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A CRITICAL ANALYSIS OF MANAGEMENT INDICATORS FOR THE DIRECTOR OF MATERIEL MANAGEMENT, SACRAMENTO ALC.

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Recent correspondence and conferences within the Air Force Logistics Command have questioned the reliability of management indicators as an information tool. The purpose of this thesis was to prove or disprove that contention through an analysis of the management indicators periodically reviewed by the Director of Materiel Management at the Sacramento Air Logistics Center. Questionnaires and personal interviews were used as the means to define D/MM objectives and goals. The indicators themselves were defined and then evaluated in terms of their information contribution to decision making and in turn to the achievement of goals and objectives. The objectives were also classified into a hierarchy of information needs to establish the time spans for planning and control. Our research findings concluded that the present information system is process oriented and, therefore, of little value in strategic planning. Present indicators are inadequate to meet the D/MM's information needs.

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A CRITICAL ANALYSIS OF MANAGEMENT INDICATORS FOR THE DIRECTOR OF MATERIEL MANAGEMENT, SACRAMENTO ALC

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vii
LIST OF FIGURES	viii
Chapter	
I. INTRODUCTION	1
Overview	1
Problem Statement	5
Scope	5
The Directorate of Materiel Management	5
Motivation	8
Plan of the Report	9
II. LITERATURE REVIEW	11
Summary	21
Research Objectives	23
Research Questions	24
III. METHODOLOGY	26
Overview	26
Application of the Methodology	28
The Population	28
The Instrument	29
The Data	31
Criteria for Admissibility of the Data	31

Chapter Page

How the Research Questions were Answered 32

Assumptions 36

IV. FINDINGS AND ANALYSIS 38

Overview 38

Research Objective 1 41

Research Objective 2 59

Research Objective 3 62

Fill Rate 64

Backorders 66

Age of Backorders 68

Technical Order Stock Availability 70

Government Furnished Materiel (GFM) at Contractor Facilities 71

Age of Unprocessed Exceptions 72

Purchase Request/Military Interdepartmental Purchase Request (PR/MIPR) Processing Within D/MM 74

PR/MIPR Processing Within D/PM 76

Economic Order Quantity (EOQ) Repeat Buy Notices 76

Material Improvement Projects (MIPs) . . . 78

AFTO Forms 22 80

Noncredit Material Returns 81

Aircraft Production (Contract) 83

Air Force Industrial Fund (AFIF) Contract--Review Variance, Profit and Loss 84

Chapter Page

Initial Provisioning Workload Percent Delinquent Over Sixteen Days 85

Master Materiel Support Record (MMSR) . . . 87

V. CONCLUSIONS AND RECOMMENATIONS 89

APPENDICES 94

A. INTERVIEW GUIDE 95

B. SURVEY QUESTIONNAIRE AND COVER LETTER 98

SELECTED BIBLIOGRAPHY 104

A. REFERENCES CITED 104

B. RELATED SOURCES 110

LIST OF TABLES

Table		Page
1.	Population Definition	30
2.	Data Sources for Research Questions	33
3.	Perceived Objectives	46
4.	Objectives by Management Levels	56

LIST OF FIGURES

Figure		Page
1.	The ALC Wheel as it Relates to the D/MM	6
2.	The Management Wheel Within the D/MM	7
3.	Hierarchy of Information Needs	14
4.	Systems Model of Information Systems	22
5.	Interaction of Research Questions and Objectives	39
6.	Initial Decision Structure	44
7.	Functional Substructure	48
8.	Management Substructure	49
9.	Technical Substructure	50
10.	SM-ALC/MM Decision Structure	52
11.	Multi-level Hierarchy of Information Needs	54

CHAPTER I

INTRODUCTION

To manage a business well is to manage its future; and to manage its future is to manage information.

— *Marion Harper, Jr.*

Overview

Management today is literally being barraged with information in its attempt to deal with ever-increasing complexity and sophistication in its systems and organizations. This is especially evident within the Air Force Logistics community where data on a wide variety of functions and operations are routinely recorded and reported via a host of information systems. Massive data files abound and computer reports of reformatted data daily inundate the logisticians. Their overall computerized information system, the Logistics Data System, is comprised of seven data subsystems: the equipment Management System, the Materiel Management System, the Maintenance Management System, the Comptroller Management System, the Procurement Management System, the Plans and Program System, and the Transportation System. These subsystems are, in turn, comprised of additional reporting subsystems, each of which generates numerous daily, weekly, monthly, and quarterly management products. For example, the Materiel Management

Data Subsystem alone is comprised of 44 reporting subsystems. One of these, the DO32 Items Management Stock Control and Distribution System, generates 89 separate products (54).

These products provide various elements of reformatted data, including: (1) certain established "management indicators" which are routinely reviewed and evaluated at all levels of command, and (2) other data points which are available for review and use by management as required. However, the logistician is unable to completely understand and digest this overabundance of available data; information overload results. Consequently, the logistician relies primarily upon the Air Force and MAJCOM directed management indicators to aid him in assessing the status of his operations and in making decisions. Therefore, it is imperative that these indicators be clearly defined, understood by the managers who use them, be capable of accurately assessing the system, and providing pertinent information relative to goal achievement. However, these criteria do not appear to be satisfactorily fulfilled by the present set of indicators. Several events suggest this. They were brought to light as a result of a formal request for assistance ". . . in researching management indicators at the wholesale logistics level" which was submitted to the Dean, School of Systems and Logistics, AFIT, on 27 August 1979 by Colonel Monroe T. Smith, the Director of Materiel

Management at Sacramento Air Logistics Center. In his letter to the Dean, Colonel Smith stated,

> We do not currently have a single integrated set of clear, concise, management indicators that (a) tells us "what's happening," and (b) allows management action to flow from the indicators [47].

To learn more about wholesale logistics level indicators and the nature and level of interest in the problem Colonel Smith had presented, a visit was made to AFLC Headquarters. Here it was learned that Major General Waters, the Deputy Chief of Staff, Logistics Operations, had also expressed dissatisfaction with the current indicators (23). He had directed that item managers be querried during the Item Manager Conference, held on 26-27 June 1979, at the Sacramento Air Logistics Center (SM-ALC) regarding their impressions of the indicators.

The consensus at that Conference was that the major management indicators

> . . . are no longer adequate in a 1979 environment. Above all, it was felt management should not be forced to spend too much time in reviewing historical data. Management expertise should be used to work with a forward looking system of indicators and goals [30].

Based on these comments, all ALCs were directed to review and evaluate the indicators being used by HQ AFLC (31). The replies to this directive indicated further dissatisfaction with the indicators. However, obvious differences of opinion were revealed as to what the problems were and what changes were required in the present indicator system (59; 48; 35; 14).

Given this information, personnel of the HQ AFLC Inspector General Staff were informally interviewed to determine what findings, if any, had been made with respect to management indicators and to get their impressions of the present system. Although no "findings" had been made by the IG in this area during the past year, the office was particularly interested in the subject. A talking paper had been prepared by one of the inspectors which suggested serious shortcomings of the indicators. The paper states, "AFLC management indicators for Maintenance Item Subject to Repair (MISTR), fill rates, and quality programs do not accurately portray ALC performance [46]."

An attempt was also made to determine the source and reasoning for the standard percentages which had been set for each of the indicators; the standard being the goal which each ALC is to meet. This information as well as information concerning what actions can or should be taken when management fails to meet the "standard percentages" could not be found in written form. It apparently exists primarily as "corporate knowledge."

Given these criticisms of the present indicators, disagreements as to what the problems are, and lack of documentation on the indicators and their standards, we formulated our problem statement.

Problem Statement

There is a need to evaluate the management indicators in use at the wholesale logistics level to insure that they support decision making and goal achievement.

Scope

Since the "wholesale logistics level" was too broad a topic to deal with effectively within the given constraints, and the MM Director at Sacramento had indicated a personal interest, we elected to focus upon the Materiel Management Directorate at the Sacramento Air Logistics Center.

The Directorate of Materiel Management

As portrayed in Figure 1,

> . . . the D/MM is the pivotal point of the Air Logistics Center logistics management functions. It is the responsibility of the Director of Materiel Management to weave together the capacities and capabilities of the ALC's effort in supporting operations of maintenance, storage, distribution, and transportation into the unified support of all customers [8:35].

To accomplish this integrative function, the Director of Materiel Management at Sacramento ALC coordinates the activities of six subordinate divisions as shown in Figure 2. This directorate is staffed with more than 2,000 military and civilian personnel (45:28). They are responsible worldwide for providing logistics support management for weapon systems, support systems, and various other projects assigned by the Air Force Logistics Command.

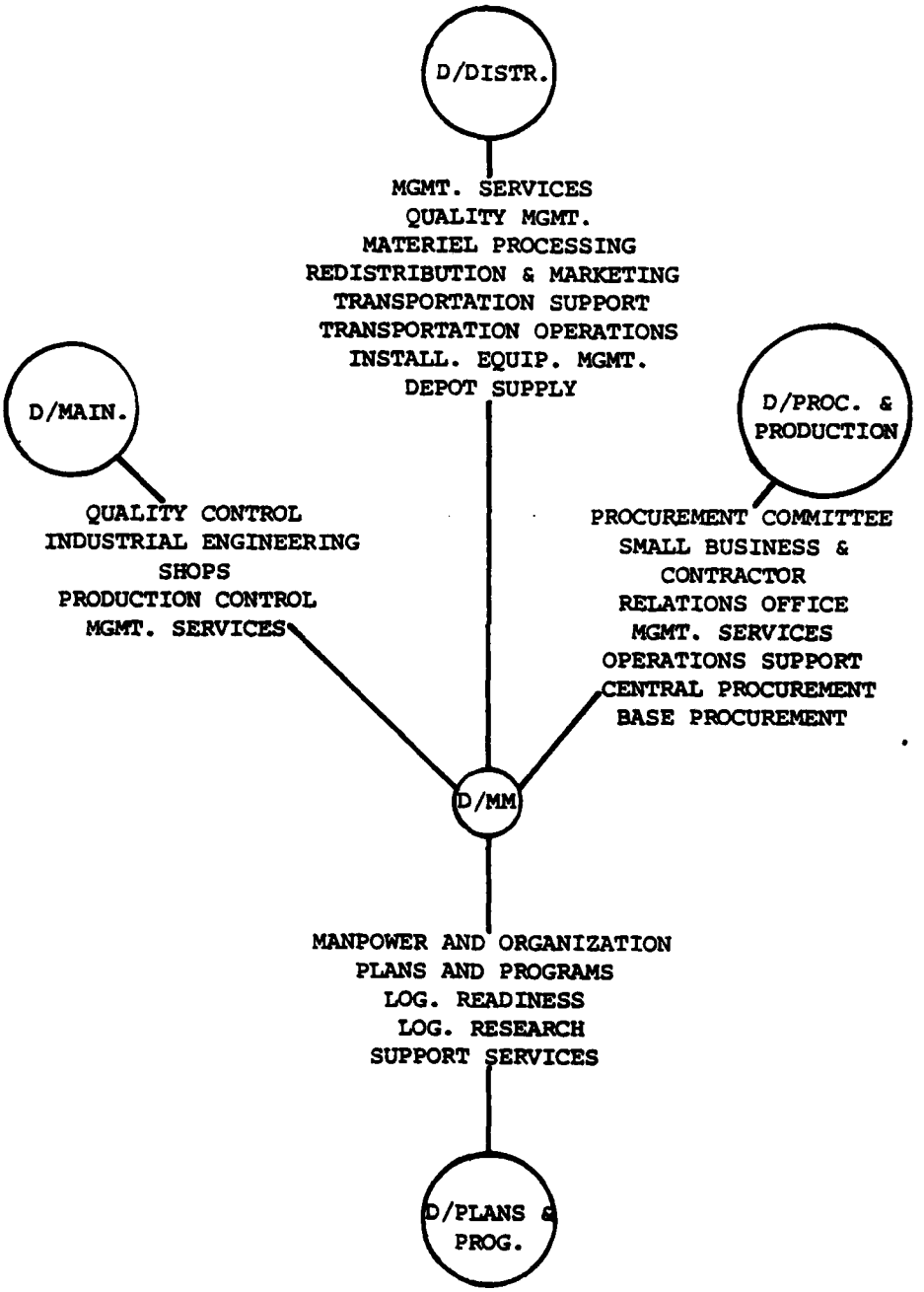

Fig. 1. The ALC Wheel as it Relates to the D/MM [8:37]

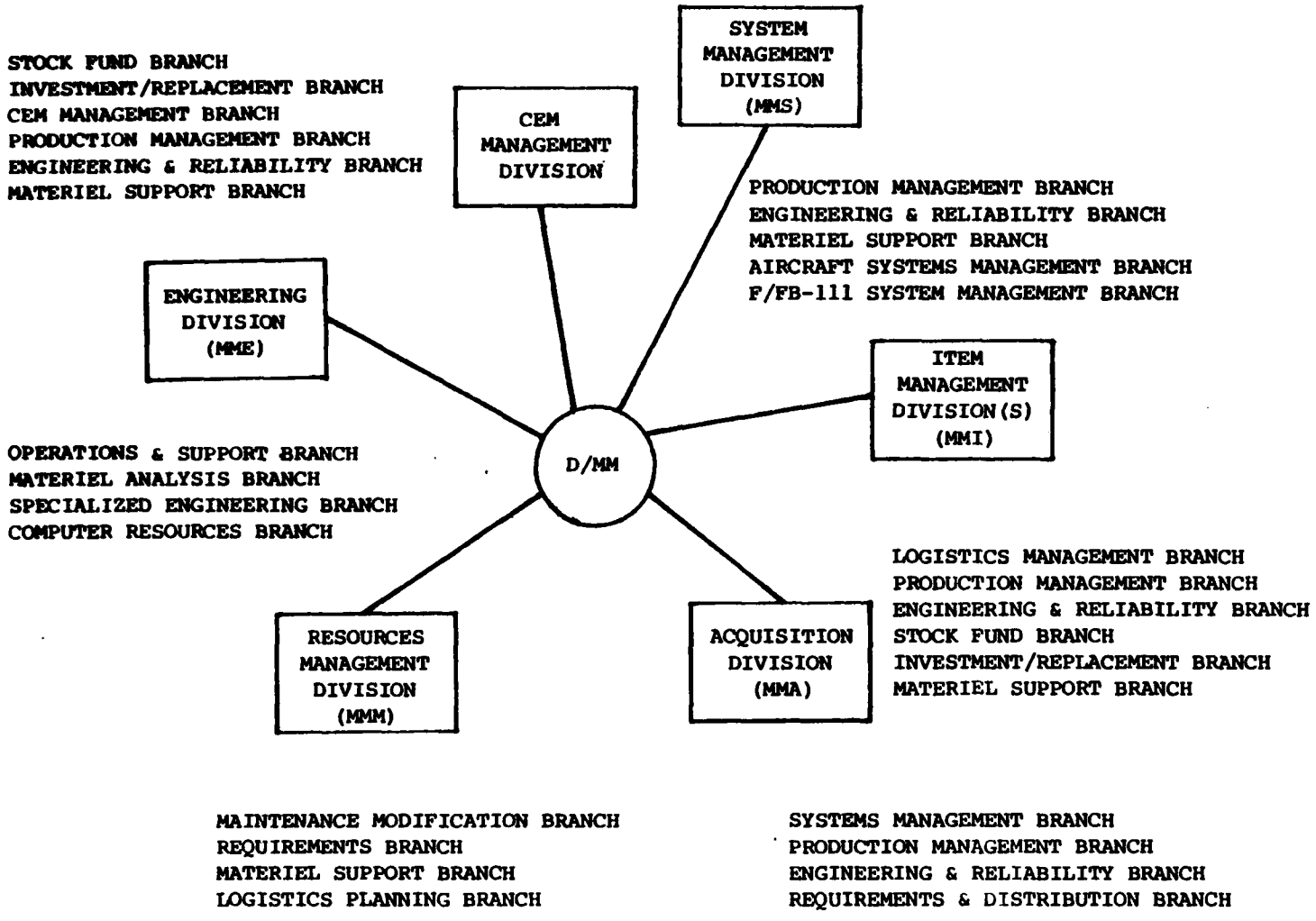

Fig. 2. The Management Wheel Within the D/MM [8:39]

Aircraft managed by the directorate include all versions of the F-111 and FB-111, the A-10, the F-104, F-105, T-39, and C-12A embassy aircraft. In addition, they manage fixed surveillance radar systems, space surveillance systems, electrical generators for many aircraft and fixed installations, and ground communications systems. Recently, responsibility for managing the space shuttle system was also extended to Sacramento. The directorate plays a key role in supporting the Air Force mission, and must have good indicators of the level of support they are providing.

