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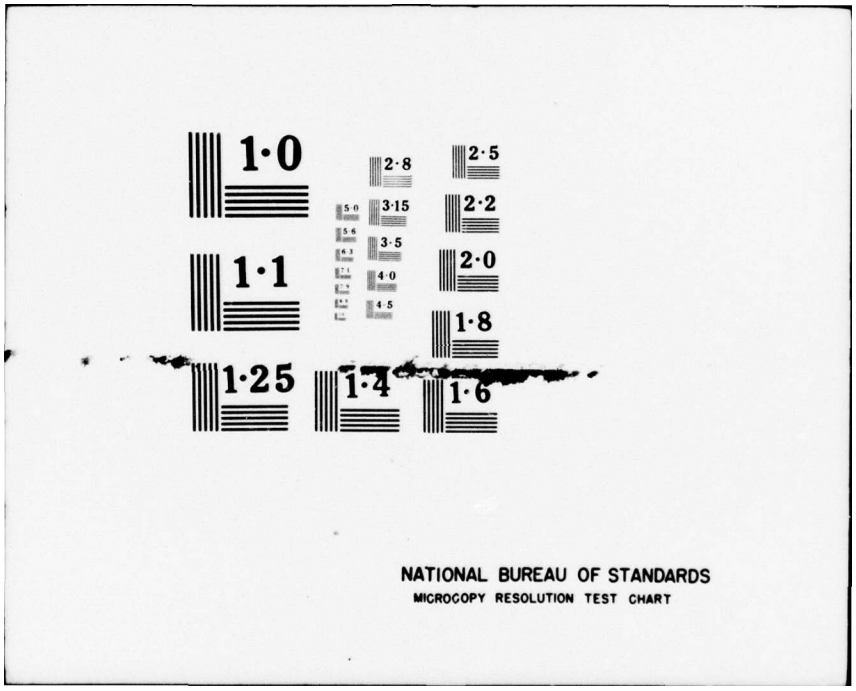
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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE:

INFORMATION SYSTEMS FOR PROGRAM MANAGERS

STUDY GOALS: The purpose of this study was to learn what constitutes a management information system, what guidelines one should follow to develop one, and what actions have been taken to reduce the proliferation of management systems.

STUDY REPORT ABSTRACT

In 1966 both the Department of Defense and Industry had independently identified a major problem which still exists today. Briefly, the problem was described as a proliferation of management systems of all kinds having a cumulative effect which is adverse to mutual objectives of government and industry.

This study provides the reader with a good foundation upon which he can advance his knowledge of information systems. It starts with the basic definitions of what a management information system is, what is is used for, its characteristics and the role of information in management functions. Attention is then focussed on the development of an information system. The nature and extent of the proliferation problem is explored with a detailed review of actions that the Office of the Secretary of Defense, and the Air Force, have taken to solve the problem. Forty major events in the 1962-1974 time period were analyzed to show the concern and attention being given to this topic of current interest.

The central theme of the study is that management information systems are very important, because they are a mandatory tool for the successful management of any program. In addition, high-level DOD emphasis is being focussed on this area of study. The program manager must be aware of the ever-changing DOD policies and the basic principles upon which he can build or modify his management information system. He can no longer play a passive role, but must be an active participant in its development and operation.

KEY WORDS: MATERIEL ACQUISITON PROGRAM MANAGEMENT INFORMATION SYSTEMS COMMUNICATIONS

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Carl William Rule

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May 1974

DEFENSE SYSTEMS MANAGEMENT SCHOOL

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

INFORMATION SYSTEMS FOR PROGRAM MANAGERS

STUDY REPORT
PMC 74-1

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INFORMATION SYSTEMS FOR

PROGRAM MANAGERS

An Executive Summary
of a
Study Report
by

Carl William Rule
Major USAF

May 1974

Defense Systems Management School
Program Management Course
Class 74-1
Fort Belvoir, Virginia 22060

INFORMATION SYSTEMS FOR PROGRAM MANAGERS

STUDY REPORT

Presented to the Faculty

of the

Defense Systems Management School

in Partial Fulfillment of the

Program Management Course

Class 74-1

by

Carl William Rule
Major USAF

May 1974

This study represents the views, conclusions, and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School nor the Department of Defense

EXECUTIVE SUMMARY

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ACKNOWLEDGEMENTS

I would like to express my sincere thanks to several members of the faculty who assisted me with this research effort. Commander Timothy Hall was instrumental in obtaining required literature from the Defense Documentation Center, Cameron Station, Virginia. Mr. Andrew Low and Dr. Andrew Mosier provided invaluable insight to DOD policies and the efforts to reduce the proliferation of management systems. Valuable guidance concerning Cost Schule Control System Criteria was given by Mr. Arnold McManamon. I am especially indebted to my advisor Lieutenant Commander Joseph E. Callahan. He is greatly responsible for any degree of success obtained in this endeavor.

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INFORMATION SYSTEMS FOR PROGRAM MANAGERS

Introduction

Mutual DOD-Industry Problem

By early 1966, both the Department of Defense (DOD) and industry had independently identified a major problem which still exists today. In a speech delivered in March 1966, the then Assistant Secretary of Defense (Comptroller), Robert N. Anthony, stated the following:

> During the last decade, the Military Departments have developed and produced a wide variety of weapon and support systems, and they have also designed a wide variety of management systems for dealing with these major acquisitions. Each manager has separately wrestled with the problem of devising a system for describing plans, for measuring and controlling progress against those plans, and for recording experience so that the estimating and management job could be done better the next time. The result has been a proliferation of systems, reports, and acronyms (2:2).

The aerospace industry outlined its findings of a year-long study conducted by the Aerospace Industries Association (AIA) in its May 1966 presentation to top management within DOD. The primary finding was:

> We (Industry) find that the greatly increasing number of management systems of all kinds emanating from different functional arms of DOD and the Services, in a variety of forms, from a variety of sources and in a variety of time-phasing, often coming in through different doors of Industry, have an interrelationship with a cumulative effect which is adverse to the mutual objectives of Government and Industry (2:2).

In 1970 the Blue Ribbon Defense Panel quantified the magnitude of the management system proliferation problem. Its report estimated that one out of every seven acquisition dollars had been used for management

system purposes. In FY 1969 this estimate represented 4.4 billion dollars of the Defense Budget (6:45).

Purpose

The main purpose of this study is to enhance my knowledge and professional development as a manager by researching the subject of management information systems as it relates to the proliferation problem that industry and DOD have identified. It is also intended to share whatever knowledge is gained with others who have similar interests.

Research Questions

In order to accomplish the purpose, the research effort addressed itself to the following questions:

1. What constitutes a Management Information System?

2. What guidelines should one follow to develop a Management Information System?

3. What is the nature and extent of the management system proliferation problem?

4. What are some of the actions that have been taken by the Office of the Secretary of Defense, and the Air Force, to reduce the proliferation of management systems?

Significance of the Study

Management information systems are very important, because they are a mandatory tool for the successful management of any program. In addition, high-level DOD emphasis is being currently focussed on this area of study. The program manager must be aware of the ever-changing DOD policies and the basic principles upon which he can build or modify his management

information system. He can no longer play a passive role, but must be an active participant in its development and operation.

This study is significant in that it addresses a topic of current interest and may help reduce the proliferation of duplicative, inefficient, and ineffective management systems.

Limitations

Due to the relatively short period in which to complete this study, effort was limited to a survey of current literature in the field. Admittedly, the coverage is not exhaustive on every facet, but it should provide the reader with a good foundation on which to advance his knowledge of information systems.

Organization

Four main areas are to be discussed in this paper. Chapter II defines what a Management Information System (MIS) is, what it is used for, its characteristics, and the role of information in management functions. In Chapter III attention is briefly focussed on the development of an information system. Next, in Chapter IV, the nature and extent of the management proliferation problem within DOD is explored. A somewhat detailed review is given of what actions the Office of the Secretary of Defense (OSD), and the Air Force, have taken to solve the problem. This portion of the study culminates in what is perceived as the current DOD policies on acquisition management systems. Chapter V, the fourth and last area, outlines the conclusions and recommendations for future studies.

Summary

In this introductory chapter, a mutual DOD-Industry problem was identified. Briefly, the problem was described as a proliferation of

management systems of all kinds having a cumulative effect which is adverse to mutual objectives of government and industry. The purpose of this paper is to study MIS as it relates to the proliferation problem. Next, four research questions were identified, and several reasons were given to describe the significance of the study. The scope of research was limited to a literature survey of DOD programs and efforts. A preview of the four remaining chapters was given in the organization section. Now we are ready to consider the study of Management Information Systems in Chapter II.

Management Information Systems

Definitions

The first problem encountered in the study of a Management Information System (MIS) is trying to define it. As Dearden has suggested, it is difficult to describe MIS in a satisfactory way because this conceptual entity is embedded in a"mish-mash" of fuzzy thinking and incomprehensible jargon (10:90). Many authors and experts have already established their own unique definitions. References such as Coleman and Riley contain comprehensive lists (7:4-7). The problem then is to adopt a standard definition which is acceptable to the academic, commerical, and government communities. For example, in Dickson's (1970) survey of MIS definitions, half the respondents classified MIS as a "thing"; the other half classified it as a process or philosophy (16:16). The DOD definitions for information system and acquisition management system are quoted below.

