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DEVELOPING DEPARTMENTAL MEASURES
OF PERFORMANCE IN A WHITE-COLLAR
ENVIRONMENT

THESIS

Kirk H. Rumsey, Captain, USAF

AFIT/GSM/LSG/90S-24

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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OF PERFORMANCE IN A WHITE-COLLAR
ENVIRONMENT

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 Systems Management

Kirk H. Rumsey
Captain, USAF

September 1990

Approved for public release; distribution unlimited

Preface

The purpose of this study was to derive a method for developing departmental measures of performance in a white-collar environment. The immediate need for this information is to assist the System Program Offices (SPOs) within Aeronautical Systems Division in the departmental measurement aspect of the Total Quality Management movement.

An integrated measurement development approach was compiled through extensive literature research. This integrated approach was then grounded with interviews with Pratt & Whitney's Government Engine Business to provide a practical perspective to accompany the theoretical concepts. The final step in this process would be to test the integrated approach within one or more SPOs to ascertain whether this approach works in the government arena.

This thesis effort leaves me greatly indebted to many people. I would like to thank my advisor, Lt Col John Shishoff for his patience and support throughout the process. I am also grateful to Pratt & Whitney for their invaluable assistance and participation. I would like to thank my family, especially my brother, Kevin, for being an inspiration. Finally, I would like to thank my fiancée, Shanda, for helping me keep everything in perspective while providing continued understanding and thorough support.

Kirk H. Rumsey

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Abstract

In implementing the total quality initiative taking place within Aeronautical Systems Division of Air Force Systems Command, a need was discovered for a measurement development procedure designed specifically for the department level of a white-collar environment. The objective of this research study was to develop a procedure to fill this need.

The research was designed around answering two questions. The first question was what do the authors in the field of measurement say is the best way to develop white-collar departmental measures of performance? This question was answered by reviewing the work of six authors and integrating their ideas into a single, integrated procedure.

The second question was how did several Pratt & Whitney Government Engine Business departments develop their measures of performance? This answer was derived by interviewing twelve managers from Pratt & Whitney.

The answers to the above questions provided an integrated measurement development procedure, but could not provide substantial grounding of this procedure within Pratt & Whitney's Government Engine Business. The procedure is, however, the recommended approach for developing departmental measures of performance within a white-collar environment.

DEVELOPING DEPARTMENTAL MEASURES OF PERFORMANCE
IN A WHITE-COLLAR ENVIRONMENT

I. Introduction

1.1 General Issue

The need to have a measurement development procedure designed specifically for the departmental level of a white-collar environment surfaced as a result of the Total Quality Management initiative within Air Force System Command's Aeronautical Systems Division (ASD). This thesis is designed to address such a need.

ASD is currently participating in a performance-enhancing Total Quality Management (TQM) program. The program consists of changing the philosophical approaches to many of the business practices within ASD. Much emphasis is being placed on customer requirements and doing things right the first time in the hope of improving overall performance. The development of sound departmental performance measures is important for the evaluation of progress within the TQM program, since the only way to determine improved performance is by some method of measurement.

The notion of improving productivity within ASD is part of a larger movement found throughout industry. Many companies are seeking to raise their performance in an

effort to upgrade national productivity and to fight inflation, as well as to remain competitive within world markets. Performance measurement provides a key, along with planned managerial undertakings, to improving performance (Siegel, 1980:1).

Developing a departmental measurement program to improve performance includes an educational aspect of how to teach a department to do measurement, as well as a motivational aspect of how to inspire a department to do measurement. Finally, it also includes the particular problem facing ASD, which is how to measure the performance of its departments (see Figure 1, page 5). The research concentrated specifically on how to develop measures of performance, with no attention paid to the motivational or educational aspects of the larger issue.

1.2 Investigative Questions

The research effort to find a measurement development procedure for a white-collar environment led to two investigative questions. The first question involved what current literature is available on the subject of departmental measurement. What do the measurement experts say is the best way to develop white-collar performance measures at the department level?

The second investigative question involved identifying what a private sector business is doing in this field. The private sector business that was used was Pratt & Whitney.

Pratt & Whitney was chosen because, as a defense contractor, many of its departments closely resemble, in structure and function, the departments within ASD. Also, Pratt & Whitney was chosen because it has a quality program in place and measurement was on going as a performance evaluation tool. With potential applicability within a SPO being a key issue involving the results of the research, it was important to choose a business that had a structure similar to that of the SPO, or at least departments within the business that performed functions resembling those accomplished in a SPO. How does this business measure the performance of its departments and how were these measures developed?

1.3 Key Definitions

Prior to reviewing the research, it is necessary to understand the key terms used throughout the thesis. The key terms to be explained are measures of performance, the associated components of performance measures, and white-collar departments.

According to Sink and Tuttle, seven criteria must be examined when measuring performance (Sink and Tuttle, 1989:136). These measures of performance are evaluations of how well a department is doing in the areas of effectiveness, efficiency, quality, productivity, quality of work life, innovation, and profitability/budgetability (Sink and Tuttle, 1989:136).

The first component of performance measurement is effectiveness. Effectiveness can be defined as the degree to which an organization achieves its goals (Daft and Steers, 1986:334). Paralleling effectiveness is efficiency. These two concepts are closely linked, in that efficiency is the cost-benefit ratio incurred in the pursuit of organizational goals (Daft and Steers, 1986:335). To illustrate this dual concept, an army could be effective in winning a war, but its measure of efficiency would not be the win, but the number of soldiers lost or the amount of time spent in winning.

Quality is the third criterion evaluated when measuring performance. According to the Office of Management and Budget (OMB), quality is the extent to which a product or service conforms to requirements and meets customer's needs (OMB, 1989:3). The fourth criterion is productivity, which is the relationship between use of resources and the results of that use (Lehrer, 1983:31). Quality of work life is number five. "Quality of work life means that one receives psychic personal satisfaction from work experience in addition to economic benefit" (Lehrer, 1983:304). Innovation, which is the introduction of something new, according to Webster's Ninth New Collegiate Dictionary, is the sixth criterion evaluated when measuring performance, and profitability/ budgetability is number seven. Profitability and budgetability refers to the financial gain

COMPONENTS OF A MEASUREMENT PROGRAM

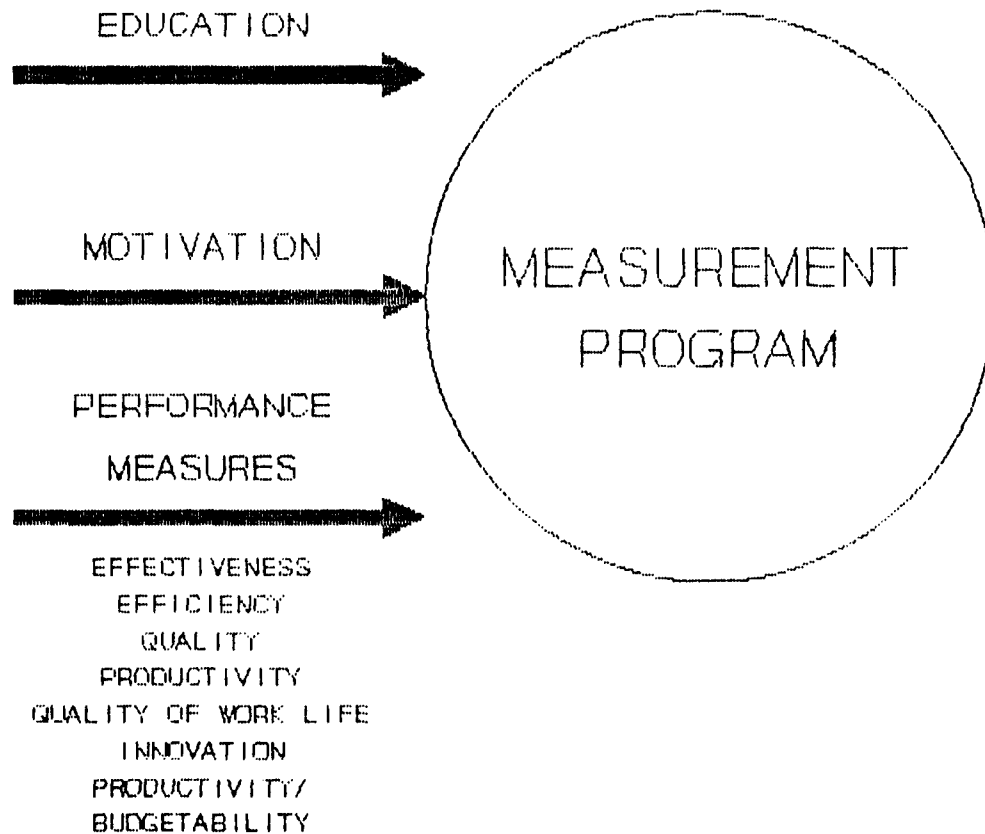


Figure 1: Components of a Measurement Program

or the adherence to the budget that the target system maintains.

Sink and Tuttle did not speak of a hierarchy of the components of performance. The order of precedence, then, depends on the priorities of the department. In fact, many of the facets of performance are closely related. For example, increases in productivity generally lead to positive effects on profitability, sales, capital, materials, people, competitiveness, and cost per unit (Sink, 1985:8).

For this thesis, white-collar departments are defined as those that produce no hardware product. Department, work environment, target system, and organization are all terms which will be used throughout the thesis to refer to the actual subject of the measurement system, or the group being measured. For the purpose of this thesis, this subject is any group of employees within a business entity that has a unique mission; for example, a contracting group for a particular engine procurement team, or a specific program management team. Other examples are those which served as pilot, or test, organizations for a recent American Productivity Center two-year study in the area of performance measurement:

accounting and finance, customer service, engineering, facilities management, marketing and sales, operations, information systems management, human resources, and research and development. (Leth and others, 1985:3)

The study had thirteen sponsors including General Dynamics

Corporation, McDonnell Douglas Corporation, Johnson & Johnson, and Rockwell International Corporation as well as more than 250 corporate, labor, government and academic supporters (Leth and others, 1985:2-3).

1.4 Scope of the Research

The research was confined to investigating procedures for developing measures of white-collar department performance, as opposed to investigating methods of developing personal measures of performance. As alluded to previously and to be discussed in more depth in the next chapter, departmental performance measurement is the area of measurement causing difficulty within ASD and industry. The basis for the integrated measurement development approach was the information gathered from current literature on the subject of departmental performance measurement. The interviews grounded the theoretical baseline derived from the literature providing the practical insight associated with the managers' perceptions of the process of measurement development. The measures discussed with the managers during the interviews also serve as examples for departments starting a measurement development process.

To reiterate, a measurement program consists of performance measures, motivation, and education. The research concentrated specifically of developing measures of performance. Addressing the issues of motivation and education is beyond the scope of this project.

1.5 Roadmap to the Thesis

The thesis follows an overall research theme of developing departmental measures of performance in a white-collar environment. Chapter 2 begins with a discussion of the history of performance measurement. Also in Chapter 2 is an analysis of the problems associated with white-collar performance measurement and the guidelines to be followed when creating performance measures. This chapter serves to set a baseline understanding of the problem of developing measures of performance.