Motivation

Two primary factors led the authors to undertake this task. First, as Air Force supply officers, we had frequently experienced the frustrations associated with attempting to understand and use the current supply management indicators. In particular, we feel there are too many indicators, dispersed throughout numerous daily and monthly reports. All too frequently, these indicators are only reformatted data requiring detailed analysis to glean from them usable management information. In attempting this analysis, the formulas have to be sought out from various sources. Different "standards" apply to the numerous indicators; and, rarely can any documentation of the logic substantiating these standards be found.

Stockage effectiveness for investment spares is a good example. The widely accepted "unofficial" minimal

standard for this indicator is 70 percent. However, information as to what threshold constitutes a significant deviation from the standard is unavailable. If a decision to take corrective action appears warranted, further detailed analysis is required. Numerous line items of investment spares may be in the inventory. Analysis is required to determine which particular item/items are responsible for the deviation. Given that this can be determined, we still don't know what impact this has on our customer's ability to perform his mission. Still further, information regarding the customer, the priority of the request, and the required delivery date is required before a decision can be made. The result is, we casually note the indicator, steer clear of further analysis, and implement crisis management at a later date. As indicated by the above example, supply management indicators are, indeed, a valid source of frustration, hence, we felt a significant contribution could be made.

Our second motivation was personal in nature. We took advantage of this unique opportunity to gain a deeper understanding of supply management, our career specialty.

Plan of the Report

Chapter I has provided an overview of the problem, justification as to the high level of current Air Force interest in the problem, its prevalence throughout the

logistics community, and the personal motivations of the researchers. Chapter II will summarize the current literature pertinent to our study and identify our research objectives and research questions based upon the relationships identified therein. Chapter III will describe the research methodology. Chapter IV will present our analysis and findings. Finally, Chapter V will summarize our key findings and present our conclusions and recommendations.

CHAPTER II

LITERATURE REVIEW

"Cheshire Puss," she [Alice] began . . . "would you please tell me which way I ought to go from here?" "That depends on where you want to get to, said the cat."

— Lewis Carroll

A 1979 thesis, "The Identification of Performance Indicators for the Engineering and Installation of Ground CEM Systems" (37) written by Lieutenant Colonel John Nauseef, Squadron Leader A. G. Tahir and Captain Ted I. Zidenberg provided the initial direction for this research effort. That thesis centered on a study of performance indicators for use within Air Force Communications Service. The general thrust of the effort paralleled very closely what we, the authors, were trying to accomplish in identifying a set of indicators for an Air Logistics Center (ALC) organization. Therefore, we utilized that 1979 thesis as a general model to guide our research.

The Nauseef et al. thesis addressed performance/management indicators as one element of a much larger system known as a management information system (MIS). Therefore, from our point of view, a seemingly logical starting point for this research effort was to review the current literature relating to the somewhat broader subject of MIS.

This search began with an inquiry to the Defense Logistics Studies Information Exchange (DLSIE) for bibliographic data and in turn a request to the Defense Documentation Center (DDC) for hard data. In addition, thesis abstracts, business periodicals, professional journals and management-oriented books were reviewed. The information obtained from these sources provided an initial roadmap to guide this research and was utilized as an aid to obtain other related secondary sources of background data.

In his book, Management Information Systems: Concepts, Techniques and Applications, James J. O'Brien describes the building blocks necessary to develop a MIS. His book is written from the manager's perspective, and was, therefore, extremely useful in establishing a baseline for this research. The author stressed the fact that a prerequisite to a successful MIS is to define management goals for the organization and to determine the way in which these goals are or could be met. The initial emphasis during this definitional phase involves the need to pose the correct series of questions to the decision maker (38: 13). Finally, O'Brien says that a MIS should be oriented toward the needs of management and that a properly designed system will contribute to the classical management functions of planning, decision making, control, etc. (38:61-62).

The importance of the need to relate MIS design to organizational goals was again stressed by William I. Spencer

in his article, "What Do Upper Executives Want from MIS?" He went on to say that MIS must be custom-tailored to the particular needs of a given organization in order to,

> . . . provide top management with (1) the information to exercise control over operations, (2) early warning of developing problems, (3) enough data on non-routine problems to indicate action required, . . . , and (5) adequate information to allocate resources [49:27].

In order to serve these purposes a MIS must exhibit uniformity, timeliness of information, flexibility and consiseness (49:27). Spencer concludes his article with an assertion of the need to establish information priorities. The result of a lack of priorities is a proliferation of demands for MIS at the lower management levels (49:55). Spencer closes by saying:

> . . . what top management wants is . . . exactly enough relevant information at precisely the right moment to produce an infallible management decision at the lowest possible cost [49:68].

Hugh J. Watson and Archie B. Carroll, in their book Computers for Business: A Managerial Emphasis reinforce the relationship of MIS to decision making.

> . . . an MIS should be able to summarize past and present data, make projections into the future, utilize both internal and external data, support the most fundamental managerial functions, and have a decision support orientation [56:262].

Watson and Carroll extended the concept of tailoring MIS to organizational goals by defining a hierarchy of information needs applicable to almost any organization (see Figure 3). Differing levels in the hierarchy have

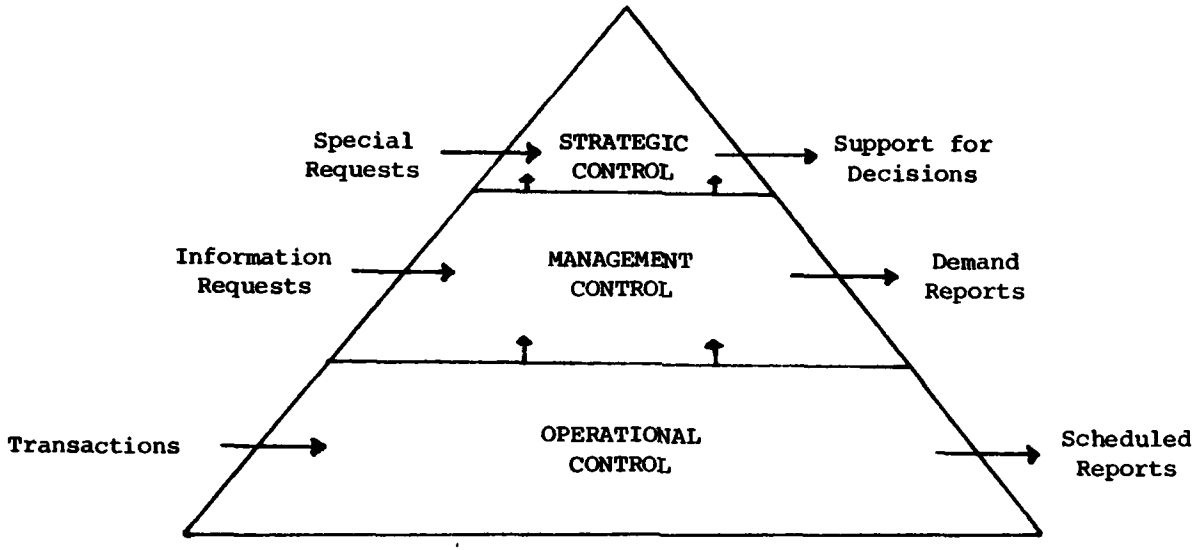

Fig. 3. Hierarchy of Information Needs [56:262]

differing information needs. The operational control level has the responsibility for insuring that the organization's basic day-to-day activities are carried out as planned. The management control level, in turn, integrates and processes inputs, directs the activities of the operational level and plans and controls the use of the organization's resources. Finally, the strategic control level, the most unstructured of the three levels, must decide upon the long-range goals of the organization and is responsible for the organization's interaction with external environmental forces (56:262-265).

In his study of MIS and the computer, Mr. Stuart N. Goodman provides a more concise definition of the characteristics of hierarchy of information needs. He states that,

> The pyramid illustrates that the quantity of information required by management is least for top management, and is greatest at the lowest levels of management. The pyramid also illustrates that information requirements at the lower levels act as a baseline for the higher levels of management . . . the base part of the pyramid applies to structured, well-defined procedures that require more programmed decisions, while the top part involves more ad hoc, unstructured processes that require more nonprogrammed decisions. The information generated by the lower levels of the pyramid are of more use to lower-level managers, while the information generated by the higher levels applies primarily to top management [24:4].

He further defines the fact that the purpose of a MIS is to provide information to the manager to increase his knowledge and therefore decrease the uncertainty of a decision.

A computerized MIS can provide a great deal of useful information, but this information must be evaluated in consonance with other known information which is not quantifiable (24:7).

In their technical report, "Spinning Our [Information] Wheels: A Look at the Maintenance Data Collection System" Majors Richard V. Badalamente and Thomas D. Clark discuss the principles of MIS design relative to Air Force maintenance management information systems. Although this report focused strictly on the maintenance function, the conclusions drawn appear to be equally applicable to a materiel management operation. In addition, the applicability of the principles of MIS to an Air Force setting were confirmed. Majors Badalamente and Clark closed their report by saying,

> . . . the decision-making process used at each step in the organizational structure must be analyzed and appropriate informational needs defined . . . two major recommendations. . . . The first is to look at every command level and identify the three types of decisions being made and ensure the information system responds to the decisional structure. The second is to shift emphasis from reporting of data to use of information and to involve the manager in the design of the system that provides that information [12:22-23].

The references to "command level" and "the three types of decisions" made by Majors Badalamente and Clark tie in directly with the hierarchy of information needs defined by Watson and Carroll and Goodman.

"Control and Planning of Information Systems," an article written by Mr. John A. Zackman, addresses MIS from the perspective of the three planning and control levels present in most organizations. Specifically, he makes the point that each level requires different kinds of information based upon the specific functions of each level. He goes on to say,

> . . . a weak point in the planning, measurement, and control system is extremely detrimental to the system. Characteristically, the weak point in planning, measurement and control systems is the measurement component for two reasons. First, human beings tend to avoid defining measurements (because if you define measurements, you are likely to be measured!). Second, in order to measure anything, consistent data is required . . . [60:35].

Mr. John F. Rockhart, "Chief Executives Define Their Own Data Needs," makes the point that executives get too much information from management systems and that as a result information presented is only partially digested and that much of the information received is irrelevant to the manager's needs in the first place (43:82). Obviously, something must be done to insure that managers get only that information which is essential and that actually contributes to decision making.

A thesis effort by Unger in 1978 addressed the manner in which humans process information in making decisions, particularly the effect of information overload on managers. His findings supported the hypothesis that as the available information increases, a saturation point is

reached beyond which the manager decreases the amount of information used in making a decision. His results further suggest that Air Force managers employ as many as eight key factors in the decision process (53:60-62).

From the Rockhart article and the Unger thesis there appears to be both an upper and a lower limit on the number of factors/indicators that a decision maker can assimilate or needs to assess to insure organizational success.

In their research study for the Air Command and Staff College, Majors Robert D. LaRue and James T. Leahy address the determinants of MIS effectiveness, in an Air Force context, once a system has been operationalized. They discuss several determinants which have been noted in earlier literature, but also, introduce several new concepts. These concepts include the need to assess the attitudes of the manager toward the system in terms of his use of its products (34:16); the format of the reports being produced (34:19); and, the capability of the system's products to reduce the degree of risk associated with decision making (34:20).

User attitude towards an MIS and user acceptance of the MIS are repeatedly listed in the literature as essential characteristics. For example, Johnson, Kast, and Rosenzweig state,

> Any system, no matter how well designed, is worthless unless accepted by the people who operate it. If they do not believe it will benefit them, are opposed to it, are pressured into using it, or think it is not a good system, it will not work. Two things can happen: the system will be altered by the people who are using it, or the system will be ineffective and ultimately fail. Unplanned alteration of an elaborate system might result in a situation which is worse than the "presystem" era. This is why it is so important for operating managers to help in designing the system [29:145-146].

In his article "Resistance to Rational Management Systems," Chris Argyris suggests,

> The first step is for all concerned to become aware that MIS (or any other new system) is not the basic problem. The basic problem is that organizations are full of concealed dysfunctional actions and defenses that are revealed by MIS. Perhaps if ways could be found to make quantitative models more accurately reflect the world as line managers experience it, their fears and resistances would be lowered [11:251].

A 1973 contract report, "Logistics Performance Measures at the Intermediate Level," addressed the problem of establishing and quantifying supply performance measures at the intermediate level of Army operations. Three major considerations are advanced. First, it was proposed that supply performance is greatly influenced by the policies imposed upon the supply system. Therefore, the development of performance measures must consider these policies and their impact upon the system. Policies were taken to include the rules, procedures, and guidelines used in supply functions. Second, it was stated that while these measures must provide stability, they must also be flexible enough to allow them to survive and adjust to ever-changing

conditions. Finally, five uses of quantitative performance measures were advanced:

1. To express a level of performance that is deemed reasonable wherein the quantity of work is considered as the expected normal performance [sic]
2. As a basis for comparing performance and deviations from established standards
3. To promote and obtain uniform performance from geographically separate facilities
4. For estimating facets of logistics operations such as inventories, costs, and maintenance times
5. To plan personnel allocation [32:1-18]

Joel E. Ross, in his text, Modern Management and Information Systems, stresses the importance of a master plan as, "an essential prerequisite for success in the design, implementation, and utilization of a management information system [44:225]." In his discussion of the master plan he cautions against applying a narrow technical system as a temporary solution to a larger, longer run problem. In addition, the master plan should distinguish between "lifestream" and administrative systems, and should establish precedence relationships (44:226-227). Also relevant to the master plan is the inclusion of an orderly classification of information systems. The following classification approaches were specified:

1. Task: the job, the function representing the purpose for which the information is reported.

2. Resource: the objects or events being used or acquired.

3. Networks: flows of information and resources representing a model of the organization.

4. Levels: representing the hierarchy of information needs.

5. Environment: the environment external to the organization which affects organizational planning (44:216).

Some combination of the cited approaches, fitted to the organization, must be utilized as one of the bases or guides during MIS development and planning.

