this step, the functional group, which is comprised of various components of the DoD, will describe its future function within the DoD. Since the various DoD components are involved, dynamic interaction must take place and a consensus must be agreed upon. The agreed upon mission and scope will then be subdivided into four parts. The mission and scope that is agreed upon during this step will provide the context and the boundaries for the function.

TABLE I

COMPOSITION OF CIM FUNCTIONAL GROUPS [Ref. 1]

	CIVILIAN PAYROLL	DISTRIBUTION CENTERS	FINANCIAL OPERATIONS	CIVILIAN PERSONNEL	MEDICAL SERVICES	GOVERNMENT FURNISHED MATERIALS	MATERIAL MANAGEMENT	CONTRACT PAYMENTS	TOTAL
OSD (Func'l)	3	2	4	2	1	1	1	2	16
OSD (CIM)	1	1	1	1	1	1	2	1	9
OASD				1	7				8
ARMY	3	4	7	4	8	1	8	3	38
NAVY	3	2	8	6	7	1	5	2	34
AIR FORCE	3	3	8	6	6	1	5	3	35
MARINE		1	1	1			2	1	6
JCS					1				1
DLA	3	3	5	5		1	10	5	32
DMA				1					1
WHS			1	1					2
FACILITIES	1	1	1	1	1	1	1	1	8
ADMIN	1		2	1	1		2	1	8
TOTAL (Permanent Members)	18	17	38	30	33	7	36	19	190

2. Proposed Future Policy and Guiding Principles

During this step, the group will establish a unified proposed policy and guiding principles that will establish the guidelines for the future. This step recognizes that the various DoD components have very different approaches to the same problem. This is why this step is so crucial. It will establish a single approach for the entire DoD. The group will draft their proposed policy and guidelines, based on input from senior OSD functional policy leaders.

3. Future Vision

This step will force the group to foresee and articulate the future of the function ten years in the future.

In completing this step, the group must determine projected trends and their related impacts. All major trends are to be identified and their impacts analyzed. These trends may be the result of both internal and external factors. The group will then write a statement for each trend, and categorize it.

C. PHASE II: FUNCTIONAL BUSINESS PLAN

During this phase, the group will provide the functional business requirements, the current and future functional models, and review current and future information systems requirements. All of the steps to be performed during this phase are described in more detail below.

1. High Level Functional Situation Analysis

During this step, the group studies the internal and external environments that affect the function. This study will include, but not be limited to, a description of the operational environment, legislative environment, the regulatory and policy environment, and the technological environment. Any proposed or ongoing initiatives that could affect the function will be identified and described. The completion of this step begins parallel activities on three separate paths: the future function path, the current functional path, and the current information systems path.

2. Goals

The group develops goals which outline "what" has to be accomplished to achieve success. In addition to stating

"what" needs to be done, the group will also state what indicators and time limits determine its achievement. The output from this step will be used directly in formulating the objectives, which is the next step.

3. Objectives

The group will develop objectives, which will include distinct measures such as "when", "where", "how much", and "to whom" that must be satisfied in order to meet that goal. The group will also identify the customers and organizations to be served, and the organizations directing the implementation.

4. Strategy

The group will develop a broad strategy that supports the goals and objectives that were developed in earlier steps. The group's emphasis in this step is on "how" to achieve the vision. The group will list, into logical groupings, possible actions that could be taken to achieve each objective. Each of these items on the list will then be evaluated for risk, feasibility, benefits, and affordability. The group will then select the best strategy for achieving the vision.

5. Future Functional Concept

In this step, the group uses the goals, objectives and strategies that it defined earlier to build a picture of the function in the future. During this step, the group will have to make critical decisions that will define functional and informational needs for the future. After the group has

drafted the future functional concept, it will investigate and identify industry trends and practices in this area to insure that they have incorporated the most recent and imaginative business practices that are available. The group will then revalidate the outputs from Phase I to insure that they are consistent with the future functional concept.

6. **Future Functional Model**

During this step, the group will develop a more detailed description of the functional activities by breaking them down into their component processes. The group will also re-examine external interfaces and organizational roles and responsibilities to ensure their completeness and consistency.

7. **Future Functional Information Model**

During this step, the group will review the information classes identified in the future functional concept. The group will then analyze these classes to identify entities and define characteristics of these entities. After the entities and their associated relationships have been defined, an entity-relationship (E-R) diagram will be constructed.

8. **Future Functional Requirements**

During this step, the group will review the already developed functional processes and entities and will then relate the processes to the entities. The group will provide these relationships graphically in matrix form.

9. Functional Business Plan

This step will mark the completion of Phase II. The plan will include all documents that have been generated up to this point. In addition to this step being a binding of the documents, it is also the point at which a number of analytical and assessment tasks take place. This step also brings together the outputs from the current functional path and the current information systems path.

One of the key items in this step is the identification and quantification of benefits. The goal of CIM is to ensure that the future functional concept provides a better, more efficient way of doing business than was done in the past.

10. Current Functional Baseline

At this step, the group will describe, at a high level, the function as it is operating today in each DoD component. This step is a more detailed analysis of the work begun in the previous step, which is the High Level Situation Analysis.

11. Current Functional Model

In this step, the group will review each of the DoD components' functional processes. The group will then break each of these processes down into sub-processes, until differences between the DoD components can be identified. This step is conducted in parallel with similar activities associated with the future model of the function.

12. Current Functional Information Model

During this step, the group will review the high level information classes used by functional area activities and processes. The group will then analyze these classes and define the major entities. The group will develop graphical representations of how the entities relate to one another by drafting an E-R diagram.

13. Composite Functional Requirements

In this step, the group reviews the different ways in which the function is executed in each of the DoD components, and develops streamlined and simplified functional processes and practices. These new processes and practices could require changes in current policies, practices, instructions, or forms. The group will outline the actions necessary to implement these changes. The primary role of this step is to provide an analysis of the previous steps, and the bundling of this analysis into a set of requirements.

14. Information Systems Catalog

In this step, the group will analyze existing and proposed systems to gather essential knowledge for developing the DoD-wide information systems strategy. The group will develop a catalog of all these systems. At this time, the group will also identify which of the systems will not be considered further.

15. Automated Information Systems (AIS) Profiles

During this step, the group will begin to document which of the existing or planned systems will best support the function. The group will develop a set of functional requirements for evaluating each of the AISs. The group will also note any deficiencies, constraints or impacts found.

16. Information Systems Capability Assessment

During this step, the group will assess current and planned systems and identify any potential candidates that can be used as a baseline to meet future functional requirements. At this time, the group will also determine if none of the systems will meet future functional requirements.

D. PHASE III: INFORMATION SYSTEMS STRATEGY

During this phase, the group will develop the future, composite, and information system process and data models, and also develop their implementation for design. Each of the specific steps is discussed in more detail below.

1. Future Process Model

In this step, the group will develop a model to compare the logical processes and the relationships among them so that an implementation strategy can be determined. The group will also produce a process decomposition diagram and a data flow diagram (DFD).

