THE DEVELOPMENT OF PERFORMANCE MEASUREMENT STANDARDS FOR THE UNITED STATES AIR FORCE BASE LEVEL SUPPLY SYSTEM

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20 September 1972

UNITED STATES AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

R

116

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
Air Force Institute of Technology, School of Systems and Logistics	2b. GROUP

3. REPORT TITLE

The Development of Performance Measurement Standards for the USAF Base Level Supply System

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Thesis

5. AUTHOR(S) (First name, middle initial, last name)

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6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
20 September 1972	~~129~~ 116	55

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO.	SLSR-12-72B
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Publish and distribute under Provisions of Statement A, unlimited distribution. (DDC,AFR 80-45)

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Cleared for public release IAW AFR 190-17.	JERRY C. HIX, Capt, USAF Director of Information

13. ABSTRACT

The System to Automate Logistics (STALOG) study group has been formed to develop an integrated base level logistics system. This research effort is directed toward evaluating the current status of the supply performance measurement system. The current lack of a standard package of measurement areas for base supply is not conducive to optimal management at base level. The Delphi technique was tested to ascertain its effectiveness in identifying measureable areas to determine effective support to aircraft maintenance. A consensus was obtained on seventeen measureable areas from a panel of maintenance and supply experts. The use of the Delphi technique and its limitations are discussed.

KEY WORDS:

Delphi Technique

Measurement Methods

Performance Indicators

STALOG Study Group

Supply Performance

DD FORM 1 NOV 65 1473

I-A

Security Classification

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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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I-C

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and approved in an oral examination, has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

Date: 15 September 1972

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ACKNOWLEDGMENTS

No research effort can be successfully accomplished without the patience, understanding, and assistance provided by the research advisor and the families of the researchers. This particular thesis is no different. Therefore, particular credit and thanks must be extended to our research chairman, Major Alan Goldstein and our wives, Linda and Robin. The patience of our families is even more significant in view of the fact that our year before AFIT entrance was spent in Vietnam.

Finally, a thank you to Mrs. Joyce Clark for her impeccable professional typing of this thesis and our other papers.

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CHAPTER I

INTRODUCTION

Background

The Air Force has initiated a study to determine the optimum base level logistics system to support the weapon systems and force structure in the 1975-1985 time frame. The System to Automate Logistics at Base Level (STALOG) Study Group was given this task. (42:2) The STALOG study was a direct result of Department of Defense (DoD) Directive 5126.43, "DoD Logistics Systems Planning," which calls for a Logistics System Plan to complement the Five Year Defense Program (FYDP). (53:1) As the FYDP's purpose was to integrate the Planning, Programming, and Budgeting systems, so must the Logistics System Plan integrate the functional logistics areas. The necessity for integrating the logistics functions was a primary element of the Blue Ribbon Defense Panel Report. It stated: "There is substantial room for improvement and greater integration of management throughout the supply, maintenance, and transportation systems of the Department." [italics mine] (33:1) Past advances in

management approaches to logistics functions, particularly at base level, have been developed in a functional vacuum. This has caused many system redundancies. In the current environment of stringent budgetary controls and complex weapon systems requiring world-wide support, it is imperative that a fully integrated logistics system be developed with maximum cost effectiveness. Currently, the Air Force is operating or developing separate systems in each logistics area. These consist of the Standard Base Supply System (SBSS) with its own dedicated UNIVAC 1050-II computer system, the Maintenance Management and Information Control System (MMICS), the Transportation Integrated Management System (TRIMS), and the Customer Integrated Automatic Procurement System (CIAPS). Total integration of these base level systems is necessary to improve the over-all logistics function. Each of these separate systems has played a major role in the vast improvements made in the logistics area. However, the continuing advancements made in management science and computer systems now provide the framework necessary to develop a truly integrated, cost effective logistics system. This framework, as viewed by the authors, is a systems approach to the management of the integrated logistics function.

A review of available literature indicates a proliferation of information concerning the systems approach to management, management information systems, and management control systems. In

recent years, the literature has increasingly indorsed viewing the organization as a system.

> A system is an organized or complex whole: An assemblage or combination of things or parts forming a complex or unitary whole. (26:110)

The entire organization may be viewed as a complex interrelationship of subsystems performing their function within the total system framework. Webster defines the word system as, "An aggregation or assemblage of objects joined in regular interaction or interdependence; an orderly working totality." (54:2322) The emphasis in the definition is on the interrelationship of the parts of a system or organization. These relationships were first set forth by a biologist, Ludwig von Bertalanffy, and classified by Kenneth Boulding in his article, "General Systems Theory: The Skeleton of Science." (5:197) Numerous authors have since developed the framework of general systems theory. This theory and its approach provides the process for accommodating the complexity of the modern organization. The trend of applying the systems approach to management is certain to accelerate. (31:4-5) The synergistic characteristic of the systems approach is to achieve the simultaneous action of separate, but interrelated parts producing a greater effect than the sum of the effects taken independently.

Although the military has traditionally managed along functional lines, they have found the systems theory of management to be

a useful approach to the solution of many of its problems. (34:10) Nonetheless, the major management theory applied by the military remains functionally oriented. (27:20) This view can be attributed, in part, to the increasing specialization of all organizations, not just the military, and has resulted in the failure to interrelate the functional areas of an organization into a unified whole. The management of a system or organization essentially involves the input of resources, the transformation of these resources to an output as a result of organizational processes, a control methodology to direct the system process and an information system to provide the necessary information to integrate all the organizational elements. This last item makes the operation of all other elements possible. (31:30)

The management information system provides an integrating role in the organizational environment by providing: (a) information on resource systems (money, men, material, facilities and machinery) utilization; (b) a means to evaluate the resource systems; (c) historical data on the decision processes of the resource systems; and (d) output information on a routine or exception basis that reflects the operation of the resource system and the management information system. (31:158) The development of a management information system to control a business or firm is not a new concept. The concept has undergone significant change from a firm controlled and owned by one man where all the necessary data was maintained in

simple ledgers or in his head, to a complex computer oriented information retrieval system. In either case the information system provides information to assist in the decision making process.

The requirements of any management information system must be based upon answers to the following questions:

a. What information is really required?

b. How often is it required?

c. Who needs the information?

d. How is the data best collected?

e. What is the required output report format for the information?

f. How can the data be summarized for different levels of analysis? (10:24)

Finally and most important perhaps, does the cost of the information collected, summarized and output justify the increased effectiveness gained from such a system?

"Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of an organization's objectives." (3:306) The development of a management control system must be considered an integral portion of any organization. The management information system may be utilized as a basis for developing control mechanisms or to indicate variances of a given unit's effort compared to the planned

activity. (29:28-30) Management controls are involved in a continuing process of planning, operating and reviewing action versus planned outcomes. The control functions embrace all activities or operations directed towards attaining a desired end. "It involves objectives, planning, and appraisal." (29:32) With rare exceptions the management control system is built around a financial structure and as a result, resources and outputs are expressed in monetary terms. (3:307)

The management control system is a coordinated integrated system. However, it can best be described as a set of integrated subsystems which may include a production system, financial accounting system, a personnel system, an inventory system, etc. Each segment of an organization may be measured by several different systems, but each has the objective of providing a resume of actual operations. (3:306-307)

Evaluation of an organization's activities is done by a management control system collecting data, summarizing the data, comparing the information obtained and analyzing the information against predetermined standards. These standards have been set on an exception basis and generally only desire to measure performance varying from established standards. These variances detect out-of-tolerance activities and normally require further review by the manager to determine the reason which caused the variance.

Thus, organizations are often managed on an exception basis, reviewing those areas not progressing in accordance with previously set objectives. Exceptions are not only danger signals; they may also display opportunities or outstanding performance. (4:31) The main advantage of managing by exception is the avoidance of overmanaging some areas at the expense of other areas which do require management attention. Management by exception can accomplish the following:

a. Save personnel time.

b. Concentrate management efforts on problem areas.

c. Lessen the frequency of decision making.

d. Make fuller use of available data.

e. Obtain higher manager utilization.

f. Identify crises and problem areas.

g. Provide qualitative and quantitative measurement of people.

h. Enable inexperienced managers to handle new assignments with a minimum of experience and training.

i. Encourage a more comprehensive knowledge of all phases of an operation.

j. Stimulate communication between different segments of an organization. (4:9-10)

There are dangers, however, in utilizing the management by

exception principles. These include complacency, the tendency towards proliferation of paperwork, the assumption of an unnatural stability in an organization, the tendency for standards of comparison to become outdated, and the fact that some factors in an organization are impossible to measure. In addition, the principle of management by exception requires a comprehensive observation and reporting system, and standards on which exceptions are based must be updated periodically. (4:12-13)

Problem Statement

A requirement currently exists within the Air Force for the development of an integrated management control system to improve the over-all management and operation of the base level logistics functions of Supply, Maintenance, Transportation and Procurement. An essential element of any effective control system is the presence of meaningful and realistic standards. Within the supply area, standards must be developed to measure intra-supply activities as well as interfaces with other logistics functions. Specifically, this thesis will address the activities of the Standard Base Supply System (SBSS) and attempt to develop a methodology for establishing standards. The principle management doctrine used will be management by exception.

> Management by exception, in its simplest form, is a system of identification and communication that signals a manager when his attention is needed; conversely it remains silent when

> his attention is not required. . . . The primary purpose of such a system is, of course, to simplify the management process itself, permit a manager to find the problems that need his action and to avoid dealing with those that are better handled by subordinates. (4:5)

Without proper standards, a control system cannot be effective in this environment. The immediate problem is to determine (1) what activities require standards, (2) what type standards are appropriate, (3) what information the manager requires to determine if the standard is being met, and (4) what data must be collected and how it must be processed to provide the manager this information. The solution to these problems should allow the manager to concentrate his attention on selected reports to control the supply function in the most cost effective manner.

Scope

This thesis was limited to the management control needs of base level logistics managers. The interaction of the base supply activity with numerous agencies beyond the base environment, such as the Advanced Logistics System (ALS), cannot be ignored by a systems approach; however, emphasis was placed on building a methodology by using a single objective of the Base Supply System, support to aircraft maintenance.