> Information System.
>
> An orderly way, generally including a documented procedure, of providing managers the information necessary for (1) assessing the effectiveness of existing policies, and the development and evaluation of policy changes, and (2) accomplishing objectives and utilizing government and contractor resources in the most effective and efficient manner. An information system may be manual or automated (40:1).
>
> Acquisition Management System.
>
> A documented method for assisting managers in defining or stating policy, objectives, or requirements; assigning responsibility; controlling utilization of resources; periodically measuring performance; comparing that performance against stated objectives and requirements; and taking appropriate action. A management system may encompass part or all

> of the above areas, and will require the generation, preparation, maintenance and/or dissemination of information by a contractor (40:1).

One can note that elements from the DOD definition of Information Systems are contained in the definition for Acquisition Management Systems. Both definitions must be considered to fully define MIS concepts.

Management Information System (Army). As previously mentioned, there is difficulty in obtaining a single universally acceptable definition even within DOD. For instance, the Army has a different definition. Formally, a Management Information System is defined by the Army as:

> . . . an organized assemblage of resources and procedures required to collect, process, and disseminate data for the purpose of converting it to meaningful information for decision making in executing the command management functions of planning, organization, staffing, directing, coordinating, and controlling the use of resources to accomplish missions and tasks (32:A-1).

Management Information System (Communication). According to Murdick and Ross, MIS can be defined as a communication process in which information (input) is recorded, stored, and retrieved (processed) for decisions (output) on planning, operating, and controlling (23:292). This concept is shown in Figure 1. Along with Murdick and Ross, Lefkovitz (16:17) submits that MIS constitutes the most complex form of communication system in existence.

MIS Concepts

So far, considerable emphasis has been placed on rigorous and formal definitions. The reason for this is that most recent research and development has been on formal information systems (16:16). If one were to examine

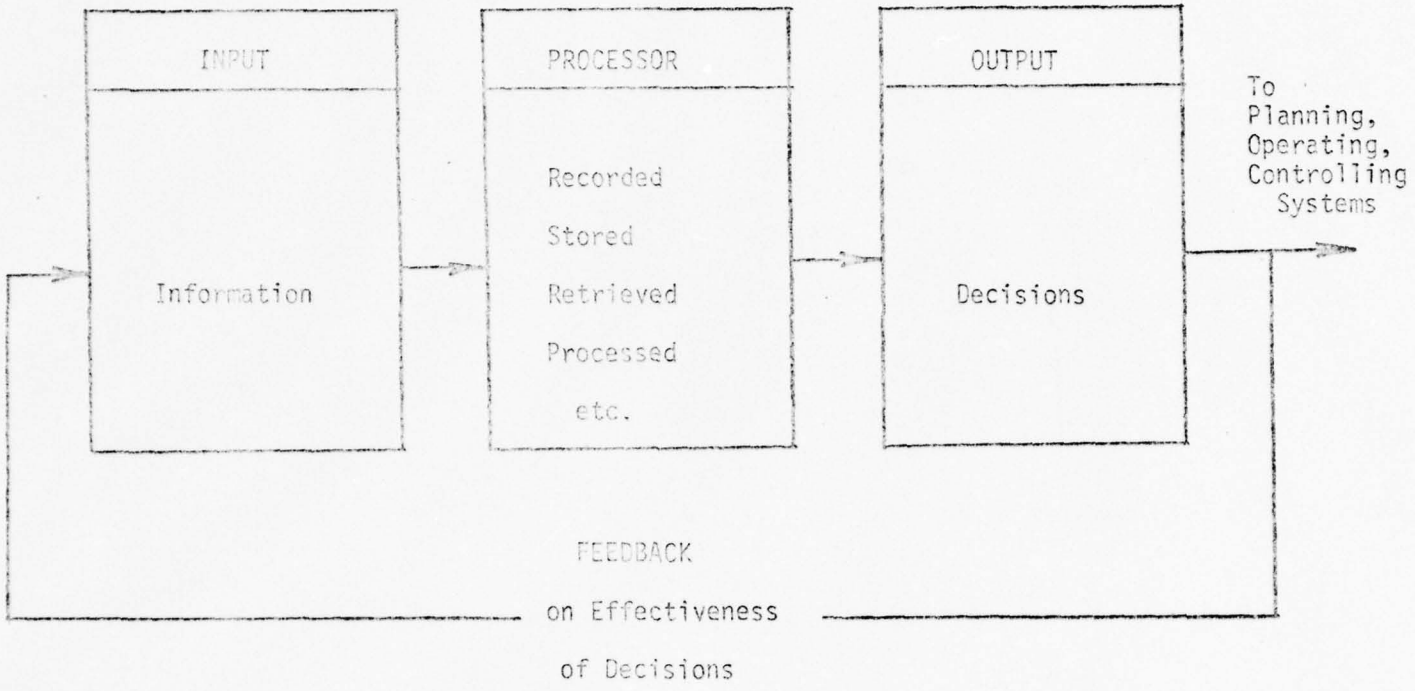


Figure 1. Information and Decisions--A System (From ref 23:293)

the foregoing formal definitions and express them in less rigorous language, one might describe a Management Information System as providing the right information to the right people at the right time and at the least cost to make management decisions. The key characteristics or concepts in the definition of MIS are that it is a disciplined system that processes information in order to reduce risks in management decisions while making effective use of resources (men, money, and material).

History

Now that the MIS concepts have been described, the reader may be curious to know how long MIS has been in existence. One author has suggested that perhaps Moses had the first MIS when he came down the mountain with the Ten Commandments chiseled into stone tablets. He humorously added that today's reports carry more information per pound, but they are certainly no lighter to carry than the stone tablets of Moses' day due to reams of data which are commonplace today (4:1).

One can find many other interesting examples of early information systems dating back to 2000 B.C. Those early systems had much in common with those we have today. The most common thread is the concept that information is a source of power. We now use the term "control" to be more precise in interpreting the basis behind power (26:69).

Information

The definition and history of MIS as discussed in the previous two sections concentrated on a very important key word. That word is "information." The meaning and value of information must be understood before proceeding any further.

Information is not the same as data, and it is important to distinguish the difference. Data are the symbols--the surrogate images of activities in the operating organization and external environment--that are communicated, processed and stored (16:19). They are facts in isolation, the raw and intermediate material from which information is produced. Information is evaluated data that is meaningfully related to a user's problem (or opportunity) (22:1).

Ideally, information is the sum total of data needed for decision making. Its value can be considered in terms of relevance, timeliness, accuracy and actionability. Each term is briefly discussed below.

Relevance. Information must influence decisions. No information is worth producing if it does not influence management decisions or functional operations of the organization. According to Forrester, "If management is the process of converting information into action, then it is clear that management success depends primarily on what information is chosen and how the conversion is executed. The difference between a good manager and a poor manager lies at this point." (20:5)

Two corollaries to the foregoing quote are rather obvious. Prevent valueless information from being produced by not requesting it; and, second, cancel reports that become obsolete (15:44). Effects of inadequate determination of relevant information becomes greatly magnified over the life cycle of the program.

The Logistics Management Institute has made several recommendations concerning relevance of information.

Most important, he needs it in a form he can use; that is, in a form which will provide at least four things:
(1) A ranking of problem areas by criticality.
(2) An indication of potential trouble spots.
(3) Anticipated schedule slippage and cost overruns or underruns.
(4) A means of determining where management can withdraw resources to assist more critical phases." (19:35-36)

Timeliness. Information should be provided at the appropriate time to make a given decision--not too soon and not too late. Intervals at which information is required varies with each situation. If it is determined that real-time reporting is required, one must consider the acceptable "reporting delay." That is the time it takes to record, process, and transmit data from the time an event is observed (13:692). Few programs, if any, require this continuous type reporting. Dearden (11:123) supported this statement as follows: ". . . of all the ridiculous things that have been foisted on the long suffering executive in the name of science and progress, the real time management information system is the silliest."

For more routine decisions, the "reporting interval" is important to determine. This is defined as the time between reports. Hirsch (15:43) provides valuable insight to the advantages and disadvantages of long vs. short reporting intervals.

Accuracy. More accuracy means higher costs. Therefore, the amount of accuracy provided should be kept down to the point below which decisions of operations would be different.

Actionability. This term implies that information is of value only if it influences policy or operations, and thus has no value if prepared for individuals without the appropriate influence. One could correlate this with the concept of getting the right information to the right people. Information supplied to poeple who do not enter into the decision process, but would otherwise feel by-passed, is information of no value.

Reasons for PMIS

A logical question to ask is, "Why have a Project Management Information System (PMIS)?" A preliminary thought is that a PMIS is imposed on program managers in response to requests for information or to requirements levied by DOD top-level management. A few examples of the major events and reports which help motivate the need for MIS are the Defense System Acquisition Review Council (DSARC) process, Selected Acquisition Reports (SAR), Program Assessment Reviews (PAR), and Command Assessment Reviews (CAR) in the Air Force. In addition to these special reports and reviews, there are "everyday" functions a PMIS must perform.

Functions of PMIS

Archibald (4:4) has identified the primary functions which have been paraphrased below:

(1) Plan, subdivide, estimate, integrate, forecast, evaluate, and control all projects, integrating all their life cycle phases.

(2) Integrate action plans, schedules, and resources (money, manpower; machines, etc.) with the Work Breakdown Structure elements and organizational responsibilities. This would also include estimates, budgets, variances, actual expenditures, schedule progress, and forecasts of time and cost to complete at completion.