2. **Future Data Model**

During this step, the group will concentrate on the data necessary for the successful execution of the function. The group will first develop an initial data model that includes entities and relationships. This initial model will then be normalized, which will identify entity subtypes. This normalization process will result in a more detailed model. The group's final task in this step will be to identify the specific attributes that describe an entity.

3. **Functional Information Systems Requirements**

Previous steps have identified the requirements necessary to support the function. In this step, the group will list the improvements that are required, from a systems perspective, and describe their associated benefits. The group will also identify and record functional applications that will be required in the future. The group's decisions will be documented in the functional information system requirements.

4. **Prioritized Requirements**

This step will begin by receipt of the functional information system requirements. In this step, the group will establish priorities for the requirements so that the information implementation strategy can proceed in a constrained environment. The group will develop the criteria that it uses to prioritize these requirements.

5. **Implementation Strategy**

During this step, the group will compare the requirements, that were developed in earlier steps, with the selected information systems. The group will perform an analysis to determine the gap between current information systems, and what is required to perform the function currently, and in the future. The group will then discuss how this gap is to be closed, and a course of action will be developed. The group will then, as in Phase II, develop goals, objectives, and strategies for ensuring information support to the function.

6. **Composite Process Model**

During this step, the group's focus will be the identification of logical partitions of the function and the identification of functional interfaces. The group will then decompose the processes. Dependency analysis will then be performed at each level. The final outcome of this step is that the nature of the dependency will be expressed as a data flow.

7. **Composite Data Model**

During this step, the group will focus on the data necessary for execution of the function. The group will develop an initial model which will include data entities, relationships, and unique identifiers. This model will then be analyzed, as the process model was, to identify entity

subtypes. Each entity and relationship will then be analyzed to document the business rules that apply to the appropriate instance of the entity.

8. Information System Process Model

During this step, the group will review system documentation, with an emphasis on design documentation, to determine what technique was used to originally develop or modify the system. This will provide the group with the necessary information to develop a unique way to build the process model for each information system.

9. Information System Data Model

During this step, the group will develop the model that explains the logic of each system with respect to the data it contains. The group will develop the data model, based on standards developed during the future data model step.

E. INTERIM

Once CIM unveils the eight functional area strategies, they will still require eight to ten years to implement. During this interim period, the DoD will be required to comply with the Interim Information Systems Charter. The following provides a summary of this charter:

- An interim information system will be used only if net benefits accrue to the DoD prior to implementation of the CIM system.

- An interim system may be a current operational system from one of the DoD components, or a hybrid or two or more existing systems.
- If the interim system doesn't meet all of the functional requirements, an analysis will be performed to see if the missing requirements warrant development.
- Support of redundant systems will be stopped. A plan for transitioning to the interim system will be developed. [Ref. 6]

F. CONCLUSION

This chapter has provided a very brief synopsis of the Corporate Information System Process Guide. It is not intended to make the reader an expert concerning the CIM methodology, but to give him an idea of the enormous scope of work that is being tackled by each functional group. It is important to realize that the CIM initiative is long term, eight to ten years, and that much can change during this time.

III. REVIEW OF COST SYSTEMS

A. INTRODUCTION

This chapter provides a review of six of the most commonly used cost systems in the public and private sector. These systems include: Actual, Normal, Standard, Variable, Cost-Volume-Profit, and Job Costing. The review of these systems will aid the reader in understanding the remaining chapters. Before going any further, it would be helpful to define some of the terminology that will be used.

1. Direct vs Indirect

Whether a cost is direct or indirect depends on one's frame of reference. For example, the cost of a college administrator is a direct cost of running the college, but is an indirect cost of a specific class.

A direct cost is one that can be obviously and physically traced to the particular segment under consideration [Ref. 7:p. 36]. Referring again to the college administrator example: if the segment under consideration is the cost to teach a specific class, the instructor's cost is a direct cost. The administrator's cost would be an indirect cost since it is not obviously and physically traced to this one class.

The following two guidelines will aid in distinguishing between direct and indirect costs:

- If the cost can be obviously and physically traced to a particular product, it is a direct cost of that segment.
- If the cost must be allocated in order to be assigned to a product, it is an indirect cost of that segment. [Ref. 7:p. 37]

2. Overhead

a. Manufacturing

Manufacturing overhead is comprised of the sum of all manufacturing costs associated with the production of a product, with the exception of direct material and direct labor costs.

b. Nonmanufacturing

Another component of overhead is nonmanufacturing costs. These costs are generally broken down into two categories: marketing or selling costs and administrative costs. Marketing and selling costs include advertising, selling, and any other costs that are involved in delivering the product to the customer. Administrative costs include executive salaries, clerical costs, and all other costs that can't be logically grouped under either marketing or manufacturing. [Ref. 7:p. 26]

B. ACTUAL

The actual cost system is one of the simplest and easiest systems to understand and use. The user of this type of system would keep track of all the monies that were spent in the production of a product or service, and this total cost would then be the cost of goods that are sold to the customer. For example, if the inputs to produce a widget are $10.00 for labor, $25.00 for materials,and $100.00 for overhead, the final actual cost to produce the widget would be $135.00. This computation is outlined in Table II.

TABLE II

COMPUTATION OF ACTUAL COSTS

Direct Labor	$ 10.00
Direct Materials	25.00
Mfgr Overhead	100.00
Total Cost	$135.00

Actual cost systems would collect data on direct materials, direct labor, and overhead. Getting back to the example discussed previously, the cost to produce one unit was $135.00. If ten units were produced, it would cost $45.00 per unit which is a significant decrease in the cost per unit. Table III illustrates how this cost per unit was computed. The decrease in the cost per unit is because the overhead costs do not change when more units are produced (assuming fixed, not variable overhead). This type of cost system does not use a predetermined manufacturing overhead rate to assign

overhead costs to production. Instead, it uses the total actual costs to produce the units and divides it by the number of units produced to compute unit cost.

TABLE III

COMPUTATION OF ACTUAL COSTS WITH MULTIPLE UNITS

Direct Labor	$ 10.00	x	10 units	= $100.00
Direct Materials	25.00	x	10 units	= 250.00
Mfgr Overhead				= 100.00
Total Cost for 10 units				= $450.00

Cost per unit = $450.00 / 10 units = $45.00 per unit

C. NORMAL

Normal costing is much the same as actual costing except that the overhead is applied to each unit based on a predetermined rate. The biggest difficulty with this type of cost system is that one has to estimate the overhead costs for the period (normally one year) and the base, or level of activity, used to allocate the costs to production during the period.

Overhead costs may include fixed and variable costs which make it difficult to estimate accurately. However, most of the costs are usually fixed which is why overhead tends to remain constant over a period of time. Overhead costs are assigned to units as indirect costs using an allocation base. Due to this fact, if production in a period (i.e. month) was low, the cost per unit would be high. Conversely, if the production was high, the cost per unit would be low. In order

to alleviate this fluctuation in the overhead cost that is applied, the company would use a normalized overhead rate. Hence the name normal costing. This rate would be based on an average activity level that would span many periods.

One of the problems is that of the choosing of the base can be critical. A base needs to be common to all products that are being produced. The goal is to choose a base such that all of the overhead costs are allocated equitably to each product during the period and that all overhead costs are covered.