Objective and Research Questions

This thesis had three primary objectives. These were (1) to

describe the current environment existing in the Air Force base level supply system, (2) to determine those areas where supply standards will be required in a base integrated logistics system, and (3) to develop a methodology for establishing standards. The over-all goal to be accomplished is to develop a methodology to identify critical area measurements that will provide base level managers the necessary information to control the supply system in the most cost effective manner. A secondary goal will be to identify the type of measurement to be used and the level which should receive the information at base level. The following research questions were used to guide the authors toward the over-all objectives.

1. What is the environment in which the existing base level supply system functions?
2. Are the existing supply management standards sufficient to control the supply function?
3. In what areas will supply standards be required for a base integrated logistics system?
4. Can a methodology be developed to identify areas where supply standards are necessary and to establish specific standards in a base integrated logistics system?

CHAPTER II

EVOLUTION OF THE SUPPLY SYSTEM

The Supply area was the first Air Force logistics function to design and implement a fully standardized, computerized system. This was a natural evolution primarily caused by the world-wide deployment of forces, increasing complexity of weapon systems, and continuing budgetary restrictions.

> In the early 1950's, more sophisticated weapon systems began phasing into the Air Force inventory, bringing with them increasing complexities of supply management. . . . This provided the impetus to the evolution of supply management from its World War II status to the current posture of highly automated processes. (17:56)

Twenty years ago the Air Force supply system was a completely decentralized, manual accounting system. Although some innovative improvements had been instituted, it was essentially the same system inherited from the Army. Each base unit had its own supply section which dealt directly with the single base supply agency for support.

As the Air Force grew, it soon became obvious that a manual, decentralized supply system was inadequate. Steps were necessary to improve the efficiency of the base level supply organization. The early actions were characterized by accounting and reporting

improvements instituted by each Major Air Command (MAJCOM). From this grew a myriad of incompatible automated accounting systems at base level to manage the inventories. At many locations, several base organizations jointly used the computer, and supply was granted a low priority. Although many base functions were standardized during the 1950's, no attempt was directed at supply. The lack of specific guidance from Air Force headquarters resulted in each MAJCOM developing the best possible system to suit their mission. (37:3-46) This was progress, but it lacked for central control or standardization outside the MAJCOM environment. Some of the unfavorable aspects of this movement were: (1) constant changes in training requirements, (2) inability to develop standard manning factors, (3) a myriad of management reports with no specific performance measurement standards, and (4) no real-time updating of supply inventory records.

The next step in the evolution of the Air Force supply system was directed toward a standard base computer system and companion organization. (37:3-47) The key element of the new system was standardization. During the late 1950's and early 1960's, the developers worked hard to provide standardized hardware and software in conjunction with a complete new organization. The primary objectives of this system were:

a. An automated management system which, under

program control, would respond instantaneously and fully to all transactions as they occurred.

b. A flexible capacity to support Air Force missions and other responsibilities designated by the Joint Chiefs of Staff and DoD.

c. Compatibility of data links between electronic supply systems, Air Force, and DoD communications transmission systems.

d. Reduce the need for systems analysis and design by minimizing the number of supply system design agencies.

e. Provide greater discipline in enforcing supply policy.

f. Provide more expedient, capable, and efficient control in updating and modernizing automated supply/equipment procedures.

g. Develop standard training courses which enable supply personnel to perform effectively at automated bases in any command.

h. Standardize manning criteria for automated inventory control functions.

i. Standardize reporting of operational effectiveness data for management review at major command and Headquarters Air Force/DoD levels.

j. Standardize management data for all levels of management.

k. Provide accurate and timely management data for budget and buy programs.

l. Minimize the use of external files. (51:1-4)

Under the auspices of the Air Force Supply Systems Design Office, this program was brought to fruition in early 1964. This system has brought about large scale improvements to the base level supply operation. One area has, however, remained unsolved. That is the heart of a management control system, standards. Although many attempts have been made, no set of standards has been developed to assist the base manager to control the supply function. This is a vital part of any management system, especially in view of an integrated logistics function at base level.

Current Management Control System

The proliferation of standards within the SBSS has followed the same pattern of development as did the different supply computer systems during the 1950's. Each Major Air Command has developed specific areas of measurement with corresponding standards or goals to measure the different aspects of supply performance. Although there had been continuous discussions and studies concerning the need for a standard set of performance measurement indicators, these have never been developed. The primary reason for this failure has been the lack of agreement between logistics personnel as well as the major commands concerning what should be measured and what standards should be applied. Thus, a proliferation of formal and informal standards have been developed by each individual command down to and including base level managers. These are not standardized to any

substantial degree and reflect, in part, individual opinions of what should be measured. This is not intended to judge the merits of these many measurement areas, it is simply to point out that while the SBSS has been standardized throughout much of the Air Force, there still has been no determination of what standard measures should be provided management to assist them in their decision making process to control the system. The current management control system of the SBSS is perhaps best described by a statement made by Russell Ackoff, Professor of Statistics and Operations Research, University of Pennsylvania, in his article entitled "Management Misinformation Systems."

> Most management information systems are designed on the assumption that the critical deficiency under which most managers operate is the lack of relevant information. I do not deny that most managers lack a good deal of information that they should have, but I do deny that this is the most important informational deficiency from which they suffer. It seems to me that they suffer more from an over abundance of irrelevant information. (1:B-147)

One objective of the SBSS, implemented in the early 1960's, was to provide a standardized package of management data. (28:1-4) The reports were standardized but the final job of identifying the critical areas to measure to indicate effective supply support, what specific standards should be assigned, and what level of management should receive the information was never accomplished. This situation was confirmed in an interview with an individual who was a part of the SBSS development team. In answering the question by one of the authors

concerning the consideration given to the development of a standard package of management control indicators, he stated this was a consideration. However, due to the lack of consensus of what this package should contain and the refusal of the Air Staff to commit themselves, a standard package was not included. Instead, everyone's ideas were included to the extent possible and statistics on these areas were programmed to be gathered and output at specific times. The M-32, Monthly Supply/Equipment Management Data Report, is a good example of this approach. It is one of the world's greatest collections of statistics--an attempt to satisfy everyone. Major commands were given the task to dictate corresponding standards as necessary to their bases. (35)

The fact that the SBSS management control system did not satisfy everyone is well documented. A review of the basic measurable areas published by each Major Air Command, to provide statistics on base performance, reveals 65 separate measurable areas of which only 2 are common to all. A listing of these areas is identified in Appendix A. Many of these measurement areas are related, but are measured in different ways. Also, in addition to the many standard computer programs available to provide selected readouts of data for special reviews, you can find numerous major command special programs developed for additional measures not covered by the standard system. These are changed periodically. What is the effect of this

unstable method of measurement? The TIG Brief made a statement which covers this aspect very well. It said,

> Command changes in requisitioning and reporting procedures results in confusion, breaking of standards, misdirected resources, and a compromise of an essential management tool throughout the Air Force. (43:10) [italics mine]

The lack of firm guidance from Air Force headquarters had led to this situation. The only measurement accomplished at this level is done by the Air Force Data Systems Design Center (AFDSDC) who publishes a monthly report entitled, "USAF Supply Management System --20 Selected Items." (48) This report is simply a ranking of all SBSS bases in each of the 20 areas with no standards established. In addition, this report is not published and distributed until one to two months after the period in which the data was collected. This same problem exists for most major command summaries. None of these systems meet the requirements of a mangement control system; that of providing managers information on which to base decisions necessary to assure resources are obtained and used effectively and efficiently in the accomplishment of an organization's mission. (3:306) Further, the one characteristic of a management control system is to provide data to managers that is timely, understandable, useful, economically measurable, and pointed toward the accomplishment of organizational objectives. These objectives have not been met in the current SBSS. The only established goal of the SBSS, iterated in AFM 67-1, is that of delivery time. (51:8-20) This standard is perhaps the

only one which is not measured by the Univac 1050-II automatically and is one which is affected by so many variables (distance, availability of vehicles, etc.) that it is virtually useless as a standard.

As previously noted, many attempts and approaches have been made to develop a standard set of measurable areas and related standards. The authors feel this is necessary especially at the organizational levels of the Chief of Supply, Chief of Maintenance, and Director of Logistics. The main reason this has not been accomplished is due to the inability of major commands and logistics personnel to agree. If the integrated base level logistics system is to become a reality, there must be a way for the base functional managers (Chief of Supply, Chief of Maintenance) and the Director of Logistics to know how well their subordinate functions are performing their mission. For example, all three of the mentioned managers must know how well supply is supporting aircraft maintenance. Another area which has not been addressed is the question of whether or not the support provided is cost effective.

To summarize, the current system has no set of standard measurement areas to indicate how well the system is supporting its assigned objectives. A proliferation of areas are currently being measured by all levels of command, but no consensus on what is important to whom has been established due to a diversity of opinion. In view of this situation, this thesis is a research effort to test a new

approach to identify these areas that are essential to base level managers. This new approach, the Delphi technique, by using a group of functional experts, attempts to overcome command parochialism and acquire a consensus of these experts as to what areas are critical to effective support.

CHAPTER III

METHODOLOGY

This chapter will describe the research plan and the methodology used in the study. The first two research questions were answered through literature review. By tracing the historical development of the base level supply system, an understanding of the current environment was acquired. This review also revealed the basic mission and objectives of the base level supply system which allowed the categorization of supply performance measurement standards. Specifically, once an objective was identified, such as support to aircraft maintenance, a hierarchy of standards was identified which pertained to that specific area. This method allowed a matching of current standards against the primary objectives of the organization. The second research question was also answered by a thorough literature review.

Although there had been continuous discussions concerning the need for a standard set of performance measurement standards, these have never been developed. The primary reason for this failure has been the lack of agreement between logistics personnel as well as the

major commands concerning what should be measured and what standards should be applied. Thus, a proliferation of formal and informal standards have been developed by each individual command and by base level managers. These are not standardized to any degree and reflect, in part, individual opinions of what should be measured. One objective of the standard supply system implemented in the early 1960's was to provide a standardized package of management data. (51:1-4) The reports were standardized, but the final job of identifying what is important was never accomplished. Also missing in the current system is the ability to pinpoint specific critical areas existing between base level logistics functions. In view of the Air Force goal to devise an integrated logistics system at base level, these interface areas would appear to be of critical importance to future logistics managers to allow effective control of the logistics elements.

