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Systems For Determining Real Costs In Selected Research And Development Organizations.

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SYSTEMS FOR DETERMINING REAL COSTS IN SELECTED RESEARCH AND DEVELOPMENT ORGANIZATIONS

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SYSTEMS FOR DETERMINING REAL COSTS IN SELECTED RESEARCH AND DEVELOPMENT ORGANIZATIONS

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THESIS

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ABSTRACT OF THESIS

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ABSTRACT

Today's society demands that more and more federal funds be made available to combat social ills, such as urban development, housing, environment, and welfare. The amount of funds needed to solve these social problems probably will not be provided by a large increase in the total federal budget, but by some reduction and redistribution in funding for some of the present ongoing programs. This will require better management techniques to accomplish program objectives with reduced funds. Cost accounting is one management technique that can improve economy and efficiency. To this end, the Department of Defense requires that cost accounting be used in all their research and development projects.

Some of the Defense laboratories have had problems in implementing the cost-accounting system imposed on them by the Department of Defense. The Army and Navy are using cost-accounting systems which they implemented after some deviation and some delay. The Air Force has not yet (1972) established a cost-accounting system for their research and development work.

It is considered that some of the problems in the Department of Defense laboratories may be caused by the use of significantly new or different cost-accounting principles. The approach used in this thesis is to define the cost-accounting techniques used by a government contractor, a Navy facility, and an Air Force laboratory in the performance of research and development work. The cost-accounting

techniques used by these three different organizations are compared to determine if there are any significant differences among them. The technique used by the contractor is used as a basis for comparison because they have used cost-accounting techniques in their private enterprises as well as for justifying costs on government contracts for years.

The results of the study show that the Defense laboratories do not carry a cost burden for the administrative levels above the laboratory or for capital investments such as buildings or special facilities in their local cost-accounting systems. By contrast, a private industrial concern includes all such costs. It is concluded that although there are significant differences between the detail of the costs accounted for in the DOD laboratories and those accounted for in industry, the difference is generally that less detail of costs is accounted for by the DOD laboratories. Therefore, it is concluded that the problems encountered by the DOD laboratories in implementing cost accounting are not inherently caused by the cost-accounting principles used.

The study recommends that a uniform system of cost accounting be used in all government research and development, that a training program be provided to train all levels of employees in the purposes and advantages of cost accounting, and that a uniform cost-accounting system be made applicable to all levels and all fields of government.

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CHAPTER I

INTRODUCTION AND BACKGROUND

A. Introduction

Research and development organizations of the Department of Defense (DOD) have been directed to use a concept of service funding, or alternate working capital arrangements, in their operations. Service funding is a form of industrial funding in which all costs identified with a given work effort are charged to that work effort. Any alternate working capital arrangements must provide accounting data in a format that is compatible with those produced under a service funding arrangement and must be approved at the Department of Defense[1] level. The purpose of these funding arrangements is to simulate a buyer-seller relationship in the research and development efforts performed by the DOD laboratories thereby promoting economy and efficiency. A good accounting system for all the costs associated with a given work effort is therefore necessary to these funding arrangements.

B. Background

Service funding for research and development can trace its beginnings to the development of what is called the program budget. As far back as 1912 the Taft Commission on Economy and Efficiency stressed the importance of budgeting

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[1] U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), p. 20.

for the subjects of work to be done.[2] This was probably the first official recognition of program or performance budgeting by the federal government.

Little was done in the federal government to require program budgeting until after World War II, although during the War, a form of program budgeting was used by the War Production Board as part of the wartime fiscal control system.[3] Then in 1949 the Hoover Commission recommended the following Recommendation Number 1:

> We recommend that the whole budgetary process of the Federal Government should be refashioned by the adoption of a budget based on functions, activities, and projects: this we designate a "performance budget."[4]

The recommendation was made into law by the National Security Act Amendment of 1949 and the Budgeting and Accounting Procedures Act of 1950. In 1955, the Second Hoover Commission recommended a "program budget" and suggested improvements for the government accounting practices that would simplify budgeting on a cost basis.

W. H. McNeil, who was the Assistant Secretary of Defense (Comptroller) from 1949 to 1959, selectively used the recommendations of the First and Second Hoover Commissions

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[2]Jesse Burkhead, *Government Budgeting* (New York: John Wiley & Sons: 1956), p. 134.

[3]David Novick, "The Origin and History of Program Budgeting" in *Program Budgeting*, ed. by David Novick (Cambridge, Mass: Harvard University Press: 1967), pp. xvi-xix.

[4]Commission on Organization of the Executive Branch of the Government, *Budgeting and Accounting* (Washington: 1949), p. 8.

to develop the foundations for the modern financial management in the DOD.[5]

However, little was done in actual program budgeting until 1961 when Robert McNamara became Secretary of Defense. Mr. McNamara was given two general instructions by President Kennedy:

> Develop the military force structure necessary to support our foreign policy without regard to arbitrary budget ceilings.
>
> Procure and operate this force at the lowest possible cost.[6]

Charles J. Hitch, who served as Assistant Secretary of Defense (Comptroller) under Mr. McNamara, had the task of implementing the Presidential guidance. Hitch developed the actual methods used in program budgeting in the DOD. The planning-programing-budgeting concept used by the DOD employs five major elements. These elements are defined by Novick as

> 1. A program structure in terms of missions, forces, and weapon support systems.
> 2. The analytical comparison of alternatives.
> 3. A continually updated five-year force structure and financial program.
> 4. Related year-round decision making on new programs and changes.
> 5. Progress reporting to test the validity and administration of the plan.[7]

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[5]Steven Lazarus, LCdr, USN, "Planning-Programing-Budgeting Systems and Project PRIME," *Defense Industry Bulletin*, Vol. 3, No. 1 (January 1967), p. 1.

[6]*Ibid.*, p. 3

[7]David Novick, "The Department of Defense," in *Program Budgeting*, ed. by David Novick (Cambridge, Mass: Harvard University Press: 1967), p. 89.

The programing concept as applied by Mr. Hitch to defense management continued a trend initiated by Mr. McNeil which resulted in significant improvements in specific individual management systems. However, there was no comprehensive effort to relate these individual management systems to each other or to the overall needs of the DOD in resource management. This resulted in numerous different management systems of varying degrees of usefulness.[8]

When Robert N. Anthony was appointed Assistant Secretary of Defense (Comptroller) in the summer of 1965, he was requested by the Secretary of Defense to make major changes in the department's programing, budgeting and accounting systems by July 1, 1967. This effort was called Project PRIME (acronym for Priority Management Efforts). He was also asked to perform the following tasks relating to resource management systems:

1. Study systems for the management of inventory and capital acquisitions.

2. Develop a top management reporting system.

3. Improve management education and motivation so that the new systems could be put to effective use.

4. Coordinate the development of new resource management systems and changes in existing systems.

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[8]U.S. Department of Defense, *A Primer on Project PRIME*, (published by Assistant Secretary of Defense (Comptroller) November 1966), pp. 3-4.

These tasks were to start immediately, but were not tied to the July 1, 1967, implementation date for Project PRIME.[9]

The resource management systems with which Mr. Anthony became involved are defined as those methods and procedures that are used throughout the DOD that 1) deal with resources, 2) are intended to aid in the management of such resources and 3) constitute systems. In this definition, "systems" applies to recurring orderly cycles of planning, reporting and feedback information.[10]

Systems prior to the resources management system permitted programing to be done in an orderly and logical manner, and trade-offs to be performed between alternates, but it was extremely difficult to relate programs to federal budget items. This is because programs are related to missions (outputs) while the budget is related to resources (inputs). Program items would include as missions entries like strategic forces, whereas the budget entries would include entries like military personnel salaries, operations and maintenance, or training support, all of which are resources used in the mission of strategic forces. It was extremely difficult to backtrack from the DOD program (mission) expenses to the budget resources appropriations. That is, it was nearly impossible to determine the amount of resources

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[9] *Ibid.*, p. 4.

[10] *Ibid.*, p. 7.

consumed in a given program. Therefore, Project PRIME was started.

Project PRIME, which was a special application of the Resource Management System, can best be defined by the following quote directly from the DOD publication on PRIME:

> Project PRIME is the name given to that portion of the Resource Management Systems effort which must be accomplished by July 1, 1967. Basically, Project PRIME seeks to revise the programming system, the budgeting system, and the management accounting system so that they will be more useful to managers at all levels. It is the core activity in instituting Resource Management Systems. The essence of the changes Project PRIME is making can be described in a few points:
>
> 1. Project PRIME is concerned with operating resources, as contrasted with investment resources. It has to do primarily with resources that are financed under the Operation and Maintenance and Military Personnel appropriations, not with the Procurement, Construction, or RDT&E appropriations.
> 2. Programing, budgeting, and management accounting will have an integrated structure. This means that the information used in these three systems will be consistent.
> 3. The focus in on expenses, that is, on the resources consumed by organization units in carrying out their part of the program. The programing system provides rough data on expenses by program element, but the present budgeting and accounting systems provide no information corresponding directly to program elements. In the current budgeting and accounting systems, perhaps only 15% to 20% of the resources actually used by an organization are reported as costs of that organization. The long-range goal is to charge an organization unit with 100% of the measurable expenses that it incurs.[11]

The definition of PRIME makes it quite clear that the DOD is attempting to develop a system of cost accounting. PRIME was a forerunner of the overall resource management

[11] *Ibid.*, p. 13.

system for the Department and specifically excluded research, development and test and evaluation appropriations. Burkhead and Miner have an appropriate comment on the time between introduction of program budgets and cost accounting:

> Finally, six years after the initial introduction of the PPB system, the Comptroller of the Department of Defense initiated a revision in cost accounting procedures to assure a uniform DOD-wide approach and to link cost accounts and budget accounts.[12]

Then, on January 24, 1968, the Department of Defense published Instruction Number 7220.24, "Accounting for Research and Development" (reissued on September 18, 1969), which in effect required service funding, or an approved alternate, in the DOD laboratories. This instruction provides general guidelines for the development of accounting systems for research and development which will

> 1. Encompass all financially-oriented data collections systems used in programing, budgeting and accounting and to meet both internal and external reporting requirements;
> 2. Serve the needs of managers at all echelons within the DOD;
> 3. Meet the data requirements of the Congress, the Bureau of the Budget, the Treasury Department and other external Government agencies;
> 4. Adapt basic resource management system concepts stated in DOD Directive 7000.1 (reference (b)), recognizing the peculiarities of R&D, but providing maximum compatibility of information and compatibility with all other systems;
> 5. Employ the most useful information processing techniques, including use of automatic data processing equipment when applicable, and optimum standardization of data elements and codes as set forth in DOD Directive 5000.11 and DOD Instruction 5000.12 (references (c) and (d)); and

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[12] Jesse Burkhead and Jerry Miner, *Public Expenditures* (Chicago and New York: Aldine-Atherton: 1971), p. 183.

