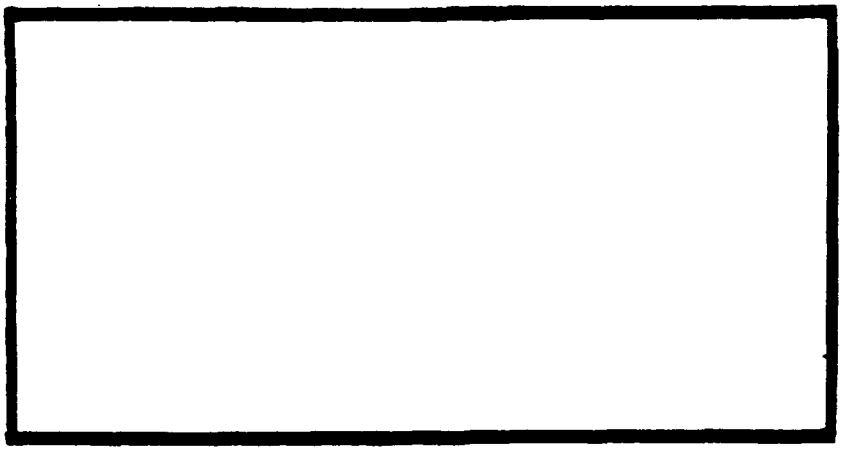

DEPARTMENT OF THE AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GIR/LSM/91D-7

AN ANALYSIS OF THE INFORMATION REQUIREMENTS OF CONUS BASED DEPUTY COMMANDERS FOR MAINTENANCE

THESIS

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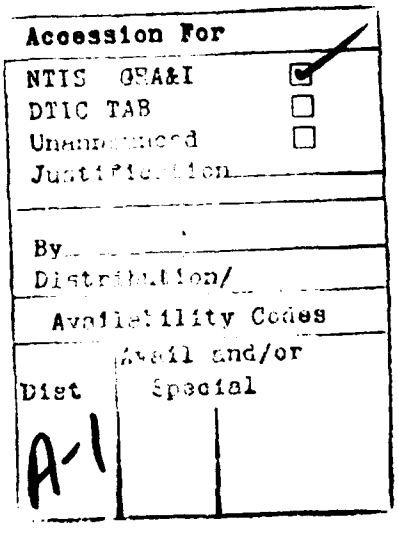
AFIT/GIR/LSM/91D-7

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information is contained therein. Furthermore, the views expressed in the document are those of the author and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.



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THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

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In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Information Resource Management

Daniel J. Green, B.S.

Captain, USAF

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Acknowledgements

The purpose of this research was to document the information requirements of Air Force Deputy Commanders for Maintenance. The objective was to provide a starting point that could lead to the development of an information system that could support their decision-making ability better than the current systems in use.

I have had a great deal of support in the writing of this thesis. First I would like to thank my wife, Jane, and my children for their continual understanding of the long hours this effort required. I would also like to thank my thesis advisor, Major Jacob Simons, who helped me to evaluate my work critically and helped to improve this research document. Last, but not least, I would like to especially thank Dr. E. W. Martin for his support of a student whom he hardly knew. His advice and his surveys saved a tremendous amount of effort.

Daniel J. Green

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Abstract

The purpose of this research was to identify the information requirements of Air Force Deputy Commanders for Maintenance. It had three basic objectives: (1) identify the critical success factors that they monitor on a continuous basis, (2) identify similarities in those requirements for all DCMs and across major commands, and (3) determine if the application of information system technology would enhance their decision making.

Surveys were sent to all CONUS based Deputy Commanders for Maintenance. The study found that there were nine critical success factors used by a majority of all the respondents. In addition, nine command-specific CSFs were identified. It was determined that executive information system technology would most benefit their decision-making processes.

AN ANALYSIS OF THE INFORMATION REQUIREMENTS OF CONUS BASED DEPUTY COMMANDERS FOR MAINTENANCE

I. Introduction

General Issue

The United States Air Force's primary objective is to win the aerospace battle—to gain and/or maintain control of the aerospace environment and to take decisive actions immediately and directly against an enemy's warfighting capacity (5:1-3). One element essential to the success of that mission is the equipment used to carry it out - the aircraft. The Deputy Commander for Maintenance (DCM) is charged by the Wing Commander with the responsibility of keeping the aircraft ready to fly and fight. This responsibility typically involves management of over 1000 people and millions of dollars worth of equipment and spare parts. Integrating these assets into a productive organization is the key to success as a DCM.

Based on current regulations, the maintenance directorate includes an analysis staff which may be used by the DCM to gather information from a variety of sources in order to manage his deputate. The analysis staff's function involves taking raw data and compiling it into the various reports required by the DCM and higher headquarters. This can be very time consuming and can result in a time delay in reporting information to the DCM, thus constraining his review and decision-making process to yesterday's data.

The Core Automated Maintenance System (CAMS) is an information system that utilizes a computerized maintenance database containing information of many types including aircraft maintenance histories, serialized parts lists, work-in-progress lists, and personnel training accomplishments. CAMS, which is in place Air Force wide (although Military Airlift Command has a slightly different version), is moving the maintenance world slowly towards a "paperless" environment, where all maintenance related actions will be kept in this database. While this may not be a reality yet, the current database is very extensive. The large volume of data kept in this database only serves to increase the previously mentioned difficulty of analysis.

In the letter attached as Appendix 3 to this document, Lieutenant Colonel Westfall, head of the Logistics Department of the Air Force Institute of Technology's (AFIT) School of Systems and Logistics, Lieutenant Colonel Charles Clark, Chief of the Functional Management Division of the Standard Systems Center, stated that CAMS currently does not support the DCM's decision-making functions as well as it could or should. It is hoped that this study will be a step toward improving CAMS in this critical area.

Specific Problem

The issues described above can be summarized into this general management question: Could the Deputy Commander for Maintenance decision-making process be enhanced through the use of information technology targeted specifically for their use?

Research Objectives

A fundamental purpose of this research is to determine what information content and format is necessary for the DCM to manage the deputate. It is likely that this identification process could be used in the improvement of CAMS in support of DCM decision making or possibly as a first step in the development of a future information system (IS) that will support the DCM in the management of his deputate. Identification of the similarities in information requirements throughout the Air Force could serve as the basis for development of a single system. If similarities discovered are command specific, then a single IS may not be the answer. Rather, a system tailored to each command may better serve the DCMs involved. A complete lack of similarity of information requirements among DCMs would signal that a custom-built system may be necessary for each DCM.

Research Questions

The management problem and the research objective stated above leads to these research questions:

1. What are the information requirements of the Deputy Commander for Maintenance?
2. Are DCM information requirements similar enough across the United States Air Force that a single decision-making solution could be developed for the DCM function?
3. Can DCM decision-making ability be enhanced through the use of information system technology?

In order to answer the above research questions, the following investigative questions must be answered:

1. What information is critical to the DCM in the management of the various functions under his control?

2. What sources are currently used to acquire this information?

3. How is the information currently gathered and formatted?

4. How should this information be gathered and formatted?

5. What information technology is best suited to providing the required gathering and formatting capabilities?

6. What are the implications of information diversity upon the development of an eventual system?

Scope/Limitations

General. The management question stated above is intentionally broad in scope. More time would be required to answer the additional questions necessary to develop a complete information system. Therefore, the scope of this study has been limited to determining the information requirements of the DCM in managing his deputate, and whether these requirements are similar enough to warrant further investigation into the development of an enhancement of the CAMS system or the development of a new system.

Population Limitation. This research will be limited to a study of DCMs stationed in the CONUS. This is necessary for two reasons. First, the time frame that constrains the completion of this thesis limits the amount of available mail and response time. It is therefore recognized that the results of this research may not be completely generalizable to overseas locations. However, it is perceived that this perspective is valid to the extent that CAMS has predominantly been influenced by its use in the CONUS as a standard USAF system.