In Chapter II a discussion was made of the numerous command criteria used to evaluate the present base level supply system. It was noted that no common set of criteria had emerged or been established by Headquarters USAF for evaluation of the supply system. In addition, no consensus as to what the supply management indicators should be has been achieved through conferences, study groups or other methods. To preclude a repetition of the historical disagreements between individuals and between commands concerning standards, the authors selected a unique approach to answer research questions three and four. This approach was the Delphi technique.

The Delphi technique seeks to induce opinion convergence through a sequence of questionnaires using controlled feedback to the participants. This technique allows selected experts to express their ideas via questionnaires. Once initial ideas are expressed, additional questionnaire iterations obtain specific opinions and rationale in light of the opinions of others in the group. The entire process has been described as one of "cybernetic arbitration." (20:3) From this exchange a well-rounded, relevant consensus is obtained. The goal is the best of expert opinion. Norman Dalkey has stated, "By collecting judgments, we simply push expert opinion a little closer to hard fact." (20:3)

The Delphi technique has proven highly effective in eliminating the undesirable aspects of committee activity and reduces the influence of certain psychological factors, such as the unwillingness to abandon publicly expressed opinions, dominance, noise and group conformity. (14:14) This is the primary reason the authors selected the Delphi technique. If the factors described above, which would be present in a committee/group attempting to establish common supply standards, could be eliminated, a resultant consensus of what the standards should be could be anticipated. Generally, the intragroup social phenomenon that occurs has been described and verified by a number of researchers. Soloman Asch, a noted psychologist, in his studies on social conformity noted significant tendencies of individuals to conform to group standards or opinions in spite of strong individual pressure to resist. Once a

number of individuals begin to conform, the remainder of the group will tend to go along with the group. A "band wagon effect" is created. (36:42, 19:226-228) The authors can in no way hypothesize what forces were present in groups developing supply standards. The above factor and the ones that follow have been found to be present in group decision processes by various researchers. The degree or strength of the factors would most likely vary greatly from group to group.

The most dominant individual in a group may "force" his opinions on a group or other group members may submit to his opinions. (25:235) Dominance can result from social ranking within a group or an external ranking structure brought into the group. (18:318) The person who can merely endure the longest in an argument may also achieve group dominance. The stature of a person in a specific field of endeavor may result in his dominating members of a group. The Oriental and Occidental tradition that age brings wisdom and knowledge could easily induce dominance in a group situation. There is also evidence that the mere perception of the existence of a hierarchy sets up restraints on communications in a group situation. (18:321) In effect, ideas or free expression of opinions are reduced by dominance.

Noise in a group can distort the achievement of group objectives. (23:47) Noise in this sense implies a sound or distortion of opinion with no relevancy which inhibits progress towards group goals. (54: 1533) The interjection of opinions which have no merit or foundation create a noise factor which may detract from group goals. Noise can be

introduced by the result of differences in perception of what is being stated and what is heard by members of a group. Noise can also occur in a group when a person makes a statement, and it is ignored by the individuals in that group. (25:239) Attempts to reduce noise may in themselves add additional barriers to the communications processes in groups. (22:246) Therefore, it would seem logical if one desired to avoid the noise difficulties in a group process, a technique should be utilized which would avoid or substantially reduce the factors which provide the impetus to the growth of noise. The Delphi technique provides this means.

The importance of intragroup aspects eliminated by the Delphi technique have been stressed by a number of authors (Bright and Fullmer). In a personal interview with Ralph C. Lenz, a noted authority on technological forecasting and the use of the Delphi technique, by one of the authors, Mr. Lenz stated that he felt the intrapersonal aspects of group activity were the most important to overcome in using forecasting techniques. The Delphi technique overcomes these factors to a substantial degree. (28) The Delphi technique alleviates the group factors of dominance, noise and conformity by the use of anonymity, controlled feedback and statistical group response. (14:16) Thus, the method falls somewhere between individual and group action. (13:9)

Perhaps the most critical portion of the data collection process was the selection of experts and the development of the questionnaire to be used. Due to the time constraints of an academic environment, this

thesis was limited to only one objective of the base level supply system. The area selected for this research was supply support of aircraft maintenance. An assumption was made that if the Delphi method could be successfully employed to identify critical areas of measurement and establish corresponding standards for support of aircraft maintenance, then the adopted methodology could be used to identify critical measurement items in other areas.

As previously mentioned, the selection of experts was crucial to the success of the Delphi technique. Two groups were selected, composed of supply experts and experts from the maintenance career field. The following criteria were used as the basis for selection.

a. Stature of the individual in his career area.

b. Breadth of experience in the career area.

c. Degree of varied assignments with different major commands.

d. Level of assignments from base, major command, and Air Force levels.

For example, only individuals who had served with at least three separate commands, and had been assigned to at least two levels of organization were chosen. The adherence to these criteria in the selection process provided a knowledgeable response. The supply experts were selected by the authors with assistance from the STALOG Study Group, Headquarters USAF. The STALOG Study Group, in coordination with Air Staff Maintenance personnel selected the

maintenance experts based on the aforementioned criteria.

In opinion samples, surveys, or polls an essential element to draw statistically valid conclusions for the population as a whole is that the selection of persons surveyed must have been done in a random manner. There appears to be sufficient evidence that most surveys are never really random, thus inducing a bias into the results of a poll or sample. The results cannot withstand rigorous statistical examination. In addition, in practice small advisory groups are never selected at random out of a potential pool of experts. (6:7, 14:12) By using the Delphi technique, the difficulty in justifying a random selection of experts was avoided. Another critical area was the size of the group of experts. Our initial group was composed of 35 personnel. Statistics based on the use of the Delphi technique by the Rand Corporation indicated that group size ranging from 10-15 was an optimal size. (14:10-14) To insure that a group of this size could be maintained for the life of the study, the initial selection of 35 was decided on. After the selection process was completed, a letter was sent to each selectee providing him with a full explanation of the research project. A copy of the letter is provided in Appendix B. The initial questionnaire to the group of experts was designed to be openended. This approach was intended to permit the experts complete freedom to identify what areas within an objective of the supply system should be measured. A copy of the initial questionnaire is contained in Appendix C. Respondents were specifically asked not to feel constrained by present

systems. Once the initial response was received, an analysis of the responses was performed. Those areas identified by more than one respondent were included in development of the second questionnaire. However, other items considered by the authors to have merit were also included to assure that the broadest spectrum of expert judgment would be included in subsequent rounds. Those areas which did not achieve a consensus were combined into the second questionnaire. This questionnaire provided a convergence of opinion for a set of areas to be measured.

An important aspect of the data analysis was the design of the follow-on questionnaire. Requestioning was designed to eliminate misinterpretation of questions and feedback and to bring to light knowledge available to one or a few group members but not to all. (9:68) Here the researchers were required to use their knowledge gained through the literature review and extrapolate the relevant data from the unstructured questions. In this regard, every effort was made to prevent any bias from entering into the construction of the second questionnaire. A copy of the second questionnaire is provided in Appendix D.

This methodology was used to answer the four research questions pertinent to our objectives. To reiterate, questions one and two were answered by literature review and three and four by the Delphi technique. The questions were:

a. What is the environment in which the existing base level supply system functions?

b. Are the existing supply management standards sufficient to control the supply function?

c. In what areas will supply standards be required for a base integrated logistics system?

d. Can a methodology be designed to develop meaningful supply performance standards for use in a base integrated logistics system?

Analysis of Responses

The objective of the Delphi technique is to obtain a consensus of expert opinion. To determine a consensus, the mode response was chosen as it is the response which occurs most often. (14:20) Explanations or analysis have been included for each consensus opinion where appropriate. In addition, the authors were substantially concerned that views which indicated that significant thought had been given to an area of measurement and yet did not achieve a clear consensus should receive attention. These opinions are included in the analysis. Robert Fullmer, a professor of Management at Georgia State University, has stated that the polarization of opinion at more than one point may indicate there are two schools of thought on a subject as a result of different interpretation of data, experience, knowledge, etc. In this case the Delphi technique serves a purpose by

crystallizing the reasoning process while identifying and clarifying major alternatives. (20:4) The analysis of questionnaire results and consensus obtained are delineated in the next chapter.

CHAPTER IV

ANALYSIS OF DATA

The procedure used to evaluate the data received from the panel of experts was primarily subjective. Although specific agree or disagree questions were used in the second questionnaire, respondents were still given the latitude to comment on any area. Although a consensus was obtained on all 17 areas, there appeared a group of opposing experts who provided comments which were of such value that they could not be ignored. Therefore, the convergence of opinion normally associated with the Delphi technique actually, in several instances, provided a polarization of opinion. Whether further iterations would overcome this action is pure conjecture. The time constraints of the academic environment precluded any further iterations. Therefore, a limiting factor in this test of the Delphi technique is time. Another possible factor which cannot be measured is the degree of effort observed on questionnaires. Many respondents were liberal in their comments justifying their selections while others gave no rationale at all.

The analysis performed in this chapter is accomplished in three

parts. These are (1) an analysis of the determination of measurable areas, (2) an analysis of the type of measurement to be used, and (3) an analysis of the levels of management who should receive the information emanating from each area. As previously mentioned, this analysis applies to a single objective of the base level supply function, that of providing support to the aircraft maintenance function.

Determination of Measurable Areas

As outlined in Appendix C, the first questionnaire was entirely open-ended. The respondent was not constrained in any regard with the possible exception of time. The pertinent information requested was simply what information would he require to allow him to determine the effectiveness of supply support to aircraft maintenance. Table 1 provides the number of responses received from the initial 35 questionnaires mailed, by command of assignment.

TABLE 1

RESPONDENTS TO 1ST QUESTIONNAIRE
BY COMMAND OF ASSIGNMENT

Command of Assignment	Number Mailed	Number Received	% Received
Hq USAF	4	3	75%
DSA	1	1	100%
AFLC	5	4	80%
AFSC	3	3	100%
ADC	4	3	75%
AU	3	1	33%
MAC	3	1	33%
SAC	5	2	40%
TAC	3	3	100%
PACAF	4	3	75%
TOTAL	35	23	65.4%

Table 2 provides the number of responses received from the initial questionnaires mailed, by type background.