The formula for calculating the Predetermined Overhead Rate (POR) is equal to the estimated total overhead costs divided by the estimated total units in the base (i.e., direct-labor hours). As can be seen from the formula, the overhead costs and the total units in the base have to be estimated for the period, normally one year. If the estimates are very accurate, all of the overhead costs for the year will be allocated. If the estimates are not accurate, the overhead will be either over-applied or under-applied. If the overhead is over-applied, the cost allocated to each unit is in excess of the actual cost. If the overhead is under-applied, the cost allocated to each unit is less than the actual cost, and all of the overhead costs will not be covered. The three cases below (Tables IV through VI) show the mechanics of each of these situations.

TABLE IV

COMPUTATION OF TOTAL COST WHEN ESTIMATES EQUAL ACTUAL COSTS

Estimated total overhead cost: $100.00
Estimated units in base: 10 direct-labor hours.
Therefore, the predetermined overhead rate is $10.00 per direct-labor hour ($100.00 / 10 DLH). If we assume that each unit requires one hour of direct labor and that ten units are produced.

Direct Labor	$10.00 x 10 units =	$100.00
Direct Mat'l	25.00 x 10 units =	250.00
Overhead	10.00 x 10 units =	100.00
Total Cost	=	$450.00

The cost per unit is $45.00 and all of the overhead costs have been applied.

TABLE V

COMPUTATION OF TOTAL COST WHEN ESTIMATES ARE LESS THAN ACTUAL COSTS

Estimated total overhead cost: $100.00
Estimated units in base: 10 direct-labor hours.
Again, the predetermined overhead rate is $10.00 per direct-labor hour ($100.00 / 10 DLH). However, if the actual overhead costs to produce the ten units were $150.00, the following would result:

Direct Labor	$10.00 x 10 units =	$100.00
Direct Mat'l	25.00 x 10 units =	250.00
Overhead	10.00 x 10 units =	100.00
Total Cost	=	$450.00

The cost per unit charged to the customer is again $45.00, but this does not cover all of the overhead expenses that were generated. In this case, the firm would be under-applying overhead, and would not cover its costs of production. A firm would not continue for long in this situation. The overhead cost that should have been applied to each unit is $15.00 ($150.00 / 10 DLH).

TABLE VI

COMPUTATION OF TOTAL COST WHEN ESTIMATES ARE GREATER THAN ACTUAL COSTS

Estimated total overhead cost: $100.00
Estimated units in base: 10 direct-labor hours.
Once again, the predetermined overhead rate is $10.00 per direct-labor hour ($100.00 / 10 DLH). However, if the actual overhead costs to produce the ten units were $50.00, the following would result:

Direct Labor	$10.00 x 10 units =	$100.00
Direct Material	25.00 x 10 units =	250.00
Overhead	10.00 x 10 units =	100.00
Total Cost	=	$450.00

The cost per unit charged to the customer is again $45.00, which more than covers all of the producers overhead costs. In this case, the firm would be over-applying overhead, and would generate additional revenue. The overhead cost that should have been applied to each unit is $5.00 ($50.00 / 10 DLH).

These three cases should make it evident that the key to success with this type of cost model is being able to chose a good allocation base and using very good estimates for the predetermined overhead rate calculation.

D. STANDARD

Standard costing is much different than the two models discussed previously. Standard costing allows managers to control prices paid and quantities used by allowing them to set the cost and quantity standards for materials, labor and overhead. The managers can then look at any exception to these standards instead of reviewing all of the data. This concept is known as "Management by Exception".

The most difficult element of this cost model is the actual setting of the standards. It has been said that setting standards is more an art than a science. However, the key to setting any standard is a thorough review of the past. This data can aid the manager immensely in the standard setting process, but he must remember that this is historical data and that the future also has to be considered.

There are a few schools of thought when it comes to setting standards. Some believe that very high standards, sometimes called "ideal standards", should be set so that it is almost impossible for a worker to achieve them. Others believe that "practical standards" should be set, which can be achieved through hard work. Most all agree that "practical standards" are superior to "ideal standards".

1. **Direct Material Standard**

This standard consists of two parts: the direct material price standard and the direct material quantity standard. The price standard shows the total cost of the materials. This can include restocking fees, and discounts. The quantity standard shows the amount of material that will be used to produce the finished product. By multiplying the direct material price standard by the direct material quantity standard, you'll arrive at the direct material standard.

2. Direct Labor Standard

This standard also consists of two parts: the direct labor price standard and the direct labor quantity standard. These standards are normally expressed in terms of labor rate and labor hours [Ref. 7:p. 309]. The labor price standard reflects the total cost (per hour) of the labor. This price includes all costs, including fringe benefits. The labor quantity standard delineates the labor required to produce the finished product. This standard can be very difficult to determine. By multiplying the direct labor price standard by the direct labor quantity standard, you'll arrive at the direct labor standard.

In order to paint a clearer picture of how standards are used, the following example is provided. The following Tables (VII through IX) outline how standards might be used in an auto body shop.

The following example shows how the different standards are calculated. By adding these standard costs, one can see how much it will cost to paint a mid-size car. The total cost to paint the car is $273.63 ($42.30 + $188.58 + $42.75). One can see that the bottom line of $273.63 does not yield as much information as the standards do. The standards allow a manager to discover problem areas easier if they exist.

TABLE VII

DIRECT MATERIAL STANDARDS

Price of paint (per gallon)	$9.75
Restocking fee	.25
Less: discount	1.00
Total price (per gallon)	$9.00

To paint a mid-size car would require the following materials:

Materials	4.0 gallons
Waste	.5
Touch up	.2
Total materials required	4.7 gallons

The direct material standard would be $9.00 x 4.7 gallons = $42.30.

TABLE VIII

DIRECT LABOR STANDARDS

Wage rate for painter (per hour)	$17.35
Fringe benefits	2.50
Total price (per hour)	$19.85

To paint a mid-size car would require the following labor:

Primer coat	3.0
Finish coat	4.5
Coffee breaks	.5
Cleanup	1.5
Total labor required	9.5

The direct labor standard would be $19.85 x 9.5 hours = $188.58.

TABLE IX

VARIABLE OVERHEAD STANDARDS

The variable overhead rate is based on the variable portion of the predetermined overhead rate. For this example, I'll assume this figure to be $4.50 per direct-labor hour. The variable overhead standard would then be $4.50 x 9.5 hours = $42.75. The 9.5 hours was taken from the direct labor standard.

3. Standards vs Budgets

Standards and budgets are very similar. Standards are a unit concept whereas budgets are a total concept, but you may have budgets and not use standards. Standards and budgets are both used as a means for expressing the desires, goals, and objectives of management. They are the "road map" that the company has established for the period, which is normally one year. However, budgets and standards in themselves are not enough. They both require feedback so that the manager can view how well the plan is working. If the feedback indicates that a problem exists, the manager can devote time to correcting it. If the feedback indicates that everything is going as planned, the manager can devote his time to another area.