Data Limitations. This study involves the determination of information requirements of DCMs. John F. Rockart, author of many articles on information system design, states that user involvement in determining information requirements is the key to successful system design and implementation. He cautions however, that managers may know what they want, but not necessarily know what they need (20:81-83). In this study the responses of survey participants will be treated as "expert" opinion. That is, no judgement will be made as to whether the information the respondents say they want is what they actually need.

Definitions

Information System. "A system that collects, transmits, processes and stores data and retrieves and distributes information to various users in an organization. [It] produces information that supports the operation and management functions of an organization" (1:2).

Core Automated Maintenance System.

> The Core Automated Maintenance System (CAMS) is a large, dynamic, on-line system used at base-level to manage maintenance equipment and personnel resources. It also provides much of the maintenance data needed by major commands, Air Force Logistics Command, Headquarters USAF, and other agencies to manage and track maintenance resources worldwide. The system applies to aircraft, missile, and Communications-Electronics (C.E) maintenance. In addition, some smaller tenant organizations originally exempt from CAMS implementation have implemented the system in conjunction with their host maintenance units without having dedicated remote equipment installed.
>
> [It] provides the capability for maintenance personnel to communicate to a central base-level computer via remote terminals in selected maintenance work areas. (6:2-1)

Summary

The Deputy Commander for Maintenance is the key decision maker in a wing's ability to maintain its aircraft. Identification of that

critical information required to manage his deputate may be used as the starting point for developing an information system to enhance his decision-making process. The major focus of this study is to identify those key information requirements and the applicability of information technology toward the enhancement of DCM decision-making.

II. Background

Introduction

The correct determination of information requirements is the critical step in the development of an information system that can determine its success or failure. In order to undertake this study it was necessary to accomplish a review of the literature in two areas that are directly related to the subject of concern. The first part of the review focused on a method to determine the information requirements of senior executives, like the Deputy Commander for Maintenance, for use in developing information systems. Next, a review of literature in the areas of management information systems, decision support systems and executive information systems was accomplished. This helped the author to answer research question three and investigative question five by showing what type of information system technology might be best suited for use by DCMs in the management of their deputate.

Determining the Executive's Information Requirements

The central issue surrounding information system (IS) implementation and this study is: what information is required by a manager to effectively manage? John Rockart proposed using what he called critical success factors (CSF) to determine what information was truly important to the executive. CSFs are areas that require the constant and careful attention of the executive in order for the organization to be successful. The prime sources of CSFs are: 1. structure of the particular industry, 2. competitive strategy,

3. environmental factors, and 4. temporal (short term) factors. Through a series of interviews, these CSFs are successively clarified, then are attached to performance indicators that are used to monitor the CSFs. Once that is accomplished the IS can then be constructed to provide that information in an easy-to-read and accessible form (20:86-87).

E. W. Martin applied Rockart's theory to examine the information needs of chief information officers (CIO). He first interviewed 15 CIOs and found seven CSFs that were common among them. He then interviewed a group of 17 CIOs (eight of which were from the first study) and obtained a list of information measures appropriate to monitor each of the CSFs. In his conclusion he states,

> The CSF approach, while it has its limitations, produces very specific information requirements when applied to the individual manager. But, in this study, the CSF approach was applied to a group of managers, and thus provided a broad overview of the information needs of chief MIS executives which can be helpful to MIS managers who wish to evaluate their own personal information systems and detect opportunities for enhancing them. (16:10)

In another study of chief information officer information requirements, Dr. Martin diverged from Rockart's interview technique and used a survey approach to determine their information requirements. He again showed that the CSF approach was valid for the determination of information requirements. In addition, his evidence demonstrated the validity of using surveys instead of personal interviews to determine CSFs for initial information requirements determination. (15:9)

Information Systems Technology

Because one of the purposes of this study is to enhance DCM decision making through the use of information technology, it is

appropriate to examine what information system technology would best suit that purpose. This section will briefly examine three technologies that might be applicable to the DCM decision-making situation: management information systems, decision support systems, and executive information systems. It will then attempt to draw conclusions about which technology is best suited to enhancing DCM decision making.

Management Information Systems. Historically, the first computers were used in organizations to make routine, repetitive transactions faster and more efficient. These transaction processing systems gained widespread use because of the machine's ability to process large volumes of data quickly and easily (3:5). In addition to this processing capability, they had another benefit as well: they could store the vast amounts of data that was being processed. The storage of this data, however, was of little benefit to the organization until a use could be found for it. By using the computer to aggregate the data into preformatted reports for use at higher levels in the organization, management information system (MIS) technology was born.

Davis and Olson provide an excellent, though broad definition of MIS. They define it as "...an integrated, user-machine system for providing information to support operations, management, analysis, and decision-making functions in an organization" (3:5).

This type of system, by aggregating the data for management, can help decision makers wade through the thousands, possibly millions, of transactions that occur in an organization down at the operating level. Reducing the data flow into more manageable information helps to improve management decision making by separating the 'wheat from the chaff'.

However, MIS only provides passive support of decision making. It can be useful for indicating a need for action, but it is rather limited in its ability to significantly support decision makers. It is not flexible enough to meet the needs of many, if not most decision makers (24:93).

CAMS as a Management Information System. The Core Automated Maintenance System (CAMS) clearly falls into the category of MIS. Air Force regulation 66-279 Volume II, in describing the system states:

> The Core Automated Maintenance System (CAMS) is an automated data system (ADS) that supports the Deputy Commander for Maintenance functional areas. It consists of computer programs that provide automated inventory control and management information systems for base level maintenance managers to more effectively utilize their resources in mission accomplishment. (6:1-1)

As CAMS is currently configured, it best supports first line supervisors and other squadron-level maintenance personnel in managing the day to day actions out on the flightline. Lieutenant Colonel Charles Clark, Chief of the Functional Management Division at Standard Systems Center, Gunter Air Force Base, Alabama, who has responsibility for the development of CAMS, stated in a letter to Lieutenant Colonel Fred Westfall, Head of the Air Force Institute of Technology Logistics Management Department:

> At present, the Core Automated Maintenance System (CAMS) collects data and supports managers/supervisors primarily at the maintenance work center level. In our opinion, CAMS does not support DCMs as well as it could or should. (2:1)

Clearly, there is some concern over the current ability of CAMS to provide the necessary support to the DCM for his decision making. One method of measuring the amount of support would be to examine how often DCMs use CAMS themselves to gather necessary information and how often those reporting to him use it to gather the information he needs. The

survey sent out to DCMs in support of this research asked whether the DCMs use CAMS directly to gather information or if they preferred to use other sources. Though no direct link between level of use and level of support was measured, a lack of direct use could imply that CAMS does not provide the support they require, while heavy use could imply the opposite. Another way to determine if CAMS is supporting the DCM is to measure their subordinate's use of CAMS in responding to the DCMs' requests for information. This measurement is beyond the scope of this research, but is recommended as a topic for possible future research.

Decision Support Systems. In recent years there has been recognition that traditional management information systems do not support the requirements of top level managers directly. Ein-Dor and Segev stated that the apparent reason for this non-support was, "...because of the intuitive nature of chief executives and because of the way decision criteria tend to shift during the fairly long decision cycle at this level...it does not seem likely that the formulation and selection of alternatives will be trusted to information systems in the near future" (7:136).

This lack of support led Gorry and Morton to call for a new information system that would better support the less structured decisions faced by top management. They coined the term "decision support system" (DSS) and stated that its purpose would be to channel computer applications toward management decision making (11:55-70). Emmelhainz defines a decision support system as helping "...decision makers effectively confront unstructured problems through direct computer-based interaction with data and models" (8:289).