6. Conform to statutory requirements for financial management systems, including the accounting principles, standards and requirements prescribed by the Comptroller General of the United States and applicable related legislation.[13]

As shown by the guidelines for this accounting system for research and development, service funding is only a resource management system modified to be applicable to research and development.

C. Working Capital Funds

Service funding is a specialized type of working capital or industrial funding used in research and development work, and the term "service funding" is used only within the DOD. As a Department publication states:

> The industrial funds at R&D activities will be referred to by the more descriptive term "service fund" internally within the Department of Defense, but will be included in the industrial fund accounts of the Treasury and Bureau of the Budget. ...[14]

Industrial-type funding has been used for years in some DOD operations such as shipyards, printing plants, and arsenals. They are a form of working capital funds used in the Department to operate certain facilities in an industrial manner. For example, operation and maintenance funds are

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[13] U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), p. 1.

[14] U.S. Department of Defense, *Systems Description, Budgeting and Accounting for Research and Development* (published by Assistant Secretary of Defense (Comptroller) May 1968), p. 5.

available to keep a Navy ship in operating condition. When the ship goes into the shipyard for repairs, the ship (user) pays for the costs of the repair out of its maintenance funds. Naturally, the system cannot permit the complete flexibility that a true private industrial operation has, due to the peculiarities of the Defense operation. As in the ship example, it can be seen that a ship must be scheduled into the shipyard somewhat independent of its Captain's desires so that the yards will be used most efficiently.

Another example of working capital funds is the "stock fund." This is a fund that is used to stock commonly used items and has been used by the Navy since 1893. In this case, the ultimate customer pays for the items as they are drawn, and the payment is used by the supplying organization to replenish its stocks.

When the industrial fund and stock fund systems are initiated at a facility, an initial supply of funds is usually provided to start the operation. As the using organizations draw the supplies or services from the funds, they reimburse the funds for the value received. These payments are then fed back into the system to pay for replenishment of supplies or material.

Service funding is to apply the resource management system that was originally developed for operations and maintenance programs to research and development, with modifications as necessary due to the uncertainties of measurable outputs in research and development. It is intended

that all costs associated with the smallest identifiable work effort in research and development will be charged to that work effort. All elements of costs will be charged to a job order number assigned to a specific work effort. This includes

Civilian pay
Military pay
Travel
Materiel
Contracts - Research and Development, or Service
Computer time
Communications
Transportation-of-Things
Equipment
Bench stock
Overhead

These charges are made against all in-house laboratory work, where applicable. Any work that must be done outside the laboratory in other government organizations, including other laboratories or test centers of the same service, must be done on a Project Order.

The Project Order identifies the work to the project and task of the requesting organization so that all costs of a research and development work effort will be identified to that work effort. Typical examples of Air Force organizations that are heavily involved in doing work for others on Project Orders are the wind-tunnel facilities at Arnold Engineering Development Center in Tennessee and the sled-track facility at Holloman Air Force Base, New Mexico.

The service funding operation requires that each research and development transaction be recorded only once and recorded in a way that permits identification of the

transaction. Data may be accumulated, identified and aggregated by

> Program Year
> The R&D program (Program 6 of the Five-Year Defense Program), when applicable, and the RDT&E Appropriation
> Budget activities and the Five-Year Defense Program categories
> Program element and budget subactivity
> R&D project
> R&D task
> Contract or Job Order
> Organization (agency/command/installation/activity)
> Responsibility Center
> Cost Center
> Functional Category
> Element of expense[15]

This will permit ready visibility to the laboratory commander, or any level of management, of the funds expended on any work effort. It will also provide cost data for use in the Five-Year Defense Plan to update estimated costs for completion of a project or for use in making budget estimates for new projects. The Department of Defense Instruction states the objectives as

> The basic objectives of the R&D accounting system are to provide information that will assist managers to:
>
> 1. Estimate the needs for resources to implement plans;
> 2. Justify annual requirements for resources;
> 3. Identify major alternatives and obtain financial information useful in making choices; and
> 4. Obtain optimum use of resources received by:
>   a. identifying all costs of work performed by both end product and performing activity;
>   b. providing the base for timely reports of performance in relation to plans in

[15] *Ibid.*, pp. 20-21.

the format needed for both program and installation management; and

c. serving as the basis for the establishment of appropriate incentives for all personnel associated with the DOD R&D mission.[16]

The Army and Navy have been using various types of industrial fund systems for years. Specifically the Army's Harry Diamond Laboratories in Washington, D.C., have been under industrial funding since they were transferred from the National Bureau of Standards in 1956. This laboratory does research and development work in ordnance and ordnance-related areas. Likewise, the Naval Weapons Center, which covers the full spectrum of research, development, test and engineering, has been under industrial funding since 1952. In contrast, the first Air Force research, development, test and engineering facility to operate under an industrial fund was the Arnold Engineering Development Center (AEDC) which went into a test operation of what can now be termed "service funding" in fiscal year 1969. AEDC is a contractor-operated facility primarily engaged in engineering development testing. It was selected as the first Air Force research and development facility to be placed under service funding because it was believed that the contracted operation would ensure a good accounting system as a base for charges.

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[16] U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development," September 18, 1969, pp. 2-3.

The Department of Defense Instruction required that each DOD component concerned was to implement, where feasible, a system consistent with the instruction by July 1, 1968. Those changes that could not be made by that date were to be accomplished as soon as feasible and all aspects of the instruction were to be fully operational by July 1, 1969.[17] The Army and Navy were very nearly able to meet these dates because of their previous experience in industrial funding. The Army met the requirements of the instruction by using an alternate working capital arrangement for some organizations where service funding was not appropriate.[18] The Navy had some difficulty in meeting the rather short suspense date, but did implement the instructions Navy-wide on July 1, 1971.[19] The Air Force had difficulties in implementing the instructions at the Arnold Engineering Development Center and consequently suggested alternate arrangements to the Assistant Secretary of Defense (Comptroller).[20] The causes of these Air Force problems include the following:

1. Insufficient time to study and prepare for service funding

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[17] *Ibid.*, p. 20.

[18] U.S. Department of Defense, *Compendium of a Regional Symposium on Improvements in Budgeting and Accounting for Research and Development in the Department of Defense* (published by Assistant Secretary of Defense (Comptroller) 1971), p. 59.

[19] *Ibid.*, p. 74.

[20] *Ibid.*, pp. 93-94.

2. Arnold Engineering Development Center poor choice for first service fund operation (although only one possible at time)
3. Customer charges cover too much cost
   - should exclude military support
   - should exclude cost of basic capability
4. Flexibility available within system not exploited
5. Program has had too much financial emphasis
6. Tendency toward over-simplification[21]

D. Problem Statement

It is the intent of this paper to determine if there are any significant differences between the cost accounting principles employed by the Department of Defense research and development laboratories and the cost accounting principles employed by a private industrial organization engaged in research and development.

E. Theoretical Framework

The concept of accounting is not new to the DOD operation. It has been used by the DOD since establishment of the department to ensure staying within the budget. Accounting (or bookkeeping) itself has been used for centuries in business enterprises as a tool for effective management. Archeological remains indicate that as early as 2300 BC, clay tablets and devices of wood and stone were used to record payments for services.[22]

Accounting is generally defined as the principles and technical mechanisms used to classify, record, and

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[21] *Ibid.*, pp. 91-92.

[22] Clarence Rufus Rorem, "Accounting," *Encyclopaedia Britannica*, 1960, I, p. 102.

periodically present and interpret the economic data of a business for the purpose of effective control and management.[23] The government is no doubt the nation's largest organization, and it is no different from any other large organization in that it must also perform effective management which requires the use of accounting techniques. As W. A. Paton states in his book, *Essentials of Accounting*:

> The governmental unit--federal, state, and municipal--is an important illustration of an organization outside of the business enterprise which requires accounts. A government may own a considerable amount of fixed property, handle large sums of cash, carry on extensive commercial and other activities, be obligated to pay huge debts. Under these circumstances a highly developed system of accounting is evidently needed...[24]

The highly developed system of accounting selected for use by the DOD is cost accounting. Cost accounting is a more specialized system of accounting in that it accounts for all the actual costs associated with providing each specific product or service of a business. This differs from the ordinary accounting procedures which only tries to show the working results of a business as a whole. The beginning of cost accounting is unknown, but there are opinions that it was started in the tin mines in Cornwall, England, around 400 to 300 BC.[25] Cost accounting has now progressed to a

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[23]W. A. Paton, *Essentials of Accounting* (New York: Macmillan Company, 1949), p. 3.

[24]*Ibid.*, p. 8.

[25]Lawrence Robert Dicksee, "Cost Accounting," *Encyclopaedia Britannica*, 1960, VI, p. 504.

specialized system where all costs identified with a product (work effort) are charged to the product along with a prorated share of the overhead costs of maintenance, management and facilities of the total organization in which the product is produced. The requirement for cost accounting in the Department of Defense laboratories for research and development funds is a recent requirement from the office of the Secretary of Defense (Comptroller).

There has always been a need for the laboratories to live within their overall laboratory budgets, with an attendant fund-management technique to that end. But the requirement to identify and charge costs to the specific work efforts is relatively new. Consequently the laboratories have developed fund-management techniques over the years to ensure that the budget would not be exceeded. These procedures only ensured that project personnel could not expend laboratory funds without clearing the action with a central laboratory funding office to ensure the availability of funds.

On the other hand, industrial concerns have led the way in promoting cost accounting techniques because of the value of such techniques in establishing prices for commodities in a competitive market. Cost accounting was originally used in the manufacturing or production fields, but it is now applied more and more throughout the entire business world. Any industrial organization performing work under government contract must maintain cost records, at least for those contracts, so that government representatives may audit the

contract for proper and reasonable costs. Generally, if a contractor's accounting procedures conform to generally accepted accounting practices and if they show costs supportable to each government contract, they are considered acceptable to the government.

F. Hypothesis

This study will attempt to show that there is no significant difference between the cost accounting principles used by industrial research and development organizations and those cost accounting principles employed by the DOD laboratories.

Methodology

The approach to be used in this investigation will be to obtain from a typical government contractor engaged in research and development, data on the cost accounting techniques used by the contractor in accounting for allowable costs in the performance of government contracts. These data will be obtained by personal interviews with contractor personnel and will be used for comparison with the cost accounting techniques employed in the Department of Defense laboratories. The data on the cost accounting techniques employed by the Defense Department laboratories will be obtained by reviewing the directives on accounting for research and development costs that are published by the applicable organizations. This review will be supplemented by personal

interviews with laboratory accounting and finance personnel, when appropriate.