(3) Allocate resources over multiple projects or reschedule activities to utilize available resources in the most productive manner.

Three simplified words can explain the reason for PMIS. They are "documentation," "surveillance," and "projection." Documentation means to record past performance for future use such as estimating, negotiations, etc. Surveillance implies that current performance is measured against what was planned and variances can be detected when they occur. Projection suggests that the information can identify trends in the future. Such early identification can initiate corrective action in time to prevent undesirable outcomes.

Characteristics of PMIS

The foregoing definitions of PMIS functions may have been difficult reading and somewhat confusing. Archibald (4:6) has taken a somewhat different approach by specifying the characteristics of PMIS. Using this point of view, it may help to clear up and integrate what has been written so far.

(1) Purpose: The purpose of PMIS is to manage temporary rapidly-changing projects.

(2) Type of Information Handled: Many types of information are handled which affect several functional areas. Information should be timely, accurate, and relevant to be of value.

(3) Time Horizon: The PMIS exists during all phases of the life cycle.

(4) Flexibility: The PMIS should be flexible enough to meet the

changing needs of the program over the life cycle. New or additional requirements are levied and obsolete requirements for information should be deleted.

(5) Predictive Capacity: It must have strong predictive capacity reaching to the end of the project to extrapolate trends and to forewarn the manager of problem areas.

(6) Integrative Capacity: The PMIS must be highly integrative because action plans, time, cost, resources, logistics, and business acquisition must be interrelated and summarized for each project and each functional organization. The capability must exist to route information to the person or organization which requires it.

(7) Ease of Implementation. The PMIS is extremely difficult to implement due primarily to complexities in integration of tasks.

Information and Management

In the beginning of this chapter, definitions of an information system and an acquisition management system were given. Two separate definitions might imply that the information and management are two distinct things. In reality the two are very closely related. Information is a vital part of management planning, decisions, and control.

Many organizations and managers make the basic mistake that MIS can be designed or made operational without the backup of an adequate management system (23:166). The purpose of the management system is to develop

plans for achieving objectives, to organize for implementing plans, and to control performance so that plans and actions occur on schedule. Murdick and Ross (23:167) graphically show the role of information in five major steps in the management process. Specifically, information affects: (1) recognition of a problem or an opportunity; (2) definition of problem or opportunity and development of alternate courses of actions; (3) decisions; (4) implementation of plan; and (5) control of performance against plan.

Figure 2 on the following page shows the feedback role that information assumes in the system acquisition planning and control activities.

The purpose of this section was to show a strong interrelationship between management and information systems. Although they are not identical, it is not difficult to see why some authors consider the two to be inseperable. It should be emphasized that a management information system is not a substitute for management, but is a powerful tool of the program manager.

Summary

This chapter has reviewed the difficulty in trying to establish a rigorous, standard definition of MIS. Throughout the history of MIS, which stems back to the time of Moses, the common thread has been the concept that information is a source of power or control. The value of information was briefly analyzed in terms of relevance, timeliness, accuracy and actionability. Next, the functions, reasons for being, and characteristics of PMIS were explored. Basically, MIS helps the program manager fulfill two needs. First, he can respond to requirements imposed by top level DOD managers and policies. Second, he uses MIS to manage his program. Sometimes the two needs are congruent. Some of the noted characteristics of

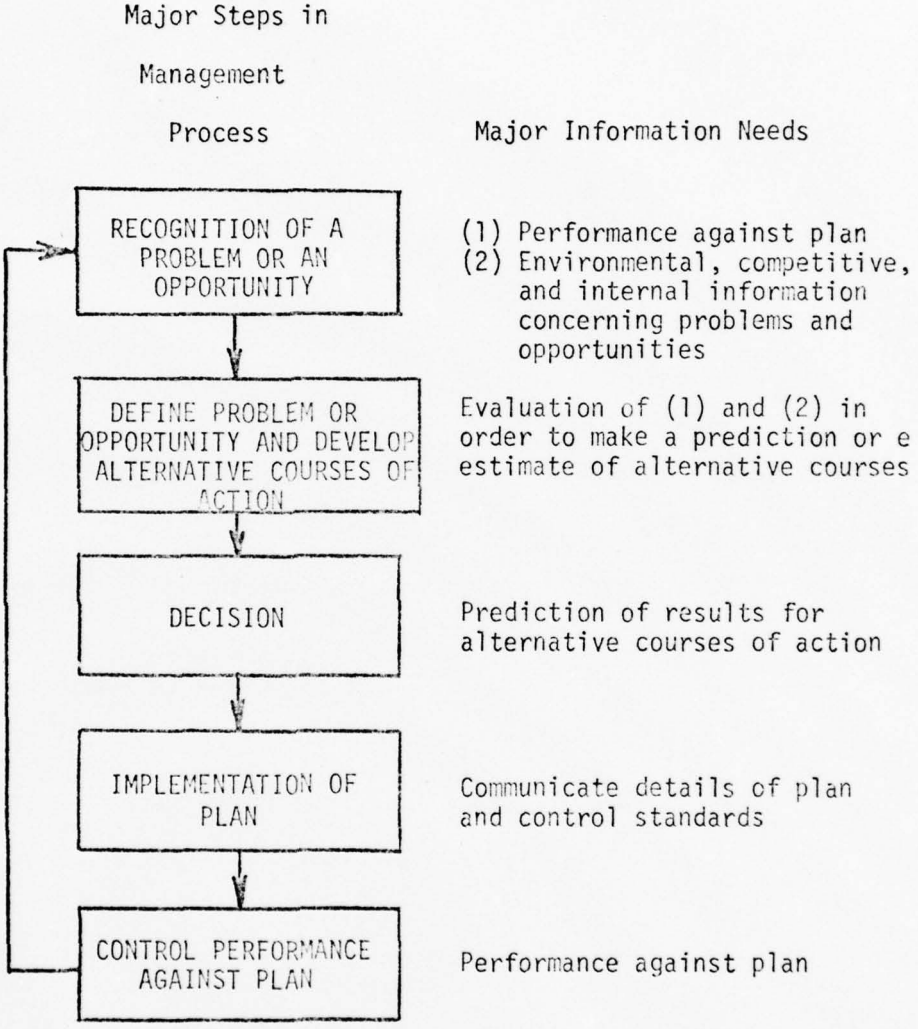


Figure 2. The Management Process and Information Needs (From Ref 23:167)

MIS are that it manages a rapidly changing program, it handles many kinds of information over the life cycle, and it is a flexible and predictive system which is difficult to implement. Lastly, the strong interrelationship between management and information systems was discussed. The next chapter will address the development of a management information system.

Developing an Information System

Guidelines

Management information systems don't just happen; they have to be uniquely constructed to fit the enterprise they are to serve (18:33). This chapter provides general guidelines to help minimize problems that are encountered when attempts are made to develop new or improved management information systems. Twelve areas will be considered.

When to Start. DOD Manual 7000.6M, Acquisition Management Selection List (AMSL), suggests that a good starting point is normally subsequent to formulation of a plan for controlling the procurement or program (36:iii). In other words, start after the Program Management Plan (PMP) has been established. Another useful document for planning MIS is the Work Breakdown Structure (WBS).

Key Documents. Archibald and Villoria have written that WBS is one of the "must" components for the design and operation of a model system (5:137). It is through the WBS that work of a company is subdivided into small manageable tasks by divisions, departments, and sections. This structured systematic subdivision of tasks allows a truly integrative PMIS which results in better planning, budgeting, scheduling and control. Other important benefits include the ability to summarize information at successively higher levels ("bottoms-up" summarization of project information), and to identify deviations from plan on an exception basis. According to

DOD Directive 5000.1, a WBS shall be developed for planning and assignment of responsibilities, control and reporting of progress, and to establish a data base for estimating future costs of defense systems (35:6). For these reasons the WBS is considered an especially valuable document in addition to the PMP for planning the management information system.

Define Objectives. Each objective should be stated as specifically and unambiguously as possible. It is strongly suggested that requirements placed on a contractor should mesh with the government management scheme (36:iii). This infers strong dependence on the PMP. Objectives should answer questions regarding the purpose or benefits expected from the system (5:138).

Who Defines Goals. Opinions of many experts are similar to the following statement made by Thurston (27:11):

> I consider that in the past decade a significant characteristic of information-systems work has been too great a degree of control in the hands of specialists. This situation has developed in part through the failure of top management to place controlling responsibilities with operating managers.

John Diebold (12:16) stated,

> A recent survey of more than 2500 executives was undertaken on behalf of the 140 U.S. and overseas companies sponsoring the Diebold Research Program. The survey indicates that technicians, not management, are setting goals for computers. This is one of the prime reasons why companies often fail to realize the true potential from their data processing investment.

Information requirements should be formulated on a top-to-bottom basis by the highest appropriate level at which the requirement for information is established and be under the direction of the responsible functional

activity (33:129). Operational managers should determine what is needed, and the specialists should concern themselves on how to obtain it (33:97).

Use the Task Force Approach. Each part of the organization that requires information should be represented on the task force or team so the needs and capabilities of each functional department will be known.

Define Needs. Needs support the objectives. Generally, the program manager must have information in the areas of cost, schedule, and technical performance in order to adequately respond to higher headquarters' reports and briefing requirements (e.g. DSARC, PAR, CAR, and SAR). He must know what specific reports are required, who the source is, when the reports are needed, and how detailed the report should be. Each affected part of the organization should similarly define their specific needs to support their objectives. They should also define the source, when the report is needed, and to what level of the WBS should their information be reported. All information which is requested should be relevant and absolutely needed to satisfy definite objectives.