Hershauer presents a model of information systems (Figure 4) which depicts very succinctly many of the issues revealed in the literature review. This model shows that only a small fraction of the total number of facts/occurrences are actually selected for data processing. However, this data processing function tends to expand the selected facts. Screening and analysis is then required to filter this data and create information. Information once available must be used. It must be communicated to the decision point. However, information alone does not act to create decisions. It is used in conjunction with the decision maker's own values and subjective judgment and the policies of the system (the variety attenuators). Finally, the results of these decisions are fed back into the system and future decisions are modified accordingly (26:28).

Summary

Recent literature on the subject of MIS has consistently stressed certain overriding factors--in order to

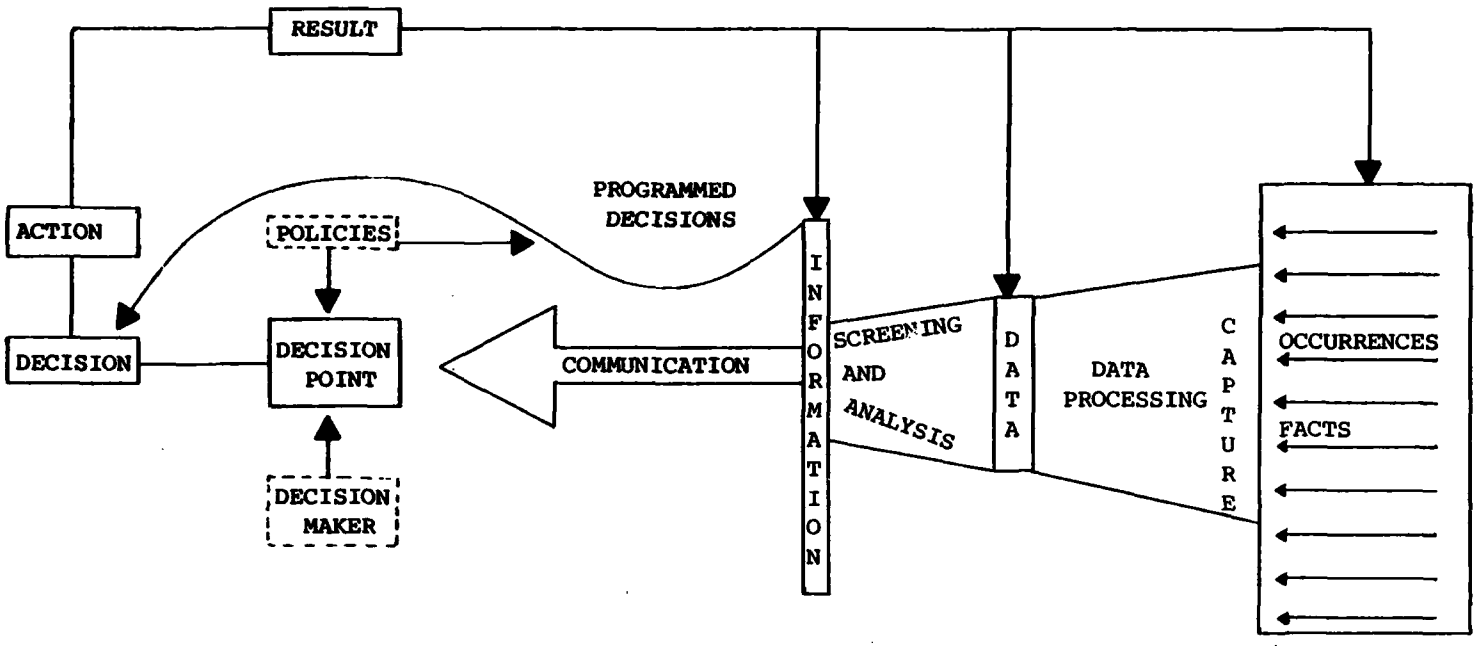

Fig. 4. Systems Model of Information Systems [26:27]

develop an effective MIS the organization's goals must be known, the MIS must be tailored to these goals, and the system user be involved. Once this is accomplished the need for pertinent and timely information becomes paramount, and, the organizational level receiving this information must be considered. The literature also clearly established the fact that there are just a few factors which management must absolutely review on a constant basis to insure organizational success.

The form in which information is transmitted was also addressed in the literature. If information transmission is unclear or doesn't really provide the information that it is intended to, then it does not contribute to effective decision making.

Finally, the concept of measurement as a major difficulty in MIS was discussed, particularly in view of the extensive external environmental factors which cannot be measured; but, which must be considered when making a decision.

Our research objectives and our research questions were formulated with our findings clearly in mind.

Research Objectives

From the relationships identified in the literature four research objectives were developed:

1. Determine the goals and objectives of the SM-ALC/MM.

2. Determine what information the SM-ALC/MM believes is required at various levels of the organization to accomplish their goals and objectives.

3. Identify and clarify the indicators presently being used by SM-ALC/MM.

4. Recommend a limited number of management indicators that specifically contribute to the goals and objectives of SM-ALC/MM.

Research Questions

1. What are the goals of the SM-ALC/MM?

2. What objectives support these goals?

3. What types of decisions does the SM-ALC/MM (the director) make?

4. What types of information does the SM-ALC/MM require to support these decisions?

5. Which indicators does the SM-ALC/MM review periodically?

6. How are the indicators defined?

7. How are the indicators used to aid decision-making?

8. What are the established standards for the present indicators?

9. Who sets these standards and how are they determined?

10. Which indicators, available for review by the SM-ALC/MM, actually provide information contributing to goal accomplishment?

11. Is there a need for indicators not presently reviewed by the MM which would provide vital information contributing to goal accomplishment?

CHAPTER III

METHODOLOGY

Overview

The methodology used in conducting this research largely parallels that used by Nauseef et al. in their 1979 thesis on AFCS Performance Indicators. From their review of the literature on performance and effectiveness measures they found

> . . . a common thread . . . ; it was centered on a goal oriented viewpoint that was the start of a hierarchial approach to the development of performance indicators. The hierarchy basically shows that in order to develop realistic, useable performance indicators, one must start at the top of the organization and determine the goals and objectives of the upper level managers, and then develop measurement criteria or performance indicators that support those goals and objectives [37:21].

This same thread was revealed in the present literature search, dealing with the somewhat broader topic of a MIS.

Therefore, the key to the process appeared to lie in the ability to accurately assess the broad goals and objectives of the Materiel Management Directorate at Sacramento and the operational objectives at the various subordinate hierarchical levels, which support these goals. In following this hierarchical framework of:

1. Establishing the organizational goals
2. Developing the objectives
3. Developing the performance indicators [37:22],

Nauseef et al. employed the following definitions:

> [Goals]--Basically, goals are plans expressed as results to be achieved. In this broad sense, goals include purposes, missions, objectives, targets, quotas, deadlines, etc. Goals represent not only the end point of planning but the end toward which other managerial activities such as organizing and controlling are aimed [33:440].

[Objectives]--"An objective is a specific result to be observed within a specified time, usually one year or a few years [10:136]."

[Management Indicator]--"An element of an activity that can be measured, and when given a numerical value, might serve to measure progress toward an objective [39:83]."

Four techniques were available for use in determining the directorate's goals and objectives: (1) observe the directorate over long periods of time and make inferences from these observations, (2) determine if written statements of the goals and objectives are available, (3) ask current management, (4) employ a policy-capturing methodology. Methods one and four were discarded as there was not enough time available to construct and validate a model of the goals and objectives if the other research questions were also to be answered. Method two was discarded as such statements might be out of date or tend more towards management's idealized conception of the organization than reality would suggest. In selecting method three, two considerations were operative. First, the Nauseef et al. methodology could be largely adopted with only slight

modifications. This would preclude reinvention of the wheel and allow more time to be dedicated to the task of synthetizing and documenting the present indicator system. Second, it was believed that the present managers are in the best position to provide information on the goals and objectives, as they are the ones pursuing them. Further, the assumption was made that management would respond in an honest fashion if they realized that the information was requested as a means of providing them better management tools.

Application of the Methodology

This section of the methodology contains a definition and discussion of the population studied, the instruments used in conducting the study, discussion of the data, and criteria for admissibility of the data. In addition, each research question is individually addressed in terms of the sources required to determine their answers. Finally, the assumptions pertaining to this research will be enumerated.

The population

The universe from which the population was drawn consisted of all the Materiel Management Directorates located at the five Air Logistics Centers. Our population for this study was the Materiel Management Directorate located at McClellan AFB, California. As stated earlier,

this particular directorate was chosen as a result of the high level of interest and the request for assistance expressed by the MM Director and the resultant support and cooperation that the authors anticipated they would receive in their information and data gathering process. This population was subdivided into three distinct sub-populations as illustrated in Table 1. In addition to the Director of MM, only those individuals filling the senior management positions within the divisions and branches were interviewed and/or surveyed.

The Instrument

The initial thrust of our empirical data collection involved the construction of an open ended questionnaire (Appendix A) which was used as a guide during a personal interview with the SM-ALC/MM and other selected division personnel. The purpose of this interview was to obtain a general understanding of the goals and information needs at the directorate level of the organization. Based upon this interview and our findings in the literature, a survey questionnaire (Appendix B) was developed for distribution to the Deputy Director of Materiel Management, all division chiefs and their deputies and branch chiefs. The survey method was used due to the number of personnel (42) who had to be contacted. The open ended question format was used, rather than a structured response format,

TABLE 1

POPULATION DEFINITION

	Subpopulation		
	1	2	3
Director, Materiel Management (MM)	X		
Deputy Director, Materiel Management (MM)	X		
Acquisition Division (MMA)		X	
Requirements & Distribution Branch (MMAD)			X
Systems Management Branch (MMAM)			X
Production Management Branch (MMAP)			X
Engineering and Reliability Branch (MMAR)			X
Engineering Division (MME)		X	
Material Analysis Branch (MMEA)			X
Computer Resources Branch (MMEC)			X
Operations and Support Branch (MMED)			X
Specialized Engineering Branch (MMET)			X
Resources Management Division (MMM)		X	
Logistics Planning Branch (MMML)			X
Maintenance Modification Branch (MMMM)			X
Requirements Branch (MMMR)			X
Material Support Branch (MMMS)			X
Systems Management Division (MMS)		X	
Production Management Branch (MMSP)			X
Engineering & Reliability Branch (MMSR)			X
Aircraft Systems Management Branch (MMSG)			X
Materiel Support Branch (MMSS)			X
F/FB-111 System Management Branch (MMSF)			X
CEM Management Division (MMC)		X	
Stock Fund Branch (MMCF)			X
Investment/Replacement Branch (MMCI)			X
CEM Management Branch (MMCM)			X
Production Management Branch (MMCP)			X
Engineering & Reliability Branch (MMCR)			X
Materiel Support Branch (MMCS)			X
Item Management Division (MMI)		X	
Stock Fund Branch (MMIF)			X
Investment/Replacement Branch (MMII)			X
Logistics Management Branch (MMIM)			X
Production Management Branch (MMIP)			X
Engineering & Reliability Branch (MMIR)			X
Materiel Support Branch (MMIS)			X

due to the nature of the questions and the responses desired (nominal level data).

The format of the survey questionnaire resulted from a condensation of the interview guide, with a primary focus upon goals, information needs and decision making. In addition, administrative data pertaining to each respondent was obtained in order to determine that the criteria for admissibility of the data were met.

In order to test its validity, the survey questionnaire was administered to selected AFIT students who possessed a "fully qualified" supply AFSC. In addition, personnel assigned to Headquarters AFLC were contacted and assisted in testing the questionnaire.

The Data

Both primary and secondary data were utilized. Primary data consisted of responses obtained from personal interviews, responses obtained from the survey questionnaire, and personal observations made by the researchers. Secondary data included official Air Force correspondence, manuals, regulations, and other publications.

Criteria for Admissibility of the Data

Responses obtained from interviews and surveys were accepted only if the respondents met the following criteria:

1. A minimum of 12 months experience within AFLC.

2. A minimum of 6 months experience as a manager within the Materiel Management Directorate at Sacramento Air Logistics Center.

These criteria were selected to insure the respondents were knowledgeable of the system and that their responses would, therefore, constitute valid data. Secondary sources were admissible only if they were official government correspondence/publications.

How the Research Questions were Answered

Table 2 depicts the data sources explored in answering each research question. Once data was collected from the indicated source it was subjected to the test for admissibility. Data which did not meet this test were disregarded and the remaining data was analyzed.

Question 1: *What are the goals of the SM-ALC/MM?* An answer to this research question was intended to provide a conceptual framework for identifying the performance indicators. However, to preclude the generation of a lengthy list of goals and insure the stated goals were, indeed, the important goals of the organization, it was agreed that consensus among at least five managers should exist.

TABLE 2

DATA SOURCES FOR RESEARCH QUESTIONS

RESEARCH QUESTION #	SOURCES							
	AFRs	Survey	Interview (SM/ALC-MM)	Interview (other)	Official Document	Official Correspondence	HQ AFLC OPRs for Indicators	Research Findings
1	X	X	X					
2		X	X					
3				X				
4		X	X					
5			X					
6	X				X	X	X	
7		X	X					
8	X				X	X	X	
9	X	X	X	X	X	X	X	
10								X
11								X

Question 2: *What objectives support these goals?* This question was analyzed similarly to question 1; however, only two managers were required to agree for the statement to be accepted as an objective. However, only those objectives which directly supported the goals determined in question 1 were utilized.

Question 3: *What types of decisions does the SM-ALC/MM make?* The responses obtained from the Director were accepted at face value. It was believed only the Director could honestly provide the answer to this question.

Question 4: *What types of information does the SM-ALC/MM require to support these decisions?* The replies of both the Director and the survey respondents were accepted at face value to provide an answer to this question. As the managers subordinate to the Director are required to provide information for key decisions, their responses as well as those of the Director were accepted.

Question 5: *Which indicators does the SM-ALC/MM review periodically?* The Director's responses and pertinent regulations and operating instructions were utilized in answering this question.

Question 6: *How are the indicators defined?* To define the indicators, the four sources depicted in Table 2 were investigated. If conflicting definitions were found

to exist, the following precedence rules determined the accepted definition for our study: (1) Air Force regulation, (2) response of HQ AFLC OPR for that particular indicator, (3) official document, and (4) official correspondence.

Question 7: *How are the indicators used to aid decision making?* Both survey responses and the Director's reply were accepted at face value.

Question 8: *What are the established standards for the present indicators?* The established standards for the indicators were determined following the same criteria outlined in question 6.

Question 9: *Who sets these standards and how are they determined?* Preliminary investigation concerning who sets the standards and how they are determined revealed a lack of information on the part of all possible sources. As these standards supposedly define acceptable levels of achievement, it was extremely important that they be meaningful and based on sound logic. Therefore, all possible sources were investigated.