The differences, if any, between the cost accounting techniques employed in industry and those employed by the Department of Defense laboratories will be compared and explained.

Plan for Remainder of Paper

The remainder of this paper will provide information on the data requirements and reporting capabilities of the cost accounting techniques employed by an industrial research and development organization and by the Department of Defense laboratories. The differences in the cost accounting techniques will be discussed and evaluated.

Chapter II will present the cost accounting techniques used by an Air Force research and development organization. The specific organization used for this portion of the study will be the Air Force Weapons Laboratory at Kirtland Air Force Base, New Mexico.

Chapter III will list the techniques used by the Navy in their cost accounting for research and development.

Chapter IV will specifically present the cost accounting techniques used by an industrial organization in performing government research and development contracts.

Chapter V will compare and contrast the cost accounting techniques investigated and will summarize the findings and conclusions of this study.

CHAPTER II

COST ACCOUNTING IN AN AIR FORCE RESEARCH AND DEVELOPMENT LABORATORY

A. Introduction

The cost accounting technique used in the Air Force research and development laboratories is called the Research and Development Job Order Cost Accounting System. The system is so new that the manual describing its use is still in the form of a draft manual (Air Force Manual 177-265) dated 30 January 1971. The manner in which this manual is implemented in the Air Force Weapons Laboratory (AFWL) is used as a typical example of the cost accounting technique used in the Air Force research and development organization.

AFWL is one of several research and development organizations under the Directorate of Laboratories in the Air Force Systems Command. It is a tenant at Kirtland Air Force Base (KAFB), New Mexico. There are approximately 800 military and 500 civilian employees in the Laboratory.

B. Definitions

The following definitions are paraphrased from the draft Air Force manual on cost accounting for Air Force research and development.[1]

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[1] U.S. Department of Defense, Department of the Air Force, *Air Force Manual 177-265, The Research and Development Job Order Cost Accounting System Draft Manual* (published by Department of the Air Force (Comptroller) 30 January 1971), pp. 1-6 to 1-14.

1. Cost Center (CC) - the lowest organizational unit or activity for which costs are accumulated. They equate with an organization having a degree of control over resource consumption and are normally subdivisions of responsibility centers (RC).

2. Element of Expense - the nature of services and items used in a job order such as travel, transportation, materiel, labor and training.

3. Job Order - an approved authorization to perform work or services. A job order is assigned a specific job order number (JON) which is unique to that particular job.

4. Responsibility Center (RC) - an organizational entity headed by a single individual to whom financial management responsibility and accountability are assigned.

C. The Cost Accounting System

The draft Air Force Manual for the Job Order Cost Accounting System spells out in great detail the objectives, data requirements, and reporting capabilities. The manual states the objectives as:

> Objectives: The Research and Development Job Order Cost Accounting System is designed to provide a reliable basis for cost reimbursement by customers.
>
> a. The basic objectives of the R&D accounting system are to provide information that will assist managers to:
>
> (1) Estimate the needs for resources to implement plans.
>
> (2) Justify annual requirements for resources.
>
> (3) Identify major alternatives and obtain financial information useful in making choices.
>
> (4) Obtain optimum use of resources received by:

(a) Identifying all costs of work performed by both end product and performing activity.

(b) Providing the base for timely reports of performance in relation to plans in the format needed for both program and installation management.

(c) Serving as the basis for the establishment of appropriate incentives for all personnel associated with the DOD R&D mission.

b. Corollary objectives are to:

(1) Minimize duplication in records and reports.

(2) Provide a basis for reducing the volume and increasing the usefulness of reports to management by effectively highlighting those conditions needing management action.

(3) Balance the need for flexibility at the operating level conducive to an innovative environment with the need for controls using uniform criteria to ensure efficient application of available resources between competing objectives.

(4) Attain a capability for providing and exchanging compatible data within and between DOD components to facilitate meaningful aggregations and summarizations of information.

(5) Standardize the data terms to provide a common base so that a single input can be used in all records and data systems, thus facilitating the exchange of data between DOD components and allowing an interface with other data systems without manipulation or conversion.

(6) Provide for expeditious installation of the improved R&D resource management system, but minimize the impact of needed changes through maximum use of systems now in existence and application of improvement in an evolutionary manner where possible.[2]

These objectives are not as unrealistic as they may appear, when the capabilities of today's automatic data processing technology are considered. Once a program is developed and de-bugged, it is relatively easy to accumulate the costs in the computer in a form that can identify the entries (costs) to the various job order numbers. Once the data are

[2] *Ibid.*, pp. 1-3 to 1-4.

stored in the computer, it is again relatively easy to recall the data in nearly any format desired.

The data input requirements for the cost accounting system are necessarily detailed in order to account for all items of cost. The system is computerized and uses computer codes to identify the various pertinent data elements. The system provides an account structure which consists of responsibility center/cost center accounts, elements of expense accounts, and job order numbers when applicable.[3] The detailed features of this system are

a. All R&D costs are accumulated.

b. A job order numbering system is implemented to identify cost incurred on any job accepted by AFSC activities.

c. All R&D costs are accumulated by cost center and identified to element of expense through the USAF Standard Base Level General Accounting and Finance System - B-3500. The cost center and element of expense accounts will serve as the account structure.

d. Direct costs are accumulated by appropriate job order and identified to the job order by element of expense codes. Indirect costs will be distributed to job order.

e. The system consists of four basic steps:

(1) Input of cost information.

(2) Costs accumulated in central files.

(3) Costs broken down into three basic categories, i.e., direct, indirect, general mission.

(4) Distribution of the indirect and general mission costs resulting in costing by job orders.

f. Inputs into this system are collected from the following accounting systems:

(1) The B-3500 computer (appropriation accounting system) contributes appropriation data for expense elements such as contract service, TDY, transportation, communication and rental costs--all identifiable by cost centers and job order, when known.

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[3] *Ibid.*, p. 1-25.

(2) The 1050-II (Materiel Accounting System) identifies supplies and equipment costs to cost centers and job orders, where applicable.

(3) The total military labor costs by cost center are developed from the military personnel file. Direct military labor hours are furnished by the cost centers incurring direct job order costs.

(4) Civilian labor costs are accumulated by cost center from the existing civilian payroll system. Direct civilian labor hours are furnished by the cost centers incurring direct job order costs.

(5) All costs incurred by the service contractors are furnished summarized by job order from their cost systems.

(6) When locally required, command-funded expenses will be identified to appropriate cost centers.

(7) Funds expended for support of tenants of other activities are also identified to cost centers and job order numbers.

(8) Provision is made to accommodate estimated costs by job orders.[4]

The cost data input to the system only accumulates the expenditures charged to the various job order numbers. In order to use the expenditure data as a management tool, it is also necessary to include an estimate of costs for the job. The cost system makes provision to include estimated costs for each job order and to include it in the periodic reports of financial status. The manual defines the job order estimate as:

Job Order Estimate

a. Job Order Estimate consists of three basic elements; namely, direct, indirect, and general mission costs.

(1) Direct Cost - represents direct effort expended by a cost center. Estimated direct cost will be prepared by element of expense.

(2) Indirect Cost - represents effort expended by a direct cost center, not readily identifiable to specific job orders....

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[4] *Ibid.*, pp. 1-17 to 1-19.

(3) General Mission Cost. Represents costs incurred by general mission cost centers, which are not incurred directly for, and are not readily identifiable with a specific job order. General Mission Costs are distributed on the basis of a general mission overhead factor to direct dollars/direct labor or some other valid basis....

b. Each RC/CC is responsible for the preparation of its operating budget for the accomplishment of its mission. Each direct cost center is also required to prepare Job Order estimates, such estimates will include direct and indirect cost and hours (quantities) if applicable.

c. Offices or organizations which are OPR for specific jobs, will receive these estimates, and have the responsibility to review, consolidate and distribute the general mission cost referred to in a(3) above.

d. Job Order Estimates may be prepared periodically, or in phases, in addition to a yearly or total job order. These phases may be on a monthly or quarterly basis depending on the requirements of the OPR for management of job orders. Estimates for each job order will reflect the fund code or expense processing code and reimbursable code....[5]

The job order estimates are for the benefit of the technical managers at all levels--from the project personnel to the Laboratory commander. It provides a base for comparing the progress of a given job.

The reporting capabilities of the system are spelled out in the manual as follows:

Reports

a. General. The R&D Job Order Cost Accounting System will not effect the appropriated funds or expense reports from AFSC activities. Operating expense and job order cost reports are prepared from the accumulated cost files. The following paragraph reflects a suggested report. Optional reports may be developed depending on local R&D requirements.

(1) Cost Report by Job Order. A separate report is prepared for each job order and reflects

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[5] *Ibid.*, pp. 2-1 to 2-2.

by job order element of expense, all costs regardless of operating budget or cost center.

(2) Base Operating Report by Cost Center. A separate report is prepared for each cost center reflecting current and year-to-date cost and estimates by Air Force element of expense. The report also reflects all Job Order costs by individual Job Order and element of expense within cost center.

(3) Base Operating Report by Job Order Element of Expense Within Cost Center. A separate listing is prepared by job order element of expense for each cost center.

(4) Base Operating Report by Responsibility Center. A separate report is prepared for each responsibility center reflecting current and year-to-date cost and estimates by Air Force element of expense. The report also reflects all job order costs by individual job order and element of expense within responsibility center.

(5) Base Operating Report by Job Order Element of Expense Within Responsibility Center. A separate listing is prepared by job order element of expense for each responsibility center.

(6) Base Operating Report Command Level. A report is prepared by account identity for each Commander reflecting current and year-to-date cost and estimates by Air Force element of expense. The Job Order Cost Report reflects all job order cost by individual element of expense and cost center within account identity.

(7) Base Operating Report by Job Order Element of Expense Command Level. A report is prepared by job order element of expense for each account.

(8) Report of Service Funds by Job Order. A listing is prepared for service funds reflecting year-to-date commitments, obligations accruals, and disbursements by job order number for each account identifier.

b. The above reports may cover resource consumption at the levels indicated from all funding sources (i.e., Base Procurement, Central Procurement, Major Command-funded, Hq USAF-funded, U.S. Army, U.S. Navy, other Air Force activities, etc.). In addition, the suggested reports are designed to facilitate a comparison of actual costs incurred with job order estimates.[6]

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[6] *Ibid.*, pp. 1-21 to 1-23.