According to McLeod, a decision support system should have three main objectives. It should:

-Assist managers in making decisions to solve semistructured problems.
-Support the manager's judgement rather than try and replace it.
-Improve the manager's decision-making effectiveness rather than its efficiency. (17:339)

Components of a Decision Support System. There are four major components of a DSS. These are: a database, a user-interface, a report generator, and a model base. The database component contains the information that serves as a reservoir for all the pertinent conditions and characteristics of the problem in question. In addition, a portion of the system must be dedicated to actually storing, retrieving and formatting information to and from the database (4:76-77).

The second component, the user-interface or "front end", provides all interaction and communication between the computer and the user. Ideally the interface hides the internal complexity of the system and provides intuitive commands that do not require the decision maker to spend valuable time learning to use the system (4:81).

The report generator, as the third component, provides the capability to consolidate, arrange, sort and display data in a concise and easily understandable form. If properly designed, the user should be allowed to query the information in any conceivable fashion, and receive the output in any desired format (4:80).

The fourth component, the model base, supports the necessary quantitative programs that allow a physical system to be depicted and analyzed in a computer. This is the component that provides the "support" in decision support. Mathematical formulation is embedded within the model to provide a mechanism through which information can be

manipulated repeatedly and the decision-maker can emulate what will actually take place. The higher the difficulty of the problem being solved, the more elaborate the model; however, the model's complexity is shielded from the decision-maker by the user-interface (4:77).

CAMS as a Decision Support System. CAMS has already been described as an MIS. What, then, would need to be accomplished in order to make CAMS a DSS? It already contains three of the four components that make up a DSS. It contains a database, a user-interface, and a limited report generating capability (6:2-1, 2-2, 2-14). Each of these, with some modifications could possibly serve as the basis for a DSS. CAMS does not, however, contain a modelling component. If the results of this research, presented in chapters four and five, provide a concrete list of information requirements, they could be used as the starting point for identifying necessary models that need to be developed in order to support DCM decision making.

Executive Information Systems. Although decision support systems are an improvement over management information systems in terms of the support provided to executives, they still fail, for the most part, to take into account the unique information requirements of top executives. Jones' and McLeod's 1986 study of the information sources of executives showed that 43 percent of the information received by executives comes from outside the organization. In addition, 15 percent of the executive's information came from organizational levels above or equal to his own (14:230-231). A typical decision support system is not geared to monitor this "outside" information. A different system, oriented toward monitoring both internal and external information, an executive information system (EIS) is necessary.

Rockart and Treacy, while not exactly defining an EIS, stated that it should contain these four features:

> 1. A central purpose - executives employ the computer information primarily in planning and controlling.
>
> 2. A common core of data - the database contains information on industries, customers, competitors, and business units in three time periods-history, present, and future.
>
> 3. Two principles of use - Executives use the EIS to access current status and projected trends, and conduct personalized analyses of the data.
>
> 4. A support organization - The executives are helped by EIS coaches in both setting up the system and using it. Middle level managers will usually serve in this role, but it can also be done by information services personnel or consultants. (21:86)

McLeod details four uses for the EIS. He first states that it enables the executive to monitor how well the firm is doing in terms of its objectives and critical success factors (17:471).

The second major use of EIS technology is for management by exception - comparing budgeted performance to actual performance. EIS software can automatically identify the exceptions and call them to the executive's attention — no more need to sort through long reports to extract the necessary information (17:472).

EIS technology also has the ability to interrogate the data behind the summarized displays. The technique, called drill-down, involves the organization of displays in a hierarchical fashion beginning with a summary. The executive is able to view the display and select an item of particular interest. This reveals a second screen that provides more detail on the selected item. Items can be selected from that screen to provide even finer detail. This enables a problem solving executive to get to the root cause of a problem (17:473).

The primary role of the EIS is information compression - providing a synthesis or distillation of a large volume of data and information much like MIS but in a format that is easier to use. If the executive tried to use the bits and pieces of data separately, their meaning could very easily be misinterpreted. The EIS meshes the information into an overview that is referred to as a "mental model" (17:472).

CAMS as an Executive Information System. As previously stated, CAMS in its current configuration is an MIS, not an executive information system. CAMS could be used as a basis to support the development of a separate EIS for the DCM function. This would require a major design effort, practically starting over from the beginning. However, the concept of an executive information system, with its ability to monitor both internal and external information, specifically tailored to support the higher level decision making required of the DCM, appears to be a better alternative to support his information needs than the concepts of management information systems or decision support systems.

Conclusion

This chapter examined two areas important to the completion of this research. First the concept of critical success factors and their use in determining senior level executives was examined. Critical success factors are the limited number of areas in which results, if they are satisfactory, will ensure successful performance of the organization (20:85). Although Rockart's original methodology was to use personal interviews to determine executive's critical success

factors, Martin showed that surveys could be used to determine CSFs with equal success.

The chapter next examined three types of information technology that could aid the decision-making efforts of the Deputy Commander for Maintenance. Management information system technology, which is currently used by the Core Automated Maintenance System, was examined first, and some of its strengths and weaknesses were discussed. Decision support system technology was considered next, with emphasis on the advantages it has over MIS. Finally, executive information system technology was examined and how it is specifically targeted at higher level decision makers was discussed. Either executive information system technology or decision support system technology would enhance the current decision-making capability of the DCM. Executive information technology, which is clearly geared toward the senior-level decisions that are made by the DCM in his daily decision-making efforts may be a better choice to support his needs. Decision support system technology, while not clearly oriented towards the executive level of decision making, would still be an improvement over the current configuration of CAMS in supporting the DCM.

III. Methodology

Introduction

This chapter outlines the methods used to answer the investigative questions posed in Chapter I. It discusses the development of the survey instrument, the general development of the methodology used, and focuses on each of the investigative questions and how they were answered.

Survey Development

After reviewing some of the work published by Dr. E. W. Martin, a professor at Indiana University's School of Business and Administration, the author decided to contact him for information and advice regarding this research effort. Two telephone interviews were conducted, during which time Dr. Martin offered the use of the surveys he had previously developed for determining executive information requirements using the CSF method. These examples proved very valuable to the author in developing the survey used for this research.

Specifically, the survey format used by Dr. Martin was followed as closely as possible. The first section, consisting of multiple choice questions, was used to acquire some demographic information, for use in categorizing responses. The second section was a free-form answer area where a short paragraph was used to describe the CSF concept, and the respondents were asked to list their CSFs and give a short explanation of each. The final section, again multiple choice, was used to determine information sources and presentation preferences, thereby

suggesting what type of information technology best suits the DCMs' decision-making functions. A complete copy of the survey sent to the respondents is provided as Appendix 1.

Dr. Martin also offered advice about how best to interpret the data once it has been collected. His comments will be further addressed below, in the discussion of general methodology.

The overriding concern of this development process was to make the survey as short as possible while still gathering the required information. DCMs are very busy people, and a long survey would be detrimental to the goal of a high response rate. However, too short a survey could possibly harm the research by trying to ask for too much information in each question. The objective was to balance the need for a short survey with the need to get the necessary amount of information.

General Methodology

The survey was sent to Deputy Commanders for Maintenance throughout the CONUS to gather information to answer the investigative questions. The question of internal validity was addressed through a pre-test given to graduate students in the AFIT maintenance management (GMM) program. Given a reasonable response rate, external validity was not considered a problem since surveys were sent to the entire population of CONUS DCMs. After the necessary revisions were made and final approval was received, the survey was mailed out to all CONUS-stationed DCMs. Respondents were allowed three weeks to answer and return the survey. Following the final cut off date, no further responses were accepted and the data was analyzed to determine the answers to the investigative questions. Two types of data were

received from this survey — multiple choice responses to the demographic and information preferences sections and free-form answers to the critical success factor section. For the two multiple choice sections, the data was grouped according to the survey question being addressed, responses to each survey question were tabulated, and response percentages were calculated manually. Responses to each question were rank ordered from highest to lowest percentage of occurrence. Subjective conclusions were drawn based upon the final results of these percentages.