Question 10: *Which indicators, available for review by the SM-ALC/MM, actually provide information contributing to goal accomplishment?* Those indicators periodically reviewed by the D/MM (question 5) were subjectively

evaluated against both the information required to support his decisions (question 4) and the stated objectives (question 2). One of three possible conditions were found to exist:

1. Indicators supported decisions and objectives and, were recommended for continued use.

2. Indicators did not support decisions and objectives and, were recommended for elimination.

3. Decisions and objectives had no supportive indicators and, therefore, provided input to question 11.

Question 11: *Is there a need for indicators, not presently reviewed by the MM, which would provide vital information contributing to goal accomplishment?* Having determined which objectives were not supported by management indicators and having knowledge of information required by the Director to make decisions, indicators were recommended to meet management's needs.

Assumptions

The following assumptions were made in applying this methodology:

1. Responses to the surveys and interviews were honest and reliable.

2. The experience levels enumerated under "Criteria for Admissibility of Data" were adequate to

provide survey respondents with sufficient background to understand the inner workings of an ALC.

3. The real goals were found.

4. That concurrence between five managers on the goals and between two managers on the objectives was sufficient agreement to classify the response appropriately.

5. The results of this research effort can be generalizeable to other MMs at other ALCs.

CHAPTER IV

FINDINGS AND ANALYSIS

Overview

This analysis will be conducted utilizing the algorithm presented in Figure 5 (Interaction of Research Questions and Objectives) and the sources presented in Table 2 (Data Sources for Research Questions). The answers to the individual questions will then be used to build upon the analysis of related questions and, finally, achieve our research objectives. First it is necessary to discuss the survey questionnaire furnished to forty-two high level D/MM managers. These managers were originally allotted seven days to complete the questionnaires and return them to the researchers. However, even after thirty days, only 47.6 percent of the questionnaires had been returned with a 50 percent success rate at the division level and a 44.8 percent success rate at the branch level. At the division level, questionnaires were provided to each of the division chiefs and their deputies. In no instance were responses received from both the division chief and his deputy; however, one response was received from each division. At the branch level, within each division, the response rate ranged from 0 to 100 percent. The overall low response rate, given the amount of time finally allowed

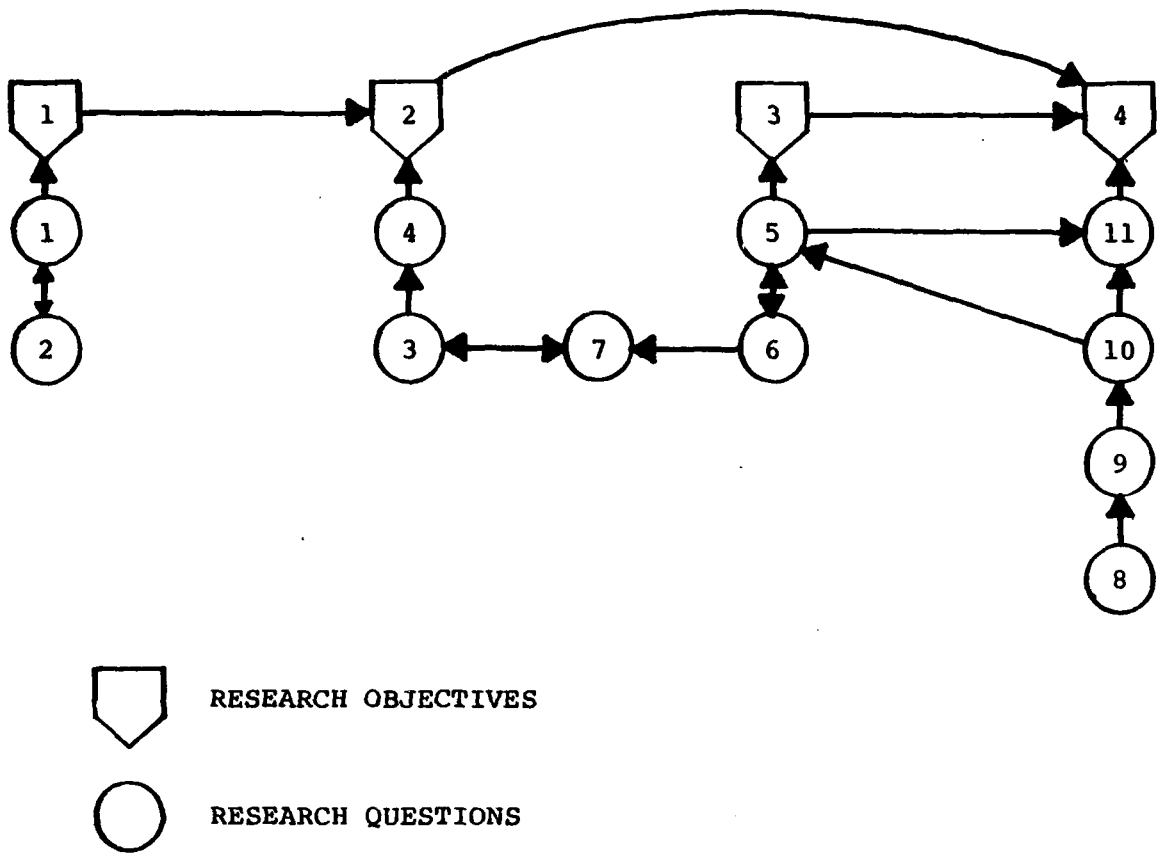

Fig. 5. Interaction of Research Questions and Objectives

to respond, may be indicative of prevailing attitudes toward changes and the lack of agreement with the problems perceived by upper management levels. Conclusions that could be drawn from these observations are that personnel at the MM division and branch levels

-- do not perceive the existence of information systems problems,

-- are displaying resistance to potential future systems changes,

-- are so busy that they have no time available to complete a questionnaire,

-- do not believe that "outsiders" could make a contribution to their organization,

-- don't care,

-- cannot support the D/MM's intended purpose for this research.

The list could go on and on indefinitely, but the point should be clear: in order for change to be really successful, "The head of the organization and his immediate subordinates assume a direct and highly involved role. . . [13:53]." At present, this may not be the case and must be a consideration in any anticipated directorate-wide change in the future.

Analysis of the research questions and their relationship to the research objectives will now be undertaken.

Research Objective 1

Determine the goals and objectives of the SM-ALC/MM.

In order to be effective, information systems must serve the objectives of the organization (55:24). Research Questions 1 and 2 and research objective 1 were developed to fulfill this need.

An interview with the D/MM established that he perceived his goal to be weapons system support such that the using commands could successfully achieve their missions, even if this required a 100 percent aircraft in-commission rate. Evaluation of the responses received from various MM divisions and branches revealed significant agreement in that the D/MM's goal should be weapons system support. A sampling of some of the responses included:

> "Providing logistics support to the user of the systems and equipment assigned SM-ALC."
>
> "Timely logistics support to customers worldwide of weapon systems/equipment for which we are responsible."
>
> "Acquire and manage spares and equipment in a manner which will best support the AF missions."
>
> "Maintain the operational readiness capability of the Air Force weapon systems assigned to SM-ALC."
>
> "Support the field/user with . . . systems and supplies that meet his operational needs at lowest cost to U.S. taxpayers (when he needs them)."

The concept of providing support to customers and/or missions appeared on thirteen (65 percent) of the completed surveys. Responses on the balance of the surveys, however,

talked around these particular concepts without specifically saying the words.

Further investigation revealed that the MM is

> . . . responsible to the ALC Commander for worldwide logistics support management of weapon and support systems . . . and other material as assigned by HQ AFLC [4:p.1-1].

Throughout this phase of our investigation several concepts appeared time and again:

Operational Readiness (4 times)

Assigned Weapons Systems/Items/Commodities (13 times)

User/Customer Support (10 times)

Logistic Support (7 times)

Management (8 times)

Timely (5 times)

Therefore, any definition of goals and objectives for the D/MM should include these concepts. However, realization of these concepts cannot be accomplished by the Materiel Management Division in isolation. For example, effective logistics support requires an active interaction between the tasks (procurement, transportation, supply, maintenance) that comprise the logistics system (40:30,33). In the present case, therefore, any definition of the D/MM's goals must be directed toward an integrated effort between the Directorates of Maintenance, Distribution, Materiel Management, Procurement and Production, and Plans and Programs.

In order to model the decision-making structure of an organization it is necessary to understand its goals and these goals must be explicitly stated (17:47). Based upon data developed and presented to this point the D/MM's primary goal should be: contribute to operational readiness by providing timely, integrated logistics support through proper management of assigned weapons systems and commodities so that using commands can achieve their required missions. Figure 6 depicts this statement in terms of our initial development of a decision support model. Operational readiness is defined as the ultimate goal towards which all efforts in the Air Force are directed. Whether or not this goal is achieved is dependent upon the capabilities of each MAJCOM to fulfill its assigned mission. To a significant degree, MAJCOM mission success or failure is dependent upon the D/MM's capability to furnish MAJCOM users (including the ALCs' Directorates of Maintenance) with the spares/parts that they require to repair and maintain their weapons systems. This leads us to look for an answer to research question 2 concerning the objectives (subgoals) that support the primary goal.

Analysis of interview and survey responses resulted in an extremely large and cumbersome list of objectives for the Directorate of Materiel Management. However, application of the criteria developed in Chapter II reduced this list to a manageable form. These objectives are presented

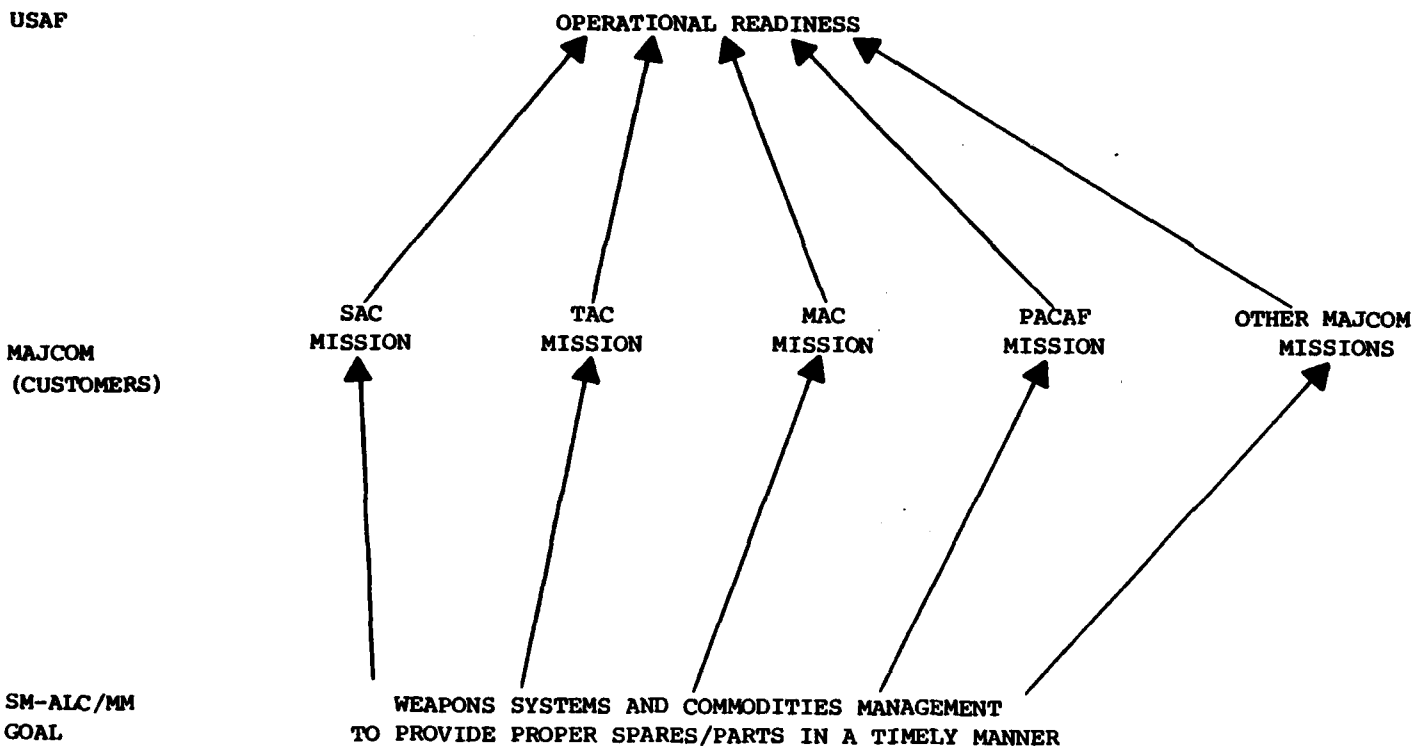

Fig. 6. Initial Decision Structure

in Table 3 and, at this point, are simply displayed in a random order. A statement by a manager that he has an objective does not in and of itself guarantee that this objective contributes to the "corporate" goal or that it is even an actual objective (22:209). Some link must be shown to exist between the stated objectives and the goal,

> . . . each subsidiary objective should contribute to the achievement of its respective immediate superior objective, thus providing a thoroughly integrated and harmonious pattern of objectives to all members of the enterprise [51:48].

This prerequisite will be achieved through the use of causal loop diagrams.

Figures 7 through 9 illustrate the causal relationships, as perceived by the authors, that exist between the Directorate of Materiel Management's stated objectives. These diagrams portray "a sequence of cause-and-effect relationships, with the arrows indicating the direction of dependence or causality [57:58]." For example, locate Figure 7 and the objective labeled "clear and timely program implementation directives." Using this as a starting point the diagram indicates that successful achievement of this objective will contribute directly to the success of four additional objectives: (1) support new systems acquisition, (2) effective provisioning, (3) establish realistic project/task priorities, and (4) accurate requirements determination. Extending this relationship, supporting new systems acquisitions will minimize customer dissatisfaction which,

TABLE 3

PERCEIVED OBJECTIVES

Maximize Fill Rate
Minimize Backorder Rate
Support New Systems Acquisitions
Maximize Engineering Support to Item and Systems Managers
Effective Funds Management
Develop Policies and Procedures Supportive of the ALC Mission
Minimize PR/MIPR Returns
Increase Productivity
Provide Improved Information Flow
Minimize Customer Dissatisfaction
Minimize MICAP Hours
Obtain Required Manpower Resources
Process Engineering Changes Promptly
Minimize Material Deficiency Reports (MDRs)
Reduce Technical Order (T.O.) Changes
Allocate Resources to Highest Needs Priority
Integrate Future Program Changes in Planning
Improve Interaction Between Directorates and Divisions
Sharpen Management Awareness
Timely Initiation of Purchase Requests (PRs)

TABLE 3--Continued

Complete and Timely Processing of Materiel Improvement Projects (MIPs)
Effective Provisioning
Increase WRM Fill Rates
Meet Modification Schedules
Establish Realistic Project Milestones
Clear and Timely Program Implementation Directives
Accurate Requirements Determination
Improve the Quality of the Workforce
Minimize Personnel Turnover
Improve Management Abilities
Highlight Leadership Qualities
Provide Quality Training Programs
Establish Realistic Project and Task Priorities
Minimize Not Mission Capable Supply (NMCS)