D. Laboratory Implementation[7]

The Air Force manual quoted in describing the Air Force cost accounting system was drafted in January 1971 with the intent of supporting a service fund, or alternate working-capital arrangement, type of operation. In such an operation all costs are actually charged to the customer through the use of identifying job order numbers. The Air Force has had so much difficulty in achieving a service-fund operation that they will use a different funding arrangement. The Air Force Systems Command feels that there are other ways to obtain the benefits of service funding with less cost and complexity. Effective with fiscal year '73, all research and development activities will be put back on institutional funding and a renewed emphasis will be placed on the development of accounting techniques that will lead to improved knowledge of the cost of services rendered to mission programs and projects.[8]

The term "institutional funding" is generally defined as the funding of an organization for salaries, working area and overhead. In other words, the institutional funds are the basic funds used to keep the organization open for

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[7]The information presented in this portion of the paper has been gathered from extensive interviews with personnel of the Programs Office in the Air Force Weapons Laboratory during January and February 1972.

[8]U.S. Department of Defense, Air Force Systems Command, *AFSC Plan for Termination of R&D Service Funds and Implementation of Improved Cost Accounting System* (published by Air Force Systems Command (Comptroller) Andrews Air Force Base, Maryland), 31 January 1972.

business. An organization that is institutionally funded will not charge its military customers all of the costs incurred in performing a specific job. This is a generalization and the practice will vary from time to time, depending on the customer and the priority of the work. For example, KAFB is the host to AFWL and both AFWL and KAFB are institutionally funded. Therefore, the base shops, procurement and accounting and finance offices, among others, do not charge the AFWL job orders for the services provided. However, they do maintain records of the amount of support provided to AFWL in their own accounting system. AFWL charges its customers in a like manner, but also maintains an accounting of the resources expended in the support of the customers in the AFWL accounting system.

The accounting system has been in operation at AFWL for less than a year and is still subject to change as the Air Force and the Laboratory gain more experience in the system. The change from planning for a complete service-funding operation to a system of institutional funding for the Laboratory represents a significant change in the operation of the system. Many of these changes require resolution by higher headquarters, which introduces delays in making the system operational. The actual effect on the cost accounting system will be minimal because both systems seek to provide better cost data. Whether the actual costs are reimbursed or not by the customer should not influence the accumulation of the cost data.

The following paragraphs provide a brief description of the cost areas considered by the Air Force cost accounting system. A brief listing of items of expense that are considered to fall in each of these areas is included as examples. It would be a monumental task to list all the various expenses that could be incurred and all the situations under which they could occur to show how they could change from one area of cost to another.

1. Direct Costs

The direct costs accumulated to job orders in this system include the costs that are definitely related to a specific job order. The elements of expense that are considered direct costs to the various jobs include:

a. Civilian pay, adjusted for fringe benefits such as government contributions to retirement and insurance, is included as costs to the job orders. The cost centers will submit manhour accounting data sheets for use as a basis for determining the civilian costs. The civilian pay costs are recorded to show the total costs of civilian labor in the job orders.

b. Military pay is accumulated in a manner similar to the civilian pay costs except that the military cost is based on a standard rate. The standard rate is an hourly wage figure calculated by higher authority based on the military fringe benefits plus hazardous duty pay.

c. The expenses of R&D contracts, service contracts, supplies, equipment, travel, transportation of items,

computer time and communications identifiable to a specific job order are charged to that job order.

2. Indirect Costs

The indirect costs cover the cost of those staff personnel at the cost center level that are supporting all cost center work and that are difficult to identify with specific job orders. The costs of office copier machines may be added at a later date to the indirect costs for those cost centers that have such copiers. This is because only those cost centers that are physically too far removed from other Laboratory copiers have their own machines, and it would be unfair to burden the remainder of the Laboratory with equipment that they could not use.

The number of personnel charged to indirect costs varies from cost center to cost center and cost is determined by the cost center commander. An AFWL staff office determines the factor to be applied to the direct costs to arrive at the indirect cost burden for each cost center, based on the data provided by the cost center commander.

3. General Mission Costs

The largest portion of the general mission costs are those that account for the costs of the Laboratory commander and his technical and administrative staff, and the administrative travel performed by them and the cost center commanders. AFWL does not carry an administrative burden for the echelons above the Laboratory level or for those R&D

related organizations, such as the Inspector General or the Foreign Technology offices.

Office furniture, typewriters, and such equipment are included in the general mission costs of the Laboratory whenever they are replaced. The costs of small items of supply such as paper, pencils, staples, typewriter ribbons, paper clips, and such minor technical supplies as resistors and electrical wire, etc., are included in the general mission account.

No costs are charged to the Laboratory for fire protection, security guards, regular building maintenance, utilities, procurement or other normal Base support functions. There is a small three percent surcharge added to items obtained through the Base stock fund to cover the cost of material purchases; this is an arbitrary figure and is not necessarily related to the overhead of managing the stock fund.

The general mission cost factor is calculated by a laboratory staff office using costs as shown in the above paragraphs.

4. Other Support to the Laboratory

There are other costs charged to the laboratory job orders by the base support organizations in their cost accounting systems. These costs include aircraft support and the civilian and military labor expended by the base shops in support of AFWL.

Building modifications that cost less than 500 dollars are not directly charged to the Laboratory, but are funded out of the Base Civil Engineers funds with accounting for the funds through BCE cost accounting system. If the cost of the modifications is in excess of 500 dollars, a charge is made to either the Laboratory general mission funds or the job order requesting the modifications.

5. Other

Capital investment items such as new buildings, extensive modifications, certain laboratory equipment or replacement parts for test facilities are not funded by or costed to the Laboratory. Funds for these items are provided by higher headquarters.

The job order estimate that may be included in the cost accounting system to aid in the management of R&D projects will be developed by an AFWL staff office. The basis for this estimate is the annual budget estimate exercise presented to the Laboratory commander by the cost centers for each active work effort.

E. Summary

The cost accounting system used by AFWL is a start into true cost accounting for research and development by the Air Force. This system has been in use for less than a year and is subject to frequent changes as new problems arise and new guidance is received from higher headquarters. It will probably be two to three years before the system will be sufficiently shaken down to make positive statements about the principles used.

CHAPTER III

COST ACCOUNTING IN A NAVY RESEARCH, DEVELOPMENT, TEST, AND EVALUATION FACILITY

A. Introduction

The Navy system for accounting for research and development costs is spelled out in *Navy Handbook NAVSO P-3062-2*, "Financial Management of Resources (Research, Development, Test and Evaluation, Navy) (Activity Level)," dated March 1971. This handbook was developed over a period of time by the Navy from the systems in use before the Department of Defense (DOD) instructions for accounting for research and development were published. The Navy started using an accrual accounting system encompassing labor, material, and local procurements on July 1, 1968.

The Naval Weapons Evaluation Facility (NWEF) at Kirtland Air Force Base (KAFB), New Mexico, is cited as a typical example of an installation that uses Navy principles in accounting for the costs of research and development. The NWEF is a part of the Naval Air Systems Command under the Naval Materiel Command. There are approximately 90 civilians and 200 military personnel in the facility.

B. Definitions

The following definitions are taken from the Navy handbook[1] on financial management of resources for research and development:

> ACCRUED EXPENDITURES. Accrued expenditures are the costs incurred during a given period representing liabilities incurred for goods and services received, other assets acquired, and performance accepted, whether or not payment has been made.
>
> ALTERATION PROJECTS. Alteration projects are those making adjustments to interior arrangement, on-base location, or other physical characteristics of an existing facility so that it may be more effectively adapted to or utilized for its designated purpose. Additions, expansions, and extensions are not included in alterations. Alteration projects at those activities authorized to distribute overhead may be financed as overhead expense and recovered through overhead rate applications.
>
> COST CENTER. A Cost Center is a subdivision of a field activity operating under the provisions of this system. An individual cost center is a group of homogeneous service functions, processes, machines, product lines, professional and/or technical capabilities, etc. It represents an identifiable organizational component of the activity for which identification of costs is desired. Once established, it is considered an administrative unit responsible for managing men, money, material, equipment utilization and operational methods and plans. Thus, it is an entity for budgetary, accounting and management purposes and is identified with single management responsibility. A Cost Center may be an entire department or may be a component (division, branch, section, shop or office) of a department. Technical and administrative guidance is channelled downward through the manager of the cost center who, in turn, is responsible to his immediate supervisor or to the Commanding Officer. Direct Cost Centers are defined as cost centers in

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[1] U.S. Department of Defense, Department of the Navy, *Navy Standing Order P-3062-2*, "Financial Management of Resources; Research, Development, Test and Evaluation, Navy; Part 2 (Activity Level)" (published by Department of the Navy (Comptroller) March 1971), pp. 1-5 to 1-10.

which the major labor effort can be identified and costed directly to job orders established for the accomplishment of assigned RDT&E or reimbursable work. General Cost Centers are defined as cost centers in which the major labor effort is performed in support of all cost centers of the activity.

DIRECT COSTS. Direct costs are expenses incurred directly for and are readily identifiable to specific RDT&E or reimbursable work assignments.

EXPENSE. Expense consists of civilian labor, overhead applied, material consumed or applied, service received, rental of facilities and equipment, travel costs, cost transfers, etc. Included as an expense are the costs of an item of equipment having a unit value of less than $1,000, and the cost of minor construction of a value of $25,000 or less financed through a program element designated specifically to finance minor construction projects. Alteration projects costing $25,000 or less at activities authorized to distribute overhead may be financed as overhead expense, and recovered through overhead rate applications. None of these items are classified as expenses when they are incurred in the procurement, production, or construction of investment items (see definition of investments). Military labor will also be included as an item of expense when performed for an agency outside the Federal Government, such as foreign governments (including reimbursable transactions pursuant to the Foreign Assistance Act of 1961, as amended), state and local governments, and private parties.

EXPENSE ELEMENTS. Expense elements identify the types of resources being consumed in the functional category or program element.

INDIRECT EXPENSE. Indirect expenses are costs incurred by direct cost centers which are not incurred directly for and are not readily identifiable with specific job orders established for the accomplishment of assigned RDT&E or reimbursable work.

INVESTMENTS. Investment costs are those costs associated with the acquisition of equipment costing more than $1,000 per unit, and expected to benefit more than one project. Items of equipment procured for the purposes of a specific R&D project are excluded regardless of acquisition costs.

RESPONSIBILITY CENTER. An R&D responsibility center is a designated organizational element or major

subdivision thereof such as a laboratory, an operating division, or a service center at an R&D installation for which overall responsibility for specific operations has been assigned to one individual and for which a separate operating budget or internal subdivision of an operating budget has been established. In instances where an R&D activity is small and a minor part of the total installation of which the activity is a satellite (for support purposes), the entire R&D activity may be a single responsibility center. Common service responsibility centers may be established to support both R&D and other customers, but in such instances the minor users will be treated as customers of the responsibility center. At an installation financed by a service fund or its equivalent, a responsibility center may be a cost center as defined in DOD Instruction 5000.8 or a combination of cost centers.