Chapter 3 is the methodology used for the research effort. It contains an explanation of how the literature analysis was conducted and what sources were reviewed. It also contains an explanation of the approach to the interviews and a justification of why case study interviews were the best research method for needed information. Chapter 3 provides the logical rationalization for the research approach.

Chapters 4 and 5 are the results of the research. Chapter 4 is the analysis of literature which summarizes the literature review and integrates the information into a single measurement development procedure. Chapter 5 compares the results of the analysis of literature with the information gathered from the interviews.

Chapter 6 contains the final recommendations and conclusions that can be made from analyzing Chapters 4 and 5. The recommendations will be given to ASD as a

substantiated approach for developing measures of performance. Chapter 6 also contains the recommendations for further study which, when accomplished, will add more valuable research conclusions to the subject of developing departmental measures of performance in a white-collar environment.

II. Background Literature

2.1 Introduction to the Chapter

The background literature is designed to provide the reader with an historical perspective of the problem of developing departmental measures of performance in a white-collar environment. Also included in this chapter is a discussion of performance measurement problems in general, as well as a justification for conducting performance measurement. Finally, the chapter provides some general guidelines of a measurement system. When developing measures of performance, it is useful to know prior to starting what some of the potential pitfalls might be and how to avoid them.

2.2 History of Performance Measurement

A review of the literature produced the following history of performance measurement. Applicable literature generally concentrated on productivity measurement. For example, C.D. Wright, the first U.S. Commissioner of Labor [Statistics] suggested in his Sixth Annual Report (1891) that many companies were in a position to compile figures on their own productivity (Siegel, 1980:10). His report was based on a study of the iron and steel industry, not white-collar environments, but it serves to illustrate the concern for productivity even in the late-1800s. The Bureau of Labor Statistics began publishing industry productivity indexes in

1926 (Siegel, 1980:11). However, shortly after World War II, a National Industrial Conference Board questionnaire revealed that while many companies were interested in labor productivity, few plants had quantitative information on the subject (Siegel, 1980:11). Apparently, the fact that few plants had quantitative productivity information remained unchanged until the mid-60s. At that point in time, businesses became even more interested in productivity. Irving H. Siegel, author of Company Productivity: Measurement for Improvement, stated, "American businessmen have been obliged by economic changes since the mid-1960s to become more explicitly concerned with company productivity improvement" (Siegel, 1980:9). The economic change referred to was caused by the persistence of unprecedented rates of inflation, the revolution in world prices of petroleum and in conditions of supply, the proliferation of government-sponsored regulation and paperwork, and the apparent deterioration of employee attitudes (Siegel, 1980:9-10). Siegel went on to say, "the current setting favors discovery and adoption by many more companies of productivity monitoring as a low-cost means of spurring productivity gain" (Siegel, 1980:10). Yet even now, only a very tiny fraction of the firms that might find measurement a sound investment seem to have formal systems in place (Siegel, 1980:10-11).

2.3 Performance Measurement Problems in General

As noted in the previous section, white-collar performance measurement has met with its share of difficulty. There are two reasons for the problems. The first is the vagueness of the white-collar business. The second is the stigma surrounding measurement.

The difficulties in developing meaningful measures of performance for white-collar workers are well known. First, most white-collar work produces no tangible end product. Second, even if input and output could be defined, most white-collar workers resist measurements. (Boyett and Conn, 1988:209)

One of the inherent characteristics of white-collar work is its ambiguity of direction and product. "The mission and objectives of most white-collar groups are vague. Until the vagueness can be eliminated, measures cannot be developed" (Boyett and Conn, 1988:210). This vagueness is not only an external perception, but also an internal one. Those who conduct analysis of white-collar work, such as Joseph H. Boyett and Henry P. Conn, authors of the article "Developing White-Collar Performance Measures," as well as those deeply rooted in the system have identified this particular weakness.

White collar workers often find that they are providing an output that is not easy to quantify. Work is often non-repetitive, and therefore, by definition, a standard for doing it has not been established. (Lehrer, 1983:38)

Because of the vagueness of the business, many mistakes can be found in the practice of its measurement. These errors fall into a number of categories.

What we find in practice is that managers at all levels and in all kinds of organizations fall into traps of:

- a) Measuring A while hoping for B. We measure the easy things, the most pressing things, the wrong things; we hope for quality while measuring and controlling only production schedules.
- b) Measuring to control in such a way as to make improvement more difficult. We focus on control of excess, creating a compliance mentality rather than an improvement orientation.
- c) Measuring to find those who have performed poorly in order to punish them while ignoring the good performers. (Sink and Tuttle, 1989:1-2)

The inability to measure performance produces a negative stigma surrounding the idea of measurement. The traps that many organizations have fallen into in the measurement area have led to employees and supervisors alike forming negative paradigms about measurement. Some of these paradigms and their explanations can be found in Table 1.

2.4 Justification for Conducting Performance Measurement

The problems associated with measurement do not decrease the need to measure. From Sink and Tuttle's Planning and Measurement in Your Organization of the Future, the overall justification, for conducting measurement in any environment starts with the idea of management. "The essence of management is that one cannot manage what one cannot

TABLE 1
PARADIGMS OF MEASUREMENT

(Sink and Tuttle, 1989:58-60)

1. Measurement is threatening. The primary use for a measurement system is for punishment.

2. Precision is essential to useful measurement. Until a completely precise measurement system is developed, there is little use for measurement.

3. Single indicator focus. As Robert N. Lehrer, author of White Collar Productivity, says,

...productivity measurement specialists sometimes prescribe very detailed and painstaking programs to develop the exactly appropriate measurement system in an organization which must be completed before productivity improvement is allowed to begin.
(Lehrer, 1983:29)

Lehrer continues by saying that it is quite reasonable to judge productivity on a collection of measures (Lehrer, 1983:41).

4. There must be an emphasis on labor productivity.

Tangible measures have become an obsession.

5. Subjective measures are sloppy. Many managers are uneasy with qualitative measures, and without hard numbers they feel the measures are of no value.

6. Standards operate as ceilings on performance. With goals consisting merely of standards, that becomes the limit to departmental performance.

measure" (Sink and Tuttle, 1989:1). They go on to describe measurement as a tool for accomplishing the performance goals of the manager.

The primary goals of managers in all areas and at all levels in the organization should be twofold:

1. Perform, get the job done; and
2. Continuously strive to improve performance. (Sink and Tuttle, 1989:1)

Thus, according to Sink and Tuttle, the first reason to measure is to use measurement as a performance indicator. Robert N. Lehrer, author of White Collar Productivity, speaks of the need for measurement to "direct attention to parts of the organization that are in a stronger or weaker position for productivity analysis and improvement" (Lehrer, 1983:30).

Sink and Tuttle's second reason to measure is to improve. Both the OMB and Robert Lehrer support this concept. Lehrer states that, "A measurement system is a tool to direct scarce resources to the targets where the most benefit can be obtained from those scarce resources" (Lehrer, 1983:29). The OMB speaks highly of measuring to improve. "One critical element of managing for continuous improvement is to know the level of quality being achieved at any given time and this requires the use of quality measures" (OMB, 1989:3). The OMB goes on to say that "measures support improvement" (OMB, 1989:3).

Why measure? Measure to improve. Measure to provide your management team with new insights into why the system performs the way it does, where it can be improved, and when

the system is in control or out of control
(Sink and Tuttle, 1989:1).

2.5 General Guidelines of a Measurement System.

In order to provide performance indicators that enhance performance within any white-collar environment, there are certain principles that should be followed. To begin with, Sink and Tuttle discuss several principles that support the theory and practice of measurement. These can be found in Table 2.

Along with following the guidelines listed and explained in Table 2, the method chosen for conducting departmental measurement should be flexible; one that can be adapted to the organization at hand.

The method that is ultimately selected for use will depend on several factors:
applicability to type of work process,
presence or absence of checklists/cost data,
ease of use, etc.... (OMB, 1989:23)

With flexibility should come appropriateness.

...the output and the input must be from the same general process. It is not very meaningful to talk about a productivity measure of tons of steel per typist employed.
(Lehrer, 1983:31)

The measures developed should be congruent with the goals of the organization. This is avoiding the "measuring A while hoping for B" trap. Also, the measures, should not reward an employee for performing in a manner contrary to the good of the company. W. Edwards Demming, the man recognized for revitalizing Japanese industry, offers a word of advice in this area. "Quotas take account only of

TABLE 2

GUIDELINES OF A MEASUREMENT SYSTEM

(Sink and Tuttle, 1989:211-213)

1. Measurement cannot be used to drive performance improvement - the driver must be the business strategy and the performance improvement plan.
2. Acceptance of the measurement process is essential to its success as a performance improvement tool.
3. Measure what's important - not what's easy to measure.
4. Adopt an experimental approach to measurement systems for improvement.
5. Eliminate the use of numerical goals, work standards, and quotas.
6. What is needed is not a set of measurements created by experts and imposed on organizations, but rather a method by which management teams and their various clientele can create performance measurement systems suited to their own inevitably special needs and circumstances.
7. The greater the participation in the process in creating a performance measurement system, the greater the resulting performance change, and the greater the ease of implementation of future changes based upon performance measurement.
8. Any system should result in a vector of performance measures, not attempting to achieve a single measure. Much of the controversy and lack of acceptance stems from attempts to make a very complex problem appear simple.
9. A performance measurement must not appear to those involved as a passing fad.
10. A performance measurement system must clearly fit into the management process and be acknowledged as a decision-making and problem-solving support.
11. The behavioral consequences, the unintended and potentially dysfunctional consequence of performance measurement must be anticipated and reflected in system design.
12. A useful system must be seen by those whose behaviors are being assessed as being nonmanipulative, not gamed.

TABLE 2 (continued)

13. An effective measurement system must build upon consistent and well understood operation definitions for the seven performance criteria.

14. The unit of analysis/target system must be clearly defined and delineated in order for measurement to succeed. An input output analysis is a necessary precondition.

15. One must create visibility and ownership for the resulting measurement systems in order to ensure effective long-term utilization.

16. One must clearly separate the process of measurement from the process of evaluation. The difference between a control chart and specifications/requirements and standards must be understood.

numbers, not quality or methods. They are usually a guarantee of inefficiency and high cost. A person, to hold a job, meets a quota at any cost, without regard to damage to the company" (Walton, 1986:36).

2.6 Conclusion

The bottom line is that measurement is vital to the success of the organization or department. It fits right in to Demming's Fourteen Points, which can be found in Table 3.

Demming talks about measuring for improvement, not measuring for the sake of measurement. C. Jackson Grayson, author of the article "...But what do I do Monday Morning?", reiterates the importance of measurement when offering advice for improving business.