The DCMs critical success factors were solicited in a free-form manner. After a short explanation of the CSF concept, the DCMs were asked to list and briefly describe their critical success factors. This is where the advice of Dr. Martin was most helpful. He suggested that each CSF listed be transcribed on a three-by-five index card along with its explanation. These cards could then be stacked together in groups and the explanations used to help clarify to which category the CSF belongs. This suggestion was followed precisely, and it made the process of grouping the CSFs very easy.

Limitations of the Survey Instrument

There were two significant possibly limiting factors in this process. The first was the creation of a survey instrument with good internal validity. The use of the opinions of Major Jacob Simons, the faculty advisor to this research effort, and Dr. Martin contributed greatly to the internal validity of the instrument. In addition, the use of graduate students to pre-test the survey helped to identify necessary revisions to assure the validity of the answers received.

The second critical factor was obtaining a high enough response rate to the survey. A low response rate would cast doubt upon the external validity of the survey and would limit its potential for generalization to the rest of the population. Ideally, following up via telephone calls to non-respondents would have contributed to solving this problem; however, AFMPC/DPMYOS, who has approval authority for all Air Force initiated surveys, felt that the researcher should not use any form of follow up due to the rank of the respondents. Specifically, in their approval letter dated 18 June 1991, AFMPC stated, "The basic tenets of the attitude and opinion survey program are to preserve the anonymity of the respondent and ensure that completing the survey is a voluntary act. We do not believe it is appropriate for Capt Green to ask deputy commanders to complete postcards so he can track returns" (12:1). As a result, no attempt to follow up the surveys was made.

Specific Methodology

This section outlines the specific methods that were completed for each of the investigative questions. It restates each question and discusses how it was addressed by the survey instrument. A complete copy of the survey is attached as Appendix 1.

Investigative Question 1. What information is critical to the DCM in the management of the various functions under his control? This question comprises the major portion of this study and as such, comprised the largest portion of the survey. Respondents were asked, in section three of the survey, to list and briefly describe the critical success factors that allow their organization to successfully complete its mission. Enough space was allowed for the respondent to list and

describe ten critical success factors. Respondents were directed to continue on the reverse side of the form if more space was required. Because responses were free-form, it was expected that responses would not exactly match each other. The author, therefore, compiled responses into groups judged to be similar and then rank ordered them by percentage of respondents who listed that CSF to obtain an ordered list of information requirements.

Investigative Questions 2, 3, and 4. What sources are currently used to acquire this information? How is the information currently gathered and formatted? How should this information be gathered and formatted? These three questions are interrelated and were treated as a group. Respondents were asked, in section four of the survey, to enumerate their top three sources of information. Respondents were then asked how satisfied they were with the information received from each of these three sources, and if they were not satisfied, they were asked to list the reason for their dissatisfaction. Next, respondents were asked to identify the source that provides them with the best information about their CSFs. Finally, respondents were asked to identify the current format and the most effective format of the information they receive about their critical success factors. These responses were used to determine if the data could be made more useful to the DCM in a different format. It was also used to determine what information they were aware of that is already available in CAMS or if the capability to generate this data remains to be developed.

Investigative Question 5. What information technology is best suited to providing the required gathering and formatting capabilities? This question was answered through the combination of two methods.

First, the opinions of the respondents were determined through responses to the last question of the survey. It discussed the use of graphics and how often they ask to see the information used to generate the graph. Second, alternative technologies, discussed in Chapter 2, demonstrated the type of technology best suited to provide the information they require.

Investigative Question 6. What are the implications of information diversity upon the development of an eventual system? This question was answered through analysis of the demographic information provided by the respondent. This determined if the responses were grouped by demographic information such as major command or location, or if the information is needed by all DCMs regardless of demographics. Groupings based on demographics may explain differences in responses and may be exploited in the future design of an IS. For example, if data were found to be command-specific, then a custom system for this major command could be designed around a generic IS developed from CAMS.

Summary

This chapter presented the methods that were used to complete this research effort. It described the process used to develop, test and administer the survey instrument. Next, a description of the limitations of the survey was presented. The chapter concluded with the presentation of the research plan for answering the investigative questions posed in chapter 1.

IV. Analysis

Introduction

This chapter presents the results obtained from analyzing the responses to the survey instrument. Originally 77 surveys were mailed; however, 4 responses, from the four Tactical Air Command Air Defense Sectors were returned with an explanation that they had no aircraft permanently assigned but use rotating resources provided by the Air National Guard (ANG). These resources are controlled by the ANG unit's DCM, so the Air Defense Sectors have no DCM position. The researcher completely removed those surveys from the population. Therefore, for purposes of this study, 73 subjects are counted as the entire population. Additionally, one survey was returned completely blank, so it was not counted as part of any totals.

Response

A total of 47 surveys were returned in time to be used; but as previously mentioned, only 42 of those surveys were considered usable within the scope of this research. This brought the response rate to over 57 percent. Table 1 provides a break down of the number of surveys sent out and the number returned. Unfortunately, neither DCM from the two wings belonging to Air Force Systems Command chose to return their surveys. This might have helped with the analysis of major command differences, but does not invalidate this research in any way.

It is considered that the results obtained from this survey represent a good cross section of DCMs throughout the Air Force.

TABLE 1

SUMMARY OF THE RESPONSES BY MAJOR COMMAND

	SENT		RETURNED	
TAC	26	35.62%	12	16.44%
SAC	24	32.88%	18	24.66%
MAC	13	17.81%	6	8.22%
ATC	8	10.96%	6	8.22%
AFSC	2	2.74%	0	0.00%
	73	100.01%	42*	57.54%

* Does not include five surveys that were returned unusable.

Analysis of Demographic Data

The first part of the survey instrument was designed to serve three purposes. The first question was used to classify critical success factors by major command with the intent of discovering if there are any command-specific CSFs. Second, it was used to ensure that the respondent population was similar to the entire population (see previous section). The remaining four questions were designed to allow the researcher to understand the approximate size and complexity of the maintenance organization. The responses to these four questions did not influence the list of CSFs or the source information gathered in sections two and three of the instrument. This discussion will analyze the data gathered in the first part of the survey and will determine what the maintenance organization "looks like".

The "typical" maintenance organization has three squadrons - 20 of the 42 respondents listed three squadrons, 47% of the total. This was well above the other responses with four and two squadrons gathering 17% of the responses each followed by those who responded with one squadron (12%) and those who responded with more than four (7%).

Most respondents stated that tney managed between 1000 and 1500 personnel (33%). Those that responded with over 1500 and those with between 500 and 1000 tied at 26%, while 14% reported that they managed less than 500 personnel.

The majority of respondents have less than 10 personnel assigned to their analysis shop (57%). Forty one percent stated they had between 11 and 40; while only 2% had more than 40.

The total aircraft managed by all respondents was 2860, making the average number of aircraft managed 68.

The "typical maintenance organization" managed by the respondents consists of 68 aircraft and three squadrons with between 1000 and 1500 personnel; less than 10 of which work in analysis. The organization managed by the DCM is fairly large and complex. The decisions that the DCM must regularly make are most likely complex as well. Recognizing this fact, any system that truly enhances the decision-making ability of the DCM, should be welcomed by the users.

Respondent Overall Critical Success Factors

The 42 respondents produced a total of 280 critical success factors. These were placed by the researcher into 24 different categories based upon the combination of the name given to the CSF by the respondent and any additional information provided. There were 35 single occurrences where only one respondent mentioned a particular CSF - 52% of the respondents had at least one single occurrence. When asked to explain their CSFs, some respondents included the performance measures that are used to evaluate them. Although these were not

specifically asked for, they are included in the explanation for completeness.