C. The Research and Development Accounting System

The objectives, accounting procedures, and reporting capabilities of the Navy system are spelled out in the handbook. The objectives are stated as follows:

> The basic objectives of the Research and Development accounting system are to provide managers with information to:
>
> 1. estimate the needs for resources to implement plans;
>
> 2. be able to justify annual resources;
>
> 3. assist in arriving at major alternatives using financial data in making decisions;
>
> 4. assist in obtaining maximum use of resources available and received by:
>
> A. identifying all costs of work performed by both end product and performing activity;
>
> B. providing the base for timely reports on performance in relation to plans in the format needed for both program and installation management.
>
> 5. minimize duplication in records and reports;

6. provide a basis for reducing the volume and increase the usefulness of reports to management through effectively highlighting conditions requiring management attention;

7. attain a capability for providing data to the Department of Defense in meaningful aggregations and summarizations.[2]

These objectives include most of the objectives listed in DOD Instruction No. 7220.24; those objectives not included are mainly for the benefit of the higher levels of the DOD and will be met if the Navy meets their objectives.[3]

The accounting procedures spelled out in the Navy handbook are detailed in order to include all accounting transactions that are possible in a research and development effort. The system provides accounts, records, and procedures for recording transactions and is designed to include controls for accounting and budgeting. The records and accounts are designed to provide cost and financial information required by internal management, sponsoring organizations and higher authority.[4] The basic characteristics of the system are:

The primary source of data for financial planning and financial control of operations is a system of

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[2] *Ibid.*, p. 1-4.

[3] U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), p. 2-3.

[4] U.S. Department of Defense, Department of the Navy, *Navy Standing Order P-3062-2*, "Financial Management of Resources; Research, Development, Test and Evaluation, Navy; Part 2 (Activity Level)" (published by Department of the Navy (Comptroller) March 1971), p. 5-3.

accrual accounting with R&D project classifications by cost center appropriate for management. The accounting system has the following features:

a. double entry method of accounting;
b. accrual basis of accounting;
c. internal control over all transactions;
d. integration of cost accounting records with the general books of account.

Effective application of the accounting system requires a carefully planned organizational structure, well defined operating policies and procedures, clear delegation of duties to subordinates, competent personnel, and a strong internal audit program.[5]

The accounting system requires a job-order structure so that accrued expenditures can be accumulated to specific work efforts. The job order is spelled out by the handbook as follows:

Job Orders.

a. Structure. Activities accounting for operating budgets will develop a job order structure to provide for the accumulation of accrued expenditures. The term "job order structure" will include any assignment of codes for the purpose of accumulating and posting accounting information. A Navy-wide job order structure is not prescribed because of the variation in requirements; however, the locally prescribed structure must be designed to collect accrued expenditures at the functional category level (NavCompt Manual, paragraph 024601), and (when such information is not derived by other methods) at the expense element level (see NavCompt Manual, par 024620 for codes and definitions). In addition, the job order system should provide for cost classification by the following categories:

1. In-house work,
2. Contracts associated with in-house effort,
3. In-house effort (administration, technical supervision, and planning) in support of contracts and grants for Systems Commands, Bureaus or other similar organizations, and,

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[5] *Ibid.*, p. 5-3.

4. Contracts other than those associated with in-house work.

The job order structure must be so designed that other required cost reporting can be obtained; e.g., R&D Project & Task Area Costs, direct and overhead costs by Cost Center, leave taken, compensatory time worked and leave therefor, fringe benefits and any other details at levels required by internal and external management and sponsors.

b. Job Order Form. The job order form for use at each activity will be designed to meet local requirements as to size and format. Job order forms, so designed, will contain all information required for accounting and performance purposes. A suggested job order format is illustrated in NavCompt Manual, paragraph 035003.[6]

The reporting system defined in the handbook leaves to the discretion of local management the format or detail used in reports for local management purposes. It is the intent of the financial and cost reports to serve both local management and higher authority.[7] The general reporting requirements are stated in the handbook as follows:

External (off station) reports will be prepared by the authorization accounting activity of the Operating Budget Holder or performing activity for submission to the organization which approved the operating budget or to sponsors issuing reimbursable orders. Although this Handbook does not prescribe a series of internal activity reports for local management purposes, it does contemplate that the summary data submitted to higher authority will be supported by locally developed management reports at a more detailed level. Certain of the data reported externally will be recorded to the appropriation accounting records maintained for the approving authority. Other data serves local and external management and sponsors as a measure of the activity's fiscal performance against planned

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[6] *Ibid.*, pp. 5-7 to 5-8.

[7] *Ibid.*, p. 6-3.

targets of the approved operating budget and reimbursable orders.[8]

The handbook also specifies in some detail the reports that must be submitted at periodic intervals to higher authority by the local management. These instructions are directed to the preparation of the proper forms in the proper format.

D. Facility Implementation[9]

The Navy handbook on financial management of resources is written to handle a working-capital arrangement of funding for all research and development work. That is, it describes the procedures to be used in accounting for the receipt and disbursement of funds that are necessary in a typical buyer-seller arrangement. The system has been in operation at the Naval Weapons Evaluation Facility (NWEF) since July 1971. NWEF is still encountering some minor difficulties in implementing the system; these they feel will be worked out in time. The data processing for the NWEF cost accounting is done by the Navy Supply Center at San Diego, California. Part of the problem that the NWEF is having with the system is caused by the physical separation between them and the data processors. Communications on the smallest error in correlating the input and output of the data

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[8] *Ibid.*, p. 6-3.

[9] The information presented in this section has been gathered from personal interviews with the Comptroller of the Naval Weapons Evaluation Facility, KAFB, N. M., in February 1972.

processing is delayed by the need for travel and personal meetings to completely resolve the problem.

The NWEF is a Navy tenant organization on Kirtland Air Force Base (KAFB), New Mexico. NWEF is a service-funded organization and therefore pays for services received, insofar as practicable. It does not pay for "rent" of the buildings occupied or for related services such as overall base security or fire protection, but it does pay to KAFB the costs of building alterations and for telephone and electrical utility services. NWEF provides its own accounting and finance service and part of its own contracting services. Those contracts not handled by NWEF are handled by other Navy facilities away from KAFB.

The Navy system of cost accounting is broken into three areas of expense. These areas are defined as direct costs, indirect expense, and general expense by the Navy. The expense elements considered in each of these areas are described in the following paragraphs:

1. Direct Costs

The Navy system accounts for all direct costs that are for a specific job order. This includes pay for civilian labor, adjusted for fringe benefits such as government contributions to retirement and insurance plans. The cost centers submit manhour accounting sheets for use in determining civilian labor costs.

The costs of materiel, travel, supplies, contracts, and communications that are related to a specific job order are charged to that job order.

The costs of military pay are accumulated from manhour accounting sheets and a standard hourly rate for military labor. The standard rate is provided by higher authority and is based on base pay, fringe benefits, and bonus pay schemes.

2. Indirect Expense

The indirect expenses are the costs at a cost center that cannot be reasonably charged to any one job order. The major portion of these costs is incurred by the cost center commander and his technical and administrative staff.

3. General Expense

The general expenses cover the costs that are not incurred for a cost center or a job order. These costs include the costs of the facility commander and his technical and administrative staff plus other items of expense. The other items include office supplies and equipment, general telephone service, building alterations, electrical power, and administrative travel. The general cost factor is calculated from these costs and applied to the costs of the direct cost centers.

NWEF performs its own accounting and finance functions and the cost is included as a part of the general expenses of the facility. NWEF is limited to contracting for items costing less than 250 dollars and the cost of such contracting

is included in the general expenses. Any contracting for more than 250 dollars must be done for NWEF by other Navy installations. To date, NWEF has not been charged for this contracting service by these other installations.

4. Other

NWEF is not charged for the buildings they occupy or for the fire protection or security guards provided by KAFB. Investment items such as building alterations or equipment that will be used by more than one job order are not classified as expenses.

Aircraft support is not treated as an expense to the job orders supported. The cost of aircraft support is accumulated but is not treated as expense for either the job orders or the general expenses. Services provided by KAFB shops are completely paid for by the NWEF job orders, except for the cost of military labor. There is no general expense adjustment for the higher authority above the NWEF in the Navy system.

E. Summary

The Navy system for accounting for the costs of research and development is primarily oriented to the problem of obtaining the costs. It shows no preference for any given automatic data-processing technique. The costs that are accumulated are those that are defined by the Navy as appropriate, and are not necessarily what would be considered by a private company.

Some expenses appear to be related to the costs of research and development that are not included as costs in the Navy system. These include the costs of overhead or general expenses for higher authority, aircraft support, and investment items.

CHAPTER IV

COST ACCOUNTING IN AN INDUSTRIAL RESEARCH AND DEVELOPMENT ORGANIZATION

A. Introduction

The Albuquerque Division of EG&G Incorporated is used as a typical industrial concern which uses cost accounting in its daily operations. The Albuquerque Division is one of several divisions of the EG&G Corporation. It employs about 400 people and does most of its work under federal government contract, although it does do work for other organizations. Roughly 25 percent of its work is commercial or non-federal-government sponsored.

The basic purpose of cost accounting by a private organization is different from the purpose of the Department of Defense (DOD) laboratories. The DOD laboratories have been directed to use cost accounting in research and development by higher headquarters as a means of promoting economy and efficiency in their efforts.[1] An industrial concern must use cost accounting in its operations to remain competitive in pricing its products or services for sale in the marketplace. Furthermore, it must use cost accounting when performing on government contracts to be able to demonstrate the amounts and allowability of costs charged to the contract.

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[1]U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), p. 20.

The system of cost accounting used by an industrial organization for purposes of competing in the market can be as simple or as complex as the organization desires. The profit or loss for the organization will reveal whether the system is adequate. On the other hand, the cost accounting system used by an industrial organization when working on a government contract must use generally accepted accounting procedures. These procedures must be able to produce costs that are properly supportable to each government contract.[2]

B. Principles Used[3]

The cost accounting principles used by EG&G have been developed to meet their needs for cost accounting. The principles used are generally accepted accounting procedures and produce costs that are supportable to each government contract.

The system accounts for direct, indirect, and general costs. One of the major requirements of this system and for any system of accounting is consistency of charges.[4] That is, the costs must be distributed in the same manner to each job so that there is no confusion in supporting the costs.