Create, in the next six months, an improved measurement system that focuses on productivity and quality. Disseminate those measures throughout the organization and incorporate them into your budget, performance appraisal system, compensation system, and reporting system....
(Grayson:239)

In summary, John Madden, retired National Football League coach and television analyst, simplified the rationale, the whole reason for conducting measurement in the first place, when he said,

I just wish everyone we deal with in the real world had a record that anybody could check. If you hire a lawyer to defend you in an auto accident, do you have somebody who's 31-1 in auto accident cases or 4-28? Nobody knows.
(Madden, 1988:9)

TABLE 3

DEMING'S FOURTEEN POINTS

(Walton, 1986:35-36)

-
1. Create constance of purpose for improvement of product and service.
 2. Adopt the new philosophy.
 3. Cease dependence on mass inspection.
 4. End the practice of awarding business on price tag alone.
 5. Improve constantly and forever the system of production and service.
 6. Institute training.
 7. Institute leadership.
 8. Drive out fear.
 9. Break down barriers between staff areas.
 10. Eliminate slogans, exhortations, and targets for the workforce.
 11. Eliminate numerical quotas.
 12. Remove barriers to pride of workmanship.
 13. Institute a vigorous program of education and retraining.
 14. Take action to accomplish the transformation.

III. Methodology

3.1 Approach

The methodology was designed around answering two investigative questions. The first investigative question was what do the writers of literature in the field of measurement propose as the best way to develop measures of white-collar departmental performance? The answer, found through an analysis of literature, provided an integrated measurement development technique.

The second investigative question was how does a selected business measure the performance of its departments, and how were the measures developed? The answer to the second question was found by conducting a case study of Pratt & Whitney's Government Engine Division. The analysis of the second question either supported or rejected the proposition that the integrated measurement technique derived from the literature can be supported with an example from existing business practices in an environment that approximated a System Program Office. The reason for starting with these two questions is because the research was designed to determine a theoretical viewpoint, ground its use in practice, and recommend future action. In every test there must be a standard - something against which to measure (Feldman, 1981:7).

This chapter is organized in the same manner that the research was conducted. It begins with the Assessment of

Literature Section, which explains the approach to the analysis of literature and highlights the purpose for conducting the analysis. Also contained in the Assessment of Literature Section are the background of the key sources and a discussion of how the literature data will be presented in Chapter 4. Following the Assessment of Literature Section is the explanation of the approach to the case study. The explanation begins with a discussion of why case study interviews were conducted, then it talks about why Pratt & Whitney was chosen for the study, and finally, how the data was used and presented in Chapter 5. The Methodology concludes with a discussion of validity and how validity relates to this research effort.

3.2 Assessment of Literature

The first investigative question addressed by following the methodology was what do the writers of literature in the field of measurement propose as the best way to develop measures of white-collar departmental performance? The purpose for conducting the analysis of literature was to establish a theoretical baseline for developing measures of performance. The answer to this question formed the backbone of the recommendations.

This question was answered by thoroughly reviewing the current literature on this subject. The search through the literature was not only for performance measurement development techniques but also for techniques for measuring

any of the seven components of performance discussed in Chapter 1. The reason for expanding the search was to encounter as many white-collar measurement development techniques as possible. An summary of the results of this expansion is included in Chapter 6. The search was for a noticeable trend among the recipes dictated by the measurement experts. A qualitative trend of this sort cannot be substantiated statistically. Nor were there a number of complete recurrences that will confirm a trend. What the research was looking for was a common thread of ideas presented throughout the literature; as individual concepts for developing measures or as completed recipes, that, when combined, produced a defensible measurement development procedure.

3.2.1 Background of the Key Sources. The authors of six sample measurement development procedures served as the primary focus of summarization. The following six paragraphs contain information intended to provide insight into the qualifications of each of the authors.

The first measurement development procedure cited in the text comes from Productivity and Quality: Measurement as a Basis for Improvement, by Everett E. Adam, James C.

Hershauer, and William C. Ruch. The book stated that the authors' academic backgrounds are from the University of Missouri - Columbia and Arizona State University. Their research includes work with the First National Bank of Mobile, Alabama, General Telephone and Electronics (GTE),

and the Marriott lodging-food services firm. The authors have written articles in the field of performance for the Journal of Applied Psychology, The Academy of Management Journal, the American Society for Quality Control Technical Conference Transactions, and the Academy of Management Review, to name but a few.

The second measurement development procedure cited in the text comes from Planning and Measurement in Your Organization of the Future, by D. Scott Sink and Thomas C. Tuttle. The authors' experiences comes from both the academic environment as well industry and public service. They integrated what they learned in the previous twelve years from managing quality, productivity, and quality of work life research and development centers at major universities. Sink was at Ohio State University, Oklahoma State University, and Virginia Tech, while Tuttle was at the University of Maryland (Sink and Tuttle, 1989:ix). Their non-academic experience comes from the organizations with whom they have worked. These organizations include the Navy, the Air Force, Baltimore Gas and Electric, San Diego Gas and Electric, Virginia Fibre Corporation, Virginia Department of Transportation, Norfolk Naval Shipyard, Naval Sea Support Center - Atlantic, Naval Ordnance Station - Indian Head, Naval Air Depot - San Diego, Veteran's Administration, Rhone Poulenc (United States and France), and the Internal Revenue Service (Sink and Tuttle, 1989:xi).

The third measurement development procedure cited in the

text was prepared by the staff of the Federal Quality and Productivity Improvement Program in the Office of Management and Budget. Private industries such as Westinghouse Corporation, 3M, Cigna Health Plans, Honeywell Aerospace and Defense, Xerox, and First National Bank of Chicago assisted in the research effort by providing information about their measurement systems.

The fourth citation containing a measurement development procedure is from the Productivity Measurement Handbook, by William Christopher. William Christopher's career includes thirty years with General Electric Company, Hooker Chemical Corporation, and Occidental Petroleum Corporation in marketing, product and venture development, internal consulting, and management. He is the president and senior management counselor of The Management Innovations Group, which specializes in "Key Performance Area" counsel and implementation services. His publications include two books on business management: The Achieving Enterprise, Amacom, 1974 (winner of the 1976 James A. Hamilton Award), and Management for the 1980s, published in 1980 by Amacom (hardcover) and Prentice-Hall (paperback) (Christopher, 1985:v).

The fifth measurement development procedure cited in the text is from Measuring and Assessing Organizations, by Andrew H. Van Der Ven and Diane L. Ferry. The information contained in the procedure was tested during 1975 and 1976 in twenty California employment service, unemployment

insurance, and vocational rehabilitation offices consisting of 250 work units and about 1300 organizations. These tests compared favorably to the tests conducted previously at the Wisconsin Department of Industry, Labor and Human Relations (Van Der Ven and Ferry, 1980:xi-xii).

The sixth measurement development technique cited in the text is from Company Productivity: Measurement for Improvement, by Irving H. Siegel. Mr. Siegel is a consulting economist, who received his Ph.D. from Columbia University. His Doctoral dissertation, Concepts and Measurement of Production and Productivity, republished by the Bureau of Labor statistics in 1952, was widely used by researchers and educators in many countries for almost a decade. Mr. Siegel has served the government as chief economist of the Veteran's Administration, member of the economic staff of the President's Council of Economic Advisers, and economic advisor to the Bureau of Domestic Business Development in the Department of Commerce. He is a fellow of the American Statistical Association, the American Association for the Advancement of Science, and the New York Academy of Sciences (Siegel, 1980:v).

3.2.2 Analysis of Sources. Each of the six sources provided a measurement development recipe to be followed by a white-collar department when performance measures are the desired outcome. By comparing the recipes to each other, it was possible to arrive at a single, integrated approach to developing measures of performance. Then, in tabular

format, each recipe could be presented next to the integrated approach to determine if all the concepts stated in the source were represented by the integrated approach. This analysis is contained in Chapter 4.

3.3 The Choice of a Case Study

Once the theoretical baseline had been established, it was necessary to attempt to ground the baseline in practice. This was done by answering the second investigative question, which was how does a selected business measure the performance of its departments, and how were the measures developed? A case study was the best method for answering this question.

The majority of information cited within this portion of the methodology is from Robert K. Yin's book entitled Case Study Research: Design and Methods. Dr. Yin's background includes a B.A. (magna cum laude) from Harvard College and a Ph.D. from the Department of Psychology, Massachusetts Institute of Technology. Dr. Yin was, at the time of the publication of his book, the President of a social science research firm. He also served as Visiting Professor in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology. His research is focussed primarily on organizational processes (Yin, 1984:160).

The case study is but one of several ways of doing social science research. Other ways include experiments, surveys, histories, and the analysis of archival information (as in economic studies). Each strategy has

peculiar advantages and disadvantages, depending upon three conditions: 1) the type of research question, 2) the control an investigator has over actual behavioral events, and 3) the focus on contemporary as opposed to historical phenomena.

In general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context. Such "explanatory" case studies also can be complemented by two other types - "exploratory" and "descriptive" case studies. (Yin, 1984:13)

With this introduction into the characteristics of a case study, the choice of a case study methodology to answer the "how" question of how does a private industry develop departmental measures of performance was obvious. The proposition itself designates the overall type of study to be performed. The proposition being investigated, whether or not the measurement development procedures highlighted in literature are applicable in practice, addresses contemporary events best observed without manipulating the behaviors of those being observed. The nature of the material indicates that a case study is appropriate. Robert K. Yin goes on to say that the "case study is preferred in examining contemporary events, but when the relevant behaviors cannot be manipulated" (Yin, 1984:19).

A case study was conducted on Pratt & Whitney's Government Engine Business in order to determine if the theoretical measurement development procedures were being followed in practice. Pratt & Whitney was chosen because of the closeness in function to an Air Force SPO and because it

has a quality initiative, complete with departmental measures of performance, established within its structure.

3.3.1 Interviews as the Prime Source of Information. It is important to choose data collection methods that will correspond in the tightest possible fit to the information needed, maximize reliability, and reduce error as much as humanly possible (Feldman, 1981:22). The choices of research techniques were not extensive.

Case studies may be based on six different sources of evidence: documentation, archival records, interviews, direct observation, participant-observation, and physical artifacts. (Yin, 1984:78)

Documentation and archival records are good sources of information for determining what the measurements of the various white-collar departments are, and they were used to the extent that they provided benefit. But in trying to discover how the measures were developed, most of the written material was of limited use.

Leaving the discussion of interviews until the end of this section, the next sources of evidence to be evaluated is direct observation and participant-observation. In certain instances, direct observation provided a good insight into how well the employees accepted the measures and how often the measures were used. But due to the limited on-site research time available, the opportunity did not present itself to directly observe any department conduct a measurement development exercise. Participant-observation, which is a mode of observation in which the

investigator is more involved than simply a passive observer (Yin, 1984:86), requires the same time commitment that direct observation does. Also, for each type of observation, a sound theoretical base must be formed prior to beginning the observation. For a study of the development of departmental measures of performance, this thesis could serve as the theoretical base, in which case, the next step would be to prove that this method works in practice. However, due to the time frame of this thesis, it was not possible to develop and test the measurement development recipe (see recommendations for continuing study, Chapter 6).

The use of physical artifacts for this study is not applicable. This involves the use of a technological device, a tool or instrument, a work of art, or some other physical evidence for data gathering (Yin, 1984:88). These items were not available during the data collection phase.

"One of the most important sources of case study information is the interview" (Yin, 1984:82). Because the information needed varied in format from respondent to respondent and was used to validate literature information, the focused interview was the best way to capture the information and served as the primary source of evidence.

The focused interview is an interview in which

a respondent is interviewed for a short period of time - an hour, for example. In such cases, the interviews may still remain open-ended and assume a conversational manner, but the interviewer is more likely to be following a certain set of questions

derived from the case study protocol.