Table 2, a partial recreation of Appendix 2. lists the nine CSFs by descending percentage that were mentioned by more than 20% of the respondents. In addition, a break down of the percentage of respondents by major command is provided. As Table 3 shows, there is some general agreement among the respondents of the importance of these nine critical success factors — 95% of the respondents listed at least one of these CSFs, while 88% listed two or more. This section will describe each of these CSFs in terms of the explanations given by the respondents, and will provide measurement criteria if it was provided as part of the explanation.

TABLE 2

A LIST OF RESPONDENTS' NINE MOST SIGNIFICANT CRITICAL SUCCESS FACTORS

Critical Success Factor	Percentage of DCMs Who Listed This CSF Total	SAC	TAC	MAC	ATC
Mission Capable Rates	59.52%	39%	58%	66%	100%
Scheduling Effectiveness	52.38%	50%	33%	66%	100%
Personnel Issues	47.62%	61%	42%	17%	50%
Maintenance Quality	47.62%	66%	25%	50%	50%
Supply Effectiveness	38.10%	50%	33%	50%	0%
Mission Effectiveness	30.95%	11%	50%	50%	33%
Training	26.19%	33%	17%	33%	17%
Departure Reliability	23.81%	39%	0%	50%	0%
Delayed Discrepancies	21.43%	17%	17%	50%	17%

TABLE 3

THE PERCENTAGE OF RESPONDENTS LISTING THE NINE MOST SIGNIFICANT CRITICAL SUCCESS FACTORS

Number of CSFs Listed	Number of DCMs Listing That Many CSFs	Cumulative Percentage of DCMs Listing That Many CSFs
9	0	0%
8	0	0%
7	2	5%
6	3	12%
5	11	38%
4	4	47%
3	11	74%
2	6	88%
1	3	95%
0	2	100%

Mission Capable Rate. Mission capable rates were listed by over 59% of the respondents making it the most often used critical success factor. Included in this measure are fully mission capable (FMC) aircraft, partially mission capable (PMC) aircraft, and totally non-mission capable aircraft due to maintenance (TNMCM). Those who described this CSF listed it as being a command directed standard that they must meet on a weekly and monthly basis.

Respondents defined FMC as the percent of time that the aircraft can fully perform its mission with no degradation while another respondent said that it reflects the number of aircraft available for scheduling.

Scheduling Effectiveness. This CSF was listed by 47.62% of the respondents which made it the second-most often used CSF. It involves a balance between the amount of training sorties needed by operations and the requirement to accomplish quality maintenance. One respondent described this dilemma as allowing your people ample time to work their

maintenance, but still providing the contracted amount of sorties to operations.

Respondents stated that this CSF is measured by assessing how well the unit executes the printed flying schedule without any changes.

Personnel Issues. This CSF, listed by 47.62 of the respondents, was a mixture of different areas that were put together by the researcher into this category. It could best be described as having enough quality personnel to do the job and insuring they are given enough responsibility and recognition.

This CSF is monitored by many diverse measurements such as manning rates, work area and aircraft appearance, promotion rates and award and decoration rates - most of which could be considered to be external information.

Quality Maintenance. Tied with personnel issues, this CSF was also listed by 47.62% of the respondents. Several respondents stated that quality points to other possible problem areas like personnel training, trouble-shooting ability of the technicians, and the desire to fix problems right the first time.

Quality is monitored by respondents using repeat and recurring write-ups, quality assurance reports, and Maintenance Standardization and Evaluation Program (MSEP) grades.

Supply Effectiveness. Supply concerns, listed by 38.1% of the respondents, was the fourth most listed CSF. It involves making sure that the technicians have the parts they need when they need them in order to fix the aircraft.

Respondents monitor this CSF by using MICAP rates and cannibalization rates. Some respondents listed one or both of these

measures, while others listed an overall concern for supply effectiveness as the CSF for this area.

Mission Effectiveness. This CSF was listed by 30.95% of the respondents as one of their top concerns. It is described as the ability of operations personnel to complete all scheduled training for that sortie with out degradation caused by maintenance write-ups.

Many respondents listed abort rates, both in the air and on the ground, as measures used to monitor this CSF.

Personnel Training. The seventh most listed critical success factor was monitored by 26.19% of the respondents. One respondent called this area the key to production which indicates the work force's ability to perform.

Respondents listed two areas that they use to measure personnel training. Completion rates for personnel upgrades are generally used; however, current Air Force programs such as Rivet Workforce also provide completion rate statistics which are used to monitor this CSF.

Departure Reliability. Known to some as on-time takeoff rate or late takeoff rate, this CSF was listed by 23.81% of the respondents (from only two major commands). One respondent said that this was only a problem if it caused a loss of aircrew training, but others who mentioned it did not describe it except to say that the cause of late takeoffs must be looked at carefully.

This CSF, as mentioned previously, is monitored by measuring either on-time takeoff rates, late takeoff rates, or both.

Delayed Discrepancies. Listed by 21.43% of the respondents, this CSF was the ninth-most listed CSF. Though no definition was provided, one respondent said that this CSF pointed out that the maintainers may

not have enough time between flights to maintain the jets. Another asked the question, "Are we making the flying commitment at the expense of good maintenance practices?"

Command-Specific Critical Success Factors

The list of CSFs described above is comprised of those that were listed by more than 20% of the respondents. In addition, there were 9 CSFs mentioned by less than 20% of the entire population, but mentioned by more than 20% of respondents within a single command. These CSFs may be good candidates for making a command- specific information system, either as a modification to the overall system, or as a separate add-on system for the command concerned. These CSFs are addressed by major command in the sections that follow.

Strategic Air Command. The respondents from SAC had two additional CSFs that they felt were critical to their success. The first, aircraft utilization rate, was listed by 22.22% of the respondents. It was defined by one respondent as the number of sorties flown per aircraft per month. In addition, 22.22% of the respondents also listed phase inspection status as a critical success factor, but no definition was provided.

Tactical Air Command. The respondents from TAC had two more CSFs that they felt were critical to their success. Fix rate was listed by 41.66% of the TAC respondents. It was defined as the number of reported discrepancies fixed within eight hours of being reported divided by the total number of discrepancies reported. The second CSF, used by 25% of the TAC respondents, is break rate, defined as the number of sorties

with status code three (major discrepancies) divided by the number of sorties flown.

Military Airlift Command. MAC respondents again had two additional CSFs that were listed by more than 20% of the command. The first, operations and maintenance cooperation, was listed by 50% of the MAC respondents, but no concrete way of measuring it was offered. The second CSF, safety, was listed by 33% of the MAC respondents. This CSF was indicated to be an absolute standard set by the command that measured incidents that involve equipment accidents and personnel injury rates.

Air Training Command. ATC respondents listed four CSFs that were used by more than 20% of the respondents. They were repair-cycle assets (66%) which measure ability to repair parts in house rather than sending them off-station for repair; fleet time, listed by 66% of the respondents, which is the average number of hours the "fleet" has until the next scheduled phase inspection; budget (50%) in terms of cost per flying hour and the ability to fly out the year's allocation of flying hours with the available funds; and break rate (33%) which was defined previously in the section describing TAC's command specific CSFs.

Table 4 summarizes the command specific critical success factors listed by the respondents. Clearly there is some command diversity shown by these CSFs. Including these CSFs in an overall system would most likely increase the cost of the system; however, some capability for tailoring the system to user needs would ideally be built in any system designed for such a diverse group of users. It would have the ability to accommodate both the command specific CSFs and other, possibly individual, specific critical success factors.