In the process of identifying total needs as a task force, it is possible to determine if a given part of the organization has the manpower to adequately review all the information that it requested. If too much relevant data has to be reviewed by too few people, action should be taken to augment the manpower shortage or to reduce their workload by automation, contracting a firm to help, or any other suitable means. It is also possible to determine if any of the sources of data is undermanned to adequately meet its responsibilities.

Explore Present Capabilities. The task force should determine what existing reports, procedures, and methods will satisfy current needs. Contractors' internal systems and data products should be used to the maximum practical extent. Present capabilities should be used or tailored as much as possible instead of imposing a new requirement. The Aerospace Industries Association charges that an additional 15 to 25 percent to the unit cost of a major end item system may result when information reporting criteria are imposed on government contractors (9:18).

Environmental Factors. Environmental factors to consider are those of social, legal, technological, demographic, economic, political, or competitive natures. For example, one could cite the DOD environment which currently favors "tailoring" existing management systems rather than designing new ones. More will be discussed on this in Chater IV.

Avoid Technical Pitfalls. Certain techniques or procedures are employed in any new system. Should any particular technique prohibit useful results, the technique should be reexamined carefully and revised or discarded (4:12). Specialists familiar with hardware operation and technological advances are very important for this phase of development.

One technique that is useful to pretest a new design is to model it by means of analysis or by simulation. Simulation can be either manual or computerized. The final system may not resemble the model, but it will be the one that works (21:58).

Educate All Affected Personnel. Failure to recognize the need for indoctrination, training, and development of all affected managers and specialists is a primary source of unnecessary difficulty. People resist

changes which they do not understand or trust. Therefore, change implies criticism of the old way, and must be offset by proper education regarding the need for change, as well as expected results (4:12).

The need for training is critical. For example, acquisition and training of qualified Army Automated Data Processing (ADP) systems personnel has not kept up with requirements or technological advances (33:7). The Army does not have sufficient qualified information systems and technical ADP personnel to staff all the organizations presently developing information systems. The problem is not limited only to the Army; shortages in ADP skills occur in industry and within the entire government (33:5).

Murdick and Ross (23:556) have suggested that the impact of MIS on business has led to three questions:

1. Who should we train in MIS?
2. What should our objective be in each case?
3. What content and educational level should we strive for in our training courses?

Investigations indicated the most pressing needs for training in MIS are for the following groups (23:556):

1. Top managers.
2. All levels of managers.
3. Managers of business systems and information systems groups.
4. Systems analysts and designers.
5. Computer programmers for systems applications.

Suggested curriculums have been described by Murdick and Ross (23:555-563), as well as by Mosier (22:16-41).

Evaluate and Iterate. The management information system should be evaluated periodically. Programs are dynamic and needs change throughout the life cycle of the weapon system. Output information should be compared against inputs to insure that all information being requested satisfies a valid need. As reports become obsolete, they should be cancelled. Or, as

time passes, a particular portion of the activities may demonstrate that it is a very low risk area; in this case, the "report by exception" principle would apply. Summary type reports have also been recognized as effective for low risk areas. Information needs are dynamic, and MIS optimization is an iterative process.

Computer-Based Information Systems (CBIS)

Whenever MIS is discussed, it is almost invariably stated that management information systems do not require a computer and that many forms of MIS are not computer-based. The introductory definition of Chapter II made this distinction. Dearden, however, makes the following observation: "Yet, if one looks at what is actually being discussed, he quickly discovers that the term 'MIS' is used, essentially to stand for computer-based information systems." (10:91).

The computer has been applied to MIS and has the potential for even wider application. Herbert Simon views the computer as the fourth great breakthrough in history to aid man in his thinking and decision making ability (23:238). There are several advantages and disadvantages which should be compared.

Advantages: First, those capabilities considered to be beneficial will be individually discussed.

(1) Speed: The single most important reason to automate a management information system according to Krauss is the need for speed and timeliness (25:6).

(2) Handles Large Volume: A great advantage of the CBIS is to handle

large volumes of data economically, quickly, and accurately.

(3) Accuracy: Computer calculation errors are almost non-existent. Those that do exist are invariably caused by computer programmers or others who prepare input data. The self-check ability of the computer helps to reduce the "man-made" errors. Also, highly precise information can be obtained very quickly which is a distinct advantage over manual methods.

(4) Economy: As the volume of data increases beyond some break-even point, the cost savings increase rapidly. A high volume of work has inherent economies.

(5) Legibility: Automated reports are neat and easy to read. This means of computer published reports contributes greatly to timeliness, as no delays are incurred for typing, hand lettering, or other means of preparation.

Having discussed the advantages of CBIS it is interesting to note Murdick and Ross' contention that the major objective of computer-based systems for decision making is integration of the functions, resources, and management levels of the organization (23:272).

Disadvantages: Next, several non-beneficial features will be summarized.

(1) Discipline and Accuracy: A great deal of precision is required to insure all input data is present, correct, and in the appropriate format. Non-proficient programmers could cause delays.

(2) Administrative Delays: Input data must be coded and key-punched. This finite time delay can be several days to several weeks in duration.

(3) Matching Program with Computer: The best available computer

may not have a library routine or program suitable to the application desired. Therefore, additional time, money, and personnel may be required to plan, program, and de-bug.

(4) Cost: Costs of design programming and start-up usually exceed that of the equipment. Modifying an existing program is also very difficult and expensive. This tends to make computer use rather inflexible. If additional resources are difficult to obtain, the organization is almost forced to keep its existing system.

The two following thoughts indicate there is much room for improvement as far as managing costs of information systems is concerned.

> Although the potential for progress in the automation of the information production process is great--some 50 percent of the cost of running our economy are information costs--improvements and innovations in the information production process are far less than in the production and manufacture of physical goods (23:239).

> . . . In fact, we are spending more and more money on computers and information systems with the apparent result that most executives realize they are not getting their money's worth from these investments (23:161).

The Aerojet-General Corporation, for example, threw out a network of computer-based management information systems that had taken 16 years to develop. The company was spending 10 million dollars per year on computer support. Besides the cost, two reasons why the Aerojet company rejected the computerized system and adopted its former manual methods were (1) changed objectives within the company, and (2) the lack of top-level support (9:x).

(5) Design: A finite time is required to plan, design, test, evaluate, and implement a new system. The program manager may be overly optimistic and expect too much too quickly. Many operations have failed

dismally in an attempt to create the ultimate system in one cut. Many companies take four or five years to achieve minimum results without refinements (7:415).

One Army project has taken approximately 9 months to design and implement its CBIS. The effort involved two men on a full-time basis. The project name is intentionally withheld complying with the DSMS spirit of non-attribution for guest lecturers.

Careful consideration must be given to the time required to implement CBIS. Available working programs or library routines should be sought to reduce the time and costs to implement the computerized system.

(6) Panacea Fallacy: The mere fact that an organization made an attempt to automate its existing files does not necessarily mean that it is a better system. It could well mean that the computer perpetuates inefficiencies at an accelerated rate. Careful planning and design applies just as much, if not more so, to computer systems than to manual ones.

Now that some of the advantages and disadvantages of computer-based information systems have been outlined, the next step is to highlight recommended steps in the CBIS development.

CBIS Development. D. L. Fisher has itemized eight steps to follow in the development of computer-based information systems (25:9). They are as follows:

1. Identification of the problem.
2. Definition of the problem.
3. Study of the old system.
4. Design of the system to solve the problem.
5. Programming of the system.
6. Testing and de-bugging the system.
7. Implementing the system.
8. Supporting the system.

Life Cycle of Information Processing

The last section did not mean to imply that only computer-based information systems have organized development plans. There are many similar checklists, plans, or diagrams for either manual or computer systems. Figure 3 on the next page compares various stages or phases in the life cycle of information processing systems as viewed by three different researchers (18:303).

Perhaps the simplest list of stages in the life cycle of an information system classifies all activities in four major areas (14:preface): analysis; requirements determination; design and development; and implementation and evaluation. The explanation of these four areas, however, is not so simple. Each area has been further defined with sub-steps and discussion which fills six volumes.

One of the points of this section is to indicate that the study of MIS is becoming more organized and structured. Due to the limited scope of this study the reader is encouraged to study other texts for a more complete treatment of how to establish a management information system.

Cost/Schedule Control Systems Criteria (C/SCSC)

The program manager needs accurate information for the reports he must submit, as well as for the decisions he must make. Therefore, he should insure that his contractor used adequate means of obtaining the information. One means to accomplish this task is known as Cost/Schedule Control Systems Criteria. DOD Instruction 7000.2 contains the basic concepts and requirements.

Teichroew (a)1968	Glans et al. 1968	British Computer Society Working Party 10 1967
Phase	Stage	
(1)Perception of need (a)What should the requirements be?	1 Study and Design 1 Study present system	Information Analysis Appraisal of information needs
(2)Statement of Requirements (a)Determination of requirements (b)Statement of requirements	2 Determine system requirements	Outline,design,and justification of information system
(3)Systems design (a)Generation of feasible design (b)Evaluation of feasible design (c)Selection of equipment (d)Improvement of feasible design (e)Optimization	3 Design new system	Systems Design Specification of processing requirements for system Procedure Design Planning and specifying non-computer processing
(4)Construction (a)System (b)Program (c)Files	2 Implementation	Programming Planning and writing computer programs
(5)Testing		Implementation Implementation of system
(6)Operation	3 Operation	
(7)Modification		

Figure 3. Steps in the Life Cycle of Information Processing Systems (From Ref 18:303)

C/SCSC has two main objectives. First, it seeks to obtain assurance that the contractor's internal management systems are sound; and secondly, it insures that the contractor can produce consistent, reliable, and timely progress information.