...a major purpose of such an interview might be simply to corroborate certain facts that the investigator already thinks has been established (but not to ask about other topics of a broader, open-ended nature). In this situation, the specific questions must be carefully worded, so that the investigator appears naive about the topic and allows the respondent to provide a fresh commentary about it... (Yin, 1984:83)

A protocol is a guide for the interviewer or researcher (Yin, 1984:66). The protocol used in this thesis is the combination of Appendix A and Appendix B.

3.3.2 Conducting the Interviews. The previous section established interviewing as the most appropriate data collection method for this case study. This section discusses the method used to construct the interviews.

The reasons Pratt & Whitney was chosen for the case study were because of its closeness in structure and function to the Air Force System Program Office (SPO), that it has a quality program in place, and the fact that concrete measurement was on going as a performance evaluation tool. The closeness in structure and function was the primary reason. With potential applicability within a SPO being a key issue involving the results of the research, it was important to choose a business that had a structure similar to that of the SPO, or at least departments within the business that performed functions resembling those accomplished in a SPO. When a letter (see Appendix B) was sent to Pratt & Whitney to request managers for the interviews, the managers requested were from the areas of

engineering, finance, program management, configuration, data, quality and manufacturing, and logistics. The duties of these departments closely resemble the duties of their counterparts in a SPO. The quality program chairman at Pratt & Whitney succeeded in scheduling managers from these areas for the interviews, and these managers formed a cross-section representation of all managers within the white-collar work environment. A summary of the information letter sent to Pratt and Whitney for assistance in determining those managers to be interviewed is Appendix A.

Once again, the research was looking for a noticeable trend in measurement development procedures, which would then be compared to the literature. The interview questionnaire was developed to allow the interviewed manager to state how he/she felt their department developed their measures of performance. The questions were focused around the integrated approach but were worded in a manner that did not force the manager to give an answer which would coincide with the integrated approach. The questionnaire is Appendix B. The results of the interviews, as well as the comparisons to the literature, are in Chapter 5.

3.4 Concern for Validity

C. William Emory defines validity in terms of whether a measure does what is claimed for it (Emory, 1985:115). Yin takes this concept to greater depth.

The case study investigator also must maximize four aspects of the quality of any design: (1) construct validity (2)

internal validity (for explanatory or causal case studies only) (3) external validity (4) reliability. (Yin, 1984:27)

An explanatory case study is one in which the researcher is attempting to pose competing explanations for the same set of events (Yin, 1984:16). For example, does a person run faster because he has better shoes or because the shoes make him psychologically better? A causal case study attempts to show a cause and effect relationship between events. For example, if a person runs faster, is it due to the new shoes? The case study for this thesis was descriptive in nature, not explanatory or causal, since it described the development of departmental measures of performance. Therefore, construct validity, external validity, and reliability must be addressed.

Construct validity, which is establishing the correct operational measures for the concepts being studied, or using the right ruler, is strengthened by using multiple sources of evidence (Yin, 1984:36). For this thesis, construct validity was strengthened by conducting multiple interviews and using appropriate available documentation.

External validity, which is "establishing the domain to which a study's findings can be generalized" (Yin, 1984:36) was also addressed by interviewing multiple departments, many of which are quite similar in function to those departments within a typical Air Force System Program Office. This technique also serves to encompass a variety of management styles as well as organizational differences.

Finally, reliability, which is "demonstrating that the operations of a study - such as the data collection procedures - can be repeated with the same results" (Yin, 1984:36) was addressed by using the same interview protocol for each interview.

3.5 Conclusion

As discussed previously, the methodology revolves around two investigative questions involving two data collection methods: an analysis of literature and a case study. The analysis of literature is intended to provide the background information necessary to develop an integrated measurement development procedure. This integrated approach then serves as the point of comparison for the remainder of the study.

The case study was designed to ground the theoretical measurement development procedure in a selected business environment. Because the study was non-manipulative in nature, it fit well into the case study framework. Interviewing was used primarily because it formed the most appropriate data collection method for this research effort. The data from the interviews was compared with the integrated approach from the literature to determine if departments that had measures of performance followed the literature principles when developing the measures.

IV. Analysis of Literature

4.1 Introduction

This literature review summarizes the current information on the topic of developing performance measures within a white-collar work environment and identifies an integrated approach to measurement development. Throughout the research, only six sources were found containing measurement development procedures for a white-collar environment. In this analysis of literature, these six measurement development procedures are outlined. These procedures act as references for the subsequent discussion. Also in this section, the steps of an integrated measurement development procedure based on the six sources are introduced. This summarized procedure serves as the basis of comparison between the literature and an industry example, as well as the basis for the overall recommendations.

4.2 Measurement Development Procedures from Literature

To facilitate reference, to form a clear basis for the discussion of the steps involved in forming a performance measurement system, and to form the basis for the final recommendations, the following performance development procedures were found to be applicable.

Procedure A is from Productivity and Quality: Measurement as a Basis for Improvement, by Everett E. Adam, et.al.,

Procedure A: Measurement Procedure Activities

1. Decide to measure productivity
2. Select project coordinators
3. Become familiar with system
4. Select participants; divide into groups
5. Define system and establish boundaries
6. Determine unit operations
7. Generate, select, and rank deviations
8. Determine final key quality deviations
9. Generate key quality deviation measures
10. Collect technology and systems input data
11. Edit measures into productivity ratios
12. Clarify edited measures and revise as necessary
13. Put measures into questionnaire format
14. Rank productivity measures by completing questionnaire
15. Evaluate questionnaire results and produce final quality-productivity ratios.
(Adam and others, 1981:41)

Procedure B is from Planning and Measurement in Your Organization of the Future, by Sink and Tuttle,

Procedure B: Five Steps of Management Systems Analysis (MSA)

1. Gaining a better understanding of the organizational system.
2. Identification of ways to improve the performance of the organization being analyzed.
3. Classify information needs/requirements in relation to the type of organizational system that a management team is attempting to manage.
4. Data requirements to provide information in Step 3.
5. The data to information transformation.
How can we best convert our data into the information that has been required by the management team? (Sink and Tuttle, 1989:192-200)

Procedure C is the procedure out of the Office of Management and Budget, which is:

Procedure C

1. Identify all customers of the program's outputs - products and services - and those customers' requirements and expectations.
2. Define the entire workprocess that provides the product/service.
3. Define the value-adding activities and outputs that comprise the system.
4. Develop quality measures or indicators.
5. Assess quality measures. (OMB, 1989:10-16)

Procedure D is from the Productivity Measurement Handbook, by William Christopher.

Procedure D

1. Identify the purpose, or mission, of the unit.
2. Identify the output produced when this purpose is successfully achieved.
3. Determine the most successful measures of this output.
4. Identify and measure inputs.
5. Develop appropriate productivity measures.
6. Report measures for the relevant reporting period and monitor trends over time.
7. Do all of the above through a dialogue process. (Christopher, 1985:195)

Procedure E is from Measuring and Assessing Organizations, by Van Der Ven and Ferry.

Procedure E

Phase 1: Evaluation Prerequisites - in this phase, the evaluators, or those who will develop the measures are determined. This book recommends using both inside people and people from outside the organization.

Phase 2: Goals Exploration - the evaluators conduct a series of meetings with various users, those that have a stake in the organizational assessment, to identify the effectiveness goals against which the organization will be evaluated.

Phase 3: Criteria Development - once the goals are determined, quantitative measures are broken out from them.

Phase 4: Evaluation Design - this is the phase when the measures are tested in a pilot program.

Phase 5: Evaluation Implementation - the tested goals are then evaluated for overall effectiveness of use.

Phase 6: Data Analysis, Feedback, and Evaluation - this is the continual assessment phase (Van Der Ven and Ferry, 1980:31-41).

Procedure F is from Company Productivity: Measurement for Improvement, by Irving H. Siegel.

Procedure F

1. The decision to measure.
2. The task force and its charter.
3. Program information and communication.
4. Inventory of data resources and skills.
5. Auxiliaries: consultants, liaison officers, trainees.
6. Design of measurement system.
7. Installation and "debugging".
8. Instructions for operation and recommendation for evaluation (Siegel, 1980:45-46).

The following is a summary of the above material and other literature reviewed.

4.3 The Integrated Measurement Development Procedure.

The integrated measurement development procedure is designed to assemble all of the similar steps of the above procedures under a single heading. The integrated measurement development procedure that encompasses all the aspects of the six procedures from the experts is:

1. Step One: Establish a measurement team.

2. Step Two: Obtain a clear understanding of the organization.
3. Step Three: Focus on measurements in the areas of strategic importance.
4. Step Four: Classify information needs.
5. Step Five: Assess the measures.

Sections 4.3.1 through 4.3.5 give explanations of the meaning of each step. Those sections are followed by charts which illustrate the comparison between each of the source measurement development procedures and the integrated approach.

4.3.1 Step One: Establish a Measurement Team. The measurement team, or management team, must be clearly defined. "Keep in mind that we define a management team to be the entire group of managers, staff, and other employees that make up a target system" (Sink and Tuttle, 1989:233). This general definition implies that all members of the target system are included on the measurement team. Siegel approaches the subject of a measurement team this way:

The help of employees could be solicited in the selection of eligible areas for special scrutiny and in the selection of measurement criteria. (Siegel, 1980:20)

Often times, it is impractical to select the entire staff of the target system for the measurement team. According to Sink and Tuttle, the size and make-up of the team must be tailored to the organization.

We suggest that for smaller organizational systems (i.e., approximately 6 to 20) that most, if not all, of the members of those

organizational systems be involved in many of the steps of the process.... (Sink and Tuttle, 1989:233)

Referring to Procedures A-D found at the beginning of section 3.4, establishing a measurement team for the purpose of developing the measures corresponds to steps 2 and 4 of Procedure A, step 7 of Procedure D, Phase 1 of Procedure E, and steps 1-3 of Procedure F (see Tables 4-9). This does not mean that the other authors consider this step insignificant. Sink and Tuttle, authors of Procedure B, say this on the subject:

An early step in the process is the formation of the teams of people who will be completing various steps of the process. We use the word teams because we believe that measurement systems cannot be successfully designed, developed and implemented by individual measurement analysts. (Sink and Tuttle:232)

The Office of Management and Budget, who supplied Procedure C quoted Carl Thor, President of the American Quality and Productivity Center when he suggested that

ideally, to ensure fairness and commitment, three actors -- the supplier of inputs, the employees of the organization providing the service, and the user/customer of the service -- should construct the measures. (OMB, 1989:9)

The use of an internal measurement team, rather than an outside expert or guidance from elsewhere in the organization that is not involved with this target system, adds to the degree of buy-in from the employees. Lehrer attributes the buy-in success to participative techniques because they add a new positive element to what might have

been a sterile and possibly objectionable exercise (Lehrer, 1983:41).

Siegel states, however, that there is some merit to using outside assistance along with, and as a member of, the measurement team, but adds a caveat:

In developing its program, a company with limited in-house talent may do well to call on outside consultants. Such supplementation of resident technical resources could reduce the number of false moves, shorten the time required for design, and yield a more authoritative result. On the other hand, a system has to be a company's "own", and responsibility for it cannot be delegated to others by contract. (Siegel, 1980:47)

While the outside assistance will not understand the organization as fully as someone who works in the department, they will add an unbiased perspective when developing the measures (Van Der Ven and Ferry, 1980:33). The amount of assistance is a decision the department must make when determining the make-up of the measurement team.