TABLE 4
COMMAND-SPECIFIC CRITICAL SUCCESS FACTORS

Critical Success Factor	Percentage of DCMs Who Listed This CSF Total	SAC	TAC	MAC	ATC
Budget	19.05%	17%	17%	0	50%
Fix Rate	19.05%	6%	42%	17%	17%
Aircraft Utilization Rate	14.29%	22%	17%	0	0
Break Rate	11.91%	0	25%	0	33%
Ops/Maintenance Cooperation	11.91%	6%	8%	50%	17%
Repair-Cycle Assets	11.91%	0	8%	0	66%
Aircraft in Phase Inspection	9.52%	22%	0	0	0
Safety	9.52%	11%	0	33%	0
Fleet Time	9.52%	0	0	0	66%

Analysis of Information Sources and Preferences

The final section of the survey addressed respondent attitudes about the sources they use to gather information about their critical success factors.

Question seven asked respondents whether or not they had CAMS in their organization. Ninety eight percent responded that CAMS was in place in the organization, while one respondent (2%) stated it was not. The next question asked respondents how often they personally use CAMS to gather information about their CSFs. Thirty four percent responded that they never use CAMS, 29% responded that they seldom used CAMS, 17% said that they occasionally used CAMS and 20% said they used CAMS often.

Question 9 asked respondents to choose their top three sources of information about their critical success factors. Seventy six percent listed maintenance supervisors or superintendents as a source of information, making it the most often used source. The next-most used source, listed by 69% of the respondents was the analysis staff. Forty three percent listed the third most chosen source, the production

superintendent. Thirty three percent listed their squadron commanders as a source of information. The troops out on the flightline and some other type of data base (other than CAMS) were both listed by 10% of the respondents. CAMS was only listed by 7% of the respondents as a source of information about their CSFs. Forty three percent of respondents also listed other sources for their CSFs.

The next six questions (10 through 15) were designed to test the respondents level of satisfaction with the sources listed in the previous question. For the source listed by the respondents as their first choice, 19% were completely satisfied, 74% were mostly satisfied, and 7% (3 respondents) were marginally satisfied. When asked why they felt that this source was not adequately meeting their needs, those not satisfied listed untimely information (66%), and incomplete information (33%) as the reasons.

When asked about the source they listed as their second choice, 17% responded that they were completely satisfied, 81% were mostly satisfied, and 2% (one respondent) were marginally satisfied. The respondent listed both untimely and incomplete information as the reasons for this dissatisfaction.

When responding about the source they listed as their third choice, 5% were completely satisfied, 83% were mostly satisfied, and 12% were marginally satisfied. Those that were only marginally satisfied listed incomplete information (43%), inaccurate information (14%), untimely information (14%), and other reasons (29%).

Question 16 asked respondents to list their best source of information. Thirty three percent listed maintenance supervisors or superintendents as their best source of information - closely

paralleling its previous score as most used source. Thirty one percent rated their analysis staff as their best source - again paralleling its rating as second-most used source. Squadron commanders were listed by 7% of the respondents as their best source of information. The production superintendent was listed by 5%, while CAMS, other databases, and flightline personnel were listed by 3% of the respondents each. Fourteen percent of the respondents listed other sources as their best source of information.

Questions 17, 18 and 19 were designed to explore formatting issues. Question 17 asked respondents to list all the ways that the information they currently receive about their CSFs is formatted. Twenty four percent of the responses were listed as formal reports directed by the respondent himself. Personal contact with the responsible individual garnered 23% of the responses. Twenty percent listed informal reports on an as-needed basis. Higher headquarters directed reports and formal reports left over from previous DCMs each received 15% of the responses. Three percent use other formats for their information.

When asked what format they found most effective in reporting information about their CSFs, 48% preferred reports that they directed, 28% preferred personal contact with the responsible individual, 9% preferred informal reports on an as-needed basis, while higher headquarters directed reports, reports left over from previous DCMs and other reports were each listed by 5% of the respondents.

Question 19 asked respondents when presented with information in graphical format how often they requested the information used to generate the graph. Twenty percent responded that they always requested

the information, 37% responded with often, 27% answered occasionally and 17% listed seldom. No one responded with never.

Analysis of Results in Terms of Investigative Questions

This section will answer the investigative questions posed in chapters one and three. It will restate each question and answers will be discussed based upon the secondary research documented in chapter two and the primary research documented earlier in this chapter.

1. What information is critical to the deputy commander for maintenance in the management of the various functions under his control? Table 2 listed those critical success factors that were listed by more than 20% of the respondents to the survey. Table 3 showed that 95% of the respondents to this survey valued at least one of these CSFs, 88% valued at least two, and 74% valued three or more. Table 4 listed the command-specific CSFs along with the major command percentages highlighted if they were over 20%. (An exhaustive list of all the CSFs listed by more than one respondent is given in Appendix 2 of this document.)

It is clear from these three tables that there is not total agreement among DCMs as to what should be monitored continuously in order to ensure success. However, almost half of the DCMs responding to this survey use four of the identified CSFs and nearly 75% use three of them as part of the information they require.

In addition, the command-specific CSFs demonstrate the diversity of the DCMs' job among the major commands. These nine CSFs, listed in Table 3, though not important to all DCMs, are very important to those commands to which they belong.

2. What sources are currently used to gather this information? Although a few sources emerged as places where DCMs go for their information, the two sources used most, maintenance superintendents/ supervisors and the analysis staff were also found to be the best sources for their information. This is not really too surprising, since a successful DCM would be expected to use his best sources most often. The data gathered by this survey does seem to confirm what Lt Col Clarke suspected and stated in his letter. That is, CAMS, listed by only 7% of the respondents as a source and only 3% as one of the best sources, is not supporting DCMs in their decision-making tasks. One respondent commented to this effect saying, "CAMS is almost useless to me personally. The troops have to use it. But it is not flexible enough nor 'user friendly enough' for use as an executive decision making tool."

3. How is the information currently gathered and formatted? In order to fully answer this question, a study needs to be undertaken of each of the sources listed by the respondents and how those sources gather the information and format it for the DCM. However, the results of this survey show that many formats are used by the respondents to gather information - almost evenly spread among the responses given. These responses show a need for flexibility in formatting reports almost to the point of tailoring them to the needs of each individual user. Current decision support system technology with its report generating capability and executive information system technology, with its ability to easily adapt to the needs of the user, could each provide the necessary flexibility.

4. How should this information be gathered and formatted? This study produced two formats that were most preferred by the respondents in receiving information about their CSFs - reports the respondent himself directed and informal reports on an as-needed basis. Again these responses point to a need for user flexibility in report design which is most easily provided by executive information system technology, but is possible to a lesser extent with decision support system technology.

5. What information technology is best suited toward providing the required gathering and formatting capabilities? A look at the list of CSFs that emerged as a result of this study show that while most of the information monitored by the DCM is internal to the maintenance organization (mission capability rates, maintenance quality, training, etc.) some of this information is external to the organization (supply effectiveness measures base supply - an external entity, and personnel issues like promotion rates come from the mission support squadron - another external entity). The ability to monitor both internal and external information is the executive information system's forté - that is what it is designed to do. In addition EIS technology is user friendly and easily modifiable. It would seem a logical choice for this application.

6. What are the implications of information diversity upon the development of an eventual system? The list of critical success factors demonstrates that there is some diversity in the information requirements of DCMs. Some is based upon personal preference, some seemingly based on the major command to which they are assigned. This diversity does not prevent designing a single system that will provide

enhanced decision making capability to its users. Enough agreement exists that a system can be developed around the nine CSFs listed by more than 20% of the respondents to the survey. The system must, however, have some ability to be tailored to individual needs of the users and to be modified to consider information that is only critical to one or two major commands. This way the system will be useful not only to the current group of respondents but to future users as well.

Summary

This chapter presented the results of the survey instrument mailed out as part of this research effort. First, it presented a summary of the demographic information along with a description of a "typical maintenance organization," which is generally a very large and complex organization. The next section presented two lists of critical success factors - those listed by more than 20% of all respondents and those listed by more than 20% of the respondents within a single command. These critical success factors are the key pieces of information that are continuously monitored by the DCMs in this study in order to ensure the organization's success. The third part of this chapter presented the respondents' source and format preferences. Finally, the investigative questions were answered in terms of the responses to the survey and the literature review presented in chapter 2.