It is important to note that C/SCSC is a set of criteria to determine the ability of the contractor to track cost and progress. It does not impose a specific management system to use or the program peculiar data requirements for cost or schedule reporting. The government program manager must still define his requirements in terms of needed information to manage contracted work (19:36).

Another key point about C/SCSC is that the schedule progress is given in terms of effective dollars, not units of time as one might expect. C/SCSC gives financial impacts of cost and schedule progress; if actual slack time is desired, one must refer to a separate schedule analysis not included in C/SCSC.

The current DOD policy is for program managers to use the contractors' internal management systems. This helps reduce the data proliferation problem, reduces costs, and improves management. Therefore, every prospective program manager should be very knowledgeable of C/SCSC.

Program Evaluation and Review Technique (PERT)

One of the best examples of a tried-and-proven management system is the PERT network. PERT is a statistical technique that may be accomplished manually or by computer program. It has been used for complex and urgent research and development programs like Polaris, TFX, Mauler, Subroc, Titan III, and Lance (5:471). PERT diagrams are excellent devices for

communications, integration, coordination, and control; however, they cannot make decisions by themselves. PERT diagrams provide the basis for decisions.

PERT identifies critical areas that may threaten completion of the program on time and within budgeted cost. Management's attention is focussed on the critical areas of "paths" where decisions regarding corrective actions must be made. The program manager can evaluate possible "trade-offs" in time and cost and analyze the value of redistributing resources to meet established threshholds. PERT also provides alternate courses of action; thereby, allowing a choice of decisions. A computerized PERT program generates a variety of data and reports that reflect time and dependency relationships between tasks, events, and other important factors in program management. This timely information is essential for making good decisions (5:13-15).

MIS Myth

If one were to believe that the PERT system of the previous section were the only system a manager would need, he would be a victim of the MIS myth. Anthony claims that it is inconceivable that a single management control system could ever be developed that will fit all organizations. This is true because the management control process takes place within the guidelines of specified objectives and policies that vary from one organization to another (3:22-33). For example, the Army Management Information System Master Plan 1971 consists of thirty-six major information systems either proposed for or now operational for the FY 1972-1976 time period (31:i).

Summary

The main points of this chapter concentrate on the key concepts in developing a management information system. The best time to start is early in the program after the PMP and WBS documents have been formulated. Top level management must play a central role in determining the goals or objectives of the MIS with help from a task force composed of functional representatives. Management should determine "what" is to be done, and the specialist determines "how" it will be accomplished. Someone should be given the clear responsibility for success or failure of the system and all affected personnel should be appropriately educated regarding MIS.

Often the term MIS is used to stand for computer-based information systems. There are many advantages and disadvantages of using automated systems which should be compared. The mere fact that a computer is used does not guarantee success of the MIS. The key to the success of either the manual or automated system is thorough planning in which management takes an active role.

Training is another important consideration of MIS. A shortage of technically qualified personnel in ADP skills exists in industry and the government. New policies for the acquisition or usage of these specialists may be required in the future.

The study of the stages in the life cycle of information processing is becoming more structured and disciplined. Representative approaches of several researchers were briefly reviewed.

Cost/Schedule Control Systems Criteria (C/SCSC) is very important. It is a formal government means of checking the adequacy of contractors'

internal management systems and their ability to provide reliable information. One of the successful management systems for complex research and development programs was noted to be the PERT network. It exhibits many of the desirable qualities sought in a management information system. PERT is only one system, and several reputable experts have claimed that no one system can satisfy all management objectives for all organizations. The Army alone has identified 36 major information systems to be used in the FY 1972-1976 time period.

The next chapter addresses the nature and extent of the DOD/Industry data proliferation problem caused by a myriad of management systems.

Proliferation of Information

> But we must be on guard to prevent duplication--eliminate obsolete items--and avoid unnecessary details. Too much reporting puts a heavy burden on citizens, industry in general, and particularly on small business. . . Our objective is simply this: (1) to simplify reports, (2) to discontinue reports where possible, (3) to save the time of the individual businessman as well as industry in general . . This should result in a long-term saving of time and money by the Government, business and the general public. -- Lyndon B. Johnson (20:28)

Background

This chapter considers what has happened in the real world to cause a data proliferation problem. Then it reviews the major actions that DOD and industry have taken to reduce the problem. Hopefully, one will note the increased attention over the years that has been placed on the integration and improvement of management systems and data programs.

Weapon systems complexity increased in the 1950's and a need for more and better information was introduced. Information system sciences were not very organized, DOD did not have data policies, and risk areas of each program were not known. Therefore, a tendency may have existed to believe that some information is "good," and more information is "better." Weapon system complexity may have been a driving force in flooding program managers with more data than they actually needed or could possible review. No data management system or government data managers existed until early 1962 (17:41). With this brief introduction, specific events will be individually addressed in their chronological order of occurrence.

Events

AFSC/Industry Conference. In 1962 AFSC and Industry held a conference at Monterey, California. This meeting allegedy provided the impetus and direction for major advances in management systems and for attacking the "paperwork jungle" (17:41,43).

AF PERT/Cost Test. The Air Force adopted the PERT/Cost management system for use on the TFX program on a test basis in 1962. Earlier in 1958, the Navy implemented PERT in their Polaris missile project (17:45). PERT was a helpful innovation; however, it had to be imposed on the existing internal management information systems of the contractor. This resulted in conflicting requirements and duplicate management systems (17:46).

AFR 310-1. Starting in 1963, AFSC and AFLC began developing the Contractor Data Management Program (CDMP). The controlling document, AFR 310-1, Acquisition and Management of Contractor Data, was published in March 1964 (7:43). The CDMP was framed within the concept of systems management as outlined in the AFR 375 series. It was designed to implement DOD policy contained in DOD Instruction 5010.12, Technical Data and Information Determination of Requirements and Procurements. A command level review board was to ensure that only "minimum essential" decision-making data would be acquired. In compliance with AFR 310-1, data items could be selected for procurement from the Air Force Approved Data List (ADL). Each item was then separately priced by the contractor and the price was evaluated by government representatives. If desired, the items would be included on the DD Form 1423, Contract Data Requirements List, and made deliverable under contract (17:43).

OSD Data Office. The OSD Office of Technical Data and Standardization Policy was established in 1964 to monitor for compliance with DOD Instruction 5010.12. The Air Force provided a representative to this office.

AFSC Tests. In 1963 AFSC contracted with a management consultant firm to determine what data should be provided to each management level to facilitate decision making. Upon conclusion of the study in 1964, the Air Force contracted again with this firm to implement the recommendations which consisted of improvements in estimating and forecasting, program cost control, schedule control, technical performance management, and integration of the management reporting structure. The two on-going programs which were selected were the F-111 program at General Dynamics, Fort Worth, Texas, and the Titan III program at the Martin plant in Denver, Colorado. These studies led to AFSC's Cost/Schedule Planning and Control Specification in 1966.

Data Management Symposium. In September 1965 an Air Force/Industry symposium reviewed the concepts and implementation of the AFR 310-1 Data Management Program. One of the important results was the clarification of the difference between technical data and management data. Technical data was explained to be that data used to define the specifications for contract end items of hardware. Management data was understood to be related to management functions within the program. When management data required for the various functional disciplines were combined, a "management system" was the result.

ASD/Comptroller Speech. In March 1966 the then Assistant Secretary of Defense (Comptroller), Robert N. Anthony, described the last decade's proliferation of systems reports and acronyms (2:2). See page 1 for a quoted excerpt from his speech.

SMAG Report. The Systems Management Analysis Group (SMAG) Report was prepared under the auspices of the Aerospace Industries Association, and it was presented to the Deputy Secretary of Defense, as well as the assistant secretaries in May 1966 (1:2). This report documented industry's concern about the increasing number of management systems that were imposed by DOD and the Services.

AFSC/CSPCS. The tests of the F-111 and Titan III plans, previously mentioned, culminated in the Cost Schedule Planning and Control Specification (CSPCS) in June 1966. Contractors were to demonstrate the "validity" of their system during contract performance by meeting certain basic minimum criteria in their internal cost/schedule planning and control system (17:46-47).

DOD Directive 7000.1. In August 1966 DOD Directive 7000.1, Resources Management Systems of the Department of Defense, assigned the responsibility to provide for the design and installation of resource management systems throughout DOD to ASD (Comptroller). (6:45).

DOD-CODSIA. In October 1966 the mutual DOD/Industry concern over the myriad of management systems resulted in the formation of DOD-Council of Defense and Space Industry Associations (CODSIA) Advisory Committee were "to eliminate redundancies and duplication and to insure compatability between existing and proposed management systems, and to control mechanisims to prevent a recurrence of the problem." (2:2,3) Activities of the group

were conducted in three phases which ended in 1969. This effort involved thousands of man hours and tens of thousands of dollars. The final report consisted of ten volumes and had many valuable recommendations (6:45).