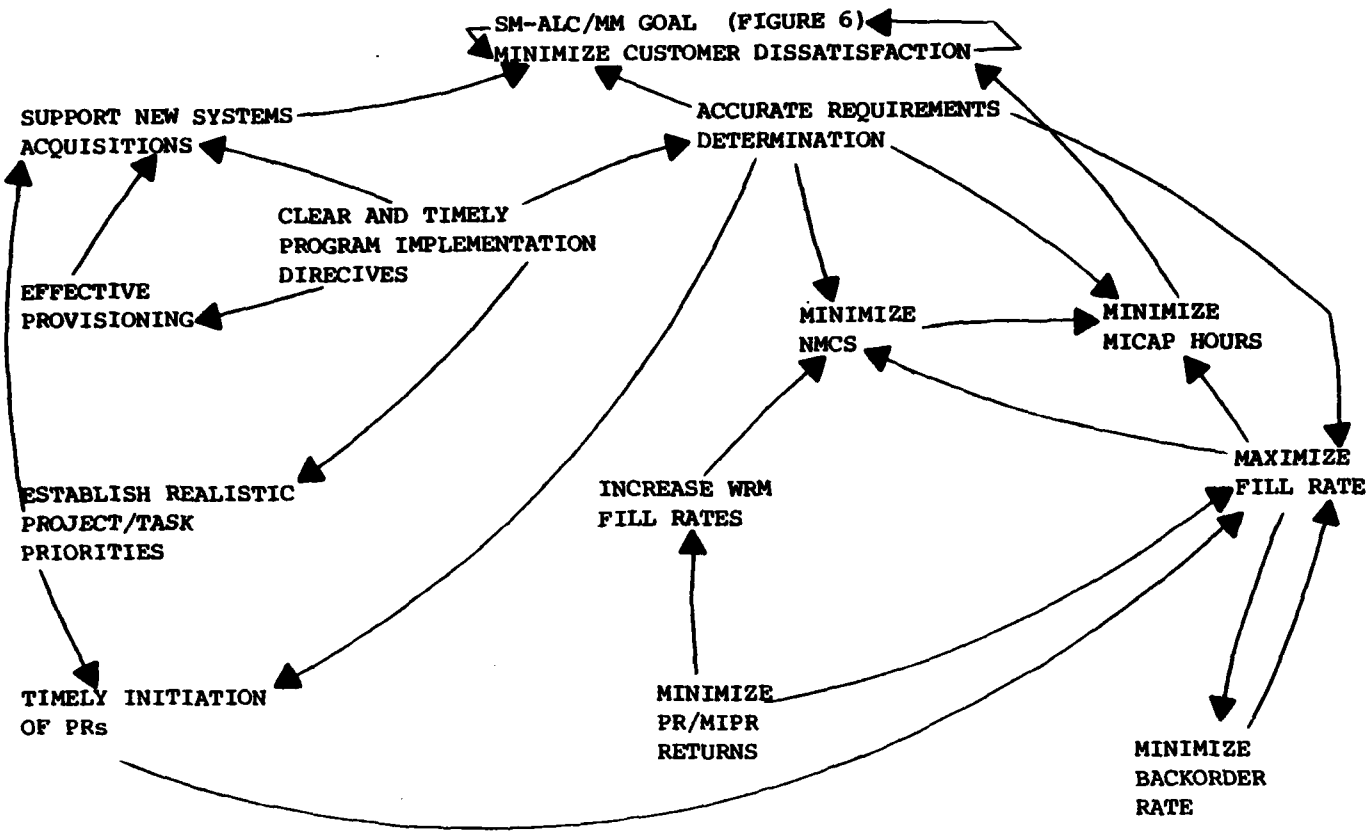

Fig. 7. Functional Substructure

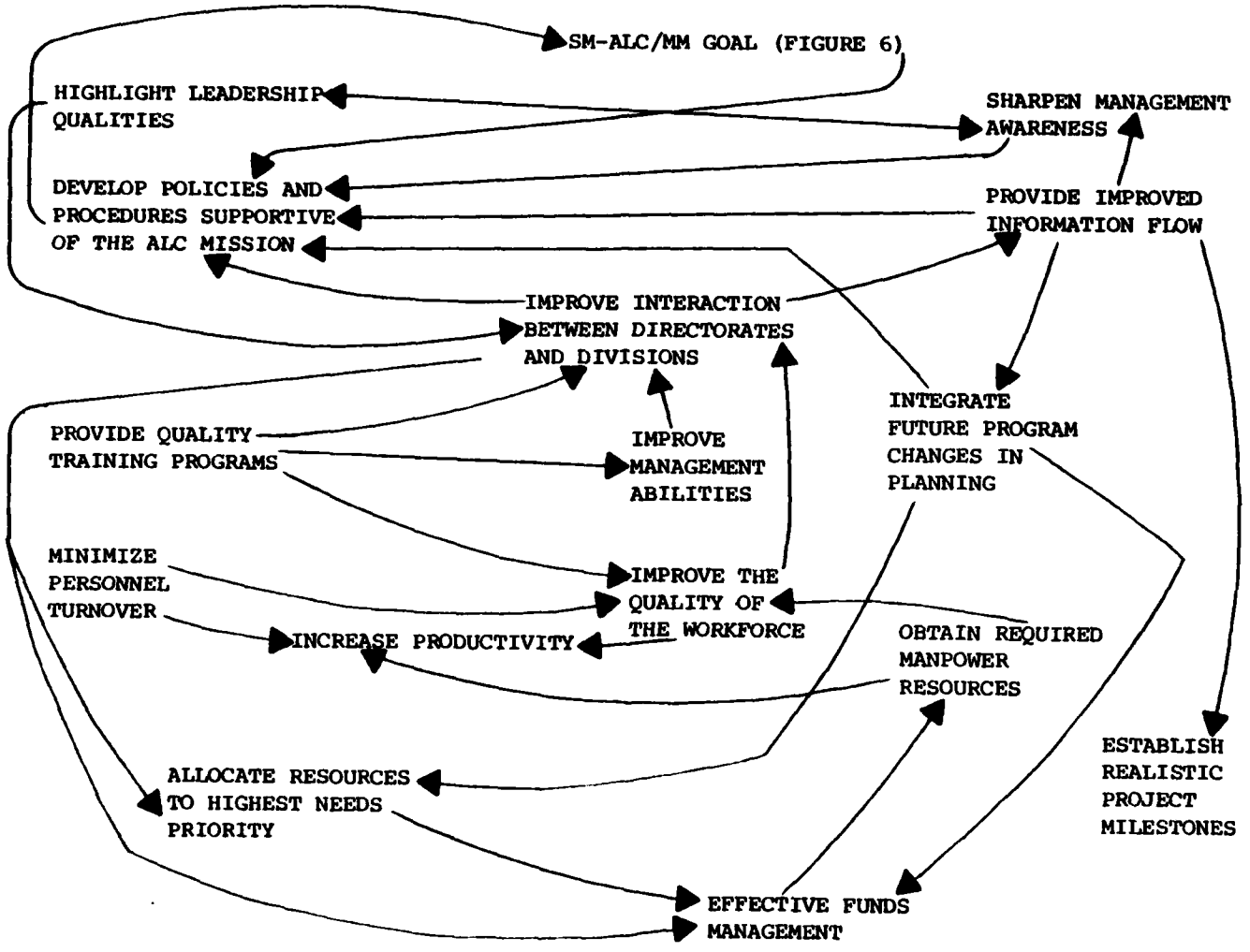

Fig. 8. Management Substructure

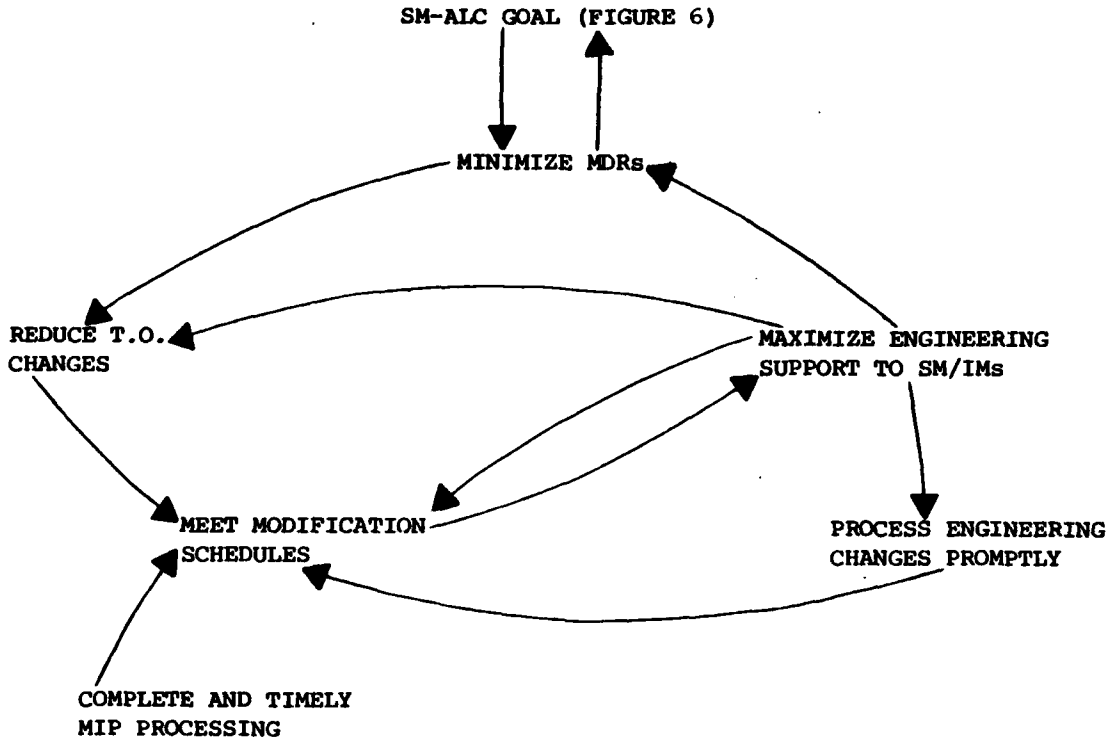

Fig. 9. Technical Substructure

in turn, contributes to the achievement of the overall SM-ALC/MM goal. This procedure can be applied to track the effect of the success or failure of any stated objective.

These causal loop diagrams also illustrate that all stated objectives do, in fact, contribute, directly or indirectly, to the SM-ALC/MM primary goal defined earlier. As can be seen, classification of the objectives did not fall into one neat little package, but required the development of three distinct substructures. For convenience, these were labeled the technical, management, and functional substructures reflecting the nature of the majority of the objectives contained within each.

Integrating these substructures with Figure 6 (Initial Decision Structure) results in the model presented in Figure 10. Attainment of the various objectives defined in the substructures will contribute to the achievement of the SM-ALC/MM primary goal which ultimately contributes to the Air Force's operational readiness capability. Furthermore, this model indicates that there must be continuous interaction between the substructures to insure a fully coordinated and integrated effort.

With the goals and objectives firmly established, the next phase in this research involved their classification into the hierarchy of information needs. First, though, it is necessary to define how the directorate fits into a hierarchy such as was defined in Figure 3. That

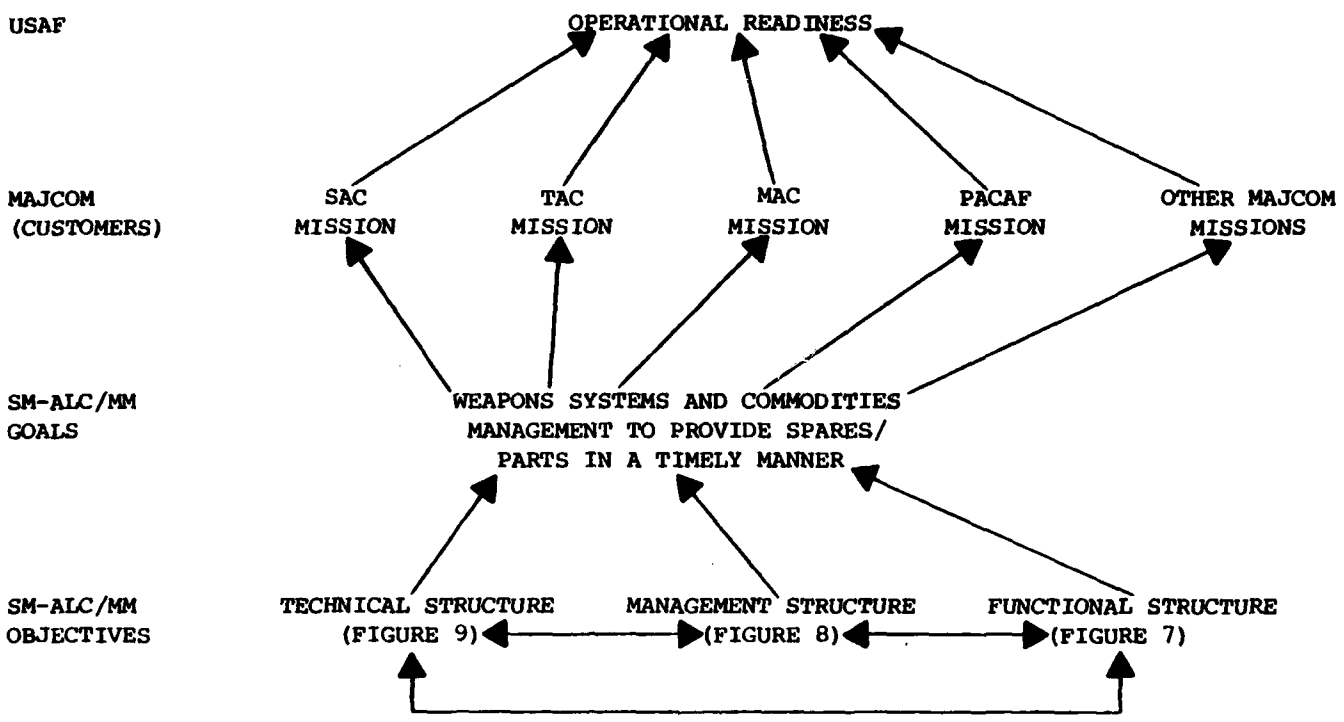

Fig. 10. SM-ALC/MM Decision Structure

illustration, however, will be modified somewhat because, "All echelons, in some way, deal with the three types of decisions and, therefore, require information to support each type [12:15]."

Figure 11 provides a graphical display of this concept. It not only conveys the philosophy presented by Lieutenant Colonel Badalamente and Major Clark, but also goes one step further. As we progress from the lower echelons to the upper echelons, we see that the degree of strategic control required increases while the degree of management and operational control decreases proportionately and vice versa. With this concept firmly established, we can see that goals and objectives may not, and need not, fall neatly into one level or another. They may, in fact, spill over into the next higher or lower hierarchical level.