Budgets can be of two types: static or flexible budgets. Static budgets are for a single level of activity while flexible budgets allow the manager to view a range of activity and the effects on budgeted data. A flexible budget allows a manager to view what activity level was attained during a period, and what the resulting costs should have been at that level. Thus, the manager can easily determine whether the variances between actual results and the flexible budgeted amounts are favorable or unfavorable.

a. Flexible Budget

A flexible budget is designed for a range of activity. Costs that will be present are analyzed to determine their cost behaviors (fixed, variable, mixed), and are then separated by their cost behavior. A formula is then calculated for the variable portion of the costs and this is used to arrive at the flexible budget. The flexible budget allows the manager to view what the costs should be for any level of activity within the relevant range that he has specified. A flexible budget for the auto body example is provided as Table X.

TABLE X

EXAMPLE OF A FLEXIBLE BUDGET

		Cars Painted				
	Unit cost	10	20	30	40	50
Labor	$ 42	$ 423	$ 846	$1269	$1692	$2115
Material	189	1886	3772	5657	7543	9429
Overhead	43	428	855	1283	1710	2138
Total	$274	$2737	$5473	$8209	$10945	$13682

(Figures have been rounded to the nearest dollar.)

E. VARIABLE

Variable costing is a method of costing that includes only variable costs in the cost of the product. In this costing model, fixed manufacturing costs are viewed as period costs and are charged off against income in each period.

Variable costing has created much controversy in the accounting field. The controversy concerns the justification of fixed costs as period costs. Since both fixed and variable costs are generated in the production of a good or service, it is argued that they both should be used in calculating unit costs. One of the problems involved with including fixed costs in the unit cost is that it does not lend itself well to conducting cost-volume-profit (C-V-P) analysis, or to flexible budgeting. For the purposes of this thesis, the controversy concerning inclusion of fixed costs will not be pursued. It will be assumed that variable costing is a viable alternative.

One of the great advantages of the variable costing model is that it lends itself very well to C-V-P analysis, which is a time-saver for managers. A comparison will help clarify the differences between variable costing and absorption costing (sometimes referred to as product costing). As can be seen from the following example (Table XI), the cost under variable costing is less than under absorption costing. This is because the fixed overhead costs are considered period costs and are charged against the period. The next section on cost-volume-profit analysis (C-V-P) will make it clear why variable costing and cost-volume-profit analysis go hand-in-hand.

TABLE XI

COMPARISON OF VARIABLE AND ABSORPTION COSTING

	Variable Costing	Absorption Costing
Direct labor	$10.00	$10.00
Direct materials	8.00	8.00
Variable Overhead	2.00	2.00
Fixed overhead	7.00	
Total cost	$20.00	$27.00

F. COST-VOLUME-PROFIT ANALYSIS

Cost-Volume-Profit (C-V-P) analysis is normally done for a company's internal use only. It allows the manager to view the costs in total and on a per unit basis. It also allows the manager to see the contribution margin--which is the sales revenue minus the variable expenses. The contribution margin is calculated for the total and per unit. The contribution margin can be defined as the amount of money that is used towards covering all of the fixed expenses. Once the fixed expenses are covered, then the amount remaining goes towards profits for the period. Table XII illustrates the concept of contribution margin. This following table shows that if 250 widgets are sold, the resulting net income will be $200.00. Each unit generates $10 in sales revenue, but costs the firm $8 in variable expenses. Therefore, the contribution margin per unit is $2. Since 250 widgets were sold, this equates to a total contribution margin of $500. This is not the net

TABLE XII

COMPUTATION OF CONTRIBUTION MARGIN

	Total	Per unit
Sales (250 widgets)	$2500	$10
Less: Variable expenses	2000	8
Contribution Margin	$ 500	$ 2
Less: Fixed expenses	300	
Net Income	$ 200	

income however, since fixed expenses (i.e., rent, etc.) must be deducted from this amount.

1. **Break-Even Analysis**

When the total sales equal the total expenses (variable and fixed), the break-even point has been reached. Beyond this point, each additional sales result in a profit equal to the unit contribution margin. The break-even point can be calculated using simple algebra. The formula for this calculation is: Sales = Variable expenses + Fixed expenses + Profit. Figure 3 shows the break-even point graphically for the widgets example discussed previously. The break-even point for the widgets discussed in the previous example is 150. This was calculated using the formula as follows: $\$10(X) = \$8(X) + 300 + 0$, where X is the number of units that must be sold to reach the break-even point. Therefore, when sales are less than 150 widgets, the company would experience a loss since not all of its costs would be covered. Conversely, if 151 widgets are sold, the net income would be

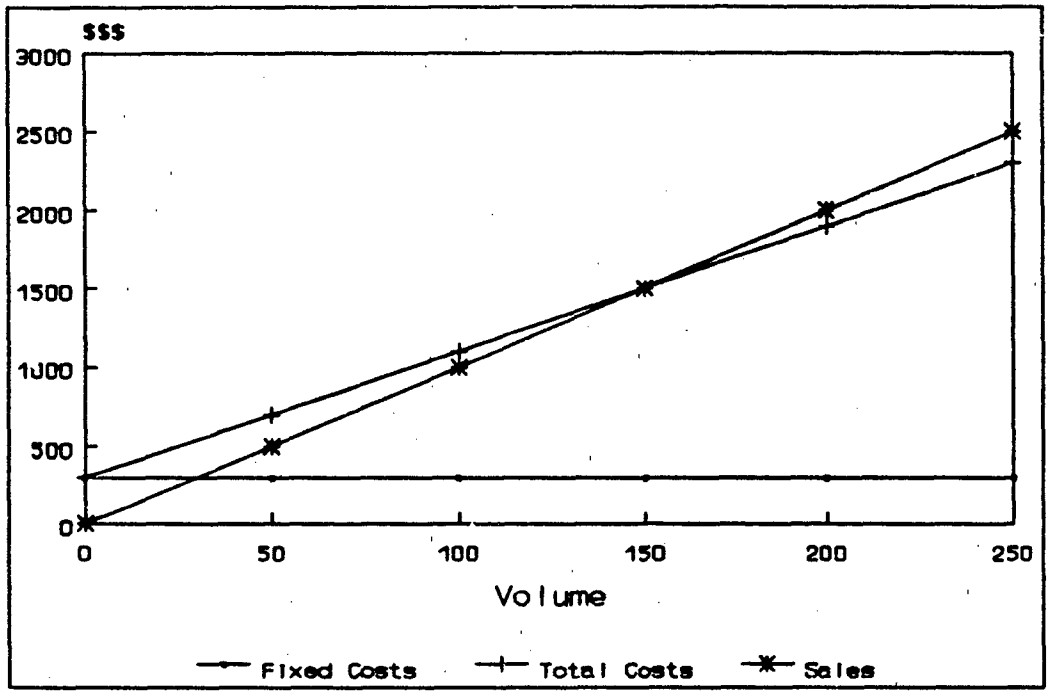

Figure 3. Break-Even Cost Curve

$2, which is equal to the contribution margin (sales revenue less variable expenses.

As was discussed earlier, the variable cost model, C-V-P analysis and flexible budgeting work very well together. They both use variable costs in their computations, and this results in less time being spent in accumulating different types of cost data.