AFSCR 375-2. The Management Techniques Application Plan (MTAP) was established in AFSCR 375-2 during June 1967. It was the Air Force's own procedure for "selection and application of management technique to individual programs in their formative stage." (17:53) Application of the MTAP procedure to the Airborne Warning and Control System (AWACS) resulted in a reduction of data items from 250 to 94 items, a reduction in MIL Specificationsof approximately 17 percent, and a 14 percent reduction in management directives (17:51).

DOD Instructions 7000.2. In 1967 this Instruction provided guidance on how the new Cost/Schedule Control System Criteria (C/SCSC) was to be implemented by all three services. The C/SCSC was virtually identical to AFSC's C/SPCS issued in June 1966. It would measure cost and schedule performance, but not technical performance. This led to the validation of the contractors' System Engineering Management program as required by AFR 375-5.

Policy Guidance. In a January 31, 1968, memorandum for the Secretaries of the Military Departments, the Assistant Secretaries of Defense, and the Directors of the Defense Agencies; Deputy Secretary of Defense Paul H. Nitze outlined the four principles quoted below:

> a. DOD management control systems should be structured to maximize compatibility with contractors' internal management and accounting systems.

b. Provisions of the proper level of Government management require a balance of prior approval, progress review (surveillance), and reliance upon reviewable contractor management (visibility).

c. Reporting requirements should be tailored to provide, from a common data base, the appropriate level of detail needed for each management echelon, based on uniform work breakdown structure which permits summarization.

d. Existing and proposed management control systems must meet demonstrated needs not met by other systems (2:3).

DOD Instructions 7000.6 and 7000.7. These Instructions were issued in June 1968 to implement the DOD policy stated in Deputy Secretary of Defense Nitze's Memorandum of January 31, 1968. They were also a result of the efforts of the DOD-CODSIA Advisory Committee (1:2). DOD Instruction 7000.6, Development of Management Control Systems for Use in the Acquisition Process, and Instruction 7000.7, Selection and Application of Management Control Systems for Use in the Acquisition Process, established formal control of the development, selection, and application of management systems. If implemented, a substantial cost savings for the Department of Defense was anticipated (6:48).

In July 1970 no real progress had been noted in implementing Instructions 7000.6 and 7000.7, despite the fact that if this project were completed substantial saving would be realized. It was noted that an ASD/Comptroller reorganization in 1969 de-emphasized the activity by reducing it to an echelon four levels below the Assistant Secretary (6:48).

Procurement Circular Number 70. This Circular was issued in May 1969 and directed implementation of DOD Instructions 7000.6 and 7000.7. It also incorporated a standard form for contractual application of management systems in the Armed Services Procurement Regulations (2:4).

Harbridge House Inc. Report. Harbridge House Inc. conducted a study for Director, Defense Research and Engineering (DDR&E). In July 1970 results indicated the cost of management systems and reports to be 10 percent of the total defense procurement dollars. Furthermore, it reported that a large number of data recipients within the government simply did not use the data they received (2:5).

DOD-Industry Systems Review. During the period January through April 1970, Review and Analysis Groups operating under the direction of the DOD-CODSIA Advisory Committee reviewed approximately 800 management systems documents and compared them with the criteria outlined in DOD Instructions 7000.6 and 7000.7. Specific dispositions to revise, consolidate, or cancel, etc., were made for each document. Of the original 800 documents in the inventory, DOD approved 170 management systems documents for contractual application (2:4).

Layering. The then Deputy Secretary of Defense, Mr. Packard, issued a memo on May 28, 1970, to the Military Departments stressing needed improvements in the management process and the need to minimize the numerous layers of authority between the program manager and the Service Secretary. These layers were not conducive to effective communication.

Selected Acquisition Report (SAR). Selected Acquisition Reports are standard, comprehensive, summary, status reports on major and selected defense systems. SARs are submitted to OSD for transmittal to Congress and other government agencies. Summary reporting of technical, schedule, quantity, and cost information is included per DOD Instruction 7000.3 which was originally issued on June 12, 1970.

AMCSL. In July 1970 DOD Manual 7000.6M, Acquisition Management Control Systems List (AMCSL), was published. It included the 170 documents approved by DOD during the January through April 1970 efforts of the Review and Analysis Groups (2:4). Only 35 Air Force management systems were included in the AMCSL which was far short of the number actually being used. Perhaps this was due to the fact that the Air Force had its own management selection and control system known as MTAP which was started in 1967 (17:53). The AMCSL, in combination with DOD Instructions 7000.6 and 7000.7, was to provide the control mechanism for management systems development, selection, and application (2:4). In March 1971 the AMCSL became known as the Acquisition Management Systems List (AMSL) (36:1). It had reduced over 1200 management systems which existed in 1968, to 129 published in AMSL as of 1971.

Blue Ribbon Report. The Blue Ribbon Defense Panel reported that the cost to the government for management systems and reports was estimated to be $4.4 billion in fiscal year 1969. This was roughly equivalent to one out of every seven dollars (6:45).

Reduce AMCSL. A memo from the then Deputy Secretary of Defense Mr. Packard, dated September 23, 1970, to the Military Departments, stated in part, "170 candidates for contractual application are too many. . . It is costly and wasteful to require a contractor to respond to two or more different documents on the same subject." (2:4).

DOD Instruction 7000.6 Revision. In compliance with Secretary Packard's memorandum of May 28, 1970, control over the development, selection, and application of management systems was decentralized. The Instruction

reflected the change in policy. Industry expressed concern that control of management systems would be compromised through decentralization and that excessively high costs would be perpetuated (2:4).

AFSC Regulation 800-1. This document, entitled Command Review of Systems Acquisition Programs, was issued in May 1971. It prescribed policies and procedures for program assessment reviews (PAR) and command assessment reviews (CAR) at HQ AFSC. It applies to all AFSC activities. Program managers design their information systems to be responsive to the requirements imposed by the PAR and CAR briefings for OSD and Command-level review (28:1).

DOD Directive 5000.19. DOD Directive 5000.19, Policies for the Management and Control of DOD Information Requirements, was revised November 29, 1971. This is the first Directive to address internal as well as external information requirements which may be placed on DOD Components, on contractors, and other external agencies and organizations. Its objectives are (1) to assure effective and economic flow of information within, from, and to DOD, and (2) to prevent generation of unauthorized and duplicative information requirements by requiring each request to be evaluated against specific criteria. Focal points were established for non-DOD requests for information.

AF Regulation 800-2. This Regulation, dated July 27, 1971, rescinded the AFR 375 series. It states policy for the management of all Air Force acquisition programs which are funded under RDT&E or procurement appropriations (28:1).

Aerospace Industries Association (AIA) Report. The AIA published its

report on industry experience with government management systems used in major procurements with recommendations for the future.

DOD Directive 5000.1. This Directive, which was issued in July 1971, establishes policy for major defense system acquisition. One paragraph that specifically applies to management information is quoted below.

> Management information/program control requirements shall provide information which is essential to effective management control. Such information should be generated from data actually utilized by contractor operating personnel and provided in summarized form for successively higher level management and monitoring requirements. A single realistic work breakdown structure (WBS) shall be developed for each program to provide a consistent framework for (a) planning and assignment of responsibilities, (b) control and reporting of progress, and (c) establishing a data base for estimating the future cost of defense systems. Contractor management information/program control systems and reports emanating therefrom, shall be utilized to the maximum extent practicable. Government imposed changes to contractor systems shall consist of only those necessary to satisfy established DOD-wide standards. Documentation shall be generated in the minimum amount to satisfy necessary and specific management needs (35:6).

DOD Instruction 5010.29. DOD policies governing the acquisition of data from contractors were outlined in this Instruction dated November 29, 1971. Its provisions encompass all recorded information regardles of form or characteristic which are deliverable under terms of a Defense contract. The Secretary of the Air Force, in coordination with other affected DOD Components, developed DOD 5010.29R to implement the policies set forth in the Instruction (34:1).

Management System Improvement Test. In November 1971 the Air Force concluded that the Acquisition Management Selection List (AMSL), described by DOD Manual 7000.6M, was not effective for either planning or control. A waiver from DOD Instruction 7000.6 and AMSL was requested to test improvements in Management Systems.

The Air Force was authorized to field test proposed improvements for control of management systems. The improvement consisted of:

a. Defining management systems by functions/requirements rather than documents per se.

b. The use of planning guides explaining what documents and data items should be used for each functional requirement, rather than the current list of management systems authorized in the AMSL.

c. The use of selection checklists in lieu of DD Form 1660 to trace the decision.

These concepts were the same as those recommended in the AIA report of July 1971. Ogden and Sacramento Air Material areas were participants in the test which lasted until September 15, 1972. The final test report was dated June 19, 1973.

Monitoring Field Test. On March 29, 1972, the Joint Logistics Commanders (JLC) established a panel to monitor and evaluate the results of the Air Force field test. Later that year the ASD (I&L), DDR&E, Army, Navy, and Air Force established an OSD/DOD Component task group to monitor the test in conjunction with JLC. The first meeting of the OSD/DOD Component task group was held on August 21, 1972.

The major issues concerning the requirements for control, who should control, and by what means, were discussed. Subsequent meetings throughout DOD addressed these very issues. The Air Force test and OSD/DOD Component evaluations of the test have been a powerful influence for future changes to DOD policies.