When forming a team for the purpose of developing measures of performance, the users of the organization's product or service should be considered. An error in measurement construction is developing measures exclusive of the users. Sink and Tuttle and Lehrer speak of this common mistake. Sink and Tuttle state that "...developing measurement and evaluation systems independent of significant user or management team involvement is widely recognized as being ineffective in the longer term" (Sink and Tuttle, 1989:232). Lehrer expands this idea:

Given that most solutions start with an analysis of outputs and objectives, consideration is needed of different methods of developing appropriate measures. The common approach has always been that an "expert" will view the process and make recommendations. Although this is sometimes appropriate in difficult-to-measure situations in the factory, it is a fairly dangerous approach in professional areas where the professional workers feel (often correctly) they know more about the process than the so-called expert. Another approach would be to have the expert interview different members of the organization and solicit their ideas as to appropriate measures. This has the advantage of getting some employee input, and it allows the analyst's previous experience to be tempered and adjusted by the special circumstance of the particular organization. (Lehrer, 1983:39)

4.3.2 Step Two: Obtain a Clear Understanding of the Organization. Obtaining a clear understanding of the organization means the measurement team must gain a complete understanding of the goals and objectives of the organizational system or target system within which the measurement will take place. As illustrated in the following tables, this step includes identifying the products/services of the organization and its departments, and the customers, or the recipients of the products/services.

A vigorous analysis of any white-collar function's effectiveness must begin with three fundamental questions:

- What are we primarily here for?
- Who relies on us?
- How do we know their needs have been met?

(Leth and others, 1985:7)

Step two is necessary to dispell the vagueness that Boyett and Conn talked about in their article, "Developing White-collar Performance Measures", when they said: "Until the vagueness can be eliminated, measures cannot be developed" (Boyett and Conn, 1988:210).

The first step in Sink and Tuttle's five-step Management Systems Analysis (MSA) found in Procedure B above deals with the idea of gaining a better understanding of the organizational system. This direction also corresponds to steps 3, 5 and 6 from the Measurement Procedure Activities found in Procedure A steps 1-2 from the procedure which came out of the Office of Management and Budget, Procedure C, as well as step 1 from the Productivity Measurement Handbook, Procedure D and steps 4-5 from Procedure F (see Tables 4-9). Although not specifically stated, obtaining a clear understanding of the organization is an important part of any goal exploration and is contained within Phase 2 of Procedure E.

There are two general areas that are involved with organizational clarification. The first is product or service identification. "In approaching measurement of white collar productivity, the first question to ask is what is the output of the processes for which an employee is responsible" (Lehrer, 1983:39). When the Air Force Human Resources Laboratory (AFHRL) discusses departmental measurement, they speak of the types or categories of results the Air Force expects the organization to accomplish

(AFHRL, 1986:14). Recalling the experimental pilot program conducted by the American Productivity Center to determine how to best conduct white-collar measurement, their results led to the belief that,

the measurement phase was intentionally positioned after services and objectives were identified so pilots could determine what was important to measure and how to use the data meaningfully. (Leth and others, 1985:25).

The second general area involved in departmental clarification is customer identification. The Office of Management and Budget, in their departmental measurement recipe (OMB, 1989:10-16), states that identification of customers is the number one concern for any measurement system. C. Jackson Grayson, author of the article "...But What Do I Do Monday Morning," offers directions to Chief Executives desiring improvement ideas.

...visit ten customers by yourself; no staff, no telephone. Ask them a simple question: 'How are we doing? How can we do better?' Create an absolutely fanatical focus on customers, starting with yourself. (Grayson:239)

W. Edwards Demming is very clear on this point.

Everyone here has a customer. And if he doesn't know who it is and what constitutes the needs of the customer, and work in the cycle of adjustment to customer's needs and what he can produce, then he does not understand his job. (Walton, 1986:28-29)

4.3.3 Step Three: Focus on Measurements in the Areas of Strategic Importance. In other words, once the measurement team is completely familiar with the organization or department, it must chose the focus of the measurements.

This is analogous to the theory of the Pareto analysis, which emphasizes separating the important few from the trivial many (Schonberger and Knod, 1988:593). Measurement of an entire organization is generally difficult, so key areas must be determined.

It is possible to rank the seven performance criteria in terms of their relative importance for the target system. In general, this can be done by starting with the performance criteria that are most closely linked to the strategic performance dimensions. (Sink and Tuttle, 1989:205)

The strategic performance dimensions are those goals the department wants to concentrate on or those activities that are essential to the department.

Reiterating an important point from the Organization Assessment Instrument, Table 8,

Therefore, in Phase 2, the evaluators conduct a series of meetings with various users to identify the effectiveness goals they have for the organizational components being assessed. Users ...[are]...people within and outside the organization who have a stake in the organization assessment (Van Der Ven and Ferry, 1980:34).

The customer should be involved in the task of focusing the measures on the areas of key importance, to the degree possible.

Determining the focus of measurements is reflective of steps 7-8 from Procedure A, steps 2 and 3 from Procedure B, step 3 from Procedure C, step 2 from Procedure D and Phase 2 from Procedure E (see Tables 4-9). Siegel, author of Procedure F concurs with this step by saying, "[The task

force] will...decide that some subgoals should be deferred and others given higher priority" (Siegel, 1980:51).

4.3.4 Step Four: Classify Information Needs. Classify information needs is the step in which the actual measures of performance are determined. The measurement team understands the department, and has focused on the most important areas of that department, it must now find measures for the key areas. Group techniques such as brainstorming and Nominal Group Technique can be used to complete this step. Examples of working measures in a white-collar environment are contained in Chapter 5.

From Sink and Tuttle's Management Systems Analysis (MSA), Procedure B, step 4, the classification of information needs is when the management team collects the data. The Office of Management and Budget, in their procedure for measurement development, Procedure C, calls this step 4, developing the quality measures or indicators. Classify information needs also summarizes steps 9-11 of the Measurement Procedure Activities found in Procedure A, steps 3-5 from Procedure D, Phase 3 from Procedure E, and steps 6-7 from Procedure F (see Tables 4-9). Now that the areas of focus have been identified, the actual measures of performance can be taken.

4.3.5 Step Five: Assess the Measures. Both the information gathered and the measures themselves must be evaluated. In Sink and Tuttle's MSA, Procedure B, assess the measures is the data transformation stage, where the management team makes the best use of the information

gathered. That is an assessment of the information.

One level beyond the information assessment is the evaluation of the measures themselves. This is the final step in the Office of Management and Budget recipe, Procedure C, step 12 of the Measurement Procedure Activities from Procedure A, step 6 from Procedure D, Phases 4-6 from Procedure E, and step 8 from Procedure F (see Tables 4-9). The Office of Management and Budget states that the measurers must:

Evaluate to the degree which they are:

- practical to implement
- easy to understand
- able to drive desired behavior
- developed with inputs from and consensus with work groups
- specific (OMB, 1989:24)

4.3.6 Tables. The following tables illustrate the integration of the six procedures from the literature into a single measurement development approach.

TABLE 4

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE MEASUREMENT PROCEDURE ACTIVITIES (Procedure A)

(Adam and others, 1981:41)

<u>INTEGRATED APPROACH</u>	<u>MEASUREMENT PROCEDURE ACTIVITIES</u>
1. Establish a measurement team.	1. Decide to measure productivity. 2. Select project coordinators. 4. Select participants; divide into groups.
2. Obtain a clear understanding of the organization.	3. Become familiar with system. 5. Define system and establish boundaries. 6. Determine unit operations.
3. Focus on measurements in the areas of key importance.	7. Generate, select, and rank deviations. 8. Determine final key quality deviations.
4. Classify information needs.	9. Generate key deviation measures. 10. Collect technology and systems data. 11. Edit measures into productivity ratios.
5. Assess the measures.	12. Clarify edited measures and revise as necessary.

TABLE 5

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE FIVE STEPS OF MANAGEMENT SYSTEMS
ANALYSIS (MSA) (Procedure B)

(Sink and Tuttle, 1989:192-200)

<u>INTEGRATED APPROACH</u>	<u>MSA</u>
1. Establish a measurement team.	
2. Obtain a clear understanding of the organization.	1. Gaining a better understanding of the organizational system.
3. Focus on measurements in the areas of key importance.	2. Identification of ways to improve the performance of the organization being analyzed. 3. Classify information needs/requirements in relation to the type of organizational system that a management team is attempting to manage.
4. Classify information needs.	4. Data requirements to provide information in step 3.
5. Assess the measures.	5. The data to information transformation.

TABLE 6

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE PROCEDURE FROM THE OFFICE OF MANAGEMENT
AND BUDGET (OMB) (Procedure C)

(OMB, 1989:10-16)

<u>INTEGRATED APPROACH</u>	<u>OMB</u>
1. Establish a measurement team.	
2. Obtain a clear understanding of the organization.	1. Identify all customers of the program's outputs and those customer's requirements and expectations. 2. Define the entire workprocess that provides the product/service.
3. Focus on measurements in the areas of key importance.	3. Define the value-adding activities and outputs that comprise the system.
4. Classify information needs.	4. Develop quality measures or indicators.
5. Assess the measures.	5. Assess quality measures.

TABLE 7

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE PROCEDURE FROM THE PRODUCTIVITY MEASUREMENT
HANDBOOK (PMH) (Procedure D)

(Christopher, 1985:195)

<u>INTEGRATED APPROACH</u>	<u>PMH</u>
1. Establish a measurement team.	7. Do all of the above through a dialogue process.
2. Obtain a clear understanding of the organization.	1. Identify the purpose, or mission, of the unit.
3. Focus on measurements in the areas of key importance.	2. Identify the output produced when this purpose is successfully achieved.
4. Classify information needs.	3. Determine the most useful measures of this output. 4. Identify and measure inputs. 5. Develop appropriate productivity measures.
5. Assess the measures.	6. Report measures for the relevant reporting period and monitor trends over time.

TABLE 8

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE ORGANIZATIONAL ASSESSMENT INSTRUMENT
(OAI) (Procedure E)

(Van Der Ven, and Ferry, 1980:31-41)

<u>INTEGRATED APPROACH</u>	<u>OAI</u>
1. Establish a measurement team.	Phase 1: Evaluation Prerequisites.
2. Obtain a clear understanding of the organization.	
3. Focus on measurements in the areas of key importance.	Phase 2: Goal Exploration.
4. Classify information needs.	Phase 3: Criteria Development.
5. Assess the measures.	Phase 4: Evaluation Design. Phase 5: Evaluation Implementation. Phase 6: Data Analysis, Feedback, and Evaluation.

TABLE 9

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE COMPANY PRODUCTIVITY MEASUREMENT PROGRAM
(CPMP) (Procedure F)

(Siegel 1980:45-46)

<u>INTEGRATED APPROACH</u>	<u>CPMP</u>
1. Establish a measurement team.	1. The decision to measure. 2. The task force and its charter. 3. Program information and communication.
2. Obtain a clear understanding of the organization.	4. Inventory of data resources and skills. 5. Auxiliaries: consultants, liaison officers, trainees.
3. Focus on measurements in the areas of key importance.	
4. Classify information needs.	6. Design of measurement system. 7. Installation and "debugging".
5. Assess the measures.	8. Instructions for operation and recommendation for evaluation. Implementation.