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[2]Henry M. Sweeney, "Accounting for Government Contracts," *Accountants Encyclopedia*, Vol. III (Englewood Cliffs, N. J., Prentice-Hall, Inc., 1962), p. 1310.

[3]The information presented in this section has been gathered from personal interviews with the Controller of the Albuquerque Division of EG&G Incorporated in February 1972.

[4]H. A. Finney and Herbert E. Miller, *Principles of Accounting* (Englewood Cliffs, N. J., Prentice-Hall, Inc., 1963), p. 239.

For example, clerical personnel cannot be charged directly to one job and carried as an overhead burden on other jobs under like circumstances.

1. Direct costs. The direct costs include the costs of labor, material, supplies, services, and travel applicable to each contract (job). The labor costs are calculated on the regular salary scale and do not include an adjustment for fringe benefits.

2. Indirect costs. The indirect costs include the costs of clerical and supervisory support at the working level. These are costs that are not allocable because they support many contracts or are not applicable to any one contract.

3. Arbitrary allocation. The allocation of arbitrary costs is in the area where there are no definite rules of application or definitions of allowable factors. In the case of government contracts, the key to these costs is that they must be supportable as contract costs and they must be applied consistently. The arbitrary allocation is broken down into categories as follows:

a. Direct labor (labor burden). These costs are distributed on the basis of labor costs of a contract and include the following items of cost:

(1) Clerical Support

(2) Administrative Support

(3) Fringe Benefits

(4) Technical Support

(5) Occupancy Costs

(6) Equipment Costs

(7) Other Personnel-Related Costs

The term "technical support" covers the costs of technical personnel when they are not productively engaged on a given contract. It includes such costs as attendance at schools or at company-sponsored training sessions. "Occupancy costs" include the costs of taxes, utilities, security and so forth, necessary to keep the facility open for business.

b. Material (handling charge or material overhead). These costs include the costs of the procurement of materials used in the performance of the various contracts that are being worked by the organization.

The above direct, indirect, labor-burden, and material-overhead costs are considered to be the "factory costs" in the performance of a contract. The total factory costs are then used as a basis for the distribution of the burden for the company's general and administrative expenses.

c. General and administrative expense. The general and administrative expense includes the following:

(1) Finance and Accounting

(2) Contract Administration

(3) General Management

(4) Marketing

(5) Corporate allocation of the costs of higher echelons of the corporation.

One final factor considered in the overhead rate for the EG&G Corporation is the recovery of a portion of the costs of company-sponsored independent research and development. The portion of these costs that may be recovered by inclusion in the overhead rate is defined by government regulations and is determined through coordination between the company and the government.

C. Summary

The accounting principles used at the EG&G Corporation are typical of the generally accepted accounting procedures that are used on government contracts. The procedures used by EG&G in their accounting for costs on government contracts are generally acceptable to the government auditors.

There is no universally accepted system of cost accounting used in either the government or in industry. Therefore, the cost accounting system used by an industrial organization for commercial work is strictly at their discretion. The system must meet certain logical criteria when used in accounting for costs generated on a government contract.

CHAPTER V

COMPARISONS, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

A. Introduction

The basic principles used by AFWL, NWEF, and the Albuquerque Division of EG&G in their cost accounting for R&D are described briefly in the preceding chapters. The principles are presented here in Tables I, II, III, IV, and V for ease of comparison of their differences.

B. Comparisons

The basic areas of expenses used in these systems of cost accounting for research and development are 1) direct costs, 2) indirect costs, 3) labor and material overhead burden and 4) general and administrative costs. For ease of comparison these costs are further separated on the basis of the system used by EG&G. The DOD uses the categories of direct, indirect, and general mission costs in their system. Therefore, the DOD general mission costs are distributed between the labor and material burden and the general and administrative costs for purposes of comparison. There are some differences between these systems in all the areas, although some of the differences are insignificant.

1. Direct costs. Table I shows a comparison of the direct costs for each of the organizations considered in this study. There are only minor differences, accepted by the accounting fraternity, between the systems in accounting for direct costs.

TABLE I

COMPARISON OF DIRECT COSTS

EXPENSE ELEMENT	AF WEAPONS LAB (AFWL)	NAVAL WEAPONS EVALUATION FACILITY (NWEF)	EG&G
Labor	Civilian labor cost included, adjusted for fringe benefits. ——— Military labor cost included at standard hourly rates.	Civilian labor cost included, adjusted for fringe benefits. ——— Military labor cost included at standard hourly rates.	Labor cost included at regular salary
Material, supplies, services & equipment	Included	Included	Included, except equipment which is included in over-head.
Travel	Included	Included	Included

As shown in Table I, the only difference between the direct costs charged by AFWL, NWEF, and EG&G is that AFWL and NWEF include the employees fringe benefits in the direct costs and EG&G does not. Table III will show that EG&G includes the employees' fringe benefits in the determination of the labor burden. This is an optional decision and is considered acceptable in cost-accounting procedures. In most companies, the fringe benefits are treated as factory overhead; but some companies charge the fringe benefits related to direct labor as an additional direct labor cost.[1]

2. Indirect costs. The expense elements included in the calculation of the indirect cost burden by the three organizations considered are shown in Table II.

The concepts of indirect costs employed by NWEF, AFWL, and EG&G appear to show a major difference only in the area of the nonapplicable costs, such as janitors, fork lift operators, or general handymen. The DOD laboratories have defined indirect costs as those costs incurred by cost centers which are not directly associated with specific job orders.[2] On the other hand, Horngren defines indirect labor to be all factory labor costs which are not direct labor. There is no clear definition of the subdivision of labor costs; Horngren

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[1]Charles T. Horngren, *Cost Accounting, a Managerial Emphasis* (Englewood Cliffs, N. J.: Prentice-Hall, Inc.: 1967), p. 27.

[2]U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), Enclosure 2, p. 2.

TABLE II

COMPARISON OF INDIRECT COSTS

EXPENSE ELEMENT	AF WEAPONS LAB (AFWL)	NAVAL WEAPONS EVALUATION FACILITY (NWEF)	EG&G
Many-user concept	Cost center administration and clerical support included. Office copiers may be included at later date.	Cost center administration and clerical support included.	Cost center administration and clerical support included.
Nonapplicable costs	Included in general mission costs.	Included in general mission costs.	Included as an indirect labor cost.

refers to the terminology and classification of labor costs using the term "usually."[3]

The use of office copiers in various, but not all, cost centers in AFWL has led to considerating being given to charging them as indirect expense to the cost centers that have them. AFWL has over three times as many employees as either NWEF or EG&G and it is reasonable to distribute office copiers among some of the cost centers and to treat them as indirect expenses for those centers.

3. Labor and material overhead burden. The elements of expense considered in this area of cost accounting are shown in Table III.

As shown by Table III, the expense elements included in the labor and material overhead burden for AFWL and NWEF are quite different in some areas from those included in the system by EG&G. The differences are mainly in the following areas:

a) Fringe benefits. These cover the costs of the fringe benefits for the employees and are included in the direct costs of labor by AFWL and NWEF. As stated in the discussion of Table I previously, it is generally accepted to include the costs of fringe benefits either as direct expense or as an overhead factor.

b) Occupancy costs. There is considerable difference in the treatment of these costs by the DOD laboratories

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[3]Charles T. Horngren, *Cost Accounting, a Managerial Emphasis* (Englewood Cliffs, N. J.: Prentice-Hall, Inc.: 1967), p. 26.

TABLE III

COMPARISON OF ARBITRARY ALLOCATION OF LABOR AND MATERIAL OVERHEAD (GENERAL EXPENSE/MISSION) BURDEN

EXPENSE ELEMENT	AF WEAPONS LAB (AFWL)	NAVAL WEAPONS EVALUATION FACILITY (NWEF)	EG&G
Labor burden			
Clerical support	Included	Included	Included
Admin. support	Included	Included	Included
Fringe benefits	Not included as labor burden, but as direct cost	Not included as labor burden, but as direct cost	Included
Technical support	Included against overhead job orders	Included against overhead job orders	Included
Occupancy costs	Not included	Partially included	Included
Building alterations	Below $500-no cost shown Above $500-cost is shown	All costs shown, but can be investment if over $25,000	Included
Equipment costs (depreciation)	Most equipment is direct cost; some is investment	Included as job cost if under $1,000 and is for one job	Included
Other personnel related costs	Not applicable	Not applicable	Included
Material handling cost (material overhead)	Token amount included	Included	Included

and the treatment given them by EG&G. There is further difference in the costs incurred by NWEF and those incurred by AFWL. AFWL pays no occupancy costs because they are Air Force tenants on an Air Force base. NWEF pays for utilities and telephones but is not charged for the building they occupy, associated fire protection and overall base security. The difference between NWEF costs and AFWL's is because NWEF is not Air Force; but NWEF is military which provides the free buildings and associated services. The DOD provides investment items such as buildings and test facilities for research and development from other than research and development funds. Therefore there is no need for AFWL or NWEF to recoup the investment in buildings. EG&G, on the other hand, must amortize their buildings and their associated costs; consequently they include a cost for the building in their cost accounting.

c) Building modifications. AFWL by benefit of being an Air Force tenant on an Air Force base only pays for building modifications that cost in excess of $500.00. The costs can be charged as either a direct cost or an overhead cost, depending on the justification for the alteration. Any major building modifications for more than one job order are funded separately from other than research and development funds. NWEF pays for all building modifications unless they are investment items benefiting more than one project or are in excess of $25,000.00 in cost. NWEF, too, can charge the cost as either direct cost or overhead cost

depending on the use. EG&G must charge for all building modifications because the cost represents private company funds and they must be recovered. The costs would be charged as overhead if for a plant expansion, but would be charged as a direct cost if for a specific job.

d) Equipment costs. In the case of NWEF or AFWL, the cost of equipment for a specific job order is charged to that job order. If the equipment is for more than one job order, it is treated as an investment item and not charged to a job order or to overhead. Expensive replacement parts for test facilities are funded from higher headquarters and are treated as investment items, and not considered in the cost system. EG&G charges a depreciation on its equipment because equipment must be replaced out of company funds. If the equipment is costed as a direct cost on a government contract, it becomes government property.

e) Material overhead. EG&G includes in their cost accounting as a part of the labor burden, the cost of expediting, procuring, and other related costs in providing material needed in the performance of a contract. AFWL pays a small surcharge on material obtained through the base stock fund. NWEF attempts to obtain all its material through the Navy Supply Activity which includes an overhead charge in the cost of the material. In the case of locally procured material, NWEF charges the cost of the procurement operation as a general expense.

4. General mission costs. The costs shown in Tables I, II, and III are considered as factory costs by EG&G and are used as a basis for the distribution of the general and administrative expenses. The general and administrative expenses are summarized in Table IV.