TABLE 2

RESPONDENTS TO 1ST QUESTIONNAIRE
BY BACKGROUND

Background	Number Mailed	Number Returned	% Returned
Maintenance	10	5	50%
Supply	25	18	72%
TOTAL	35	23	65.4%

The results depicted by the above two tables indicate the wide range of respondents by background and command of assignment.

A rigorous evaluation and tabulation of responses received on the first questionnaire was performed and used to construct the second questionnaire. The second questionnaire (See Attachment D) provided each participant with a list of the measurement areas developed through the first questionnaire along with the rationale that was given in support of measuring each area. He was then asked to indicate his agreement or disagreement. The methodology used to determine the applicability of an area for further consideration was a combination of the number of respondents mentioning the area and the judgment of the authors where an area was mentioned less than three times. Further, the second questionnaire explored two additional facets of the problem, those of the type of measurement and the level of management that should receive the information.

Table 3 provides the number of responses received from the second 27 questionnaires mailed, by command of assignment.

TABLE 3

RESPONDENTS TO 2ND QUESTIONNAIRE
BY COMMAND OF ASSIGNMENT

Command of Assignment	Number Mailed	Number Returned	% Returned
Hq USAF	3	2	67%
DSA	1	0	0%
AFLC	5	4	80%
AFSC	3	1	33%
ADC	3	3	100%
AU	3	2	67%
MAC	1	1	100%
SAC	2	0	0%
TAC	3	3	100%
PACAF	3	1	33%
TOTAL	27	17	63%

Table 4 provides the number of responses received from the second 27 questionnaires mailed, by background.

TABLE 4

RESPONDENTS TO 2ND QUESTIONNAIRE
BY BACKGROUND

Background	Number Mailed	Number Returned	% Returned
Maintenance	6	6	100%
Supply	21	11	52%
TOTAL	27	17	63%

Using the definition of consensus as being more than 50% of the respondents agreeing, a consensus was reached for all 17 areas. These

areas and the percent of consensus reached on the questionnaire are provided in Table 5.

TABLE 5

LIST OF MEASURABLE AREAS AND PERCENT OF CONSENSUS BY QUESTIONNAIRE

Area of Measurement	Percent of Consensus		Difference in Percentage
	1st Iteration	2nd Iteration	
Not Operationally Ready - Supply (NORS)	78%	76%	-2
Base Repair	87%	71%	-16
Bench Stock	61%	100%	+39
Cannibalization	26%	82%	+56
War Readiness	22%	71%	+49
Engine Status	4%	71%	+67
POL	9%	65%	+56
Delayed Discrepancies	17%	71%	+54
Delivery Time	22%	71%	+49
Fill Rate	39%	76%	+37
Depot Backorders Exceeding Milstrip	26%	71%	+45
Backorder Cancellation by Organizations	9%	53%	+44
Fund Status	26%	71%	+45
Percent Priorities	13%	65%	+52
Inventory Accuracy	13%	65%	+52
Percent Equipped	9%	76%	+67
Zero Balances - Mission Aircraft	9%	71%	+63

As can be seen in Table 5, the percent of consensus obtained was significantly increased in the second iteration in all but two cases. These two, Not Operationally Ready - Supply (NORS) and Base Repair actually decreased by a small margin. Two polarized views were

obtained on each of these areas. Each area is discussed below as to its exact meaning and specific comments determined appropriate by the authors.

a. NORS. The measurement of this area created the strongest in-depth response from respondents. Over 80% of all respondents expressed views on this area of measurement. This area of measurement is to provide the percentage of aircraft nonavailability due to a lack of supply support. The majority of respondents attacked this area regardless of whether they agreed or disagreed with it as a measurement area. The general consensus was that it must be changed to be a valid indicator of supply support. The most significant criticism was that NORS was not a single measure of supply support, but a measure of the effectiveness of the entire logistics system. Factors such as transportation, base repair capability, and depot response play a large role in affecting the NORS rate. The second largest criticism concerned the magic aura of the rate. Several respondents pointed out the futility of the rate. Comments concerning the rate indicated (1) that NORS rates can only flag possible problems somewhere in the logistics spectrum; (2) that cause codes can provide a meaningful area to analyze; (3) that over emphasis on rates instead of causes does little to solve basic problems; (4) that variable standards are required to discern between mission and support aircraft, density of assigned aircraft, base repair capability, type of missions flown, etc.; and (5) the concern with maintaining the low rates at all costs by whatever means,

is directly related to our decreasing spares budget. In summary, there is basic agreement by all respondents that a measure of supply's contribution to maintaining an operational aircraft fleet is necessary. On the other hand, there is also agreement that a better means must be developed to measure this area to provide meaningful information on which managers can base decisions to correct problems. Although the current NORS rate is supposed to measure supply's contribution to the operationally ready (OR) rate, there is much concern that this is not so. As one respondent stated, "What can a base level manager do about an unsatisfactory NORS rate? Nothing, because it is beyond local control. . . . extraordinary action is called for each time a NORS occurs, not when the rate is computed."

b. Base Repair Program. This measurement area is geared to measure the base's ability to support itself by repairing assets, thus saving procurement and transportation costs. Most respondents who disagreed with this area as a measurement of supply support to maintenance did so because, like NORS, it is an area which requires the support of all base logistics functions to be successful. As was discussed in the NORS area, base repair must be evaluated as a system or entity and not in one functional area as supply. This indicates that certain elements should be identified that adversely affect the over-all base repair capability and then be measured and evaluated by a manager with control over the responsible base logistics functions involved.

The supply areas of delinquent due in from maintenance (DIFM), awaiting parts (AWP) status, and not reparable this station (NRTS) codes reflecting non repair due to a lack of supply support are valid indicators of supply's contribution to the over-all program. Rates exceeding standards in these areas are valid indicators to require management attention. A final consensus of 71% was received in this area.

c. Bench Stock Support. As is shown in Table 5 the percent of replies during the first round indicating that bench stock support was a measure of support to aircraft maintenance was 61%. During the second round 100% concurred. Clearly, there is a true consensus that this is a measurement area which is a valid indicator of supply support to aircraft maintenance. It was the only measurement area which achieved a unanimous agreement. Nonetheless, a number of respondents provided comments which not only were considered important, but showed a great deal of difficulty still remains as to how this area should be measured. This will be discussed at a later point.

d. Cannibalization. Only 26% of the respondents during the first round indicated this to be an indicator of supply support to aircraft maintenance. However, a significant shift occurred during the second round, and 82% agreed with this area. A consensus was considered achieved on this factor. Those respondents providing comments as to why cannibalization was an indicator of supply support included:

(1) The cannibalization rate is an indicator of both

maintenance and supply effectiveness and how well maintenance and supply work together.

(2) The cannibalization rate is an indicator of the effectiveness of the base repair program.

(3) The assurance that cannibalizations are truly necessary by insuring that items are not in stock, the item cannot be repaired and reinstalled prior to a scheduled mission, no like reparable can be made serviceable to fill the requirement, and lack of the item would cause a NORS condition.

(4) The judicious use of cannibalization could be used to provide temporary relief from supply support difficulties but must not be excessive nor used to cover the lack of supply support.

The analysis of cannibalization reason codes can in itself be a measure of supply support. One respondent indicated cannibalizations were an indicator of Air Force Logistics Command (AFLC) support.

e. War Readiness Material. This area is concerned with measuring the effectiveness of supply support to enable aircraft maintenance to fulfill a wartime/deployment mission. Since this area is not one that normally affects the day to day operation, some respondents did not consider it applicable. The area was attacked primarily as regards abusing the assigned priority in obtaining normal operating requirements. Over-all, when viewing the support of War Plans and deployments, this area can be considered a critical measure of supply support to aircraft maintenance. The development of agreement from

22 to 71 percent indicated the importance of the area.

f. Engine Status. This measurement area was originally structured to include engines on hand versus authorized by type, condition, repair status, and shipping status. Those respondents disagreeing were primarily concerned that this area was controlled at higher than base level,and there was little the base manager could do to institute change or control. Over all, the respondents were in favor of this measurement area with supply support being measured on its ability to provide spares to support the base repair capability.

g. Petroleum, Oil and Lubricants (POL) Support. A fairly low percentage of consensus was obtained in this area. Further, comments of respondents as to why they were for or against this measurement area were few. Although the percent of agreement increased from 4 to 65, several respondents felt the area was important, but not specifically to indicate support to aircraft maintenance. In general, POL is not in support of aircraft maintenance, but to the over-all base flying mission. After reviewing the results of the questionnaires and supporting comments, the authors agree that POL support is a valid measurement area, but perhaps it does not belong in the group that indicates effective supply support to aircraft maintenance.

h. Delayed Aircraft Discrepancies. Delayed discrepancies on aircraft due to a lack of parts was considered important by 71% of the respondents. It appeared that many respondents were somewhat emotional since the area is historically one of the "name calling" areas

between supply and maintenance. Arguments were presented on both sides concerning whether this condition was more a maintenance or supply shortcoming. However, the general feeling was that to some extent it did indicate a lack of parts to fix the aircraft. Therefore, it would be a measure of importance to base level managers.

i. Delivery Time. During the first iteration, 22% of the respondents indicated delivery time as a valid indicator of supply support to aircraft maintenance. In the second round, 71% of the respondents indicated agreement. The respondents who agreed provided no clear rationale for their opinions. Those not in agreement provided the following summary of opinions:

(1) Delivery times should be dependent on the importance of mission priority as the system was intended to be and not as it is presently abused at base level.

(2) Delivery time is dependent on too many variables which include workload demand, distance, weather conditions, and transportation maintenance support provided.

(3) NORS--Late deliveries (NORS-LD) are a better indicator of delivery capabilities. This data is provided through the Air Force Standard Aerospace Vehicle and Status Reports, AFM 65-110.