V. Conclusions and Recommendations

Introduction

This chapter will answer the research questions posed in chapter 1 in light of the answers to the investigative questions in chapter 4. In addition, recommendations for future research will be made, followed by conclusions about the methodology.

Answers to the Research Questions

Question 1. What are the information requirements of the Deputy Commander for Maintenance? This research, using Rockart's critical success factor method with Martin's modifications, developed a list of information requirements that the DCMs felt was important to the management of their deputate. A complete list of those CSFs that were listed by more than one respondent is presented as Appendix 2 of this document. In summary, nine critical success factors were found to be significant to more than 20% of those who responded to the survey. Of these nine, four were listed by more than 45% of the respondents. Nine additional CSFs were found to be significant to more than 20% of the respondents within a single command. These critical success factors are the important pieces of information that the DCMs surveyed use to manage their deputate.

Question 2. Are DCM information requirements similar enough across the United States Air Force that a single decision-making solution could be developed for the DCM function? Although this research only surveyed CONUS-based Deputy Commanders for Maintenance, the response rate and cross section received suggest that the results

could be applied to the entire population of DCMs throughout the Air Force. The response rate to the survey was over 57% of the CONUS-based DCMs. These responses represent over 41% of all the DCMs in the Air Force.

The results of the survey demonstrated that 95% of the respondents use at least one of the CSFs on the list, while 88% use two or more. In fact nearly half (47%) use four or more of the CSFs identified. While this list may not capture all the information that DCMs require, they provide a common basis for the development of an information system to enhance the decision-making ability of the Deputy Commander for Maintenance.

Question 3. Can DCM decision-making ability be enhanced through the use of information system technology? The results of the literature review suggest that either executive information system technology or decision support system technology could enhance the decision-making capability of the DCM. Results from questions 17, 18 and 19 of the survey show that respondents preferred reports that they themselves directed, and that when given graphical information they would desire the ability to look at the information used to generate the graph. Executive information systems give the user the ability to customize the information presented and to interrogate the information behind summarized displays. This, coupled with its focus on the senior-level decisions made by the DCM and its ability to monitor both internal and external information make executive information system technology the best choice for enhancing DCM decision making.

Recommendations for Future Research

Three areas surfaced during this research which require further investigation. One area that needs to be researched is where the sources used by the DCM acquire their information. This study identified two sources that are used by most of the respondents to this study - maintenance superintendents/supervisors and the analysis staff. Where these sources get their information may provide more enlightenment into where the DCMs really get their information.

Another area that needs to be investigated is the number of measurements described in chapter 3 that are already present in CAMS. This type of study would give system designers a better idea of how much of the new information system could be borrowed from CAMS and how much would require a new design and development effort.

A third area that should be studied is why the current CAMS system is not perceived to be supporting the Deputy Commanders for Maintenance. This study demonstrated that the majority of DCMs are not directly using CAMS to aid in the management of their deputate. A study of the reasons why they are not using the system could lead to improvements in the current system.

Conclusions About the Methodology

Although the survey used in this research provided valuable answers to the investigative questions and the research questions, it did pose two limitations that might have been overcome by the use of interviews.

Some respondents listed general and unmeasurable responses as critical success factors. If interviews had been used to collect or

validate these responses, clarification of the CSF concept and the ability to clarify respondent answers might have yielded better responses in some cases.

The classification of CSFs into categories was done on a subjective basis by the researcher. If an interview had been used to gather the information, the respondents could have helped in the categorization of their responses.

Neither of these two limitations seriously affected this research; however, the use of interviews to gather the data could have made this research better.

Conclusion

This research demonstrated the value of the critical success factor method proposed by John Rockart in 1979 for determining the information requirements of a group of potential information system users. It used a variation of the method proposed by E.W. Martin in which surveys were used rather than interviews to gather the necessary data. The research produced a list of information requirements that were used by over 95% of the respondents, which can be used as a basis for the development of an executive information system that will enhance the decision-making capability of the USAF's Deputy Commanders for Maintenance.

Appendix 1: Survey Instrument

USAF SCN 91-44
30 Sep 91

I. INSTRUCTIONS

Attached is a survey I have created in conjunction with Professor E.W. Martin of Indiana University for Deputy Commanders for Maintenance. The purpose of my study is to determine what information Deputy Commanders for Maintenance use to manage maintenance production. The method I am using is based on original research done on critical success factors (CSF). CSFs are those areas that are so important to supporting the goals of your operation, that they require your constant attention.

You were selected by AFMPC from among all CONUS-based DCMs to participate in this research. Based upon preliminary research, I estimate that it will take approximately 15 minutes to complete this survey. The answers I receive will be used to find similarities and differences in the CSFs different DCMs use and how they monitor them. The information will be used by Standard Systems Center at Gunter AFB, in support of DCM information requirements.

Because I am dealing with a very small population, each response is critical to the validity of my research. Please complete the survey as soon as possible and return it to me in the enclosed envelope.

I thank you in advance for your cooperation and support. As part of my research I will send you a summary of the responses I receive. In addition, if you would like a complete copy of my research, feel free to contact me, Capt Daniel Green, at DSN 787-8989 so I can make the necessary arrangements.

II. BACKGROUND

The following questions will be used to categorize your organization and help me get a feel for its size and complexity. Please answer the multiple choice questions by circling the letter that best describes your answer. Please provide only one answer to each question, unless you are asked in the question to do otherwise.

1. What is your Major Command?
   a. Strategic Air Command
   b. Tactical Air Command
   c. Military Airlift Command
   d. Air Training Command
   e. Air Force Logistics Command/Air Force Systems Command
   f. Other (Please specify)_____

2. How many squadrons are in your deputate?
   a. 1
   b. 2
   c. 3
   d. 4
   e. More than 4

3. How many personnel are assigned to your maintenance organization?
   a. 0 - 500
   b. 501 - 1000
   c. 1001 - 1500
   d. Over 1500

4. How many personnel in your organization work in analysis? (That is, how many work in the DCM analysis branch and in each of the squadron analysis branches in total?)
   a. 0 - 10
   b. 11 - 40
   c. 41 - 60
   d. More than 60

5. How many aircraft is your organization responsible for?_____

III. INFORMATION REQUIREMENTS DETERMINATION

6. According to John F. Rockart, critical success factors are *the limited number of areas* in which the results, if they are satisfactory, will ensure the successful performance of an organization. They are the areas you monitor continuously in order to effectively manage your deputate.

In the space provided below, please name and then briefly describe each of the critical success factors that allow your organization to successfully complete its mission. The number you wish to list is up to you. If you need additional space please continue on the back of these sheets.

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

IV. INFORMATION PRESENTATION PREFERENCES

The following questions relate to your preferences for obtaining the information you use to monitor your critical success factors.