4.4 Conclusion

Many companies have slight variations to this process, but the overall themes are consistent. Rolls-Royce, for example, uses Departmental Task Analysis (DTA), in which step one is to determine assignment and responsibilities. Step two is identifying your customer, defined by Rolls-Royce and anyone, inside or outside the company, who receives an output from you. They believe that customers are the only people who can really evaluate your performance. Step three is to determine the customer's requirements. Step four is to determine activities necessary to meet customer requirements. This is when they ask if they are choosing performance indicators which are the easiest to measure or the ones which are the most important to their customers (Wedge, 1989:1-10).

Ideally, the integrated approach presented above is flexible enough to be adapted to any organization. Chapter 5 of this thesis compares the integrated approach to how members of one firm, chosen for its similarity to an Air Force SPO, developed their departmental measures of performance.

V. Results of the Interviews

5.1 Explanation of Results Format

This chapter analyzes the research data generated through interviews with Pratt & Whitney managers. Section 5.1 contains a review of the objective of the chapter, the rationale for the method of evaluation of the data, a presentation of the success criteria, and an explanation of the format of the data summary. Section 5.2 is the data summary, and section 5.3 discusses any additional findings pertinent to the research but too general for inclusion into a particular interview summary.

As mentioned in the methodology (Chapter 3), the results were tabulated in the form of a comparison between the steps found in the integrated measurement development procedure discussed in Chapter 4 and the steps used for measurement development by the various Pratt & Whitney departments. The goal of this comparison is to provide grounding in private industry for the information derived from current literature, thereby adding validity to the literature results.

The information gathered in the Results of the Interviews chapter is the manager's perspective of how the performance measurements were developed. Any use of the information must be viewed in the context in which it was collected. The questionnaire (Appendix B) was designed to remove as much of the manager's personal interpretation as possible,

but without the ability to interview the entire department, it is necessary to accept the interview answers at face value.

Along with providing insight into the development of the measures of performance, the interview results provide valuable examples of measures of performance used in practice. These examples could prove useful for any department wishing to develop its own measures of performance.

5.1.1 Rationale for the Method of Evaluation. The data collected through the interviews were the result of a guided questionnaire (Appendix B) designed to be flexible enough to adapt to each respondent and their department's unique measurement development system. As a result, the information does not lend itself to statistical analysis. The evaluation procedure, then, was to look for common ideas discussed throughout each interview and to determine how well the comments fit into a format similar to the integrated measurement development procedure from Chapter 4. This final transformation facilitates the comparison necessary to support or reject the proposition that a measurement development procedure derived from current literature is applicable, in practice, to Pratt & Witney.

5.1.2 Success Criteria. The success criteria for the interviews was 100% compliance with the above-stated proposition. Each interview was evaluated based on this success criteria when the information gathered was compared

step by step with the integrated measurement development procedure. All discrepancies are discussed in the Recommendations and Conclusions chapter (Chapter 6).

5.1.3 Explanation of the Format for the Data Summary.

Section 5.2, the Data Summary, is laid out by interview. A discussion of each interview is included to provide insight into the type of department involved. Following the discussion is a table which compares the measurement development technique used by that department to the integrated approach. If text is included in the table next to the integrated approach, it is an explanation of that department's measurement development step which was comparable to a particular step of the integrated measurement technique. If no text is presented, it means that the department did not perform that step.

5.2 Data Summary

Pratt & Whitney was chosen as a source for the interviews because its Government Engine Business has departments similar in function to those of an Air Force System Program Office (SPO), and because, as a result of Pratt & Whitney's quality initiative, many of the departments have measures in place. The following data comes from twelve departments that perform similar functions to their Air Force counterparts in a SPO and have measures of performance in place.

5.2.1 Manager 1: Supervisor of Production Pricing. The Production Pricing department is responsible for preparing cost proposals for United States military aircraft parts. The department supports audits and fact findings, as well as contract negotiations. The six members of the department produce both products in terms of cost proposals, financial analyses, and budgetary and planning estimates; and services, in terms of their support of audits, fact findings, and negotiations. The department's external customers include the United States government and foreign governments. Its internal customer is executive management.

The Production Pricing department has three forms of measurement. On the individual level, it employs a performance measurement system called the Performance Management Recognition and Rewards (PMRR) method in which the manager negotiates key job requirements, defined and measurable, with the members of the department. While this method is primarily designed for individual performance measurement, it is also a measure of department performance. This will be the only reference to the use of the PMRR, but it is used throughout the company, and each department interviewed participates in this system. For the rest of the discussions, it will be understood that the PMRR is a measurement system in addition to those presented.

Another measurement of this department is a proposal tracking system for spare parts and support equipment. This tracking system assesses how well the department is doing

processing proposals against negotiated due dates. The information from the tracking system is used by the Air Force Plant Representative Office (AFPRO) to determine the performance of the contractor.

The final measurement system used by the Pricing department is a government audit of the department's estimating procedures. The criteria used in this measure are dictated by the government and, while the department is aware of the criteria, it did not participate in developing the measures.

TABLE 10

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE THREE PRODUCTION PRICING APPROACHES

<u>INTEGRATED APPROACH</u>	<u>PRODUCTION PRICING</u>
1. Establish a measurement team.	A measurement team was not established, but each measure was designed in conjunction with the affected members of the department.
2. Obtain a clear understanding of the organization.	The members of the department are clear on what is required of them as well as the purpose of the department. This is particularly reinforced in the PMRR measurement system.
3. Focus on measurements in the areas of key importance.	Each measurement system focuses on the needs of customers, which the department feels is the area of key importance.
4. Classify information needs.	The measures of each system reflect the performance in each of the key areas defined in step three.
5. Assess the measures.	The manager continually assesses the measures and works to improve any deficiencies.

5.2.2 Manager 2: Supervisor of the Travel Audit Group.

The six members of the Travel Audit Group are responsible for reviewing the expense reports for compliance with company regulations, as well as military and Internal Revenue Service requirements. The department handles 30,000 to 32,000 reports per year. The product of the department is the information provided to the finance department for their records and the processing of the reports so that the travellers can be reimbursed. Its customers are primarily internal.

The measurement system for the Travel Audit Group is relatively simple. It uses a three box system. All expense reports that arrive at the department are placed in the first box on the first day of their arrival. All expense reports not processed on the first day move to the second box on the second day. All expense reports not processed on the second day move to the third box on the third day. Since the department set a four day commitment to process the reports, no one in the department goes home until the third box is empty.

TABLE 11

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE TRAVEL AUDIT GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>TRAVEL AUDIT GROUP APPROACH</u>
1. Establish a measurement team.	The manager did not form a team to determine this measurement system. The idea was his, and the members of the department agreed to go along with it, so it was not necessary to set up a team to come up with a different idea.
2. Obtain a clear understanding of the organization.	The mission of the department is clear to all who participate in the measurement system, who are the same people who approved the system - or at least acquiesced.
3. Focus on measurements in the areas of key importance.	The important area for the department is return time for the expense reports.
4. Classify information needs.	The system provides the required information to determine the department's performance in the key areas.
5. Assess the measures.	The manager assesses the system continuously.

5.2.3 Manager 3: Manager of a Systems Engineering

Group. The Systems Engineering Group is responsible for the reliability, maintainability, safety, configuration, and data management aspects of one of the company's primary products. The twelve members of the group also perform budget and schedule tracking for their customers, the government and the company's senior management. The product of the Systems Engineering Group is primarily the support services they provide.

The group performs several tasks and it is only logical that they have several ongoing measurement systems for the variety of tasks accomplished. The group is measured for delivery of contract data and contract required reports against the negotiated commitments with the government. It internally tracks budget versus actuals in the financial arena. The manager also keeps tabs on the responsiveness of the department members to the customer, although the department does not have a formal measurement system for this.

TABLE 12

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE SYSTEMS ENGINEERING GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>SYSTEMS ENGINEERING APPROACH</u>
1. Establish a measurement team.	The Systems Engineering Group did not formally commission a measurement team. However, all the measurements it uses are negotiated with the participating employees to achieve commitment.
2. Obtain a clear understanding of the organization.	Support requirements, the purpose of the department, are worked out with the employees. They are clear on who their customer is.
3. Focus on measurements in the areas of key importance.	The areas of key importance are the centers for each measurement system.
4. Classify information needs.	Each measurement system that the group uses provides the necessary information for judging performance in the key areas.
5. Assess the measures.	The manager feels that the measures work well and would take steps to change them if they did not.

5.2.4 Manager 4: Manager of the Hot Section Engineering Department. The Hot Section Engineering Department is responsible for the design, fabrication, and development of the high performing components for one of the primary engines of the company. The ten members of the department have external customers in the government and internal customers in the engine program office.

The Hot Section Engineering Department uses a measurement system called the Systems Engineering Detailed Schedules (SEDS). SEDS tracks the department's performance against established milestones that are on contract. The department also tracks how well it aligns with its actual expenditure versus the budget expenditures, and this information is reviewed with the participating engineers.

TABLE 13

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE HOT SECTION ENGINEERING DEPARTMENT APPROACH

<u>INTEGRATED APPROACH</u>	<u>ENGINEERING APPROACH</u>
1. Establish a measurement team.	The department did not commission a formal measurement team. But original input from the department members was required for the SEDS measurement system and all requirements are reviewed with the participants.
2. Obtain a clear understanding of the organization.	The members of the department are clear on what is required of them and what the purpose of department is. This information is reviewed twice a year. This activity is important because these are the people who are involved in setting the measures.
3. Focus on measurements in the areas of key importance.	SEDS is in alignment with what the program deems is important.
4. Classify information needs.	The SEDS system and the budget versus actuals reviews provide the necessary information to determine the department's performance.
5. Assess the measures.	The measures are continuously reviewed for aptness and would be changed if they were not appropriate.

5.2.5 Manager 5: Supervisor of the Engineering Turbine Durability Department. This department is responsible for the thermal, fluid flow and life analyses of all military engines in service today. There are twelve members of the department whose products include airfoil technical drawings as well as support service for advice on turbine durability related items, such as manufacturing and field problems. The customers of the department are project engineering, manufacturing, product support, and government services (Air Force, Navy, and Army).

The measurement systems in place are extremely customer oriented. Improved design is indicated by factors like improved man-hour repair rates and customer satisfaction. Both, in turn, are indicators of performance, although there is no formal system in place to measure them. Whenever there is a field problem, however, milestones are negotiated and the department is measured against those milestones. Finally, this department also tracks budgeted expenditures against actuals.