A number of respondents who both agreed and disagreed indicated all delivery times are subject to a great number of variables.

j. Fill Rates. The results of the first iteration indicated that 39% of the respondents favored the percent of fill as an indicator of supply support to aircraft maintenance. The second iteration results showed that 76% of the respondents agreed. Those who did not agree offered opinions, such as trends were more important than specific fill rates, a cost effectiveness trade off analysis is necessary as to determine whether an item should be stocked on a given set of demands, and fill rates should be based only on those items authorized for stock.

k. Depot Backorders Exceeding MILSTRIP Time Frames. This item was considered as a measure of support from supply sources. The nonreceipt of items by the base level supply activity may result in degraded aircraft maintenance support. Initially, 26% of the respondents considered this as a measure of supply support to aircraft maintenance. After the second iteration, 71% of the respondents agreed. Comments made by respondents indicated this measurement criteria as vital for the measure of support from the wholesale supply levels. A distinction between items shipped and items not shipped must be made. Items shipped and not received are a transportation problem to resolve, but those not shipped remain the depot's problem. The solution to this problem most likely is beyond the control of base logistics personnel. Further iterations might provide a clearer distinction as to the reasons why this item would provide an indicator of supply support to aircraft maintenance. In the authors' viewpoint, this item may provide data to indicate depot support trends which may result in deteriorating supply

support; although, the converse could well be true.

1. Backorder Cancellations by Base Organizations. This item was considered as a measure of supply support to aircraft maintenance by 9% during the first round. As a result of the second iteration, 53% of the respondents considered this item as a measure of supply support to aircraft maintenance. Numerous comments were provided by the respondents. Those in agreement provided the following opinions:

(1) Excessive cancellations cause a considerable portion of base excesses.

(2) Backorder cancellations are an indication of lack of supply discipline and poor maintenance practices.

(3) Much greater emphasis needs to be placed on this measurement criteria in the current base logistics environment.

A number of respondents were adamant in their disagreement. These opinions can be generalized as follows:

(1) It does not measure the level of supply support, but indicates poor utilization of resources.

(2) Organizations should be charged for items ordered and subsequently cancelled.

(3) It is a measure of supply discipline in organizations.

(4) If this item is considered as necessary, then a measure should be made of serviceable turn-ins which were not used by organizations.

(5) The measure of this area would further the adulteration of supply discipline by encouraging the use of the "goody box" for storage purposes. Yet the impact on supply operation and the unnecessary workload caused by erroneous ordering cannot be denied.

m. Fund Status. Respondents during the first round selected this item 13% of the time. During the second iteration, 65% of the respondents indicated this item was a valid indicator of supply support to aircraft maintenance. Most of the comments provided can be expressed as one respondent did. He stated, "Funds management is a vital element of logistics. While poor funds management can adversely affect over-all supply support, measurement of funds status will not improve supply support of aircraft maintenance. The urgent need for effective funds management is recognized. This need is most critical at the organizational level. What we need is a means of measuring the quality of funds management programs. This is not it." Another respondent added that until a metho could be devised to get base level managers involved in funds management of centrally procured investment items, funds management should not be included. The authors felt it significant that throughout their research, the respondents, persons interviewed, and the literature stressed the importance of efficient use of resources and striving to achieve the most return for the dollar spent; yet,so few considered fund status as an important element to be considered.

n. Percent of Priority Requisitions. As a result of the

first iteration, 13% of the respondents indicated this area as an indicator of supply support to aircraft maintenance. The second iteration resulted in 65% of the respondents agreeing. Those in agreement with this measurement criteria offered the following opinions in support of their position. These included:

(1) "High rates of priority 01-08 requisitions are indicative of inadequate supply management, poor supply discipline, and (perhaps) lack of effective depot supply support. This is undoubtedly the most valid indicator of the adequacy of supply support to aircraft maintenance. Only a well managed supply account, with base-wide supply discipline and an effective base repair program, can maintain a very low percentage of priority 01-08 requisitions, and a low rate of NORS occurrences. . . . The impact is felt in all elements of logistics; supply stocks, transportation, maintenance, funds, and even manpower . . ."

(2) Purely for supply discipline this area must be measured. However, the Chief of Supply is being measured for unwarranted priority requisitions beyond his control.

(3) Maintenance and supply coordination can reduce excessive rates, but not significantly with the current rate of funding.

Those in disagreement with this indicator as a measurement of supply support to aircraft maintenance provided the following opinions:

(1) The area is too subjective for measurement

because of the numerous variables involved.

(2) The inadequacy of transportation surface networks cause the excessive priority requisition rate. The same measurement shouldn't apply ". . . if you're on the wrong end of a 12,000 mile string of undependable rust buckets. . . ."

(3) "This does not measure supply support, but rather the efficiency with which the supply support was rendered."

(4) People abuse the system, rather than planning for their routine workload and requirements.

(5) This measurement area is an indicator of the unreasonable demands of supply customers.

It was noted by the authors during their research that a great deal is written concerning the abuse of the requisitioning system in such publications as the TIG Brief, logistics bulletins and supply publications, yet there appears to be a feeling on the part of the participants in this research project that priority requisitioning is extremely susceptible to other variables as well and a function of customer demands on the supply system.

o. Inventory Accuracy. This measurement area would provide managers with information concerning internal record keeping. As has been reiterated throughout our history of involvement in wars, a mass of material that cannot be located is just as worthless as none at all. A consensus of 65% was obtained in this area. Those agreeing

provided little in the way of explanation or rationale. Those in disagreement could not agree that there was a relationship between inventory accuracy and support to aircraft maintenance. General consensus indicated it is a valid measure of supply support to all functions served by the supply activity.

p. Percent Equipped. The purpose of this measure would be to provide information on how well the maintenance units were equipped to perform their mission. The increase of agreement from 9 to 76 percent was significant. Few comments were received on this area. Several disagreed only because they felt it could be measured through NRTS codes in the base repair area and that base managers could do little to control the receipt of equipment once ordered. Another element discussed was the stratification of equipment. Most respondents favored a breakout of both prime mission and support equipment.

q. Zero Balances on Stock Numbers for Mission Aircraft. This measurement area was designed to provide problem items with stock levels that indicated no stock availability for prime mission aircraft. The increase in group agreement from 9 to 71 percent indicates strong support. Most respondents in disagreement felt this area needed further definition. They felt that areas such as stock levels, no due-ins, number of aircraft supported, etc., should be obtained on an as required basis. Others felt this information would not be worth the cost to obtain. Those agreeing felt just as strongly that this was a critical area to indicate problems on blocks in the supply channel.

With the exception of four areas (backorder cancellations by base organizations, POL support, percent of priority requisitions, and inventory accuracy), a consensus exceeding 70% was achieved on all areas of measurement. This indicates strong support for those areas as most experts feel these can tell them to what extent they are providing supply support to aircraft maintenance. The authors feel that with further iterations, perhaps even greater consensus could have been obtained. However, another significant factor was that those in disagreement provided the most comments and rationale for their positions. This could be a significant factor; however, it must be left for further research to prove or disprove this hypothesis. Based on the authors' definition of consensus, all seventeen areas are accepted as important measures of supply support to the aircraft maintenance function.

Type of Measurement

There are inherent difficulties with the establishment of goals/standards and the subsequent measurement of performance against these standards. A number of respondents indicated problems have arisen in the past with management control systems when they have been used as a rating device. (See also 10.) The result was often a degradation of the information system by insuring required standards were met regardless of methods used. As one respondent stated, "One area often ignored is the difficulty of proposing performance measures without simultaneously prescribing standards or point scores. Many

realistic and useful measurement techniques have bitten the dust for lack of a standard acceptable to those being measured. One general rule is that a standard (if applied) will destroy the validity of any measure." Variance analysis is one method which aids in alleviating some of the problems associated with establishment of a single standard. If a goal was achieved within a given variance, the goal would be considered achieved. Another option could analyze trends in the absence of goals.

In the second questionnaire, each respondent was requested to consider this issue and indicate how he felt each of the seventeen measurable areas should be measured. Specifically, they were asked to choose either a specific goal, a goal with variance, or to indicate other means of measurement. Table 6 provides a summary of the opinions received.

TABLE 6

RESPONDENTS' SELECTION OF TYPE OF MEASUREMENT TO BE USED BY MEASUREMENT AREA

Measurement Area	Number of Responses for:		
	Specific Goal	Goal with Variance	Other
NORS	5	9*	3
Repair Program	6	8	3
Bench Stock	7	7	3
War Readiness Material	8	5	4
Cannibalization	0	12*	5
Engine Status	6	5	6
POL Support	6	5	6
Delayed Discrepancies	5	7	5
Delivery Time	4	9*	4
Fill Rate	6	7	4
Depot Backorders Exceeding MILSTRIP Time Frames	5	8	4
Backorders Cancelled by Base Organizations	5	8	4
Fund Status	4	8	5
Percent Priority Requisitions	3	10*	4
Inventory Accuracy	8	4	5
Percent Equipped	7	6	4
Zero Balances--Mission Aircraft	4	7	6

*Indicates consensus achieved.

As can be observed from Table 6, there is very little consensus on the type of measurement methodologies to be used. Consensus was achieved in only four areas. These areas, (NORS, cannibalization, delivery time, and percent priority requisitions) were considered to be best measured by a goal with variance. The lack of any significant degree of consensus can be attributed to the fact that only one iteration was accomplished on this data. Further iterations could have produced

a greater degree of agreement although this is only conjecture. No concrete conclusions can be drawn from this data as presented. However, the authors feel that this is a significant fear in the Air Force, that any management control system will tend to be used as a rating system. As such, respondents cannot readily separate measurement areas from assigned goals/standards. Perhaps the best approach to be used would be to establish what should be measured in isolation from the mention of any standards or type of measurement. Once the areas are identified then these two issues could be worked on as a separate project. This would tend to eliminate the subconscious bias toward standards used as a rating device. As mentioned earlier, many significant comments were received on the type of measurement to be used in the bench stock area. Since bench stock was the only area which received specific measurement recommendations on the first questionnaire, the area was specifically explored during the second iteration. These comments are summarized in the next section.