The criteria utilized in assigning the objectives to levels were provided by Gordon B. Davis in his text Management Information Systems: Conceptual Foundations, Structure, and Development. He states that operational control makes use of preestablished procedures and decision rules, is quite stable, and generally covers short periods. Management control measures performance, determines control actions, formulates new decision rules, allocates resources, and requires summary information. The strategy that will be used to achieve objectives is developed at the strategic

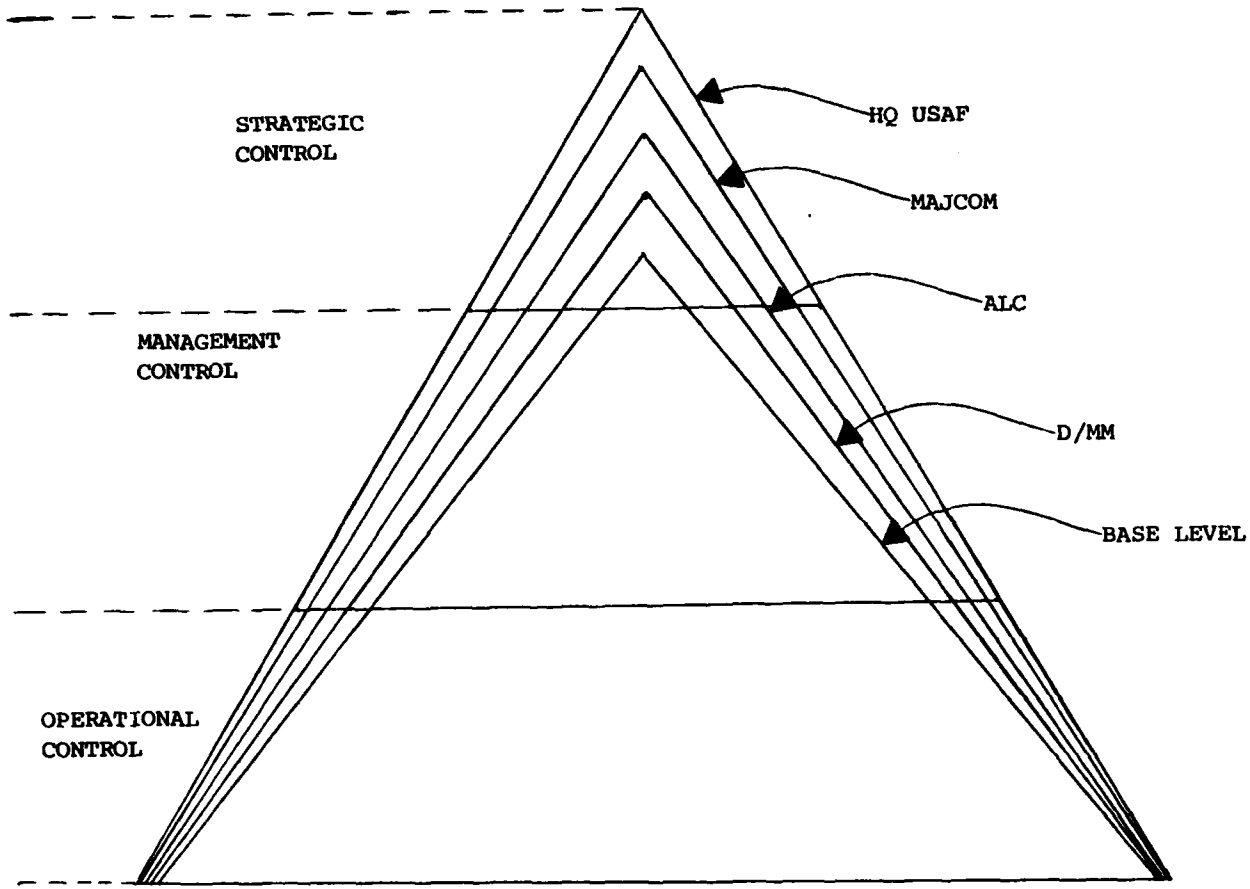

Fig. 11. Multi-level Hierarchy of Information Needs

level. Here, plans occur over fairly long time horizons and activities occur in a somewhat irregular fashion (19:208-213). In addition, Anthony and Dearden reaffirm the fact that objectives cannot be strictly assigned to a particular level in the hierarchy since adjacent levels frequently interact to achieve a successful outcome (9:12-18). Therefore, the following classification of objectives will be displayed in a matrix format in an attempt to accurately capture this concept. The design of Table 4 provides the capability to rank objectives in groups by order of importance. Since this research focused upon the needs of the D/MM, and he/she is the senior materiel manager at an ALC, then attention should be focused upon those objectives which have a strategic and management control orientation. The order of importance of groups of objectives can be classified as follows:

Vertical Axis (Time Span)	Horizontal Axis (Management Levels)
Long range	Strategic Planning
Long range	Management Control
Intermediate range	Strategic Planning
Intermediate range	Management Control
Short range	Management Control
Short range	Operations Control

Objectives which intersect at the long range time span and at the strategic planning management level, for example

TABLE 4

OBJECTIVES BY MANAGEMENT LEVELS

	MANAGEMENT LEVELS		
Time Span	Strategic Planning	Management Control	Operations Control
Long range	Develop policies and procedures supportive of the ALC mission Integrate future program changes in planning *Improve interaction* between Directorates and Divisions Clear and timely program implementation directives	Support new systems acquisitions Effective funds management Provide improved information flow Minimize MICAP hours Allocate resources to highest needs priority Improve the quality of the workforce Minimize personnel turnover Improve management abilities Sharpen management awareness Minimize customer dissatisfaction	

TABLE 4--Continued

Time Span	MANAGEMENT LEVELS		
	Strategic Planning	Management Control	Operations Control
Intermediate range	Increase productivity	Highlight leadership qualities	Maximize fill rate
	Obtain required manpower resources		Maximize backorder rate
	Effective provision-visioning		Maximize engineering support to item and systems managers
	Provide quality training programs		Minimize MDRs
	Establish realistic project and task priorities		Reduce T.O. changes
	Establish realistic project milestones		Timely initiation of PRs
			Increase WRM fill rates
			Minimize NMCS
			Complete and timely processing of MIPs
			Minimize PR/MIPR returns

TABLE 4--Continued

	MANAGEMENT LEVELS		
Time Span	Strategic Planning	Management Control	Operations Control
Short range		Process engineering changes promptly Meet modification schedules Accurate requirements determination	

require the D/MM's greatest amount of time and attention while those objectives at the intersection of the short range time span and operations control management level require his personal attention only when there is a significant deviation from the established standards.

The analysis required to satisfy research objective 1 is now complete. The D/MM's primary goal was defined in the model display in Figure 10. The supporting objectives were arranged in a hierarchical framework and defined in Table 4.

Research Objective 2

Determine what information the SM-ALC/MM believes is required at various levels of the organization to accomplish their goals and objectives.

In order to reduce uncertainty and optimize the outcome of the decision-making process, the D/MM must be provided with information that is relevant to the objectives that he hopes to achieve. Research questions 3 and 4 and research objective 2 were developed to provide some insight into this phase of the D/MM's responsibilities. The results of this analysis will ultimately be used as direct input to our recommendations and conclusions.

> It is the responsibility of the Director of Materiel Management to weave together the capacities and capabilities of the ALC's effort in supporting operations of maintenance, storage, distribution, and transportation into the unified support of all customers.

> The D/MM controls operations pertaining to assigned systems and items and relates the effort to the total ALC support effort [7:35].

This quote highlights the fact that decisions made by the D/MM have an impact far beyond the effects upon his own organization and that his information requirements also extend beyond the confines of divisions under his immediate control. These are, therefore, the criteria against which decisions and information should be evaluated.

The key issue involved in almost all decisions made by the D/MM involves the need to justify and allocate limited resources among numerous competing alternatives. The difficulty associated with these decisions increases with time as inflation eats away at the value of the dollar, Congress legislates Department of Defense manpower reductions, and the complexity of our weapons systems increase causing maintenance costs to rise dramatically. Consequently, efficiency and effectiveness of operations will have to increase if the customer mission is to be supported adequately. The most important means of adapting to these changes and assuring continued support is to provide the decision maker with the right information about the right variables. For example, if the D/MM needs to decide whether to use organic or contractor repair for a given item some of the information that he might require to reduce uncertainty and make "right" decisions could

include the priority of the repair, available organic capacity for repair, organic cost to repair versus contractor cost to repair, etc.

The problem, then, became one of determining the information needs of the D/MM. If the D/MM is to meet his goal within the constraints of limited resources, then the information he receives must convey some message about how well or poorly he is doing in relation to goals and resources. The authors believe that the following information needs are relevant to the D/MM:

1. Projected flying hour programs for assigned systems.

2. Scheduled flying hours versus actual flying hours by weapons system.

3. Failure rates of critical systems components versus the projected mean time between failure.

4. Projected systems phase-outs.

5. Projected personnel training requirements resulting from retirement, turnover, or new procedures.

6. Availability of stocked components judged against projected needs.

7. Organic repair capabilities and costs versus contractor repair capabilities and costs.

8. Systems acquisition status.

9. The relationship between projected requirements for funds to procure both parts and repair capability and the actual funding available.

Research Objective 3

Identify and clarify the indicators presently being used by the SM-ALC/MM.

This section of the analysis will attempt to answer research questions 5 through 9. Specifically, those indicators which the Director of Materiel Management at SM-ALC reviews on a periodic basis will be identified and defined. An attempt will be made to show how the indicators can be used to aid decision making. Finally, the established standards for the indicators will be discussed to include how these standards are determined and who sets them.

Sacramento Air Logistics Center MMOI 11-5 "Management Review Procedures" specifies those indicators which are periodically reviewed by the Director of Materiel Management. The management review procedures outlined therein ". . . have been developed to measure the performance of the ALC and to determine the adequacy of customer support by the D/MM [20:1]." The implication, then, is that the goal of the D/MM is "customer support." However, customer support is a highly generalized concept and was redefined by the authors as weapons system and commodities management to provide proper spares/parts in a timely

manner. Therefore, the indicators will be evaluated in terms of their adequacy in providing decision support information relevant to the achievement of that redefined goal.

The indicators are:

1. Fill Rate
   Economic Order Quantity (EOQ)
   Investment

2. Backorders
   EOQ
   Investment

3. Age of Backorders
   EOQ 1-90 days
   EOQ 91-180 days
   EOQ over 180 days
   Investment 1-90 days
   Investment 91-180 days
   Investment over 180 days

4. Tech Order Stock Availability

5. Government Furnished Materiel (GFM) at Contractor Facilities (Expense)

6. Age of Unprocessed Exceptions

7. Purchase Request/Military Interdepartmental Purchase Request (PR/MIPR)
   Processing Within D/MM

8. PR/MIPR Processing Within D/PM

9. EOQ Repeat Buy Notices

10. Materiel Improvement Projects (MIPs)
    Emergency/Urgent
    Routine with Kits
    Routine without Kits

11. AFTO Forms 22

12. Noncredit Material Returns

13. A/C Production (Contract)

14. Air Force Industrial Fund (AFIF)
    Contract
    Revenue Variance
    Profit and Loss

15. Initial Provisioning Workload
    % Delinquent over 16 days

16. Master Materiel Support Record (MMSR)
    End Items not on MMSR
    Component Parts not listed

Each of these indicators will now be reviewed in depth.

Fill Rate

This indicator depicts the percentage of issues made in relation to the total number of "net" requests (demands) for items. Since the indicator is based on "net" demands rather than "gross" demands, it tends to be somewhat misleading. Gross demands include all requisitions received by the ALC. To arrive at net demands the following categories of requisitions are exempted: (1) all requests for nonstocked items, (2) all requisitions which have an established required delivery date (RDD) or a required availability date (RAD) which does not require immediate distribution action. The exempted requisitions are reinstated to the system in ample time to meet the RDD or RAD. Further, partial fills are not recorded as issues. Credit for an issue is registered only when the entire requisition is finally distributed to the requestor. The actual formula used at the ALC to compute fill rate is:

$$\text{Fill Rate} = 100\% - \frac{\text{(Number of Non-Fills)}}{\text{Net Demands}}$$

Two fill rates are computed: economic order quantity (EOQ) fill rate and investment fill rate. This information is provided weekly by the D032HN1L "Supply Availability and Workload Analysis Report." The monthly version of this report, the D032 EX1A, must be submitted to AFLC Headquarters for review (21).

In terms of aiding decision making fill rate provides the D/MM a rough indication of aggregate customer support. That is, the value of the indicator reflects the average of the MAJCOM/weapon system specific values. For example, the D/MM may be provided the information that the monthly fill rate is 90 percent. While this is indicative of excellent "customer support," it would veil the fact that fill rate for CEM systems might be 99 percent and aircraft systems, 79 percent. Further analysis might reveal that the F-111 fill rate was as low as 57 percent. Although too much detail in terms of this indicator would be inappropriate at the D/MM level it could be displayed in terms of MAJCOM or weapon system fill rates. This would allow the D/MM greater visibility in terms of "customer support" and aid him in making decisions to improve support when necessary. Improvement would require detailed analysis of the indicator at subordinate levels. The D/MM, however, could monitor the progress of this effort. When necessary, he could coordinate with the other directorates to alleviate problems over which D/MM has no direct control.

The established standard/goal for EOQ fill rate is 85 percent. It is 70 percent for investment fill rate. MMOI 11-5 permits an allowed tolerance of 5 percent for both fill rate indicators (21). Accordingly, if the EOQ fill rate is below 80 percent or the investment fill rate is below 65 percent management action should be taken to reverse this unfavorable trend. Although the standard is established by AFLC Headquarters, extensive research (interviews with Headquarters AFLC personnel, School of Systems and Logistics personnel, and SM-ALC Materiel Management personnel) failed to reveal the rationale for its determination.

Backorders

This indicator depicts the total volume of requisitions for stocked items which cannot be filled due to a zero balance condition. Backorders are measured separately, but identically, for investment and EOQ items. "The backorder area, taken as a whole, is probably a more important measure than the fill rate since it represents customer requests that we owe [14:1]." Further, "Manpower is based on numbers of backorders [sic] [30:23]." This practice is counterproductive and provides no incentive for management to improve upon the standard. If backorders are reduced, manpower slots are lost.

This indicator is read directly from the DO32HN1L "Supply Availability and Workload Analysis Report," which

is provided weekly. The end-of-month figures are provided by the DO32EX1A report (20). It should be noted that this indicator reflects the status of backorders at a particular point in time. This status changes daily.

In terms of management information provided, the indicator informs the D/MM of the current status of support not being provided. It does not portray adequate information about operational support, however, as it counts all backorders (priorities 01-15). Backorders for priority 09-15 are for stock replenishment and do not reflect immediate customer needs. For this reason, it has been suggested that, "The indicator on volume of backorders should be revised to include only priority 01-08 backorders because only these backorders are for immediate need [35]."

The established standard/goal for the number of backorders at Sacramento Air Logistics Center is to have no more than 6200 EOQ items and no more than 7500 investment items on backorder at the end of each month. A 10 percent deviation from this standard is permissible.

> A command goal of 150,000 backorders for stocked items (investment spares and EOQ items) has been established by HQ USAF. The breakout of the goal between EOQ (81.3) and investment spares (67.7) and the ALCs' have been established by HQ AFLC. The goals are based on the proportion of backorders expected from fill rate goals (70% for investment spares and 85% for EOQ items), demand history of the ALCs, and actual backorder experience [1].

Age of Backorders

This indicator measures backorders, separately but identically for investment and EOQ items, by the age categories of 1-90 days, 91-180 days, and over 180 days old. The indicator is reflected as a percentage figure for each of these six categories. The formula used to compute the indicator values is:

$$\text{Percent of Backorders by Age} = \frac{\text{Number of B/Os X-Y Days Old}}{\text{Number of Total Backorders}}$$

The source for this information is, again, the DO32HN1L weekly report and the DO32EX1A monthly report (20). As was the case with the previous indicator (Number of Backorders) it only reflects the status of backorders at a particular point in time. The status changes daily.