NWEF and AFWL include all their costs above the indirect expenses in general mission costs. They do not charge a labor burden on direct and indirect expenses and then charge a general and administrative expense on top of the total as EG&G does. It is presented this way to make for easier comparison of the costs included in the different systems.

The differences in the expenses included in the general mission costs are significant in the detail of expenses considered by EG&G compared to those considered by NWEF and AFWL.

a) Finance and accounting. NWEF includes the cost of the finance and accounting operation in its costs, as EG&G does. AFWL does not include in its cost accounting system a cost for the services of the finance and accounting office, which is provided by the host Air Force Base.

b) Contract administration. EG&G includes the cost of contract administration in its costs. AFWL does not because of its host-tenant agreement with the host KAFB, where the cost of procurement is carried on the accounts of KAFB. NWEF carries the cost of procurement up to 250 dollars in value. Any procurements over that amount are done at no cost to the NWEF system.

TABLE IV

COMPARISON OF GENERAL MISSION COSTS

EXPENSE ELEMENT	AF WEAPONS LAB (AFWL)	NAVAL WEAPONS EVALUATION FACILITY (NWEF)	EG&G
Finance & accounting	Not included	Included	Included
Contract administration	Not included	Partially included	Included
General management	Included	Included	Included
Marketing	Not applicable	Not applicable	Included
Corporate allocation	Not included	Not included	Included

c) Marketing. This expense is peculiar to an industrial organization when considered in the literal sense. However, AFWL and NWEF have similar costs in "selling" their capabilities to higher headquarters and potential users and in coordinating details of a specific job that is nearly "sold." The cost of such activity in AFWL and NWEF is either charged as direct or indirect costs to the project that is doing the "selling," or is charged as general mission costs if the expense is incurred by the staff of the laboratory commander.

d) Corporate allocation. The corporate allocation is included in the overhead factor by EG&G. Both NWEF and AFWL do not carry a cost burden for higher headquarters, or other R&D related activities in their respective agencies. The costs of R&D staff operations at headquarters above laboratory/facility level are accounted for at headquarters level.[4]

5. Other. There are other costs that are inherent in the work done by NWEF and AFWL that are not particularly comparable to the EG&G operation at present. One specific example of a cost that is a large expense is that of aircraft support for flight testing. This is summarized in Table V.

The cost of aircraft support is such a large expense that the DOD laboratories have not as yet determined a sure

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[4]U.S. Department of Defense, *Department of Defense Instruction Number 7220.24*, "Accounting for Research and Development" (published by Assistant Secretary of Defense (Comptroller) September 18, 1969), Enclosure 2, p. 3.

TABLE V

COMPARISON OF AIRCRAFT SUPPORT COSTS

AF WEAPONS LAB (AFWL)	NAVAL WEAPONS EVALUATION FACILITY (NWEF)	EG&G
Costed at an hourly rate to the using job order through the base accounting system. The hourly rate is determined by higher headquarters and does not include overhead.	Actual costs of operating each aircraft are accumulated, but cost is not charged to facility overhead or to using job orders.	Not applicable

way to handle it. AFWL is charged a Memorandum of Charges directly to the job orders supported at an hourly rate for the hours flown. NWEF maintains accurate records of the cost of keeping the aircraft in operation at its facility, but does not charge the cost to the job orders or to overhead.

C. Conclusions

The hypothesis for this study proposed that there was no significant differences between the cost accounting principles used by the DOD research and development organizations and those used by an industrial organization. This study does not completely support the hypothesis. The comparisons in the previous section show a rather significant difference between the amount of overhead and general mission costs that are included in the costs of performing R&D

by an industrial organization and those costs incurred by a DOD organization.

However, the hypothesis was proposed to show that the reasons for the failure of the DOD laboratories to easily implement a cost accounting system were not due to an overly complex accounting system. To this end, the research supports the hypothesis. That is, the DOD laboratories do not maintain records of as many costs as an industrial organization and therefore have a simpler problem. On the other hand, the DOD laboratories have added complexity in their system in that some costs are reimbursable and some are not; the determination of which is reimbursed and which is not depends on the customer. Furthermore, the DOD provides other funds for military pay, military construction, and some investment items. These funds are separate from R&D funds and cost records are kept only as a memorandum of the costs. These factors create some confusion, but should not affect the accumulation of the costs of performing specific projects. Therefore it appears that the difficulties encountered by the DOD laboratories in implementing a cost accounting system are not caused by the cost accounting principles used.

It appears from this research that of the three organizations surveyed, only the EG&G organization attempts to account for all costs in performing research and development. This is to be as expected when one considers that EG&G must recover all costs in performing any work, and make a profit

in the process, in order to stay in business. The DOD laboratories operate under different constraints. They perform research and development that has little application to the civilian market but must still be done, if we are to have a viable national defense. Therefore the funds for the military R&D must be provided by the federal government. The DOD laboratories do not have to make money to survive and much of their expenses, such as military construction and military pay, do not have to be funded out of their operating budgets.

The Navy and NWEF appear to be accomplishing the most nearly complete job of accounting for all the costs of research and development of the two military laboratories surveyed. The Navy has been using capital fund arrangements for years in those organizations where such an arrangement was useful and has, therefore, some background in cost accounting. But the Navy system still does not provide a complete picture of the total costs of research and development projects. Failure to include aircraft support costs to the specific jobs supported and the costs of higher authority involved in R&D as general mission expenses presents an unrealistic or at least a partially realistic view of the costs.

The Air Force system, as would be expected in view of their lack of experience in cost accounting, leaves the most to be desired in determining the real costs of research and development. It may be possible that as the Air Force

achieves an operational cost accounting system, it will be the best system in the services. It appears that the Air Force system is oriented to developing an automated data processing system that could easily include all pertinent cost accounting data.

D. Discussion

A primary objective of the DOD R&D cost accounting system is to assist management in the effective, efficient, economical, and timely performance of assigned work.[5] The cost accounting principles used by the DOD organizations will probably meet these goals, if the management referred to is the local laboratory/facility commander. It would appear that the system should include the costs of all higher headquarters involved with R&D, if true accounting of all costs are to be achieved and if the system is to assist management at all levels. The Air Force, for example, also has other organizations that are very closely associated with R&D but are not considered in the costs. The costs of these organizations as well as higher headquarters should be included in the determination of overhead rates for the overall costs of R&D. For the purposes of the laboratory commander, who is responsible for the costs of his laboratory, it is probably better to omit from his accounting system all costs of organizations outside of his laboratory. He is not responsible for and has no control over the costs of these

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[5] *Ibid.*, p. 20.

organizations. But to the Secretary of Defense, it would appear equally desirable to include all costs associated with R&D because he has the responsibility and the control over all costs in the DOD.

The DOD R&D organizations should use cost accounting principles that are common to all three services and that carefully define the costs that are to be considered direct, indirect, and general mission costs. The definitions should be generated at the Secretary of Defense level and made mandatory for use by all the service laboratories. Without such definitions, there will be no way to compare the fiscal efficiency of the various laboratories. It is recognized that definitions generated in this way will appear arbitrary and unfair to various installations at various times. Nevertheless, the use of commonly accepted definitions throughout the DOD laboratories would result in a clearer understanding of what the costs mean. Consistency is a commonly accepted requirement in the cost accounting fraternity.[6] Without consistency, a comparison of costs between organizations is meaningless without a detailed analysis of the nature of expenses used by each organization.

The need for consistency is recognized by the Congress. In 1968 Admiral Rickover stated during congressional testimony that the government was unable to determine what the

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[6] H. A. Finney and Herbert E. Miller, *Principles of Accounting* (Englewood Cliffs, N. J.: Prentice-Hall, Inc.: 1963), p. 62.

costs and profits were under its contracts to industry. He suggested that the Comptroller General develop Uniform Cost Accounting Standards so that it would be possible to obtain such data. In August 1970, Congress enacted Public Law 91-379 which established the Cost Accounting Standards Board and authorized that Board to promulgate rules and regulations for cost accounting standards.[7] These standards should be applied equally to the DOD laboratories as well as to government contractors. In fact these standards could well be applied to all government agencies whether federal, state, county, or city.

The need for better cost accounting for military R&D is becoming more and more apparent, partly due to the need for federal funds for poverty, environment, transportation and other programs related to human needs and partly due to the high costs of the more sophisticated and complex weapon systems of today. As Hitch and McKean state:

> The way the services use materials and manpower deserves hard scrutiny--even at the highest levels. If congress, through the review of defense expenditures, can perceive better ways to combine objects of expenditure or discover wasteful purchases that can be eliminated, it should certainly insist upon the increased efficiency.[8]

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[7]David Neuman, *Cost Accounting Standards. What Are They? Where Are They?*, speech given to the National Contract Management Association, Washington, D.C. Chapter, July 21, 1971.

[8]Charles J. Hitch and Roland N. McKean, *Economics of Defense in the Nuclear Age* (Cambridge, Mass.: Harvard University Press: 1960), p. 51.

Reagan, in his book *Science and the Federal Patron*, also points out the need for better use of R&D funds because of the ever-increasing R&D budget and the end of the era where R&D was considered unplannable;

> ...As in economic policy, American science planning will be of the looser variety, but the days of treating R&D as unplannable and lacking in any need for top-side rationalization are clearly drawing to a close.[9]

> ...In any case, budgetary tightness is upon us, begun perhaps by Congressional alarm as the R&D total approached the 15-billion-dollar mark, and accentuated by the general stringency occasioned by the Vietnam war costs.[10]

Although the major advantage to cost accounting is in the area of improving the effectiveness and efficiency of the government research and development laboratories, there is an added benefit. This is in the area of increased care and sense of responsibility on the part of project personnel. It is one thing to spend money for "nice" items when there is no way of tracing the procurement action to the originator. But if the action can be traced to a specific individual, the willingness to spend without due care is significantly reduced. As Hitch and McKean state in talking about government contractors:

> In the competitive economy, firms risk their own money; they therefore police themselves. In military research and development contractors risk public money, and some fairly effective controls

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[9]Michael D. Reagan, *Science and the Federal Patron* (New York: Oxford University Press: 1969), p. 132.

[10]*Ibid.*, p. 135.

against malfeasance, carelessness, and irresponsibility are needed and demanded--even at the cost of some efficiency.[11]

The term "military laboratories" could be substituted for "contractors" in the above quote and the quote would be equally true. The same human characteristics that make up a "contractor" also make up a "military laboratory," and the need for controls is equally applicable.

It is recognized that cost accounting as a management tool for the administration of research and development work must operate in a much different environment than that for a production or construction organization. In the case of production or construction, a measure of progress can be established and observed. In R&D, a method of measuring progress is difficult to establish because of the uncertainty of the output. Horngren points out some of the peculiarities of accounting for research and development.