Bench Stock Support Computational Methodology

A consensus was established during the first round that the bench stock rate was an indicator of supply support to aircraft maintenance. Therefore, specific measurement methodologies were included for this area in the second iteration. These methodologies were proposed by the respondents in the first questionnaire. The following question was included in the second questionnaire:

The means of measuring the effectiveness should be:

____ Current fill rate system

____ Empty bins versus total bins

____ Number of backorders exceeding a time limit

____ Other (Please specify) _____

Comments:

TABLE 7

BENCH STOCK SUPPORT MEASUREMENT METHODOLOGY

Methodology	Concur	Percent of Replies
1. Current Fill Rate System	7	25
2. Empty Bins versus Total Bins	9	32.15
3. Number of backorders Exceeding Time Limit	9	32.15
4. Other Methods	3	10.7
	28	100%

Table 7 summarizes the responses as to how bench stock should be measured. The computational methodologies are described below. It should be noted that a number of respondents indicated multiple methods should be utilized to measure bench stock support. Seven respondents indicated two or more of the methodologies should be used

to measure bench stock support. The degree of support can be computed in the methodologies as follows:

(1) Current Fill Rate System:

$$\frac{\text{Bench Stock Issues}}{\text{Total Bench Stock Requests}} \times 100 = \text{Percent of Bench Stock Fill}$$

This data is compiled under program control during the issue process in the SBSS Univac 1050-II computer. The data is printed out daily and monthly for individual organization and summarized for total bench stock issues in management reports. This computation is done automatically.

(2) Empty Bins versus Total Bins:

$$\frac{\text{Number of Empty Bins}}{\text{Total number of Bench Stock Bins}} \times 100 = \text{Percent of Bench Stock Fill}$$

This data can be obtained by counting the number of empty bins in the bench stock locations at a given point in time and divided by the total number of bench stock bins. This data can not be obtained from current machine programs and must be accumulated manually.

(3) Number of backorders exceeding a time limit:

$$\frac{\text{Number of backorders Exceeding MILSTRIP Priority Delivery Date}}{\text{Total Issue Requests}} \times 100 = \text{Percent of Bench Stock Fill}$$

This data could be provided from the use of utility programs available in the SBSS program file. The data would be selected from internal computer records.

One must remember Table 7 was compiled from the results of

only one iteration, the second questionnaire in this research project. Subsequent iterations could provide a consensus or result in a significant change in the desired bench stock computational methodology to be utilized. Present research is incomplete and no conclusion can be derived.

Level of Management Receiving Information

Once data is accumulated, processed and displayed in a readable and usable format, it must be received at the level of management where it can be utilized. (4:256) If the data, converted to usable information, is not received by a person who can correct items which are exceeding established limits, it would appear the original gathering of the data had been pointless. The importance of determining who should receive the information is an item that must be considered during the development of a management information or control system. (10:24)

The second questionnaire included a question requesting each respondent to identify the level of base management which should receive the measured information. Included was an "Other" blank in which the respondent could identify any level of management he desired. The following is a sample of the question format:

The level of base management receiving this information should be

____ Director of Logistics
____ Chief of Supply
____ Chief of Maintenance
____ Other (Please specify)

The results of the responses are included in Table 8.

TABLE 8

LEVEL OF BASE MANAGEMENT
RECEIVING INFORMATION

Measurement Area	Number of Responses for:				
	Dir. of Logistics	Chief of Supply	Chief of Maintenance	Chief of Transportation	Other
1. NORS	14	11	10	0	3
2. Base Repair	13	12	15	0	1
3. Bench Stock	11	14	12	0	1
4. Cannibalization	13	13	14	0	0
5. War Readiness Material	14	11	7	0	5
6. Engine Status	12	9	10	2	3
7. POL Support	9	11	2	1	1
8. Delayed Discrepancies	9	10	11	0	0
9. Delivery Time	7	13	5	1	0
10. Fill Rate	11	11	3	0	2
11. Depot Backorders Exceeding MILSTRIP Time Frames	9	12	1	1	0
12. Backorder Cancellations by Base Organizations	10	11	8	0	0
13. Fund Status	11	11	6	0	3
14. Percent Priorities	11	10	7	0	7
15. Inventory Accuracy	7	13	1	0	1
16. Percent Equipped	10	11	8	0	2
17. Zero Balances --Mission Aircraft	5	11	3	0	0

These responses included in the "Other" column included wing/base commander, organization commanders, AFLC depot inventory managers (IM) or no response. Items 5 and 14 were recommended especially for the wing commander in several cases. No reason was provided. Item 13 was recommended to be sent to organizational commanders. Again no justification was provided.

Table 9 identifies those levels where consensus was obtained for each measured area. One should recall that for this question only one iteration was performed.

TABLE 9

FIRST ROUND CONSENSUS MANAGEMENT
LEVEL TO RECEIVE INFORMATION

Measurement Area	Level of Management		
	Dir. of Logistics	Chief of Supply	Chief of Maintenance
1. NORS	X	X	X
2. Base Repair	X	X	X
3. Bench Stock	X	X	X
4. Cannibalization	X	X	X
5. War Readiness Material	X	X	
6. Engine Status	X	X	X
7. POL Support	X	X	X
8. Delayed Discrepancies	X	X	
9. Delivery Time		X	
10. Fill Rate	X	X	
11. Depot Backorders Exceeding MILSTRIP Time Frames	X	X	
12. Backorder Cancellations by Base Organizations	X	X	
13. Fund Status	X	X	
14. Percent Priorities	X	X	
15. Inventory Accuracy		X	
16. Percent Equipped	X	X	
17. Zero Balances-Mission Aircraft		X	

With only one iteration completed, it would normally be invalid to draw any conclusion. The above table is provided for the reader's information. Subsequent iterations could possibly change such a chart.

This chapter has provided the results of the questionnaires and an analysis of the comments received. The documentation provides a base upon which further research can be pursued. The next chapter provides a summary of the findings of this research effort and the conclusions reached.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The research and analysis accomplished in this thesis was directed toward determining the supply measurement areas for an integrated base level logistics system for the 1975-1985 time frame. The present supply system at base level was designed during the early 1960's. Included in the standard base level supply system were management reports designed to identify certain measured areas which were intended to provide information on supply performance. The supply system, however, has been treated as a separate function and not an integrated part of the base logistics system. This functional approach to the logistics environment must be avoided in future systems.

The implied objective of the base level supply system is to provide effective and efficient support to its customers. The authors believe the best management approach to insure this goal is that of management by exception. Proper implementation of this approach requires three basic components: (1) an organizational objective, (2) performance areas to be measured, and (3) associated standards against which actual performance can be compared. This research

effort was an attempt to point out some inadequacies of the current system of performance measurement. Specifically, an attempt was made to codify a finite set of measurement areas against which actual performance could be measured. Without a common set of standards against which actual performance can be compared, managers tend to develop their own standards which may or may not be optimal. This is presently the case as is evidenced by the proliferation of standards and areas of measurement by major command and local supply managers. Thus, local managers are determining the policy (general objectives) of the supply system. This is not the job of middle managers, but one of top management to obtain unity of thought and operation throughout the entire organization. Top management must restate the over-all objectives and develop the necessary measurement areas and standards to insure performance is directed toward the achievement of those objectives.

At this point, the research questions and the associated findings of this research effort will be reviewed.

Findings Relative to Research Question 1

What is the environment in which the existing base level supply system functions?

1. The present environment of the SBSS is a highly complex one due to rapid technological growth and continuing budgetary limitations.

2. The present supply system has evolved from a proliferation of supply systems developed by major commands. The SBSS was designed and implemented to reduce the number of different base level systems to a standard Air Force base level supply system.

Findings Relative to Research Question 2

Are the existing supply management standards sufficient to control the supply function?

1. The present supply measurement areas are so varied and numerous that no single set of standards is common to base level supply functions utilizing the standard base level supply system.

2. Agreement between various commands as to a common set of supply standards has not been achieved.

3. The present base level supply system provides a great volume of statistical information, but no set of common standards controls the system.

4. The use of the principle of management by exception is not effectively utilized in the present supply system reports because of this lack of common standards. Therefore, each Chief of Supply is left to determine what he perceives as the specific objectives of the base level supply system and to develop whatever standards he needs to measure the achievement of these objectives.

Findings Relative to Research Question 3

In what areas will supply standards be required for a base integrated logistics system?

1. This research effort attempted to identify measurement areas by supply system objectives. The objectives were functionally oriented.

2. The research identified seventeen areas to measure for supply support of the aircraft maintenance function. Together, these areas indicate the degree to which the objective has been met.

Findings Relative to Research Question 4

Can a methodology be developed to identify areas where supply standards are necessary and to establish specific standards in a base-integrated logistics system?

1. The Delphi technique can be utilized to establish areas where supply standards are necessary. This was accomplished in this research effort with a consensus attained on seventeen measurable areas to evaluate supply support to aircraft maintenance. Time did not allow the development of associated specific standards. However, this technique has several limitations which must be recognized.

a. This technique requires sufficient time to allow for a minimum of two iterations per study required with the selected group of experts. During our research it became apparent that separate studies would be required for measurement areas, type of

measurement employed, levels of organization to receive information, and specific standards to be applied. Therefore, in this instance, a minimum of eight total iterations would be required. This time includes that required for the individuals to complete the questionnaires, mailing time involved, and the time required for the researchers to evaluate replies and develop subsequent questionnaires.

b. The Delphi technique is not conducive to use for a wide range of questions. It provides much better results when the area to be explored is limited. In this study each iteration produced many alternatives which could have been complete Delphi studies in themselves, such as NORS. Any future effort should evaluate a single area to completion before opening another area.

c. To use the technique to greatest advantage requires the assignment of researchers who have a knowledge of the area being investigated and who can remain with the effort to its completion.

d. The selection of experts to use in this technique must be accomplished with much thought. Experts selected should be well versed in the subject area, have a wide range of assignments, and be willing to provide the degree of thought necessary to provide their ideas through the feedback process.

2. In general, the Delphi technique can be used as an effective method to identify certain areas of a mangement control system. It is very effective in obtaining deep thought and development of ideas through controlled feedback of expert opinions and avoiding the

common pitfalls of command parochialism, personality conflicts, band-wagon effect, or the "not invented here" syndrome.

3. The Delphi technique is not, however, the total answer as a methodology. Besides the limitations mentioned earlier, determination of a consensus is not a strict mathematical operation, but one which requires some subjective evaluation. For example, if you have nine experts agreeing and seven disagreeing, you would consider this a consensus. However, if the majority of those in disagreement provided comments or rationale for their selection while those in agreement did not, how would this affect the determination of consensus? Areas like these require a subjective determination which is not easy to make.