This indicator informs management of trends experienced in requisition backlog status. Ideally, the majority of backorders should be only 1-90 days old. If the majority of backorders are over 180 days old, serious problems exist which must be immediately analyzed. Thus, management remains attuned to how quickly action is being taken to satisfy customer requirements for items which are not available for immediate distribution. A serious problem with this indicator, however, is that priorities of the items are not considered.

> MILSTRIP and UMMIPS logic direct shipment of backorders by priority. Age is a factor only as a tie-breaking device between backorders of equal priority; and even as a tie-breaking device, age ranks lower in importance than JCS project codes, MICAP conditions and required delivery dates. Hence, basing a backorder indicator on age causes undue management attention and actions to be expended on an aspect of backorders which is not deserving of these efforts [35].

For example, if the percentage of EOQ items over 180 days old increased to 30 or 40 percent, management might take action to emphasize clearing these backorders. If, however, the majority of these unsatisfied requests were for stock replenishment (priorities 09-15) whereas the majority of the EOQ items 1-90 days old were 01-08 priorities, the action would be totally inappropriate. The question must be raised--Are we doing the job right or are we doing the RIGHT job? (41)

The established standards and permissible deviations for this indicator are:

Indicators	Standard	Allowed Tolerance
EOQ 1-90 days	70%+	5%
EOQ 91-180 days	20%-	3%
EOQ over 180 days	10%-	2%
Investment 1-90 days	70%+	5%
Investment 91-180 days	20%-	3%
Investment over 180 days	10%-	2%

These standards were set by the Sacramento Air Logistics Center and, are based upon the past twenty-four months net demand history and aging factors of the backorders (20).

Technical Order Stock Availability

T.O. Stock Availability reflects the percentage of out-of-stock technical orders (on a line item basis) in relation to the total number of assigned technical orders. The formula used to compute this indicator is 100 percent minus the number of technical orders which are out of stock divided by the number of assigned technical orders (15). Oklahoma City ALC maintains records on which ALCs are responsible for publishing various technical orders and this information is provided monthly to the SM-ALC technical order monitor. Records as to which SM-ALC assigned technical orders are zero-balanced are maintained at SM-ALC.

This indicator aids decision making only to the extent that it provides information on the effectiveness in meeting customer requirements for technical orders. However, technical orders which are out of stock are printed daily at SM-ALC. Therefore, the technical order stock availability indicator is rarely out of tolerance and seldom creates problems with which management must deal (15). Far more decision-support information would be rendered by a technical order indicator which showed the trend of increasing/decreasing workload or revealed how many technical orders had to be rewritten due to improper planning/oversights in the initial writing.

The standard for this indicator is 98 percent and is locally determined by SM-ALC. No rationale for this standard, other than past experience, was apparent.

Government Furnished Materiel (GFM) at Contractor Facilities

This indicator expresses the quantity of expense GFM which is either located at the contractor's facility or enroute to the contractor. This information is obtained monthly from the G072D1CC2 Materiel Inventory and Issues Report. The indicator is computed by dividing the total expense GFM located at the contractor's facility and intransit by the monthly authorized quantity; the quotient being expressed in months of stock available (27). A detailed explanation of GFM, monthly authorized GFM stock levels, and exceptions is located in AFLCR 66-8 (2).

The indicator is used to aid decision making in that it provides information to insure funds are not overly committed to inventory. At the same time, enough materiel must be available to the contractor to prevent work stoppage. This has been a subject of continual evaluation by the Government Accounting Office.

The standard, as determined by AFLC Headquarters, is three months of GFM. This policy was established based upon safety stock considerations and daily demand rates. Detailed logic for this stock level computation is outlined in AFLCR 66-8 (2).

Age of Unprocessed Exceptions

During requisition processing, exceptions are generated when the DO32 Item Manager Stock Control and Distribution System encounters an erroneous or incompatible entry which cannot be mechanically corrected. These exceptions require manual research and when not corrected within prescribed time limits, ". . . the computer generates follow-up stuffer card listings in the same format of the original controlled exceptions [54:p.9-2]." These listings are output in accordance with the following age criteria:

Priority designators 01-08

1. "Overage"--output one time on the fifth day
2. "Delinquent"--output one time on the tenth day
3. "Critical"--output on the fifteenth day and every forty-fifth day thereafter until the exception is cleared

Priority designators 09-15

1. "Overage"--output one time on the fifteenth day
2. "Delinquent"--output on the twentieth day
3. "Critical"--output on the thirtieth day and every forty-fifth day thereafter until the exception is cleared (54:p.9-2).

The indicator "Age of Unprocessed Exceptions" is determined by dividing the number of total critical exceptions (priority designators 01-15) by the total number of

exceptions (priority designators 01-15, overage, delinquent, and critical) and subtracting this quotient from 100 percent. The source of this information is the DO32.FP1L "Controlled Exception Status Summary." The indicator reflects the status of exceptions as of the last day of the month, a status which, however, is changing day by day (58).

This indicator provides decision-making information on the percentage of the oldest ("critical") unprocessed exceptions. However, because of the method of computing the indicator (subtracting the quotient explained above from 100 percent) it is confusing. Sound management would logically dictate a small value for this indicator. The method of computation results in a large value. This practice should be changed. Further, decision-making information would be enhanced by not aggregating the priority 01-08 exceptions with the priority 09-15 exceptions. The reasons for separating the high and low priority groups was previously discussed in relation to the UMMIPS/MILSTRIP logic. Management must also be aware that all part-numbered requisitions generate exceptions. Extra research time is required in clearing these exceptions since drawings and other catalog information must frequently be requested from the Defense Cataloging Agency, Battle Creek, Michigan. For this reason, part-numbered requisitions often get to the "critical" stage. Given these

considerations, the indicator does inform management that some requisitions are not being processed in a timely fashion. Trends should be carefully monitored, bearing in mind that the status of the indicator changes daily.

The established standard for the indicator is 95 percent. Again, this means no more than 5 percent of the total exceptions are allowed to be "critical." SM-ALC has established the standard based upon the indicator's history (58).

Purchase Request/Military Interdepartmental Purchase Request (PR/MIPR) Processing Within D/MM

This indicator reflects the percentage of PR/MIPRs which were not processed within the allotted time.

> A standard of 11 workdays is established for processing PRs-MIPRs from the date of preparation to the date forwarded to procurement when the requiring and procuring activities are located at the same installation, and coordination with another installation is not required [5:p.6-1].

During this period, extensive coordination on the PR/MIPR is required. The following are required coordination points:

(1) Accounting and finance activity except PRs and MIPRs for stock fund and industrial fund requirements.
(2) Cataloging activity.
(3) Standardization activity.
(4) Responsible engineering activity. . . .
(5) Packaging and materials handling activity.
(6) Provisioning activity (for system, subsystem, and/or end article requiring spares, repair parts, SE, etc., including modification PRs).

(7) Engineering data activities.
(8) Transportation activity.
(9) Quality and reliability assurance activity.
(10) Responsible technical order activity.
(11) Staff judge advocate when required by ASPR Section IX.
(12) Safety Office when required by AF and or AFLC/ AFSC 122 and 127 series regulations.
(13) Material Utilization Control Office for all AF initiated PRs and/or MIPRs for GFAE, and for other PRs and MIPRs when required by AFM 67-1, volume III, part one [5:pp.6-1 to 6-2].

Copies of the PR/MIPR are simultaneously released to the above activities. They have five workdays for coordination, this time being included in the D/MM eleven-day processing standard. If a document is delayed beyond the five-day standard established for coordination activities, daily telephone follow-ups are conducted. After two days delinquency, the problem is elevated to division/directorate level (5:pp.2-1 to 2-2). The indicator reflects the efficiency of the coordination process and other internal D/MM processing actions. It is computed by dividing the number of PRs/MIPRs processed within the allotted eleven days by the total number of PRs/MIPRs processed. The source of this information is the JO41. E9R3 "Monthly Summary of Workdays Used to Coordinate on Completed PR/MIPRs" (18).

The indicator aids decision making by providing information concerning the timely processing of PRs/MIPRs. Delays in this area increase lead times in satisfying customer requirements.

PR/MIPR Processing Within D/PM

This indicator reflects the percentage of error-free PRs/MIPRs processed by D/PM. It is computed by dividing the number of error-free PRs/MIPRs processed by the total number of PRs/MIPRs processed. The quotient is expressed as a percentage. The source of this information is the JO41.E9RB and the number of AFLC Forms 709 returned to D/MM with PRs/MIPRs to be corrected (18). AFLC Form 709 explains the nature of the error. It is used only when errors are too major in nature to be resolved by telephone and corrected by D/PM (5:p.22-23).

Information is herein provided to decision makers on the effectiveness of the PR/MIPR processing quality assurance program. This program is explained in detail in Chapter 22 of AFLCR 57-7. Errors result in delayed processing times which in turn increase requirements lead time. For this reason, management action must be taken to analyze the errors and prevent recurrence.

Ninety-seven percent has been established by SM-ALC as the standard for this indicator (20). No rationale other than past experience could be found.

Economic Order Quantity (EOQ)
Repeat Buy Notices

This indicator reflects the number of repeat buy notices generated by the DO62 system. A repeat buy notice indicates that the PR is not in the DO62 system, although

a valid requirement necessitating PR action has been generated. Repeat buy notices will continue to be produced until the JO41 system interfaces with the DO62, indicating that action has been taken on the PR. Two values of the indicators are presented, both are computed using the same formula and have the same source of information, the DO62D11A "Executive Management Summary." The first value reflects the number of first, second, third, and fourth repeat buy notices generated for the month. The second value reflects the number of fifth, sixth, seventh, eighth, and ninth repeat buy notices generated. The formula used to compute the indicator is 100 percent minus the sum of repeat buy notices 1-4 or 5-9 divided by the total number of requirements for the month which necessitated PR action (28).

The indicator alerts the decision maker that follow-up action is required. It must be realized, however, that numerous valid reasons exist for not completing a buy. Detailed analysis is required to determine if the inaction is/is not appropriate. Further, the method of computation (subtracting from 100 percent) results in misunderstanding and confusion. Although management desires a low percentage of repeat buy notices, the method of computation results in a high percentage. This is unnecessary and should be changed.

SM/ALC has established the following standards for the indicator: EOQ Repeat Buy Notices (1-4) 90 percent and EOQ Repeat Buy Notices (5-9) 99 percent (21). Again, notices 1-4 should remain under 10 percent and notices 5-9 under 1 percent. No rationale for the standard was determined.

Material Improvement Projects (MIPs)

> The MIP is the authoritative device used by implementing, operating and support commands to monitor the status of analysis and evaluation/solution of materiel deficiencies reported to AFLC [6:p.10-1].

The MIP is normally generated by a Materiel Deficiency Report (MDR), Engineering Change Proposal (ECP), or Teardown Deficiency Report (TDR). Various priorities are assigned to these MIPs according to the following criteria:

> a. MIPs requiring immediate action will be assigned an emergency "E" priority. These MIPs will be processed under the governing factors of safety conditions, the uncorrected existence of which could result in fatal or serious injury to personnel or extensive damage to or destruction of valuable property. Such conditions embody risks which are calculated to be intolerable.
>
> b. MIPs requiring urgent action will be assigned an urgent "U" priority. These MIPs will be processed under the governing factors of combat necessity or potential hazardous conditions, which could result in injury to personnel, damage to valuable property or unacceptable reductions in combat efficiency. Such conditions compromise safety or embody risks which are calculated to be tolerable within definite time limits. MIPs to effect, through value engineering or other cost reduction efforts, net life cycle savings to the Government of a total of more than $100,000, will be assigned an urgent priority, where expedited processing of the change will be a major factor in realizing the lower costs (MIL-STD-480).
>
> c. The Category I MDR is assigned an MIP priority of either emergency "E" or urgent "U" commensurate with seriousness of the reported deficiency. The "E" or "U" MIP priority is retained throughout the Category I MDR

materiel improvement cycle. Assignment of a routine "R" MIP priority to a Category I MDR investigation is not authorized after some improvement action is taken and while a more permanent solution is being developed.

d. MIPs which are less urgent than the E and U priorities but are considered essential, will be assigned a routine "R" priority. These MIPs will be processed under the governing factors of equipment or procedural deficiencies of a materiel, mechanical, operational, or tactical nature, the uncorrected existence of which would through prolonged continued usage:

(1) Constitute a hazard.

(2) Have a negative effect on operational efficiency.

(3) Reduce tactical or tactical support utility.

(4) Reduce operational life or general service utilization of equipment.

(5) Create economic burdens (manpower and money). Such conditions embody degrees of risk or requirements calculated to be tolerable within broad time limits.

e. The Category II Design, Maintenance or Computer Program MDR is assigned a routine "R" MIP priority [6:pp.10-2 to 10-3].

The Materiel Improvement project indicator measures the timeliness of MIP processing separately but identically for emergency/urgent MIPs, routine MIPs with kits, and routine MIPs without kits. The formula used to compute the indicator is

$$100\% \times \frac{\text{Number of MIPs Processed within Established Timeframes}}{\text{Total Number of MIPs in Categories Above}}$$

(42). This information is provided monthly by the G026 (RCS:LOG-LOL(M)71117) "Progressive MIP Status Listing."

The indicator aids decision making by informing management that MIP processing is/is not on schedule.

They are invaluable for this purpose and will enhance timeliness of MIP processing; however, they must not be confused as being compatible or incompatible with time schedules used for other purposes as prescribed by other Air Force directives. Early detection of MIP slippages permits realignment of resources as necessary to obtain the objective stated

above. Time gained early in the MIP life cycle by processing many phases simultaneously may be used in later phases to avoid a MIP becoming overage. MIPS will be elevated in the echelon of command for determination of whether they should be continued or cancelled when they become overage under the goals established herein. There will be exceptions to MIP goals; these are defensible when genuine reasons for slippage are recorded in the G026 system [6:p.1-7].

Goals have been assigned by AFLC for processing the various categories of MIPs. These goals (expressed as the total processing time) for completing the MIP by priority and kit/no kit categories are:

Category	Goal (Total Time)
Emergency MIPs	15 days
Urgent/no kits	60 days
Urgent/kits	90 days
Routine/no kits	120 days
Routine/kits	400 days
Routine/kits (acquisition exceeds $100,000)	445 days

(6:pp.11-37 to 11-42). Based upon these AFLC established timeframes and past experience in processing MIPs, SM-ALC has established the following standards for the MIP indicator:

Emergency/Routine	90 percent
Routine With Kits	90 percent
Routine Without Kits	95 percent (21)

AFTO Forms 22

The AFTO Form 22 is submitted by the operating units to the ALC when a technical order deficiency is discovered. For example, the T.O. might specify the wrong test procedures, the wrong control limits, or the wrong sequencing of maintenance procedures. The indicator

reflects the percentage of AFTO Forms 22 which are processed within the specified timeframes. It is computed by dividing the number of AFTO Forms 22 processed within the allotted time by the total number of AFTO Forms 22 processed during the month. The result is expressed as a percentage (25).

The indicator provides information to decision makers concerning the timely processing of AFTO Forms 22. However, processing of emergency, urgent, and routine deficiencies are aggregated into one indicator. Further, workload trends are not charted which would indicate to management the number of T.O. deficiencies resulting in changes. Therefore, action to prevent recurrence is not monitored at the D/MM level.