G. Job Order

Job order costing is typically used in manufacturing industries where many different types of products are produced to meet different customer needs. This type of cost system is

also used in the Navy Industrial Fund (NIF). For example, in a ship repair facility where three different types of ships are being overhauled, each would have a job cost sheet assigned to it. The job cost sheet would list the direct labor and direct material costs that have been incurred in overhauling that ship. The total overhead costs for the entire facility are calculated using the predetermined overhead rate equation discussed earlier. The calculation would yield a dollar value per base unit (i.e., direct-labor hours). This value would then be applied to each ship based on its direct labor-hours. Again, it should be noted that if the estimates used for the predetermined overhead rate calculation are inaccurate, it could result in the overhead costs being over or under applied.

H. Conclusion

This chapter has provided six different cost systems that are used in the public and private sector. While reviewing these systems, it was necessary to make some assumptions. The categorizing of costs into only variable and fixed was one of these assumptions. The effort required to perform this task could be substantial, depending on the organization's size, and thus cost the organization a great sum of money and time.

1. Variable

It was assumed, as is generally the case, that the variable costs were linear. This makes computations much

easier. However, variable costs can, and do, exhibit a step-function rather than a linear relationship. Figure 4 depicts the linear and step functions.

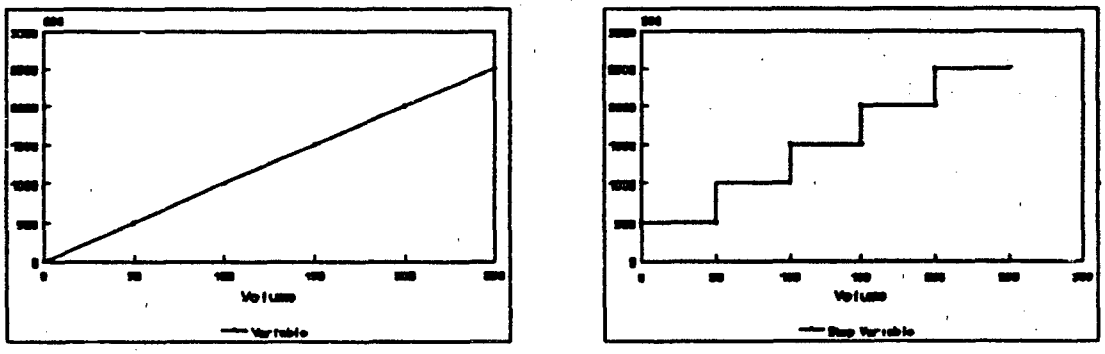

Figure 4. Comparison of Linear and Step Variable Cost Curves

2. **Fixed**

Fixed costs, it was assumed, were constant over time. This is not entirely accurate for every case however. Fixed costs are only constant over a specific period or relevant range. For example, the fixed costs to operate a manufacturing plant could be ten million dollars per year. If an addition was to be added to the plant the following year, the fixed costs would increase to 10.6 million. Over the two year period the costs are not fixed, but they are fixed within each year.

3. **Mixed**

In addition to pure variable and pure fixed costs, some costs exhibit traits of both, depending on the level of activity. In order for these costs to be used in the cost

systems discussed, they must be broken down into their variable and fixed components. An enormous amount of effort, time, and money can be expended in performing this transformation.

4. **Advantages and Disadvantages**

There are some clear advantages and disadvantages inherent to the cost systems discussed. The discussion which follows outlines some of these.

a. Actual

The main advantage with this cost system is that no estimates or forecasts need to be performed and that all costs will be covered. While having all costs covered is an advantage, it is also a disadvantage. By having all costs covered, there is no real incentive to look for more efficient ways to produce the product.

b. Normal

By normalizing the predetermined overhead rate, the unit cost for the product can be kept fairly constant over time, which is an advantage. The biggest problem with this type of cost system is the estimates that are used to arrive at the normalized predetermined overhead rate. If the estimates are not accurate, the system will not perform well.

c. Standard

The biggest advantage of this cost system is that it allows the manager to "manage by exception". The manager

only has to give his attention to items that are not within the set standards. The disadvantage to this system is the actual setting of the standards. Setting wrong or improper standards could lead to bad employee moral and possibly even dysfunctional consequences. This is also a very costly process involving industrial engineers, cost accountants, and operation personnel.

d. Variable

The advantage of this type of cost system is that it's easily integrated with flexible budgets and cost-volume-profit analysis. This allows one type of cost data (variable) to be collected and used in different types of systems. The disadvantage is that fixed costs are not used in the decision-making process. Depending on which accountant you talk to, this could be an advantage or a disadvantage.

e. Cost-Volume-Profit Analysis

The advantage of this cost system is its easy integration with flexible budgets and variable costing. The concept of contribution margin and break-even analysis allow the manager quick and easy methods to view different levels of activity and their associated costs and profits. Again, a possible disadvantage could be the absence of fixed costs in the decision-making process.

f. Job Order

This type of cost system is indispensable when a few unlike units are being produced. It allows all of the associated costs for each particular product to be assigned to its job sheet. A possible disadvantage of this type of system is once again the estimations required to arrive at the predetermined overhead rate. If the estimates are not accurate, the cost system will not function very well, which could result in the company losing money if the overhead is being under-applied.

IV. UNIT COSTING AND THE DoD

A. INTRODUCTION

The CIM initiative will require eight to ten years to become fully implemented. During this time, other DoD initiatives are being implemented, such as consolidation and unit costing. At some point in the future, the CIM initiative, which is a global concept, will have to deal with how these programs are going to be incorporated into CIM. This incorporation could consist of the CIM adopting one of these other initiatives fully, or totally ignoring it. CIM is viewed as being the global management information system (MIS) for the DoD. Any other system must therefore be a subset of CIM. This chapter focuses on the unit costing concept that the DoD is currently implementing and compares it to some of the cost systems discussed previously in Chapter III.

B. BACKGROUND

The unit cost initiative in the DoD has its roots in a 10 August 1989 memorandum [Ref. 8] from the Principal Deputy Comptroller of the DoD, Donald B. Shycoff. In this memo, Mr Shycoff states that although the government is not a profit-making business, it would benefit from business-like concepts in planning and budgeting operating activities. He states that the environment and the culture of activities need to

change in order for this to take place. Since the government is not a profit-making business, costs will have to be cut in order to meet reduced budgets. Shycoff states that the only way to accomplish this is to use unit costing.

In his 10 April 1990 memorandum [Ref. 9], Mr. Shycoff continued the implementation of the unit costing concept by identifying the eight functions that would be implemented. These functions include:

- supply operations
- supply depots
- health care
- recruiting
- base operations
- military training
- depot maintenance
- commissaries

The memo called for implementation of these functions by 1 October 1990 (FY91). Data for this initiative is currently being provided by the Defense Manpower Data Center (DMDC) in Monterey, California. Financial reports from the services for 1989 are being collected to provide a baseline for the unit costs.

C. UNIT COSTING

Before discussing the DoD's unit costing guidance in detail, a review of unit costing techniques is in order. Recall from Chapter III that a unit cost is computed by dividing the total costs to produce the product or service by the total number of units produced. For example, if it costs $50.00 to produce two widgets, the unit cost of each widget is $25.00 ($50.00/2).