The authors have noted throughout the research and especially in the replies to the questionnaires by the respondents the inherent distrust of a performance evaluation system. The fear stems from the prostitution of performance measurements into rating systems for supply and maintenance activities as well as for individuals. These fears must be overcome if any set of measurement standards can be used to control performance in a base level logistics environment. If efficiency is to be achieved in the logistics environment, then indicators of substandard performance must be noted. Management action must be initiated to determine and correct the cause rather than to treat symptoms of the problems or place the blame. The cause must be pinpointed and the level of management determined which can

provide the corrective action. Then action must be initiated to insure the causes, and not symptoms, are corrected. In short, managers must realize the system is for their use in decision making to improve their operation.

One of the respondents indicated that many of the factors identified by this research indicate the failure of supply to support the Air Force mission in the most effective and efficient manner. He indicated three factors were instrumental in creating this condition: funding, people, and the constant changes to the present standard base level standard supply system.

Funding has been previously discussed. The amount of change in the base level supply system can best be depicted by the number of changes to the Air Force supply manual (Vol II, Part Two, AFM 67-1) regulating the operation of the system. As of the date of writing this final chapter, approximately 200 amendments to the manual have been published. The remaining factor is people.

People still have control over Air Force management systems. Their knowledge and initiative can provide the impetus to the development of future systems to control the allocation of resources to achieve the most return for the defense dollar. Concurrent with the design of these systems must be the design of a comprehensive management information and control system meeting the criteria of providing information which is timely, understandable, useful, economically measurable, and pointed toward the accomplishment or organizational

objectives.

Another respondent recommended that ". . . efforts to develop a new conceptual approach to evaluation should be explored, rather than a re-examination of the approach which has proved inadequate in the past. Rating factors are not the problem; we have more than enough already. Our problem is to develop a better way to evaluate and integrate them into a single over-all assessment." In order to accomplish this, the perpetuation of present functional systems in the logistics environment would not seem to be the answer.

In the initial chapter of this thesis the authors stated the systems approach would be utilized in this thesis endeavor. In the same manner, the base integrated logistics system should be designed using the systems approach. Concurrently, a management control system must be designed as part of this system. Unfortunately, the efforts in this thesis indicate many operating managers either do not have the time or are unable to provide a guide to future management systems. They appear to be constrained by the present system.

Recommendations

After a thorough review of the entire research effort, the following recommendations are submitted by the authors.

1. The task of defining management performance indicators should be given to a group whose sole objective is the determination of what supply support indicators are required for a base level integrated

logistics system. This group should be composed of individuals having extensive experience and academic training to utilize the most current techniques to determine performance measurement criteria and methodologies.

2. Initial research indicates that the Delphi technique can be effectively used for design of some elements of a management control system if the limitations mentioned previously are considered.

3. Further study should be conducted to determine if systems management can be utilized as the total base level integrated logistics management philosophy. Such a research project is underway at the School of Systems and Logistics. It should be encouraged and receive top management support.

4. A common set of performance standards are vital to the successful design of a base level integrated logistics system. Top level management must insure such standards are not used as rating devices but as a management tool for base level managers to measure their performance toward achievement of over-all objectives.

5. The development of cost accounting methods is urgently required. Of primary concern is what Robert N. Anthony calls responsibility accounting. ". . . responsibility accounting requires that costs be classified: (1) by responsibility centers; (2) within each responsibility center, by whether controllable or noncontrollable; and (3) within the controllable classification, by cost types, or natural

elements, in a way that provides a useful basis for analysis." (3:303) Several respondents were highly concerned that this requirement must be satisfied by any new system. We must be able to measure the cost of providing certain levels of support. This will allow managers to decide the most cost effective level of support and to measure the costs associated with that support.

APPENDIX A

LIST OF MAJOR COMMAND SUPPLY MEASUREMENT AREAS*

Performance Measure	Number of Commands Measuring
Total Supply Effectiveness	7
Repair Cycle Supply Effectiveness	4
EOQ Supply Effectiveness	2
Expedite Supply Effectiveness	5
Bench Stock Effectiveness	5
Routine Maintenance Supply Effectiveness	1
Other Supply Effectiveness	1
Not Operationally Ready-Supply (NORS)	5
Engines NORS	4
Priority Requisitions	6
Inventory Accuracy	6
Inventory Adjustments	1
Records Past Due Inventory	3
Inventory Turnover	6
Excesses	7
Excess Due Ins	1
Repair Cycle Time (Average)	2
Delinquent Due In From Maintenance (DIFM)	6
Bench Checked/Repaired--10 Days	2
Stock Fund Variance	5
Item Records Greater than 305 Days Old	3
Item Records--No Demands	4
Item Records with Special Level	3
Item Records with Special Level--No Demand 365 Days	4
Item Records Past Due Inventory	3
Item Records--Total	1
Special Requisitions	4
Receipts Not Due In	5
Due In Cancellations	2
NORS--No Due In	1
Vehicles Deadlined--Parts (VDP)	1
Due Ins Exceeding 365 Days Old	3

Performance Measure	Number of Commands Measuring
Special Level Rate	2
Total Due Ins	4
Number of Rejects	3
AFRAMS Reporting Effectiveness	4
AFRAMS Redistribution Orders Denied	1
Number of Reverse Posts	6
Warehouse Location Accuracy	6
Awaiting Parts--No Due Outs	3
Mobility Equipment Fill Rate	3
Bench Stock Turnover	1
Cannibalization to Cure NORS	1
Simulator Status	1
Minimum Levels	1
Cancellation of Requisitions	1
Number of Zero Balances	1
Receipt Summary	2
Receipt Not Billed/Billed Not Received	2
Shipped Not Credited	2
Issue/Due Out Summary	1
NRTS/Condemned--5 Days	1
Inventory Completion	1
Delinquent Documents	1
Number of Inquiries	1
Computer Utilization	2
Civil Engineer Work Order Status	1
Manning	1
Equipment Record Accuracy	1
Unauthorized Equipment in Use	2
Support Equipment Fill Rate	4
Equipment in Stock	4
TA 000--Authorizations	3
Tool Kit Fill Rate	1

Source: Compiled from Selected Major Command Supply Evaluation Publications. (38, 39, 40, 44, 45, 46, 47, 48, 49, 50).

APPENDIX B

STALOG SURVEY LETTER

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

REPLY TO ATTN OF: AF/LGX

19 May 1972

SUBJECT: STALOG Survey

TO:

1. Air University is currently conducting research to identify primary management control factors within the base level logistics environment. This research is part of the Study of the Automation of the Logistics System at Base Level (STALOG) sponsored by this office. You have been carefully selected as a participant, and as such, you will have the opportunity to contribute your knowledge and experience to an effort designed to improve the management of logistics at base level.

2. You will receive from one to four questionnaires. Where sequential questionnaires are employed, these will be sent to you at periodic intervals through August 1972. In every case your total cooperation is necessary to support the study and to meet the time constraints.

3. Please complete the attached questionnaire and return it within 14 days of your receipt of this letter. A preaddressed envelope is included for return of your completed questionnaire. Thank your for your support.

FOR THE CHIEF OF STAFF

William R Hayes

WILLIAM R. HAYES, Brigadier General, USAF
Assistant for Logistics Planning

APPENDIX C

FIRST QUESTIONNAIRE

QUESTIONNAIRE

SECTION I. INSTRUCTIONS

The purpose of this research project is to identify critical areas within the base level supply system that require measurement. The basic technique being used is the Delphi Method. In this method a series of questionnaires is employed w. h a small group of experts to obtain a consensus without the basic psychological pitfalls associated with direct group interactions. You will be required to respond to a series of three or four questionnaires through June 1972. Your responses will be held in confidence.

The research effort is concentrated into three basic objective areas of supply support. The first questionnaire is totally open ended. Request you provide your response to the questions on the attached sheets. You may refer to any material you feel is necessary. Do not constrain your responses to current system output.

SECTION II. PERSONAL DATA

Please provide the following information:

1. Name (Optional): _____

2. Present Duty AFSC: _____

3. Present Grade: _____

4. Major Command of Assignment: _____

5. Level of Assignment: _____
(Hq USAF, CMD Hq, NAF, Base, Etc.)

SECTION III.

In this section, request you provide a list of the critical areas within the base level supply system that should be measured to indicate the effectiveness of support to Aircraft Maintenance. Express those areas which would tell you as a manager that the function was being adequately supported. You may provide a brief justification or your rationale for each area if you desire. Items you may wish to consider include NORS rates, DIFM rates, bench stock fill rates, etc. (Handwritten responses are acceptable.)

APPENDIX D

SECOND QUESTIONNAIRE

DEPARTMENT OF THE AIR FORCE

AIR FORCE INSTITUTE OF TECHNOLOGY (AU)

WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

REPLY TO ATTN OF SLG

6 July 1972

SUBJECT STALOG Survey (USAF/LGX Ltr, 19 May 1972)

TO

1. The attached questionnaire is the second iteration in a series of questionnaires to identify management control factors within the base level logistics environment. Every effort has been made to reduce the time required for completion of this questionnaire.

2. Please complete the attached questionnaire and return it within 10 days of your receipt of this letter. A preaddressed envelope is included for return of your completed questionnaire. Thank you for your continuing support.

3. Headquarters USAF Survey Control No. 72-94 has been assigned to this Research Project.

Larry Wellman

LARRY N. WELLMAN, Major, USAF
Research Chairman

QUESTIONNAIRE

SECTION I. INSTRUCTIONS

The purpose of this research project is to identify critical areas within the base level supply system that require measurement. The basic technique being used is the Delphi Method. In this method a series of questionnaires is employed with a small group of experts to obtain a consensus without the basic psychological pitfalls associated with direct group interactions. You will be required to respond to a series of three or four questionnaires through July 1972. Your responses will be held in confidence.

The first questionnaire was totally open ended. This second questionnaire requires your evaluation of the results of the first questionnaire. Request you provide your response to the questions on the attached sheets. You may refer to any material you feel is necessary. Do not constrain your responses to current system output.

SECTION II. PERSONAL DATA

Please provide the following information:

1. Name (Optional): _____

2. Present Duty AFSC: _____

3. Present Grade: _____

4. Major Command of Assignment: _____

5. Level of Assignment: _____
(Hq USAF, CMD Hq, NAF, Base, Etc.)

SECTION III. MEASUREMENT AREAS

In the first questionnaire you were asked to provide a list of the critical areas within the base level supply system that should be measured to indicate the effectiveness of support to aircraft maintenance. There were 17 measurable areas which indicated some degree of agreement; however, a consensus of opinion was obtained on only three of these

areas: NORS, Base Repair Program, and Bench Stock. Listed below are each of these 17 areas with the rationale as to why the area was considered important. Request you evaluate each of these and provide the following information.