Joint Logistics Commanders concluded that the planning guide concept was valid and recommended that JLC develop a list of management systems. It was recommended also that Commands restrict use to those systems on the list, but to continue to develop improved systems.

COGP. In a summary report of the Commission on Government Procurement (COGP) published in December 1972, Recommendation 34 pertained to management systems. It is quoted as follows: "Establish Government-wide criteria for management systems which are prescribed for use by contractors, including standards for determining mission-essential management data requirements."(8:31)

Circular A-40. This document, dated May 3, 1973, was extremely important. It included the requirement to approve management systems and management data under "public" reporting procedures and excluded technical data. Under A-40 the DOD management systems program must conform with Office of Management and Budget (OMB) requirements.

DOD Directive 5000.19 Revised. In June 1973 Directive 5000.19 was revised with OMB A-40 included as an enclosure. Management of technical data such as engineering drawings, specifications, manuals, technical reports, etc., were exempted from the Directive. It delegated ASD(C) the responsibility for management systems and data, and it gave ASD (I&L) the responsibility for technical data. (40:1)

Review Boards. In a Deputy Secretary of Defense memo dated July 17, 1973, Mr. Clements stated his concern over the high costs of management

systems and data. He also requested each Military Department to establish Review Boards for Requests for Proposals/Contracts Requirements.

Inventory and Review. Only two days later, on July 19, 1973, Mr. Clements tasked the Military Departments to inventory all management systems, purge and refine them as necessary, and to submit them for OMB approval. Results are to be forwarded to ASD(C) with the target date of completion being January 1, 1975.

DOD Instruction xxxx.x (Draft). Instruction "quad x point x,"as it is referred to, is dated November 29, 1973. It is very interesting to note the incorporation of many previous recommendations and policy memorandums.

Very basically, it proposes to implement DOD Directives 5000.1, 5000.19, and 5100.36. A DOD Manual xxxx.xM would be authorized and when published would cancel DOD Instructions 7000.6, 5010.12, 5010.29, and Memorandum for the Secretaries of the Military Departments regarding Review Board requirements. The Air Force had previously recommended cancellation of DOD Instruction 7000.6 based on its field tests previously described.

Instruction xxxx.x provisions would encompass all requirements for generation, maintenance, or delivery of information or data contained in a solicitation or contract. Government-wide criteria for application of acquisition management systems and data requirements in contracts have also been included in the proposed Instructions. This would implement COGP Recommendation 34.

Some old definitions from cancelled publications have not been included in Instruction xxxx.x. In fact, there are many new and revised terms.

It appears to be a very strong, new attempt to minimize the number of management systems and data requirements invoked in contracts. It also attempts to improve their content and promote optimum standardization. That is to say, the contractors' internal systems and data products will be used to the maximum extent possible. If a management system is required to be put on contract, it must be one that is on a government list of acceptable systems; this new list has yet to be formulated. In addition, it must meet the criteria and be approved in accordance with DOD Instruction xxxx.x.

AFSCP/AFLCP 800-14. The Joint Logistics Commanders have prepared a document dated February 27, 1974, that has greatly reduced the number of management systems curently listed in the AMSL and DOD Manual 7000.6M. This Pamphlet also states that commands will restrict use of management systems to those on the list.

In essence, there are only two major management systems that have been included in AFSCP/AFLCP 800-14. They are PERT and the Cost/Schedule Control System Criteria. To date, it is believed that the Pamphlet has not been forwarded to OSD from any of the Service Secretaries.

Summary

Increased weapon system complexity in the 1950's and the absence of a data management program were probable causes of a data proliferation problem. The problem still exists today. This chapter has traced forty major events in the 1962-1974 time period to show the concern DOD and

industry have expressed and what actions have been taken to resolve the problem.

For example, in 1968 over 1200 approved management systems existed; by 1971 the number had been reduced to 129. Action is in progress to further reduce the list of government approved systems. Target date for recommendations from the Services to OSD is January 1, 1975.

Management systems have been distinguished from technical data. Each has its own separate directives. Management systems are subject to public reporting and must conform with OMB requirements. The ASD(C) was delegated the responsibility for management systems and ASD (I&L) was given the responsibility for technical data.

Current policies are to use the contractors' internal systems and data products to the maximum extent possible. If a management system must be put on contract, it has to be on the government-approved list or special permission must be obtained. A very vigorous effort is in progress to reduce the number of approved systems. PERT and C/SCSC have appeared on all lists to date and will likely be recommended for future use.

Over the years, increased attention has been placed on the integration and improvement of management systems and data programs. The effort will most likely continue for at least several years more.

This chapter should have provided the reader with an appreciation for what has been done, what the current policies are now, and what DOD environment the program manager will probably face in the forseeable future.

Conclusions and Recommendations

Conclusions

Definitions. Many definitions of a management information system were studied and no single definition was found to be universally accepted; however, they all had similar ideas. This study concludes that the MIS concept is a disciplined system that processes information in order to reduce risks in management decisions while making effective use of resources (men, money, and material). The process is traceable and can be used to document, to surveil, and to predict cost, schedule, and technical performance.

Development. Good program management systems do not simply happen. Much careful planning is required in order for them to be effective. The program manager can no longer play a passive role, but must be an active participant in its development and operation.

Uses. Very basically, MIS is used as a tool to help manage programs and to provide information to Congress, OSD officials, and high-level Service Commanders.

CBIS. Management information systems are very complex and it is likely that computer-based information systems will be required in the future. Technical assistance will be required to help program, simulate, test, de-bug, operate and maintain the CBIS. At present, however, there is a shortage of computer trained specialists, and the costs of using computer resources is high. This is a significant problem that needs attention.

Proliferation. A data proliferation problem has existed since the 1950's when weapon systems became more complex. Many efforts on the parts of DOD and industry have attacked the problem. During the last decade the Department of Defense has had changing policies concerning management systems and data. With changing administrations and reorganizations, emphasis has ranged widely. At times management systems were almost de-emphasized; at other times they appeared to have top-level attention within DOD. The degree of control has changed from none whatsoever to a range that varies between centralization and decentralization as a function of time.

At present, management systems have been distinguished from technical data. A great deal of attention at all levels is being focussed on how to reduce the number of management systems imposed on contractors. The contractors' systems are to be used to the maximum extent possible; if the contractors' system is not adequate and a different system must be put on contract, it must be one of the "approved" systems. In the past much wasteful or valueless information has been generated at great expense. Program managers will be expected to do a more effective job of managing their management information systems in the future.

Recommendations

Examples Needed. Analyses of actual management information systems should be made comparing the theoretical criteria of what makes a good MIS to what actually exists. It would be of interest to include the number of people, amount of time, and approximate costs it requires for the development, operation, and maintenance stages.

Use of Computer Resources. In view of the increasing complexity of management information systems, it is likely that computer-based information systems will be needed in the future. However, a shortage of trained computer specialists now exists, and the costs of using computer resources are very high. A study should be made including recommendations on how to effectively acquire, train, and use computer personnel and equipment resources for future CBISs.

Corporate Memory. A corporate or institutional memory would be valuable to the program manager. It would help prevent him from making the same mistakes others have committed. Recent work has begun on the development of a corporate memory as referenced in the Project ACE Findings and Action Plans, Air Force Systems Command, dated October 5, 1973. This is an important area of investigation wherein the potential for valuable contributions exists.

ANNOTATED BIBLIOGRAPHY

1. Acker, David D. "Placing the Management of Defense and Space Programs in Perspective." Journal of Engineering for Industry, ASME,1-4 (November 1970).

   The author assesses the management of defense and space programs. He describes the contractual environment leading to development of management systems.

2. Aerospace Industries Association. Management Systems in Future Government Procurement. Washington, D.C. 1971.

   This is a very good as well as concise report on industry experience with government management systems used in major procurements. Recommendations were made for future procurement.

3. Anthony, Robert N. Planning and Control Systems A Framework for Analysis. Boston: Division of Research Graduate School of Business Administration Harvard University, 1965.

   This book sets up a framework that is intended to be useful in thinking about the subject of management planning and control systems. It is a classic in its field.

4. Archibald, Russel D. Management Information Systems for Projects and for Organizations: A Comparitive Overview. New York: ITT Corporation, 1972.

   A very good article that includes many fundamental concepts of program management information systems.

5. Archibald, Russell D. and Richard L. Villoria. Network-Based Management Systems (PERT/CPM). New York: John Wiley and Sons Inc., 1967.

   An excellent text about a class of management systems based on the concepts of network planning and critical path analysis. These systems including PERT and CPM are of immediate practical use to get things done in less time and at less cost than would otherwise be possible.

6. Blue Ribbon Defense Panel, Report to the President and the Secretary of Defense, Appendix E, Staff Report on Major Weapon System Acquisition Process, Washington D.C., 1970.

This is a monumental outstanding effort that is often referenced. Many of the recommendations this report made have already been implemented.

7. Coleman, Raymond J., and M. T. Riley. MIS: Management Dimensions. San Francisco: Holden-Day Inc., 1973.

An excellent collection of contemporary articles and thinking on the subject of management information systems.

8. Commission on Government Procurement. Summary of the Report of the Commission on Government Procurement. Washington, D.C.: Government Printing Office, 1972.

An abbreviated version of the COGP report that is very easy to understand.