There are two components to the unit cost equation. The numerator, which consists of the total costs including direct costs, indirect costs, and general and administrative (G & A) expenses and the denominator which is the total number of units. The denominator is measured in the output unit that is chosen, such as direct-labor hours, machine hours, number of invoices processed, etc. Each of these components require further explanation.

1. Total Costs (Numerator)

The numerator of the unit cost equation consists of the direct and indirect costs along with the G & A expenses associated with it. Recall from Chapter III that whether a cost is direct or indirect depends on one's frame of reference. The same holds true here.

a. *Direct Cost*

A direct cost is one that is clearly identified and traceable to a specific product or service. A professor's

salary would be a direct expense of conducting a class that he teaches. For a specific department, such as purchasing, all costs of workers, machines, utilities, and supervision are direct costs of that department.

b. Indirect Cost

An indirect cost is one that cannot be traced to one specific product or service or a department. It's costs are incurred by more than one product or service, but not by all products or services. Referring to the example concerning the professor, his secretary's cost would be an indirect expense. The secretary works for one department and provides a service to all the professor's in that department. She does not work for all of the professor's on the campus.

c. General and Administrative Expenses

General and administrative expenses can be thought of as overhead. These expenses cannot be associated with a specific product or service, but benefit all products or services. Again using the college professor example, the cost of the janitorial staff, personnel department, security, etc. are all G & A expenses. None of these expenses can be traced directly to a particular professor, course, or department but they benefit the entire college and all of its professors.

d. Allocation

Because they are not directly traceable to cost objectives, indirect costs and G & A expenses must be

allocated to cost objectives. In order to allocate these costs, a base is needed. Part 403 of the Cost Accounting Standards Board lists some suggestions for possible bases. The concept of allocation was discussed earlier, and an example was provided in Tables IV through VI in Chapter III.

It should be noted that in depot maintenance, the DoD, and specifically the Department of the Navy (DoN), is already using a unit cost system--job costing. Ship overhauls, aircraft repair, public works, and computer systems are all costed on a unit basis, except that not all of the G & A may have been allocated.

2. **Measure of Output (Denominator)**

The denominator of the unit cost equation contains the total number of units of some measure of output. Counting the number of units is not difficult, however deciding on the correct measure of output to use can be. For a manufacturing company, counting the number of physical units produced (e.g., computers, automobiles) would be one possible measure of output. This would be very easy to use in practice and makes sense. In the DoD however, services rather than products are usually the output of operating activities. A measure of output needs to be chosen so that it allocates the costs fairly to all outputs (i.e., products or services).

Choosing a good measure of output is required for the unit costing system to work effectively. After a lengthy

investigation by DoD task groups for each of the eight unit cost areas, agreement was reached on measures of output. For the eight functions that are currently being implemented using unit costing, Table XIII provides a list of the measures of output that are being used.

D. DoD UNIT COSTING GUIDANCE

After numerous working drafts, the DoD's most recent unit cost guidance was published in an interim form on 5 October 1990 [Ref. 10]. As of this writing, no further guidance is available. This guidance is being used by each of the eight functions identified earlier.

The guidance states that a business type accounting system should be used. The guidance states:

> The goal is to have each product or output bear as accurate a cost as possible. No savings are directly attributable to unit cost. Savings are only realized as processes are changed or eliminated and the effects of these changes are reflected in the actual cost per output. [Ref 10:p. 2]

The guidance goes on to say:

> A unit cost system will not solve all the problems of managing an activity or function. It is not a substitute for management, but rather another tool for managing. Activities must still be responsive to corporate policy, even if that policy increases the unit cost. This system provides ability to focus on the cost of a policy. It will identify costs, not eliminate them. Recognition of total costs, along with the flexibility to manage costs, provides the opportunity for improvement. [Ref 10:p. 2]

TABLE XIII

MEASURES OF OUTPUT [REF. 10]

FUNCTION	PRIMARY OUTPUT MEASURES
Base Operations	1. Base Support Services cost per average FTE workforce 2. Facilities support services cost per square foot
Commissaries	1. Appropriated funds cost per dollar sales 2. Stock Fund cost per dollar sales 3. Trust Fund cost per dollar sales
Depot Maintenance	1. Profit or loss based on fixed price policy
Health Care	1. Cost per medical work unit
Military Training	1. Cost per recruit training graduate 2. Cost per officer candidate graduate 3. Cost per specialized training graduate 4. Cost per undergraduate pilot graduate 5. Cost per professional education graduate
Recruiting	1. Cost per contracted enlisted workyear 2. Cost per medical officer candidate recruited 3. Cost per other officer candidate recruited
Supply Depots	1. Cost per line item received 2. Cost per line item shipped
Supply Operations	1. Cost per dollar of stock fund sales

1. Budgeting and Resourcing

The guidance discusses how the eight functions will receive their budgets for the fiscal year. This can best be shown through an example. In the upcoming fiscal year (FY1), the activity expects to perform a workload of 1,000 units. In FY0, the activity performed a workload of 2000 units at a cost of $10,000. This equates to a unit cost of $5.00 ($10,000/2000). For FY1, the activity will be provided with a budget of $5,000 ($5.00 X 1,000), which is equal to the unit cost times the number of units expected to be produced. However, this is not a guaranteed amount for the activity. If the activity produces only 500 units, they will only receive $2,500 ($5 x 500). There is one very big problem with this, it assumes that all costs are variable. The interim guidance states:

> ...all costs are variable which is not the case. However, until such time as variable and fixed costs are distinctly defined and supportable, earnings will fluctuate with work load as though all costs are variable and adjustments will be made when necessary. [Ref 10:p. 8]

2. Computing Unit Costs

Recall from Chapter III the discussion concerning break-even analysis. The DoD guidance assumes that all of an activity's costs are variable and thus bases the activity's funding on its output. This can lead to major problems since many of the costs are fixed. For example, while civilian personnel costs are normally viewed as variable costs, they really are not. Much of the DoD's work force is tenured and it would prove very difficult to reduce this work force. Therefore, the cost of the personnel is relatively fixed and will not fluctuate much with an activity's output.

If an activity's costs are purely variable, the cost curve will resemble Figure 5. As the level of activity increases, the funding also increases. However, the unit cost remains constant at varying levels of activity. The unit cost is $5.00 at both points A and B.

Refer again to the above example where the activity was budgeted $5,000. If we assume that there are variable and fixed costs and that the fixed costs are $3,000 then the cost curve would be as shown in Figure 6. The break-even equation for this curve is $5(X) = 3000 + 3.5(X)$, where X is the number of units. The break-even point is 2,000 units (point X).