1. Indicate whether you agree or disagree that measurement of the area concerned would indicate to you the status of supply support to aircraft maintenance.

2. Indicate what level of management should be provided this information. For example, what level of base management would have the capability to control the area and take necessary corrective action? The levels are (a) Director of Logistics, (b) Chief of Supply, (c) Chief of Maintenance, and (d) Other (i.e. Wing Commander). You may indicate one or all.

You may provide any comments you feel necessary to support your selections.

1. NORS--This area was considered important as it indicates basic supply support provided to the flying program. Most responses indicated that all logistics areas affect the NORS rate, not just supply. Emphasis was placed on the fact that a rate exceeding the standard could be caused by any of the logistics areas and should lead to a further analysis of areas such as cause codes, demand levels, DIFM status, and transportation time. This indicates that the rate needs to be evaluated at a level above the functional areas concerned. Another new approach to this area was the use of different NORS rates for separate types of equipment. For example, the B-52 would require a different rate than a C-47 base support aircraft.

a. I consider NORS as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. I feel a variable standard should be established based on the importance of the particular system to the Air Force mission.

____ Agree

____ Disagree

d. Comments:

2. Base Repair Program--This area was considered of prime importance as it indicates a base's ability to support itself. Recycling of assets through organic repair shops result in dollar savings in procurement and transportation costs. Specific measurable areas mentioned were overdue DIFM items, AWP status, and the use of certain NRTS codes. As both maintenance and supply actions can affect this area, this again implies the necessity of review at a level higher than the individual functional areas.

a. I consider the Base Repair Program as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

3. Bench Stock Support--This area was considered important as it is the least expensive and time consuming means of providing material to the maintenance man. Many comments were made concerning how it should be measured. Ideas expressed were the current fill rate system of requested versus filled, the number of empty bins versus number of total bins, and the number of backorders exceeding a time limit.

a. I consider the Bench Stock area as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. The means of measuring the effectiveness should be:

____ Current fill rate system

____ Empty bins versus total bins

____ Number of backorders exceeding a time limit

____ Other (Please specify) _____

d. Comments:

4. Cannibalization--This area was considered important as it would normally indicate the inability of supply to provide a part to maintenance. The practice is normally more expensive and increases the chances of damage. Areas requiring measurement are why the action had to be taken and why did an out-of-stock condition occur.

a. I consider cannibalization as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

5. War Readiness Materiel--This area was considered important as it indicates a unit's readiness to support war plans. Basic measurement required would be the amount on hand versus authorized. In addition, some stratification of the importance oi items missing might be important.

a. I consider Readiness Materiel as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please Specify) _____

c. Comment:

6. Engine Status--This area is considered important as availability of engines are necessary to provide proper support to the base flying mission. Measurable areas mentioned included on-hand versus authorized by type, condition, repair status, and shipping status.

a. I consider engine status as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

7. POL Support--This area was considered important as the availability of fuel is a necessary requirement to the base flying mission. Measurable areas include response time and contamination status.

a. I consider POL Support as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

8. Delayed Aircraft Discrepancies--This area was considered important as delayed discrepancies are repair actions which have not been completed. Currency between aircraft records (AFTO Forms 781) and supply records is required to insure supply support is provided. Potential NORS conditions may be alleviated if delayed discrepancies are cleared.

a. I consider delayed aircraft discrepancies a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please spe _____

c. Comments:

9. Delivery Time--This area was considered important for measurement as it indicates whether urgently needed parts are delivered within established time frames to meet maintenance priorities. Failure to meet required delivery time frames may result in missed sorties.

a. I consider delivery times as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

10. Fill Rate--This area was mentioned by respondents as a measure of supply effectiveness. Their basic concern was that this item should be measured on the basis of authorized stockage. On items not authorized stockage due to Air Force policy restrictions or depot criticality, the Chief of Supply should not be penalized as he can not exercise any direct control over these items. Authorized stock includes both items with or without stock levels.

a. I consider fill rate based on items authorized stockage as a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

11. Depot Backorders Exceeding MILSTRIP Time Frames--This area was considered necessary for measurement as base requirements for items which have been on order and not received within MILSTRIP time frames should be measured so corrective action can be initiated. These items should be identified by source of supply and stratified by time on order. The nonreceipt of items may result in poor supply support.

a. I consider a measurement of depot backorders exceeding MILSTRIP time frames as necessary to indicate supply ability to support aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

12. Backorder Cancellations by Base Organizations--Respondents indicated this area would pinpoint possible supply discipline problems or indicate where training is necessary. The rate of cancellations per total requests could be measured by organization and stratified by reason to provide this information.

a. I consider a measure of backorder cancellations by base maintenance organizations a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

13. Fund Status--Respondents indicated this area should be reviewed in several areas. These areas include the management of stock fund programs, proper processing of internal (supply) requirement cards for stock replenishment, and organization O & M fund allocations.

a. I consider fund status as a necessary measurement area to insure adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify)

c. Comments:

14. Percent of Priority Requisitions--Respondents considered this area as important for measurement as excessive unwarranted priority requisitions adversely affect the Air Force supply channels. Additionally, it is an indicator of organizational supply discipline, and some respondents indicated it should be provided to a higher level than the Chief of Supply.

a. I consider percent of priority requisitions as a necessary measurement area to indicate adequate supply support to maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Wing/Base Commander

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

15. Inventory Accuracy--Respondents indicated a measurement of inventory accuracy is essential to insure effective operation of a supply account. Accuracy of stock records is vital and should be measured. Measurement areas could include warehouse refusal rates, inventory accuracy by type of item, etc.

a. I consider inventory accuracy as an essential measurement area to indicate adequate supply support of aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

16. Percent Equipped--Respondents indicated this area of measurement was considered important as it indicated the ability of an organization to accomplish its mission. Without the necessary essential equipment, a base repair program may be degraded and aircraft would be more difficult to maintain. Measurement of this area could be stratified by essentiality, prime mission equipment, shop, etc.

a. I consider percentage equipped as a necessary measurement of adequate support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management receiving this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. The measurement of percentage equipped should be as follows:

____ Mission and support equipment

____ Prime mission only

____ Other (Please specify) _____

d. Comments:

17. Zero Balances on Stock Numbers for Mission Aircraft--Respondents indicated this measure would indicate the ability of supply to support the base assigned aircraft. It could be used in conjunction with application codes/weapon system usage data to pinpoint problem areas for corrective action. Items could be stratified as to source of supply, source of repair (on or off base), or weapon system. Future support problems could be avoided by early identification of trends towards increased zero balances.

a. I consider zero balances on stock numbers for mission aircraft a necessary measurement area to indicate adequate supply support to aircraft maintenance.

____ Agree

____ Disagree

b. The level of base management which should receive this information should be:

____ Director of Logistics

____ Chief of Supply

____ Chief of Maintenance

____ Other (Please specify) _____

c. Comments:

SECTION IV. TYPE OF MEASUREMENT

There are inherent difficulties with the establishment of goals/standards and the measurement of performance against these standards. A number of respondents indicated problems have arisen in the past with management information systems being utilized as a rating device. The subsequent result was a degradation of the information system by insuring required standards were met regardless of methods used. Variance analysis is one method which aids in alleviating some of the problems associated with establishment of a single standard. If a goal was achieved within a given variance (plus or minus a preset percentage), the goal is considered satisfied. Please indicate whether you feel a specific standard should be assigned for the following items, a standard with a variance, or another method of determining goal achievement. If you select other, please provide your proposed method. Please note a standard or goal is not required, but only the methodology of goal measurement.

Measurement Area	Specific Goal	Goal with Variance	Other
NORS	____	____	____
Repair Program	____	____	____
Bench Stock	____	____	____
War Readiness Materiel	____	____	____
Cannibalization	____	____	____
Engine Status	____	____	____
POL Support	____	____	____
Delayed Discrepancies	____	____	____
Delivery Time	____	____	____
Fill Rate	____	____	____
Depot Backorders	____	____	____
Backorder Cancellations	____	____	____
Fund Status	____	____	____

Measurement Area	Specific Goal	Goal with Variance	Other
Percent Priority Requisitions	____	____	____
Inventory Accuracy	____	____	____
Percent Equipped	____	____	____
Zero Balances/Prime Mission Items	____	____	____
Mission Items	____	____	____

Comments:

APPENDIX E

EXPLANATION OF TERMS

EXPLANATION OF TERMS

AFRAMS--Air Force Recoverable Assembly Management System.

Awaiting Parts (AWP)--The status of an item not reparable for the lack of component parts.

Bench Stock--A stock of consumption type supplies and parts established at or near points of consumption to insure continuous and uninterrupted operations.

Cannibalization--The authorized removal of specific components from an item of Air Force property for installation on another item of Air Force property to meet priority requirements with the obligation of replacing the removed components.

Delayed Aircraft Discrepancies--Discrepancies documented on AFTO Form 781, Aircraft Record, which requires parts for repair to be accomplished. The discrepancy is non-grounding and doesn't impair the operational status of the aircraft.

Due In From Maintenance (DIFM)--A recoverable item flowing through maintenance from the time of removal to actual turn in.

EOQ--Economic Order Quantity.

MILSTRIP--Military Standard Requisitioning and Issue Procedures.

Not Operationally Ready Supply (NORS)--The failure of an aircraft, missile, or supporting systems to perform its assigned mission(s) due to lack of a specific part(s) or component(s).

Not Reparable This Station (NRTS)--A status condition determined during shop processing of an item used to indicate that the item cannot be repaired at base level due to lack of authorization, technical skills, parts, facilities, manpower, or any other causes.

Operations and Maintenance (O&M) Funds--Funds utilized to support mission operations and maintain facilities.

Petroleum, Oils and Lubricants (POL)--A broad term which includes all petroleum and associated base fuels used by the Armed Forces.

Supply Discipline--Is the command management control of supply functions and material adequate to insure compliance with regulations and directives.

War Readiness Material--That material required to augment peacetime assets to completely support forces, missions and activities reflected in USAF war plans.

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