7. Is the Core Automated Maintenance System (CAMS) in place in your organization?
   a. Yes
   b. No

8. If you answered yes to question 7, do you directly access CAMS to gather information, and if so, how often?
   a. No, never real answers.
   b. Yes, but seldom
   c. Yes, occasionally
   d. Yes, often

9. What sources do you most often use to obtain information about your critical success factors? (Please circle top three sources and number them in the space at the right 1, 2, or 3.)
   a. My analysis staff_____
   b. Directly from CAMS myself (if applicable)_____
   c. Some other type of data base_____
   d. Squadron commanders_____
   e. Maintenance Supervisors or Superintendents_____
   f. Production Superintendent_____
   g. The troops out on the flightline_____
   h. Other (Please specify) _____
   _ _____

10. For the information source you identified as #1, how satisfied are you that this source is meeting your information needs?
   a. Completely
   b. Mostly
   c. Marginally
   d. Not at all

11. If you answered c ord to question 10, why do you feel that it is not adequately meeting your needs? (Circle all that apply.)
   a. The information I receive is inaccurate.
   b. The information I receive is incomplete.
   c. The information I receive is not timely.
   d. I receive too much information so that I have to sift through it to find the
   e. Other (Please specify) _____
   _____

12. For the information source you identified as #2, how satisfied are you that this source is meeting your information needs?
   a. Completely
   b. Mostly
   c. Marginally
   d. Not at all

13. If you answered c or d to question 12, why do you feel that it is not adequately meeting your needs? (Circle all that apply.)
    a. The information I receive is inaccurate.
    b. The information I receive is incomplete.
    c. The information I receive is not timely.
    d. I receive too much information so that I have to sift through it to find the real answers.
    e. Other (Please specify) _____
    _____

14. For the information source you identified as #3, how satisfied are you that this source is meeting your information needs?
    a. Completely
    b. Mostly
    c. Marginally
    d. Not at all

15. If you answered c or d to question 14, why do you feel that it is not adequately meeting your needs? (Circle all that apply.)
    a. The information I receive is inaccurate.
    b. The information I receive is incomplete.
    c. The information I receive is not timely.
    d. I receive too much information so that I have to sift through it to find the real answers.
    e. Other (Please specify) _____
    _____

16. Of the three sources you identified in question 9, which source do you feel gives you the best information about your critical success factors?
    a. My analysis staff
    b. Directly from CAMS myself (if applicable)
    c. Some other type of data base
    d. Squadron commanders
    e. Maintenance Supervisors or Superintendents
    f. Production Superintendent
    g. The troops out on the flightline
    h. Other (Please specify) _____
    _____

17. How is the information you receive about your critical success factors currently formatted? (Circle all that apply.)
    a. As formal reports that are directed by higher authority
    b. As formal reports that I directed
    c. As formal reports that were used before I became DCM and are still being used
    d. As informal reports on an as-needed basis
    e. Through personal contact with the person responsible for providing me the information I require
    f. Other (Please specify) _____
    _____

18. Which format do you find <u>most</u> effective in providing you the information that you require? (Please circle only one answer.)
    a. As formal reports that are directed by higher authority
    b. As formal reports that I directed
    c. As formal reports that were here when I became DCM and are still being used
    d. As informal reports on an as-needed basis
    e. Through personal contact with the person responsible for providing me the information I require
    f. Other (Please specify) _____

19. When information is given to you in a graphical format, how often do you ask for the information used to generate the graph?
    a. Always
    b. Often
    c. Occasionally
    d. Seldom
    e. Never

This concludes the survey. I would like to thank you again for your cooperation in furthering my research efforts. If you have any other comments regarding this survey or the research effort, feel free to use the reverse of these pages to give me any feedback you may have.

Appendix 2: Complete List of Critical Success Factors

Background

In all, the respondents to the survey listed a total of 280 critical success factors. Eighty-seven percent, or 245, of these were named by more than one respondent and fell into one of 25 categories. Thirteen percent, or 35, were only listed by one respondent. They are treated in this list as a category listed at the end labelled "Single occurrences."

Critical Success Factor	Number of DCMs Listing This CSF	Percentage of DCMs Listing This CSF
Mission Capable Rates	23	59.52%
Scheduling Effectiveness	22	52.38%
Personnel Issues	20	47.62%
Maintenance Quality	20	47.62%
Supply Effectiveness	16	38.10%
Mission Effectiveness	13	30.95%
Training	11	26.19%
Departure Reliability	10	23.81%
Delayed Discrepancies	9	21.43%
Budget	8	19.05%
Fix Rate	8	19.05%
Aircraft Utilization Rate	6	14.29%
Ops/Maintenance Cooperation	5	11.91%
Break Rate	5	11.91%
Repair-Cycle Assets	5	11.91%
Aircraft in Phase Inspection	4	9.52%
Safety	4	9.52%
Fleet Time	4	9.52%
Exercises/Evaluations	3	7.14%
Alert Status	3	7.14%
Maintenance Cancellations	3	7.14%
Aircraft Ground Equipment Status	2	4.76%
Base Self Sufficiency	2	4.76%
Single Occurrences	35	52.38%

Appendix 3: Standard Systems Center Letter

DEPARTMENT OF THE AIR FORCE
STANDARD SYSTEMS CENTER (AFCC)
GUNTER AFB AL 36114-6343

Lieutenant Colonel Fred Westfall
Head, Department of Logistics Management
School of Systems and Logistics
Air Force Institute of Technology
Wright-Patterson AFB OH 45433

Dear Fred

During our telephone conversation in December, I expressed an interest in having an AFIT graduate student write a thesis on the information requirements of Deputy Commanders of Maintenance (DCMs). I am following up that conversation with this written correspondence.

My objective is to develop a means of providing better information supporting decisions of DCMs who must perform high level functions of management control and strategic decision making. At present, the Core Automated Maintenance System (CAMS) collects data and supports managers/supervisors primarily at the maintenance work center level. In our opinion, CAMS does not support DCMs as well as it could or should.

One of your officers, Major Jake Simons, has expressed his willingness to serve as a consultant and has submitted an outline of a research plan to me. I agree with his proposed approach of performing a combination of case studies and structured interviews at a small number of selected locations. I seek your approval and support of this important initiative. Anticipating that you will approve, I have begun process of identifying prospective bases for case studies.

I look forward to hearing from you on this matter. If you have any questions, please call me at AUTOVON 446-3418/4174.

Terry

CHARLES T. CLARK, Lieutenant Colonel, USAF
Chief, Functional Management Division

Appendix 4: Survey Approval Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MILITARY PERSONNEL CENTER
RANDOLPH AIR FORCE BASE TX 78150-6001

REPLY TO ATTN OF: DPMYOS

18 JUN 1991

SUBJECT: Survey Approval (Your Ltr, 6 Jun 91)

TO: AFIT/XPX

Capt Daniel Green's survey, "Information Requirements of Deputy Commanders for Maintenance", is approved and assigned Survey Control Number (SCN) 91-44 which expires 30 Sep 91. We recommend Capt Green add his name prior to the DSN number on the instruction sheet. Also, on the last page of the survey, "feedback" should be one word. Finally, the basic tenets of the attitude and opinion survey program are to preserve the anonymity of the respondent and ensure that completing the survey is a voluntary act. We do not believe it is appropriate for Capt Green to ask deputy commanders to complete postcards so he can track returns. If Capt Green has any questions, he may contact Capt Burgess at DSN 487-5680.

CHARLES H. HAMILTON, GM-13
Chief, Personnel Survey Branch

cc: AFIT/GIR/LSM
(Capt Green)

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13. ABSTRACT (Maximum 200 words)

The prupose of this research was to identify the information requirements of Air Force Deputy Commanders for Maintenance. It had three basic objectives: (1) identify the critical success factors that they monitor on a continuous basis, (2) identify similarities in those reqirements for all DCMs and accross major commands, and (3) determine if the application of infcrmation technology would enhance their decision making.

Surveys were sent to all CONUS based Deputy Commanders for Maintenance. The study found that there were nine critical success factors that were used by a majority of all respondents. In addition, nine command-specific critical success factors were identified. It was determined that executive information system technology would most benefit their decision-making processes.

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AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: AFIT/LSC, Wright-Patterson AFB OH 45433-6583.

1. Did this research contribute to a current research project?

   a. Yes b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

   a. Yes b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Please estimate what this research would have cost in terms of manpower and/or dollars if it had been accomplished under contract or if it had been done in-house.

   Man Years _____ $_____

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3 above), what is your estimate of its significance?

   a. Highly Significant b. Significant c. Slightly Significant d. Of No Significance

5. Comments

_____ _____

Name and Grade Organization

_____ _____

Position or Title Address