Timeframes for processing emergency, urgent, and routine deficiencies have been established by AFLC and are outlined in AFLCM 66-14, Draft Chapter 17 (25). SM-ALC has established a standard of 90 percent for the indicator based upon past experience (21).

Noncredit Material Returns

This indicator reflects the relative number of material returns, made by the contractor to the ALC, which were not credited to the contractor's account for bonafide reasons. There are many cases where credit is not allowed. For example, the material may be unserviceable or the

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A CRITICAL ANALYSIS OF MANAGEMENT INDICATORS FOR THE DIRECTOR O--ETC(U)
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UNCLASSIFIED AFIT-LSSR-50-80 NL

project which necessitated the requirements for the material may be completed. The dollar value of material returned without credit is recorded under General Ledger Account Code (GLAC) 31660. The source of this information is the A-H075C-4J1-MO-MM1 "Monthly Contractor Expenditure List." The contractor's total material usage for the month is recorded under GLAC 31621. This value is provided by the G072D1CCZ "Contract Materiel Ledger." The formula for the indicator is:

$$100\% - \frac{\text{GLAC 31660}}{\text{GLAC 31621}} = \% \text{ for month}$$

Information provided by the indicator allows management to assess the percentage of material being returned by contractors which has not been effectively utilized. It provides some information as to the amount of material which may require transfer to the Defense Property Disposal Office (DPDO). Such waste must be controlled. Again, the method of computation results in a confusing high value for the indicator. Sound management logic dictates a small value. This practice could be easily corrected.

The SM-ALC standard for this indicator is 97 percent (21). That is, no more than 3 percent of the contractor's total material requirements for the month should be returned by the contractor when credit conditions are not met. No rationale for this standard was found.

Aircraft Production (Contract)

This indicator reflects the percentage of aircraft scheduled for maintenance at the contractor's facility which are completed on schedule. The number of aircraft meeting the established schedule is divided by the total number of aircraft scheduled for the month; and, the result is expressed as a percentage. This information is provided by the G039 "Aircraft and Missile Maintenance Production Report" and the G072E "Depot Level Maintenance Requirements and Program Management System". (16).

This indicator informs management of the contractor's ability to meet scheduled maintenance production. When schedules are not met, the Production Management Specialist must perform detailed analyses to determine the causes. Two methods are used to insure schedule compliance: compression and acceleration. Compression involves doing only that work which is absolutely required. Acceleration involves performing normal maintenance actions on an aircraft but at a faster pace by hiring more workers or approving overtime. AFLCR 66-3 discusses compression and acceleration. Scheduling is discussed in detail in AFLCR 66-5.

The SM-ALC established standard for this indicator is 85 percent on-schedule production. The only available rationale for the standard was past history (16).

Air Force Industrial Fund (AFIF)
Contract--Revenue Variance,
Profit and Loss

The Depot Maintenance Service, Air Force Industrial Fund (DMS,AFIF) is a working capital account used to finance

> . . . depot-level maintenance operations by providing initial working capital and allowing recovery of operating costs through the sale of products or services. It provides for effective and economical use of resources and products. Through this technique, costs are held in suspense until the ordering activity (customer) receives the serviceable product or service [3:p.1-1].

DMS, AFIF finances all contract maintenance costs for labor, expense material, and all other costs with the exception of investment material. An Annual Customer Order (AnCO) AFLC Form 194 is used when products or services are to be obtained by the AFIF from commercial contractors. It is basically

> . . . a planning document which reflects the quantities and average sales price of the products/services that the customer plans to purchase from the DMS, AFIF. The AnCO will be specific as to the depot level maintenance to be ordered [3:p.12-1].

The selling price is established by the production manager and reflects his best estimate of the expected costs. Details on the construction of the selling price can be found in AFLCR 66-9, Chapter 14. In order to maintain the solvency of the DMS, AFIF, the value of sales must equal the production manager's estimated costs of sales. In

accordance with AFLCR 170-10, the operations will be maintained at zero profit and zero loss.

The AFIF indicator reflects any profit or loss incurred during the month in contract maintenance operations. If the selling price (the estimated cost of sales) is less than the actual cost of repair, a loss is incurred. If the reverse is true, a profit will be realized. The G072D1CCE "Sales and Cost of Sales Report" provides the source of this information (27).

The indicator informs decision makers of the financial status of the contract depot maintenance program. "This system was implemented to provide for better management of contract/interservice production by utilizing industrial fund practices [3:p.11-1]." An indicator which related workload to AFIF expenditures to date would be of much greater value in aiding decision making.

The established standard for the indicator is zero profit and zero loss (21). AFLC has established this standard based upon the requirement to maintain the solvency of the DMS, AFIF. AFLCR 170-10 provides more in-depth details (27).

Initial Provisioning Workload
Percent Delinquent Over
Sixteen Days

This indicator reflects the support provided SM-ALC by other ALCs in completing action on Provisioning

Technical Documentation (PTD), The PTD is a contractor-provided printout which lists the recommendations of the contractor concerning initial spares lay-in. The prime ALC for the weapon system then holds a provisioning conference for the purpose of assigning SMR (Source, Maintainability, Recoverability) Codes. These codes result in reparable/expendable determination and establish the level at which repair is authorized. However, some of the items listed in the PTD may be assigned to other ALCs for management. In this case, these ALCs are suspensed to reply to SM-ALC regarding SMR determination. Generally, forty-five days is allowed for the ALC's response. AFLC Form 755, Monthly Provisioning Document Delinquent Listing, is used to record all delinquent responses. AFLC Form 729 provides a monthly summary of the AFLC Form 755 information. This form must be submitted to HQ AFLC/LOLCP as RCS:LOG-LOLCM 71229 "Provisioning Action Summary Report." It reflects the number of responses over sixteen days delinquent. The indicator used at SM-ALC also reflects this information. It is computed by dividing the number of responses which are more than sixteen days delinquent by the total number of suspensed actions. The result is expressed as a percentage.

Information provided by this indicator is very general in nature. It reflects the timeliness of provisioning action completion to a very limited degree. Inaction

by other ALCs can delay SM-ALC's processing actions. However, it does provide useful information to AFLC Headquarters, where the entire program is monitored. There may be many reasons for delinquent responses and AFLC Headquarters is in the best position to monitor these and provide assistance where required (50).

SM-ALC has established a local standard of 4 percent for this indicator (21). No rationale for this standard could be found.

Master Materiel Support Record (MMSR)

The Master Materiel Support Record contains information on the stock numbers of end items that are depot repaired. For each end item, the bits and pieces comprising the end item are listed. This information is then maintained in the D049 system (52).

> When a new MMSR is first established in D049, a mandatory element of data is the estimated number of component items required to have a complete MMSR. After initial establishment, the computer counts the actual number of component items in the MMSR. When the actual is less than the estimated, the difference is mechanically computed . . . [35].

The MMSR must then be validated by comparing it with the Illustrated Parts Breakdown (IPB). This requires a time-consuming page-by-page comparison. The MMSR indicator reflects this workload for the month by depicting the gross number of end items not on the MMSR and the gross number of component parts not listed (52).

The indicator informs management only of the workload (mostly manual) required to validate the D049 records. The record itself is extremely important as it allows the ALC to lay in the necessary spares to support the end item. For this reason, perhaps a better indicator would be the percentage of MMSRs which have been validated to date.

No standard has been established for this indicator (21). Further information concerning the MMSR is available in AFLCR 65-1

The analysis and findings discussed in this chapter served as input to our conclusions and recommendations. In the following chapter, research questions 10 and 11 will be discussed and all analysis conducted will be synthesized to achieve research objective 4 which is to recommend a limited number of goal-directed management indicators for use by the D/MM.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The results of our analysis led to the conclusion that those indicators currently briefed to the Director of Materiel Management do not provide adequate information to support his decisions. Based upon the goals and supporting objectives of the D/MM relevant information needs were suggested (page 61). Our evaluation of the present sixteen indicators revealed that only three (fill rate, number of backorders, and age of backorders) contribute to the suggested information requirements. These three provide information on the availability of stocked components judged against actual needs. However, several improvements are possible in these three indicators. As mentioned in Chapter IV, they currently provide an over-aggregated view of "customer support" and do not adequately distinguish between routine and urgent customer requirements, as priorities 09-15 are combined in the calculations with 01-08 priorities and all are weighted equally.

While the remaining thirteen management indicators do provide useful information on various aspects of D/MM operations, they do not provide information to support the Director's decision-making process. In our opinion, these

indicators should be reviewed and used for management control at the appropriate division level.

This basic deficiency in strategic-level management indicators stems in part from the nature of the Logistics Management Information System. Colonel A. Graham McConnell, the Director for Logistics Management Systems Requirements at AFLC Headquarters, describes the present information system used by AFLC as being mainly "process oriented." According to him, the system was designed to provide information for operational control. It provides little information of use at the management control level and no strategic level information without manual reformatting (36). In reformatting this information, however, attempts to filter detail often result in indices which are aggregated to the extreme with a resultant loss of necessary information. Further, there appears to have been far too great a tendency to make use of the data readily provided by operational control systems in developing management indicators. The need to, first, determine management's requirements for information based on the goals/objectives of the organization and then structuring the data base/information, has been overlooked (36). Colonel McConnell and his staff are now working to reverse this adverse trend in MIS design.

In taking this latter approach to designing management's information requirements, eleven indicators appear

to be warranted at the D/MM level. These are:

1. Fill Rate, Priority 01-08, by Weapon System
   Investment
   EOQ

2. Number of Backorders, Priority 01-08 by Weapon System
   Investment
   EOQ

3. Age of Backorders, Priority 01-08, by Weapon System
   1-90 days
   90-180 days
   Over 180 days

4. Projected flying hours for assigned weapons systems

5. Scheduled flying hours versus actual flying hours by weapon system

6. Failure rates of critical systems components versus projected mean time between failure (top ten)

7. Project system phase-outs next two years (if any)

8. Projected personnel training
   Projected turnover
   New procedures

9. Organic repair capabilities and costs versus contractor repair capabilities and costs

10. Systems acquisition status--planning milestone chart

11. Projected requirements for funds to procure both parts and repair capacity versus actual funding available

Again, it must be emphasized that the present indicators do provide useful information. However, it is information that is relevant to some level subordinate to the D/MM and should, therefore, be monitored at that level. Information concerning the indicator should be conveyed to the D/MM only when there is a significant problem or deviation from the standard.

The standards established for management indicators should be carefully developed. They should be challenging, yet attainable, with full consideration given to resource limitations. Certainly, the rationale for the standard should be documented and readily available for management review. These criteria do not appear to be met. No rationale could be determined for the majority of the sixteen indicators reviewed. The only rationale that was found involved basing the standard on the indicator's past history. Specifically, MMOI 11-5 states that when a new indicator is first introduced, there will be no associated standard for the first three months. At the beginning of the fourth month, the values of the indicator for the first three months are averaged and this mean value plus 5 percent becomes the established standard. After twelve months, the values are again averaged to arrive at a new standard (21). This practice could easily encourage manipulation of the indicators. During the short term, productivity could be purposely limited, thereby establishing a standard easily attainable yet unrealistic in terms of future goal attainment. Further study of this area appears to be warranted. Specifically, this research should focus upon methods of developing realistic and reliable standards for the indicators and defining what constitutes a "significant" deviation from the standard.

A second area for further study concerns the practice of basing authorized personnel levels on the number of backorders. This policy is counterproductive and warrants immediate reevaluation.

The final subject that requires attention concerns the definition of goals and objectives by subordinate D/MM managers. Analysis of the survey questionnaires revealed that a number of managers at the division and branch levels defined their immediate objective as customer support. Management levels below the D/MM should have objectives contributing to his goal. This does not appear to be the case and may indicate that subordinate managers do not understand their positions in the hierarchy. The D/MM should direct a study to review his goal structure.

In conclusion, the results of this thesis may have been influenced both by the limited survey response and the subjective nature of the analysis. No doubt, there may be disagreement with our findings. There is usually much room for contention in any management undertaking. However, if it has caused management to pause and reflect on the current indicator system and, has demonstrated the need to structure management information based upon the decisions required in goal accomplishment, it will have more than served its purpose.

APPENDICES

APPENDIX A

INTERVIEW GUIDE

1. What are your responsibilities here at the ALC?

2. How are these responsibilities related to the overall mission of the ALC?

3. What management initiatives have been taken to improve MM during the past five years?

4. What new management initiatives to improve MM are on the horizon?

5. Are you satisfied with these new management initiatives? If not, what ones would you suggest?

6. What do you consider to be the major strengths of MM management?

7. What do you consider to be the major weaknesses of MM management?

8. What types of problems take up most of your time?

9. Which specific management indicators do you utilize to assist you in decision making?

10. Do these management indicators provide you with all the information that you need to make the best possible decision?

11. What additional information would you find useful in making better decisions?

12. Do you believe that you have adequate information at your disposal to make good decisions concerning future events?

13. How would you characterize a future/forward looking management indicator?

14. What are the goals of the SM-ALC/MM directorate? Which one of these goals do you believe is the single most important?

15. Do you believe that there now exist management indicators which serve no useful purpose?

16. How often do you review management indicators?

17. Do your indicators have an established standard?

18. Who sets the standard?

19. How is the standard determined?

20. Is the logic for these standards in writing? Where?

21. What do you define as an unfavorable trend in your management indicators?

22. What management action do you take to improve an unfavorable trend?

23. What factors do you consider critical to success in goal achievement?

24. Do you at present have the devices necessary to monitor these critical success factors?

25. What are they?

26. If not available, why do you believe they are not available?

27. Do you have any additional comments?

APPENDIX B

SURVEY QUESTIONNAIRE AND COVER LETTER

FROM: MM

25 MAR 1980

SUBJECT: MM Sponsored Research

TO: All MM Division, Deputy Division and Branch Chiefs

1. The need for more meaningful management indicators has been of concern to this Directorate for quite some time. Research and analysis of the "problem" is being conducted by our own staff resources. In addition, to bring an outsider's fresh and uninfluenced view into the project, this Directorate requested research assistance from the School of Systems and Logistics of the Air Force Institute of Technology. As a result, a research team is presently studying the problem.

2. The attached questionnaire is a significant part of that study. It is imperative to the success of this study that we cooperate to the greatest extent possible. Please complete the attached survey instrument and return it directly to the researchers in the envelope provided NLT 1 April 1980. All responses will remain anonymous.

3. Your cooperation is sincerely appreciated.

1 Atch
Questionnaire

CLAUDE J. FARINHA
Deputy Director, Materiel Management

1. To which division are you currently assigned? (Circle One)

   MMA MME MMM MMS MMC MMI

2. At which organizational level are you currently assigned? (Circle One)

   DIVISION BRANCH

3. How much experience have you had in a supply position (in months)? _____

4. How long have you held a position within AFLC (in months)? _____

5. How long have you held a management position within the SM-ALC/MM (in months)? _____

6. What do you consider the overall mission/goal(s) of the MM Directorate to be?

7. What are your goals for your specific area of responsibility?

8. Which specific management indicators do you utilize to assist you in decision making?

9. What additional information do you find useful in making better decisions?

10. What do you define as an unfavorable trend in your management indicators?

11. What management action do you take to improve an unfavorable trend?

12. What types of problems take up most of your time?

13. Please add any additional comments which you feel might be pertinent to the present research.

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