TABLE 14

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE DURABILITY DEPARTMENT APPROACH

<u>INTEGRATED APPROACH</u>	<u>DURABILITY DEPARTMENT APPROACH</u>
1. Establish a measurement team.	A formal measurement team was not established. The requirements of the department, however, are negotiated with the participating members.
2. Obtain a clear understanding of the organization.	Each member of the department is clear about the requirements of their job and what is expected of them personally.
3. Focus on measurements in the areas of key importance.	For this department, the key areas are customer satisfaction, fixing field problems, and budget constraints. These are the areas against which the members are evaluated.
4. Classify information needs.	Each of the measurement systems in place provide the information necessary to determine the level of performance for the department in those key areas.
5. Assess the measures.	Because the measures are unique in many cases to the problem at hand, continual assessment of measures is not necessary. For those measures that are constant, they are monitored for adequacy.

5.2.6 Manager 6: Supervisor of the Enhanced Flow Compressor Test Group. This department is responsible for fan and compressor test contracts. The sixteen members of the department run government contracted tests, as well as in house tests. The customers include divisions within Pratt & Whitney and the government.

The performance measures for this department are test schedules, budget versus actuals, and customer satisfaction. Formal measures for customer satisfaction are not in place, but the other two measures are negotiated with the department as part of the test contracts.

TABLE 15

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE ENHANCED FLOW COMPRESSOR GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>COMPRESSOR GROUP APPROACH</u>
1. Establish a measurement team.	A formal measurement team does not exist. However, the members of the department are participants in the development of the contractual statements of work.
2. Obtain a clear understanding of the organization.	Through the writing of statements of work, the members of the department get a clear understanding of what is required of them.
3. Focus on measurements in the areas of key importance.	Once again, the statements of work play a key factor. Since the work from this department is laid out, along with the measures, in these documents, they automatically focus the measures where the customer chooses.
4. Classify information needs.	The information produced by the measures is what is required for an assessment of the department.
5. Assess the measures.	Since the measures are not the same for each contract, assessment is ongoing with each statement of work creation.

5.2.7 Manager 7: Supervisor of the Computational Structural Methods Group (CSMG). The mission of this group is to produce advanced structural analysis, design tool and data management methods that will satisfy the customer's requirements for capable, efficient and usable computer programs. There are ten people who work for the supervisor. The customers of this department are internal: Pratt & Whitney's Government Engine Business, its Commercial Engine Business, and Pratt & Whitney Canada.

This particular department has difficulty identifying appropriate measures of performance. Whenever programming is involved, it is easy to try measuring performance by the number of lines of code written, or number of programs written. However, the manager did not believe that these are effective measures because they did not measure the performance of the department, just the quantity of output. Internal to the Computational Structural Methods Group, it monitors how often each program it writes is used. This measure is used to determine what the customers requirements are and whether they are being met. Pratt & Whitney also has a Software Quality Assurance group whose job it is to determine if the programs written conform to the specifications Pratt has adopted. The Computational Structural Methods Group provides inputs into these measures.

TABLE 16

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE COMPUTATIONAL STRUCTURAL METHODS GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>CSMG APPROACH</u>
1. Establish a measurement team.	CSMG did not establish a formal measurement team. However, each member of the department participated in measuring the use rate of their programs and the department on the whole was involved with establishing the measures.
2. Obtain a clear understanding of the organization.	The CSMG department had a formal mission statement signifying that it had a firm grasp on what the duties of the department are as well as who its customers are.
3. Focus on measurements in the areas of key importance.	Since this is a service department, customer satisfaction is an area of key importance. Also, as a functioning unit within Pratt, following Pratt's policies is another area of key importance.
4. Classify information needs.	The measures it employed provided the necessary information to assess the performance of the department.
5. Assess the measures.	After assessing the measures with the manager, these were the best available. He periodically assesses them for validity.

5.2.8 Manager 8: Supervisor of the Complex Support Equipment Group. This department is responsible for the engine test stands, the test equipment, and the boroscopes delivered to the Air Force. The thirty members of the department provide the aforementioned products as well as the service of supporting these items once they are in the Air Force inventory. The customers include the Air Force and the program managers within Pratt & Whitney.

The measurement system for this department involves meeting the contract schedule for delivering the support equipment to the Air Force. These contractual requirements, which are negotiated, are the criterion against which both the internal and external customers measure the department.

This particular department had a typical example of how it arrived at their measures of performance. A unique piece of test equipment required a long term solution to its delivery problems. The department formed a team to solve the problems and come up with some measures of performance to compliment the contractual requirements. The team worked with the Air Force to determine actual needs and worked to meet those needs. The measures used by this team were for the purpose of determining performance as well as improvement. The corrective action worked. The problems were solved and the team continued to use the measures as performance indicators.

TABLE 17

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE SUPPORT EQUIPMENT (SE) GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>SE GROUP APPROACH</u>
1. Establish a measurement team.	In this case, a team was used to come up with the best measures of performance for its sector of the department. This sector has its own goals, consistent with the goals of the department.
2. Obtain a clear understanding of the organization.	This department has a clear mission. Each member understands what their role is within the department.
3. Focus on measurements in the areas of key importance.	Since the number one concern of the department is customer satisfaction, achieved through on-time deliveries, the department is focusing on the areas of key importance.
4. Classify information needs.	The department members use a war room to status the performance of each program within the department. The measures provide the information necessary to update each status. This information is then passed to management to assess the performance of the department.
5. Assess the measures.	The department had its choice of whatever measures it wanted. It chose the war room for a summary of the measures and it continually assess the measures.

5.2.9 Manager 9: Supervisor of the System Integrity

Group. This is the internal systems audit group within Pratt & Whitney that determines whether the departments are following procedures. While the group does not have prime examples of departmental measures, the purpose of discussing this department is because it employs many of the same measurement development procedures as the departments it audits.

The System Integrity Group tracks the quality measures for Pratt & Whitney. The measures are based on goals. The results of the measures are used by the AFPRO to determine the performance of Pratt & Whitney as a the whole. Each of the measures are negotiated, so that the departments being evaluated have a large voice in determining how they will be evaluated. All products and services are identified and each of the quality indicators, or measures, come complete with explanations.

This discussion is an evaluation of a system used throughout Pratt & Whitney. It is not an evaluation of a particular department's measurement development system.

TABLE 18

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE PRATT & WHITNEY APPROACH

<u>INTEGRATED APPROACH</u>	<u>PRATT APPROACH</u>
1. Establish a measurement team.	Pratt & Whitney does not form a team of the entire Government Engine Business when establishing its measures of performance. It formed the System Integrity Group as an internal audit group to come up with measures.
2. Obtain a clear understanding of the organization.	The products and services of each department are identified. This allows the System Integrity group to obtain a clear understanding of the department being evaluated.
3. Focus on measurements in the areas of key importance.	After the products and services are identified, the measures are designed to focus on performance in those key areas.
4. Classify information needs.	The measures are used at the Product Assurance and Contractual Effectiveness meetings. The measures, and the information gained from the measures must contribute to accurate assessments of each department's performance.
5. Assess the measures.	The measures are assessed for aptness by the group supervisor, AFPRO, and Pratt & Whitney.

5.2.10 Manager 10: Manager of Operations and Quality Assurance. This purely service department performs dimensional inspections, assembly test and overhaul inspections, and in-process inspections of engines in production. The customers of the 110 member shop include the assembly shop, the engineers, and the Air Force.

There are three measures of performance for the inspectors. First, a re-inspector reviews the work of the inspector. Not all the work is reviewed. The re-inspector chooses pieces at random and inspects those pieces against the same list the first inspector used.

Second, the inspectors are timed to determine how long it takes them to perform the inspection tasks.

Finally, there are inspections of the engine when it arrives at its destination. This inspection determines, from the customer's perspective, how well the Pratt & Whitney inspectors did at finding any manufacturing errors.

The goals of these measures are self-imposed, based on customer needs. They are reviewed by higher management periodically.

TABLE 19

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE INSPECTION GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>INSPECTION GROUP APPROACH</u>
1. Establish a measurement team.	The inspection group did commission a team to determine the measurement needs of the department. Each measurement goal is self-imposed by the department and the inspectors know what the goals are.
2. Obtain a clear understanding of the organization.	The members of the inspection department are clear on the mission of the department.
3. Focus on measurements in the areas of key importance.	The area of key importance for this group is to not allow manufacturing errors to get by undetected to the customer. The measures developed focus on this area.
4. Classify information needs.	The measures are designed to provide information on the department's performance in the key area.
5. Assess the measures.	The measures are assessed and they appear to work.

5.2.11 Manager 11: Program Manager of the J58 Engine Group. This department has overall program, repair, overhaul, and field support responsibility for the J58 engine. There are forty-eight members of the group, reporting to the program manager, that perform tasks in the assembly, logistics, operations, and field arenas. The customer for this group is the Air Force.

The primary measurement system for this group is called Management Tracking Parameters (MTP). The idea behind MTP is to set goals for critical items and track the items to those goals. The employees are involved with goal setting. These goals are then reviewed at the Quarterly Program Management Reviews.

TABLE 20

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE J58 ENGINE GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>J58 ENGINE GROUP APPROACH</u>
1. Establish a measurement team.	The measurement team for this program is the entire J58 engine group.
2. Obtain a clear understanding of the organization.	The team has a clear understanding of the program and its goals.
3. Focus on measurements in the areas of key importance.	The measures focus on the critical items of the program.
4. Classify information needs.	The team generated measures to provide information about the key areas.
5. Assess the measures.	The measures are assessed.

5.2.12 Manager 12: Chief of Engineering Drafting. This department is responsible for engineering hardware drawings. The five who work for the Chief of Engineering Drafting have customers in the design engineering departments and the process planning departments. The primary product are the drawings.

The measurement system used by this department is a self-imposed inspection of the drawings for errors. The errors in the drawings would cause production of bad hardware. The goal of the department is a 2% error rate.

TABLE 21

COMPARISON BETWEEN THE INTEGRATED APPROACH
AND THE ENGINEERING DRAFTING GROUP APPROACH

<u>INTEGRATED APPROACH</u>	<u>DRAFTING GROUP APPROACH</u>
1. Establish a measurement team.	This department did not formally commission a measurement team. However, the members of the department have bought in to the measures being used.
2. Obtain a clear understanding of the organization.	The people involved with the measurement system have a clear understanding of the products and customers of the department.
3. Focus on measurements in the areas of key importance.	The customer is the area of key importance for this department. The measures are designed to measure customer satisfaction.
4. Classify information needs.	The measures provide the necessary information to assess performance.
5. Assess the measures.	The measures are evaluated and they are effective.

5.3 Additional Information

Many of the departments interviewed had groups within the departments that, although they fell under the same general mission, performed different tasks. It is for this reason that some of the departments needed many measures of performance.

VI. Conclusions and Recommendations

6.1 Introduction.

The final chapter summarizes the results of research, presents overall findings, and provides recommendations for further study. The summary of the results will follow the format of data collection. It will first entail a discussion of the literature, followed by a discussion of the interviews.

6.2 Summary of the Results of the Research.

6.2.1 Summary of the Analysis of Literature. The first observation found when compiling the information from the literature review was that many of the sources simply indicated what measure would be best for a white-collar environment, rather than expounding on the best method for developing the measures. An example of this comes from a book called White Collar Waste: Gain the Productivity Edge, by Val Olson. This book discusses specific measures associated with planning the use of time; for instance, comparing the actual use of time against the planned use of time (Olson, 1983:153).