9. Constant, Dennis L. From MIS to MBC: An Investigation into Why One Corporation Eliminated Its Computer-Based Management Information Systems. Thesis, GSM/SM/73-07. Ohio: School of Engineering, Air Force Institute of Technology, Wright-Patterson Air Force Base, October 1973.

A very thorough analysis of why the Aero-Jet General company eliminated its CBIS.

10. Dearden, John. "MIS is a Mirage." Harvard Business Review, 50:90-99 (January-February 1972).

A very provocative, thought-stimulating article that is "must" reading for anyone interested in the subject of MIS.

11. Dearden, John. "Myth of Real-Time Management Information." Harvard Business Review, 123-132 (May-June 1966).

A down-to-earth article that challenges the need for real-time information. A well known article by a forerunner in his field.

12. Diebold, John. "Bad Decisions on Computer Use." Harvard Business Review. 47:14- (January-February 1969).

The author suggests that new criteria for judging cost-effectiveness of data processing. Very good questions are posed that policy makers should be asking themselves and their organizations.

13. Feltham, Gerald A. "The Value of Information." Accounting Review, 684-696 (October 1968).

This article is a combination of rigorous mathematical studies as well as a basic general layman type discussion on some of the measures of "value" regarding information.

14. Hartman, W.; Matthes, H.; and Proeme, A. Management Information Systems Handbook. New York: McGraw-Hill Book Company, 1968.

A very comprehensive handbook that is very detailed. Full descriptions of every phase of computer technology are included. This is a permanent reference in a constantly changing field.

15. Hirsch, Rudolph E. "The Value of Information." Journal of Accountancy, 41-45 (June 1968).

This article includes a discussion of when information value can and cannot be calculated, what determines information costs, and some techniques for controlling them. Many good thoughts.

16. Kriebel, Charles H., and Richard L. Van Horn. "Management Information Systems." Management Information Systems: Progress and Perspectives. Edited by Charles H. Kriebel, Richard L. Van Horn, and J. Timothy Hearnes. Pittsburgh, Pennsylvania: Carnegie Press, 1971.

This publication offers a comprehensive examination of substantive concepts, research, and applications related to management information systems development.

17. Lee, Robert G. Evolution of the Data Proliferation Problem Within Major Air Force Acquisition Programs. Thesis, SLSR-34-71B, Ohio: School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson Air Force Base, 1971.

A documented retrospection necessary for understanding and insight into the problem of data proliferation. Very useful reference for this study.

18. Li, David H. Design and Management of Information Systems. Chicago: Science Research Associates Inc., 1972.

This book presents twenty-two reading selections and nine case studies. It is intended for a beginning course in Information Systems Analysis and Design. Very easy reading.

19. Logistics Management Institute, Introduction to Military Program Management. LMI Task 69-28, Washington D.C., 1971.

One of the best publications on the subject of management. It is concise, yet comprehensive and easy to read. Highly recommended.

20. Meltzer, Morton F. The Information Center. New York: Vail Ballou Press, 1967.

This book explains the basic concepts of establishing a management and technical information center and ways of improving existing centers. Discussion is limited to information centers and was not of great use in my study. Nonetheless, a good clear text.

21. Moravec, Adolph F. "Using Simulation to Design a Management Information System." Management Services, 50-58 (May-June 1958).

The author contends it is costly and time consuming to wait to correct the flaws in a new information system until it is in operation. Simulation is a useful pretest. This article not of great use for my purpose.

22. Mosier, Andrew P. A Curriculum for Executive Professional Development in Computer-Based Information Systems. Summary Report R-247-1, Washington D.C.: Industrial College of the Armed Forces, 1972.

An extremely well written report that discusses many of the fundamental concepts of management information systems. The curriculum study was the best I have read to date.

23. Murdick, Robert G., and Joel E. Ross. Information Systems for Modern Management. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1971.

An excellent text covering theory and applications of information systems.

24. Murdick, Robert G., and Joel E. Ross. "Management Information Systems: Training for Businessmen," in MIS: Management Dimensions. Edited by Raymond J. Coleman and M. T. Riley. San Francisco: Holden-Day Inc., 1973.

This is a very short article that encourages companies to examine its current stage of sophistication of its MIS people and managers, and the urgency of its need for advanced systems in order to develop feasible and profitable training programs.

25. Peixotto, Roland E. Computer Based Information Systems and the Middle Manager. Carlisle Barracks, Pennsylvania: Army War College, 1972.

A short easy-to-read study that addresses many of the fundamental principles of extablishing or modifying a CBIS. Very basic reading that deserves attention of people who want a basic foundation of CBIS.

26. Sage, David M. "Information Systems A Brief Look Into History." Datamation, 14:63-69 (November 1968).

An interesting article on the history of information systems.

27. Thurston, Philip H. "Who Should Control Information Systems?" Reprints from Harvard Business Review Management Information Series Part I No 21115.

A well-stated position that control of information systems has been in the hands of the specialist instead of top level management.

28. U.S. Department of the Air Force. Command Review of Systems Acquisition Programs. Air Force Systems Command Regulation 800-1, Washington D.C., 30 Aug 1972.

This regulation prescribes policies and procedures for program assessment reviews and command assessment reviews. It applies to all AFSC activities.

29. U.S. Department of the Air Force. Acquisition Management: Program Management. Air Force Regulation 800-2, Washington D.C., 16 Mar 1972.

This regulation states policy for the management of all Air Force acquisition programs which are funded under RDT&E or procurement appropriations.

30. U.S. Department of the Air Force. Joint AMC/NMC/AFLC/AFSC List of Authorized Acquisition Management Systems. AFSCP/AFLCP 800-14, Headquarters Air Force Systems Command, Washington D.C., 1974.

The Joint Logistics Commanders have prepared this document which proposes to greatly reduce the number of management systems currently in the Acquisition Management Systems List, DOD Manual 7000.6M. To date the Pamphlet has not been forwarded to the OSD.

31. U.S. Department of the Army. The Army Management Information System Master Plan. Washington D.C., 1971.

This document sets forth a master plan for the design, development and implementation of Army Management Information Systems for the FY 1972-1976 time period.

32. U.S. Department of the Army. Management Information System Policies, Objectives, Procedures, and Responsibilities. Army Regulations 18-1, Washington D.C., August 1971.

Very broad guidance for management information systems is outlined in this Regulation. It is directly applicable to the Army and was not of great use in this study.

33. U.S. Department of the Army. Study of Management Information Systems Support (SOMISS). Management Information Systems Directorate, Office Assistant Vice Chief of Staff Report to Chief of Staff. Washington D.C., 1968.

A very good staff study that addresses information systems and automatic data processing problems which require resolution in the Department of the Army.

34. U.S. Department of Defense. Acquisition of Data from Contractors. DOD Instruction 5010.29, Washington D.C., 1971.

This Instruction governs the acquisition of data from contractors. Its provisions encompass all recorded information regardless of form or characteristic which are deliverable under terms of a Defense contract.

35. U.S. Department of Defense. Acquisition of Major Defense Systems. DOD Directive 5000.1, Washington D.C., 1971.

An extremely well-written Directive that establishes policy for major defense system acquisition. The guidance provided for management information/program control must be understood by every program manager. This is mandatory reading for those who share an interest in DOD program management.

36. U.S. Department of Defense. Acquisition Management Selection List. DOD Manual 7000.6M, Washington D.C.: Government Printing Office, 1971.

This document in combination with DOD Instructions 7000.6 and 7000.7 provides the control mechanism for management systems development, selection and application. It contains a list of approved management systems as well as broad guidance on the acquisition of management systems. Very interesting and worthwhile reading.

37. U.S. Department of Defense. Control of Acquisition Management Systems and Data Requirements. DOD Instruction xxxx.x (Draft), Washington D.C., 1973.

This document, which is in draft form, will incorporate many of the recommendations from DOD and industrial organizations. Its provisions would encompass all requirements for generation, maintenance, or delivery of information or data contained in a solicitation or contract.

38. U.S. Department of Defense. Development of Management Control Systems for Use in the Acquisition Process. DOD Instruction 7000.6, Washington D.C., 15 Mar 71.

This Instruction is designed to implement DOD policies concerning control, development, selection and application of management systems.

39. U.S. Department of Defense. Performance Measurement for Selected Acquisitions. DOD Instruction 7000.2, 22 Dec 1967.

This Instruction provides guidance on now the Cost/Schedule Control System Criteria (C/SCSC) is to be implemented.

40. U.S. Department of Defense. Policies for the Management and Control of DOD Information Requirements. DOD Directive 5000.19, Washington D.C., June 1973.

This Directive addresses internal as well as external information requirements which may be placed on DOD Components, on contractors, and other external agencies and organizations. It also establishes focal points for non-DOD requests for information.

41. U.S. Department of Defense. Resources Management Systems. DOD Directive 7000.1, Washington D.C., 1966.

This Directive assigned the responsibility to provide for the design and installation of resource management systems throughout DOD to ASD (Comptroller).

42. U.S. Department of Defense. Selected Acquisition Report (SAR). DOD Instruction 7000.3, Washington D.C., 1970.

A very useful guide that addresses summary reporting of technical, schedule, quantity and cost information which is submitted to OSD for transmittal to Congress and other governmental agencies.

43. U.S. Department of Defense. Selection and Application of Management Control Systems for Use in the Acquisition Process. DOD Instruction 7000.7, Washington D.C., 6 Jun 1968.

This Instruction in conjunction with DOD Instruction 7000.6 establishes formal control of the development, selection and application of management systems.