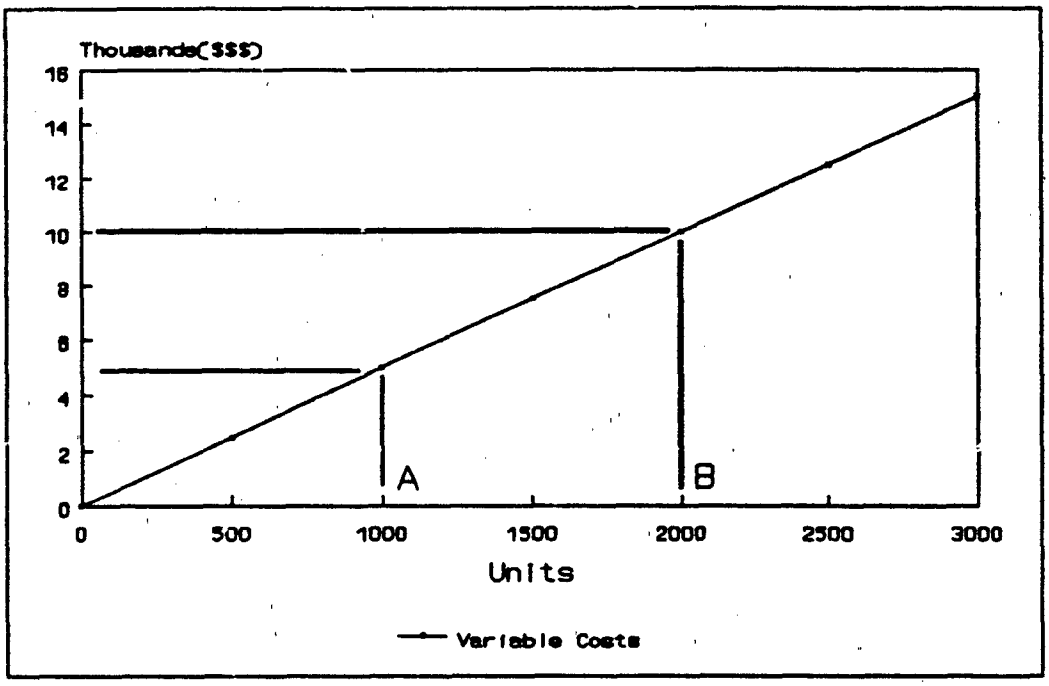

Figure 5. Pure Variable Costs

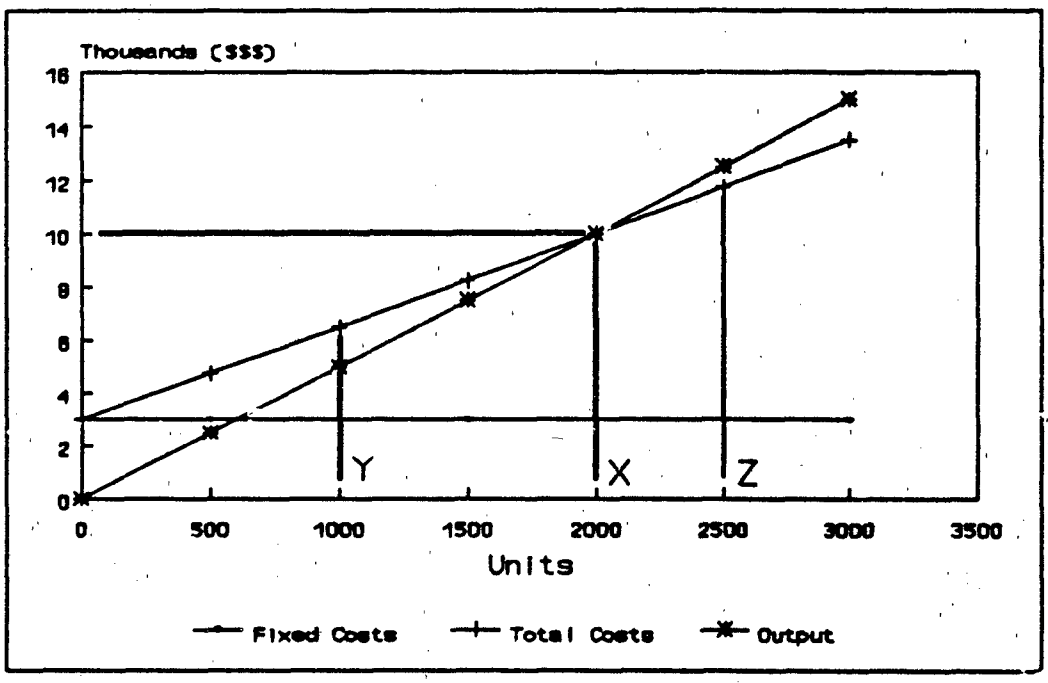

Figure 6. Variable and Fixed Costs

At point X, the unit cost is $5.00 which is what the budget is based upon. If the activity produces only 1000 units (point Y), they will only receive $5,000 in funding. If the activities fixed costs are $3,000, they will not receive enough funding to cover their total expenses. At point Y, the unit cost required to cover all expenses is $6.50. Since the activity is only budgeted at $5.00 per unit, they will sustain a loss of $1500 (($6.50 - $5.00) X 1000 units). Alternatively, if their output is 2,500 units (point Z), they will receive $12,500 and their fixed costs remain at $3,000. At point Z, the unit cost required to cover all expenses is $4.70. Since the activity is budgeted at $5.00 per unit, they will earn a profit of $750 (($5.00 - $4.70) X 2500 units). This would provide the activity with a surplus of funds. Thus, the activity would have no incentive to view all costs and look for inefficiencies. Table XIV shows the profit and loss computations at points Y and Z.

Over the long run (more than one year), all costs are considered to be variable. By adopting this assumption, the DoD guidance of treating all costs as variable would prove to be correct. However, since the activity receives its budget based on the previous year's output (short-run), the costs need to be broken down into their fixed and variable components. This is the only way to ensure that the budgeting process is fair and accurate. One could also take the long run view and use full costs in which the separation of

TABLE XIV

COMPUTATION OF PROFIT/LOSS

	Point Y	Point Z
Revenue	$5,000	$12,500
Less Variable Costs	3,500	8,750
Contribution Margin	1,500	3,750
Less Fixed Costs	3,000	3,000
Profit/Loss	($1,500)	$750

variable and fixed costs become unimportant. Over the long run, only total costs have to be covered.

E. COMPARISON TO OTHER COST MODELS

Unit costing could be used with any of the six cost systems discussed in Chapter III. Currently, the DoD does use a unit cost job order system for their industrial funds.

1. Standard Costing

The DoD unit cost guidance is very similar to the standard cost system described earlier. The DoD develops a unit cost based on past performance. This "standard cost" is then used to provide the activity with the funding for the current year. As was shown in Figure 6, the unit cost varies at different levels of activity due to fixed costs. This would require the standard, or unit cost, to be reset yearly in order to reflect the current cost. One of the problems with this type of system in the DoD is that there is no physical output, only performance of services. Also, it is hard to define the labor and material standards per output.

2. C-V-P Analysis

The DoD unit cost system and C-V-P analysis are different. The DoD accounts for total cost per unit. The C-V-P system looks only at variable costs because they change with volume. Fixed costs are charged against the period. Table XI in Chapter III demonstrates the differences between variable and product costing. The C-V-P system could be made to conform to the DoD system by adding the fixed costs to the variable costs and then dividing by the total output.