> Basic accounting for research and development is little different from other types of accounting. Costs are projected and accumulated by responsibility, by nature of expenditure, and by project. But research has the following peculiar characteristics:
>
> 1. The over-all amount to be spent is appropriated by top management much as is done for advertising. The general emphasis of the research program is also settled by top management.
> 2. The details of execution are in the hands of the research director, who necessarily must be a *manager*, an individual who sees that his personnel work effectively. This effectiveness is difficult to measure but is essential for a successful research program. Put another way, research must be managed, and yet research workers need a

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[11] Charles J. Hitch and Roland N. McKean, *Economics of Defense in the Nuclear Age* (Cambridge, Mass.: Harvard University Press: 1960), p. 51.

stimulating, unfettered environment accompanied by a minimum of red tape. Most research workers are extremely intelligent and self-starting. They need an impelling atmosphere and enough cost-consciousness and direction to insure that company objectives will be achieved.

3. The central problem in appraising research performance is measuring effectiveness and benefit. This problem is not solved merely by comparing cost incurrence with cost budgets. A research department may consistently stay within its budget constraints and yet be ineffective. The difficulties of joint costing are overwhelming. For example, it is often hard to isolate the relative contributions of research, production, and sales effort to the success or failure of a new product. In the long run, a research program necessarily must be judged by its over-all fruitfulness. In the short run, the effective utilization of research resources is dependent on the selection of appropriate personnel and *managerial* talent on the part of its administrator.[12]

Although Horngren's concepts are specifically related to industrial research and development, they apply equally well to military R&D. He further states:

> As already mentioned, keeping actual expenditures within budgeted amounts is not desirable in itself without some measure of project progress (output). About the only gauge of output is some kind of progress report, however fuzzy it may be.[13]

Mitch and McKean also recognize the difficulties of defining the output of an R&D project with any degree of certainty.

> Exploratory R&D often produces quite unpredicted payoffs. Hence, while the output of R&D is of enormous significance to future capabilities, that output is extremely uncertain in both form and magnitude, and there is no way to show what a particular year's program will produce. Judgement on the size and character of the program must be based

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[12]Charles T. Horngren, *Cost Accounting, A Managerial Emphasis* (Englewood Cliffs, N. J.: Prentice-Hall, Inc.: 1967), pp. 388-389.

[13]*Ibid.*, p. 391.

largely on experience with similar programs in the past, taking both successes and failures into account.[14]

There is also a need for training the managers and project personnel at all levels in the purposes of cost accounting as a management tool. Horngren has the following to say about the administration of accounting techniques:

> Responsibility accounting, budgets, standards, and other accounting techniques have arisen to aid management. When they are administered skillfully, they are of indispensable help. However, when they are not so administered, they may do more harm than good. We all know that organizations achieve objectives through human beings and inanimate resources like machines, buildings, accounting techniques, and materials. To do a good job, the laborer must use the materials and machines skillfully. And so it is with accounting techniques and systems; they must be administered astutely if their planning and control effectiveness is to be maximized.
>
> Unfortunately, the human aspects of cost accounting are much more troublesome in practice than the technical phases....
>
> Accountants in general need to become more cognizant of the administrative problems which evolve from the very nature of budgets and cost controls. Accounting systems put operating people on the spot--under surveillance. The natural reaction to the pinpointing of performance is self-defense. A major duty for accountants is to persuade the users of data that accounting reports really exist to aid the manager in doing a better job.
>
> It has been said that, in today's complicated business world, accounting is the Seeing Eye dog of management. But often it's a case of the blind leading the blind. This is the accountant's greatest challenge. Accountants must communicate their techniques with care and enthusiasm, particularly to the top executives, whose attitudes often trickle down throughout the entire organization. Otherwise,

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[14]Charles J. Hitch and Roland N. McKean, *Economics of Defense in the Nuclear Age* (Cambridge, Mass.: Harvard University Press: 1960), p. 51.

> the best ideas will be rejected by managers who may not comprehend their importance.[15]

If a manager does not have a proper understanding of the significance of the data presented to him from a cost-accounting system, he may make some wrong decisions on various projects under his direction. In general, the cost-accounting information can only provide a warning that something is not as predicted. For example, the cause for surplus funds in a given project can be anywhere from sickness of a key typist in the procurement office to a nationwide strike of the transportation system. Or it could also be due to poor performance on the part of the project personnel. Each one of these causes requires a different action on the part of management. It is a wise manager that makes sure of his ground before launching into any remedial actions. As Horngren states

> Budgets and standards will be helpful management tools if managers use them skillfully. A superior tool in the hands of a clumsy oaf may do more harm than good; in the hands of a skilled artisan, it becomes an important instrument that helps toward pleasing results.[16]

The Navy recognizes the need for training technical personnel as industrial managers and operates a training program to that end at Port Hueneme, California. The foreword to their pamphlet used in the training program

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[15]Charles T. Horngren, *Cost Accounting, A Managerial Emphasis* (Englewood Cliffs, N. J.: Prentice-Hall, Inc.: 1967), p. 275.

[16]*Ibid.*, p. 288.

demonstrates their understanding of the importance of communications between the technical personnel and the accountants:

> The Civil Engineer Corps Officers School has long recognized that many undergraduate engineering curricula do not provide sufficient information to prepare the military engineer for his ultimate role as an industrial manager. In consequence, his knowledge of business practices and his ability to communicate with contemporaries in the navy industrial community have been impaired.
>
> Over the past several years the added responsibility which has been assigned to the Naval Facilities Engineering Command in facilities management, and the consequent challenges to the Civil Engineer Corps Officer, have further highlighted the problem.
>
> The CECOS curricula, for some time, has included a short course in the operations of the Navy Industrial Fund, as employed by the Naval Facilities Engineering Command at its Public Works Centers. In addition to the goal of providing an overall exposure to the Navy's Industrial System, the course has also attempted to provide the young CEC Officer with the vocabulary of the accountant, and a knowledge of the accountant's tool.[17]

The research performed in this study touched on the concept of "service funding" in the DOD laboratories. The service funding concept is the reason the laboratories are forced into a cost-accounting system for research and development. The Air Force experienced numerous problems in its test of service funding at the Arnold Engineering Development Center. The level of these difficulties was of such magnitude

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[17] U.S. Department of Defense, Department of the Navy, *Knowing NIF - A Managers Guide to the Navy Industrial Fund* (published by Department of the Navy, Naval School, Civil Engineer Corps Officers, Port Hueneme, California: April 1970), p. iii.

that the Air Force does not plan to use service funding now. Some of the problems encountered by the Air Force in its test of service funding are listed here to show their diversity.

1. Project personnel at new System Project Offices were reluctant to state the costs of AEDC testing in their programs for fear it would jeopardize their entire program.[18]

2. NASA was performing wind-tunnel testing under federally financed arrangements which were considerably cheaper than the AEDC service funded operations.[19]

3. AEDC test cell programers were not participating in advance planning with customers. In some cases, contracts were let with commercial organizations by systems project offices which committed AEDC to considerable testing before AEDC learned of the testing requirement.[20]

4. The costs of testing at AEDC are expensive and it is necessary for each customer to program for these costs. For example:

> The MINUTEMAN and F-111 programs, each of which had over the years received more than $25 million in test support at no cost to the systems involved. During FY 1967, the F-111 program had obtained over $4 million of large wind tunnel time. In the past, test support costs, except for test

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[18] U.S. Department of Defense, Department of the Air Force, *History of the Arnold Engineering Development Center, First Phase of Service Funding, Fiscal Year 1969, Narrative* (published by Department of the Air Force, Arnold Engineering Development Center, Tullahoma, Tennessee: 1969), p. II-44.

[19] *Ibid.*, p. II-58.

[20] *Ibid.*, p. II-44.

> peculiar items, had been borne by AEDC and were not reflected in specific program documentation nor, without actually saying it, in reported program costs.[21]

The Air Force problems appear to be caused by the lack of experience in an industrial fund type of operation and the lack of a good cost accounting system. Either of these factors can cause serious problems in attempting to implement a service-funding operation. Probably the more serious of the two is the lack of a good cost-data system. Without this, any attempt to charge a user for services rendered could not be supported by actual figures of direct costs or justify the overhead charges.

The concept of cost accounting for research and development work appears to offer many advantages. It is not clear from this analysis whether a service funding operation (industrial funds) is really necessary in a research and development organization if a cost-accounting system is used. The principle of service funding requires transfer of funds within the installations for each job performed outside of the responsible agency regardless of the amount of funds involved. This increases the amount of paperwork involved, but does ensure control of the expenses charged to a job order; when the funds are gone all work will stop.

Since the military research and development organizations are not profit-making organizations, it would appear to be as effective to provide funds directly to each activity,

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[21] *Ibid.*, p. II-43.

which would use the cost-accounting system to identify charges to the various programs. Such an operation would require coordination between the using organization and the servicing organization, to reach agreement on amount of work or costs that would be absorbed by the user. But it would not require the added paperwork involved in the transfer of funds and subsequent follow-up to keep track of status of funds. However, without the use of actual funds, the incentive for the performing organization to ensure that they stay within agreed-upon amounts of work will be reduced. This can lead to "overruns" in the amount of work performed in accomplishing a given project.

In any case, some form of cost accounting for research and development offers many advantages. These advantages include:

1. Cost consciousness at all levels of operation,
2. Statement of all costs to perform a task, project and/or program,
3. Opportunity for management to review progress of work.

In this day of automatic data processing, a cost accounting system should be relatively easy to provide. After the initial debugging of the program, such a system should not require any significant increase in manpower at the project engineering level.

E. Recommendations

1. It is recommended that a system of uniform cost-accounting principles be used throughout all research and development organizations within the government as well as those organizations performing work for the government. The system should define the various parameters used in the cost-accounting system and the use of such definitions by all applicable organizations should be mandatory. The work of the Cost Accounting Standards Board under the direction of the Comptroller General should be used in the development of the system.

2. It is recommended that a training program be initiated in all research and development organizations within the government to acquaint cognizant participants with the purposes and advantages of the cost-accounting system. This program should be in two parts: one part to train the managers in the proper use of cost accounting as a tool in the administration of research and development projects; the other to train the scientists and engineers to accept and trust the purposes of cost accounting.

3. It is further recommended that the program to develop and improve cost-accounting principles for research and development organizations by the Department of Defense be continued and extended to all branches of government. This includes extending cost accounting to the state, county and city levels and in such widely diverse areas as vehicle

registration, soil conservation projects, wildlife management, drug rehabilitation and the like.

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