A similarity between the DoD unit cost system and C-V-P analysis is the concept of the break-even strategy. The DoD's goal is to set the unit cost such that an activity will show no profit or loss for the period--break-even. As was shown in Figure 6, it will be very difficult for an activity to break-even due to the effect that the fixed costs have on the unit cost.

3. Job Cost

As was stated earlier, the Navy and the DoD currently use the job cost system in a unit costing fashion for industrial funded activities. This system is well suited when small numbers of dissimilar types of products such as ship overhauls or computer programs are being provided. The problem with our existing job cost systems is that they tend not to allocate all of the G & A costs. This results in the activity taking a loss. This system can be made to work, but

the activity must ensure that all costs, including G & A, are fully allocated to each job.

F. CONCLUSIONS?

One of the problems when using unit costs in the DoD is that for many activities there is not an easily measurable output such as there is in a manufacturing company. The DoD deals more with services than with products and this presents a problem when deciding on the measure of output.

With the DoD's unit costing system, budgets are provided based on expected work load and unit costs. What happens when an activity needs to buy a new copying machine or a computer? The interim guidance [Ref. 10] states that depreciation will be taken on all new investments in property, plant and equipment. This depreciation amount must provide a reserve for replacing assets in the future. However, this depreciation only applies to new items. None of the existing property, plant or equipment will be depreciated in this way. This will lead to no reserves for replacing the current assets. Since the cost of the new asset was not added into the unit cost data, the activity will have to submit a new appropriation for this new equipment. The same thing will apply when a new facility needs to be constructed or an old one renovated. Where is this money going to come from? While there is no clear guidance as to where these funds will be obtained from, CIM personnel need to be aware of these type of

problems. These type of issues must be incorporated into any long range plan for the DoD.

V. CONCLUSION

A. SUMMARY

Chapter I provided a brief background on the Corporate Information Management (CIM) initiative and discussed such issues as: what is CIM, why CIM was initiated, the purpose of CIM, and the implementation of CIM. This overview, of this innovative DoD approach, is necessary for understanding the remainder of the thesis.

Chapter II discussed the current methodology that is being employed for the CIM initiative. This chapter provided a brief summary of the CIM Process Guide, which consists of over 220 pages. Discussions in this chapter included the three-phase methodology being used and provided a break down for each of these three phases. These phases span eight to ten years for completion.

Chapter III provided a review of six of the most commonly used cost systems in the public and private sectors. The cost systems reviewed included: actual, normal, standard, variable, cost-volume-profit analysis, and job costing. This chapter also included a discussion on three classifications of cost: direct, indirect, and manufacturing overhead costs. Differences between the behavior of costs, i.e., fixed and

variable costs, were discussed, along with the advantages and disadvantages of each of the six cost systems.

Chapter IV described the current implementation of another DoD initiative--the unit cost system. A discussion of budgeting and resourcing was covered along with how the unit costs were determined. A review of unit costing techniques was also provided to reacquaint the reader with the process. This chapter concluded with a comparison of unit costing to three of the cost models discussed in Chapter III.

B. COST MODEL

CIM personnel have two distinct directions that can be followed in adopting a cost system for CIM:

- Full cost
- Variable cost

The DoD is currently moving in the direction of the full cost system with the unit costing initiative. All costs are put into the numerator of the unit cost equation. This is the correct model to use since the DoD is viewing all costs as variable. Over the long run, all costs will be variable, and thus the full cost model seems appropriate for cost budgeting and control.

The DoD/DoN already use this type of cost model in their industrial activities. The DoD/DoN use job costing and break-even profit centers to implement this cost model.

The other approach is to use a variable cost model. This method requires that all costs be broken out by type of behavior: fixed and variable. Determining cost behavior can be very costly and take an enormous amount of time. However, if the costs are separated by type, then the variable costing system and C-V-P analysis can be used. C-V-P analysis, break-even analysis, and flexible budgets all require only variable costs in their calculations. The fixed costs that are incurred are charged against the period. A review of Figures 5 and 6 will show that unit costs will not be accurate if the fixed and variable costs are not separated.

In my opinion, variable costing and its related techniques would provide the greatest benefit to the DoD for yearly budgeting and cost control within the short-term decision horizon such as one year. C-V-P analysis, break-even analysis, and flexible budgeting would provide managers with the tools necessary to look for inefficiencies and also make it easier to adjust to varying levels of activity. The biggest "roadblock" to utilizing this variable cost system is the time and effort that must be spent to determine cost types.

CIM personnel must decide early on what cost model is going to be used so that its information requirements will be included in the model that CIM is developing.

C. NON-FINANCIAL CONSIDERATIONS

Although only financial considerations were discussed in this thesis, CIM also needs to review non-financial considerations. For example, in the civilian personnel area, measures such as turnover rates, absenteeism, etc. should be included when developing the initiative. CIM personnel need to be aware that just dealing with the financial considerations is not enough.

D. FUTURE RESEARCH

The DoD unit costing initiative began implementation in October 1990 (FY91). Since unit costing is so new, studies of its effectiveness are not available. A recommended follow-on study would be to review the activities that have adopted the unit costing concept, and provide an analysis of the effectiveness of unit costing, and also to investigate how unit costing fits the particular CIM area. Based on these results, CIM personnel would then have sufficient data to justify the incorporation or non-use of unit costing. Until unit costing develops a few years of data, it will not be feasible to conduct this type of study.

LIST OF REFERENCES

1. Leong-Hong, Belkis. CIM Functional Groups: Overview and Status. Presentation. Office of the Secretary of Defense, 18 June 1990.

2. "The DMR at Work: Toward Six Broad Goals," *Defense 90*, March/April 1990.

3. Atwood, Donald J., Official Memorandum, Subject: DoD Corporate Information Management, 4 October 1990.

4. Addington, David S., Official Memorandum, Subject: Corporate Information Management, 6 November 1990.

5. Corporate Information Management Process Guide, CIM Office, Office of the Secretary of Defense, August 1990.

6. O'Keefe, Sean O., Official Memorandum, Subject: Guidelines On Interim Standard Information Systems, 25 June 1990.

7. Garrison, Ray H., *Managerial Accounting: Concepts for Planning, Control, Decision Making*, Business Publications, Inc., 1979.

8. Shycoff, Donald B., Official Memorandum, Subject: Development of a Management System Based on "Cost Per Output", 10 August 1989.

9. Shycoff, Donald B., Official Memorandum, Subject: Total Cost-per-Output Measures, 10 April 1990.

10. DoD Unit Cost Resourcing Guidance(INTERIM), Department of Defense, 5 October 1990.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2.	Library, Code 52 Naval Postgraduate School Monterey, California 93943-5002	2
3.	Tung Bui Code AS/Bd Naval Postgraduate School Monterey, California 93943-5100	1
4.	Joseph G. San Miguel Code AS/Sm Naval Postgraduate School Monterey, California 93943-5100	1
5.	LCDR R. L. Knight Code AS/Kt Naval Postgraduate School Monterey, California 93943-5100	1
6.	LT David P. Faulk 186 Heather Drive Monroeville, Pennsylvania 15146	1

END

FILMED

DATE:
1-92

DTIC