The second observation found when researching the literature was that the recipes were not strictly targeted to measure performance. Procedure A discussed measuring for quality and productivity. Procedure B was more general, measuring performance. Procedure C referred to measuring

quality. Procedure D prescribed measuring productivity. Procedure E talks about measuring performance. Procedure F describes measuring productivity. However, it appears that, whether discussing performance or the related aspects of performance, the procedures proposed to develop measures are very similar.

The primary goal of this thesis was to provide a generalized measurement development procedure. The literature provided the root source for the integrated procedure that is proposed. Each of the six sources discussed in the analysis of literature went into great detail supporting the steps necessary to develop white-collar departmental measures. The following five tables (Tables 22-26) are a review of how their suggestions fit into the steps of the integrated approach. The title of each table is the integrated approach step; and the information contained in the table is the evidence from each of the authors that supports the integrated step. The information that follows is a tabular formulation of the text contained in Chapter 4 and is a useful review of the development of the integrated approach.

What the illustrate is that each of the steps contained in the integrated approach is supported by each of the sources. For this reason, the integrated measurement development approach would seem to have value as a summary method to develop departmental measures of performance in any white-collar environment.

TABLE 22

STEP 1: ESTABLISH A MEASUREMENT TEAM

Procedure A from Adam, et. al.:

2. Select project coordinators.
4. Select participants; divide into groups.

Procedure B from Sink and Tuttle:

"An early step in the process is the formation of the teams of people who will be completing various steps of the process" (Sink and Tuttle, 1989:232).

Procedure C from the Office of Management and Budget:

"Ideally, to ensure fairness and commitment, three actors -- the supplier of inputs, the employees of the organization providing the service, and the user/customer of the service -- should construct the measures" (OMB, 1989:9).

Procedure D from Christopher:

7. Do all of the above through a dialogue process.

Procedure E from Van Der Ven:

Phase 1: Evaluation Prerequisites.

Procedure F from Siegel:

1. The decision to measure.
2. The task force and its charter.
3. Program information and communication.

TABLE 23

STEP 2: OBTAIN A CLEAR UNDERSTANDING OF THE ORGANIZATION

Procedure A from Adam, et. al.:

3. Become familiar with system.
5. Define system and establish boundaries.
6. Determine unit operations.

Procedure B from Sink and Tuttle:

1. Gaining a better understanding of the organizational system.

Procedure C from the Office of Management and Budget:

1. Identify all customers of the program's outputs and those customer's requirements and expectations.
2. Define the entire workprocess that provides the product/service.

Procedure D from Christopher:

1. Identify the purpose, or mission, of the unit.

Procedure E from Van Der Ven:

This step is part of Phase Two: Goal Exploration.

Procedure F from Siegel:

4. Inventory of data resources and communication.
5. Auxiliaries: consultants, liaison officers, trainees.

TABIE 24

STEP 3: FOCUS ON MEASUREMENTS IN THE AREAS OF KEY
IMPORTANCE

Procedure A from Adam, et. al.:

7. Generate, select, and rank deviations.
8. Determine final key quality deviations.

Procedure B from Sink and Tuttle:

2. Identification of ways to improve the performance of the organization being analyzed.
3. Classify information needs/requirements in relation to the type of organizational system that a management team is attempting to manage.

Procedure C from the Office of Management and Budget:

3. Define the value-adding activities and outputs that comprise the system.

Procedure D from Christopher:

2. Identify the output produced when this purpose is successfully achieved.

Procedure E from Van Der Ven:

Phase 2: Goal exploration.

Procedure F from Siegel:

"[the task force] will decide that some subgoals should be deferred and others given higher priority"
(Siegel, 1980:51).

TABLE 25

STEP 4: CLASSIFY INFORMATION NEEDS

Procedure A from Adam, et. al.:

9. Generate key deviation measures.
10. Collect technology and systems data.
11. Edit measures into productivity ratios.

Procedure B from Sink and Tuttle:

4. Data requirements to provide information in the previous Sink and Tuttle step.

Procedure C from the Office of Management and Budget:

4. Develop quality measures of indicators.

Procedure D from Christopher:

3. Determine the most useful measures of output.
4. Identify and measure inputs.
5. Develop appropriate productivity measures.

Procedure E from Van Der Ven:

- Phase 3: Criteria Development.

Procedure F from Siegel:

6. Design of measurement system.
7. Installation and "debugging".

TABLE 26

STEP 5: ASSESS THE MEASURES

Procedure A from Adam, et. al.:

12. Clarify edited measures and revise as necessary.

Procedure B from Sink and Tuttle:

5. The data to information transformation.

Procedure C from the Office of Management and Budget:

5. Assess quality measures.

Procedure D from Christopher:

6. Report measures for relevant reporting period
and monitor trends over time.

Procedure E from Van Der Ven:

Phase 4: Evaluation Design.

Phase 5: Evaluation Implementation.

Phase 6: Data Analysis, Feedback, and Evaluation.

Procedure F from Siegel:

8. Instructions for operation and recommendation
for evaluation.

6.2.2 Summary of the Interviews. The secondary purpose for this thesis was to determine if the integrated approach, based on the literature, could be grounded in private industry practice at Pratt & Whitney. Note that the information presented in each interview is one person's view of how the measurement development process took place. Even with this limitation, the information is quite valuable. Not only was this information derived directly from the manager of the department, the person likely to have the most complete knowledge of the workings of the department, it was derived from a semi-structured interview designed specifically to determine what the measurement development procedure was, not to determine if the approach used was right or wrong.

Taking each step of the integrated approach in order, Step 1: Establish a measurement team, is the first step to be considered. Only two of the twelve department managers interviewed actually had a measurement team. In some cases, the managers themselves decided what the measure of performance would be. In other cases, the measures were imposed by the company. This is in direct conflict with the unanimous recommendations contained in the literature. Each of the department managers that did not form a measurement development team did state that they had achieved buy-in within the department for the measures. They also claimed that the measures were working. Without interviewing the entire department, it is difficult to determine whether or

not the members actually felt the measures worked. From the interview information, though, it appears that the perceived key to success is achieving buy-in from the members of the department.

Next, consider Step 2: Obtain a clear understanding of the organization. Each manager felt that the members of their department had a clear understanding of the organization. Many of the departments had printed mission statements which the members posted in a visible location. Each of the department managers held periodic personal performance reviews with each employee to evaluate their particular piece of the department's work effort. From the information presented, all the managers followed this step.

The next step to consider is Step 3: Focus on measurements in the areas of key importance. Once again, each of the managers interviewed felt that measures used by their department were focused on the areas of key importance. Since, in most cases the managers had the power to change the measures, the very fact that they were in use lends credence to the manager's opinion that the measures, at least from their perspective, were effective.

Step 4: Classify information needs is the next step to consider. Each of the managers felt that the measures provided the information they needed. Since the managers also stated that the employees within the department bought into the measures, the managers' perception was that the employees must also have felt that the measures provided at

least some necessary information.

Finally, consider Step 5: Assess the measures. All managers accomplished this step. The managers also stated that their department's measures worked. As noted earlier, most of the managers had the power to change the measures if they felt a change was necessary. Since the measures were in use, one can surmise that the managers must feel that they are of more benefit than any of the available alternatives.

The interviews are summarized in Table 27. Of all the interviews conducted, only two departments provided textbook examples of how to develop departmental measures of performance. Those two groups were the Support Equipment Group and the J58 Engine Group. Thus, to say that the measurement development procedure was entirely grounded in the interviews with the departments at Pratt & Whitney would be incorrect. In most cases the first step was not followed because the measures were provided from an external source to the department, because of changeover within the department, or because another source discovered a useful measure without the aid of a team. However, it is important to note that the rest of the integrated approach was followed to maintain appropriate measures of performance.

Each department also seemed to use measures that were suitable for its own function. The measures they developed provide good examples for a department starting this process, but to say that one specific measure is appropriate

TABLE 27

THE STEPS OF THE INTEGRATED APPROACH AND THE
DEPARTMENTS THAT ADHERED TO THE STEPS

<u>INTEGRATED APPROACH</u>	<u>DEPARTMENTS</u>
1. Establish a measurement team.	Support Equipment Group J58 Engine Group
2. Obtain a clear understanding of the organization.	All
3. Focus on measurements in the areas of key importance.	All
4. Classification of information needs.	All
5. Assessment of measures	All

for a number of different departments would be contradictory to the data presented, as well as to the literature.

6.2.3 Summary Findings. The literature reviewed provided six measurement development techniques that were integrated into a single model, without violating any of the concepts of the six authors. What is more, the integrated technique seems to be theoretically, useful whether it is to be used to develop performance measures, productivity measures, or quality measures.

Ten of the twelve department managers interviewed did not follow the general guidelines developed from the literature however, when developing their measures of performance. The measures they used, according to the managers, were working, though. There may be several reasons for the supposition that the measures worked. First, the employees may believe in the measures and therefore provide their support. Management comments tend to support this view. Second, those who developed the measures may know a great deal about the department and therefore know what type of measure works or does not work. In either case, the reasons behind why the measures work is a subject for further study that may lead to greater understanding of Step One of the integrated approach. Finally, it is also important to note that all of the other steps in the integrated approach were reported to be in use.

6.3 Recommendations for Further Research.

6.3.1 System Program Office Test. The next logical step in this process is to test the integrated approach in a SPO environment, focusing first on the smallest units within the SPO that have a specific mission. The researcher should identify the test subjects, work with them to employ the steps involved in the integrated approach, and then give the departments time to use the derived measures and get a feel for their effectiveness. Only after a period of use could the department supervisors determine whether the measurement developing method worked, actually advancing the interests of the department.

Useful information would be drawn if some of the departments chosen for the test performed similar functions as the J58 Engine Program Office or the Support Equipment Group. These are the two departments within Pratt & Whitney that used a measurement development approach closely related to the integrated approach. The examples of measures from these two departments may prove useful for generating initial ideas for the SPO departments. Also, the duties performed in these two departments very closely resemble the duties performed in a program office or support equipment office in a SPO as far as who their customers and suppliers are and the tasks that are accomplished.

6.3.2 Other Areas of Further Research. Other areas of further research include the following:

1. Determine if the measures developed in an Air Force SPO, using the integrated approach, are different than those used by the Pratt & Whitney departments that had measures thrust upon them.
2. Determine if the departments that did not have a measurement system tried the integrated approach recommended here, if they tried some other approach, or if they have not tried measurement at all. If they tried this approach, the reasons for its failure would be of interest. (It should be noted that the only departments considered for interviewing in the current study were those that already had an established measurement system).
3. Find out what development procedures businesses other than Department of Defense contractors use. This could reveal new knowledge, or provide further proof as to the external validity of the integrated approach presented here.
4. Work with a business in private industry as a facilitator to implement the integrated approach in much the same fashion as would be done in the SPO. This would also add to the reliability of the integrated approach and,

if successful, would expand the approach application.

5. Determine how Japanese industries handle this problem. Since departmental measurement is an integral part of the quality movement, and since the Japanese are the front-runners in the movement, it could prove beneficial to learn what they are really doing in this field.

6.5 Conclusion.

The primary intent of this research was to determine whether a measurement development procedure, designed for a white-collar department, could be found in current literature. This was accomplished. As evidenced by the information presented in Chapter 4 and summarized in Chapter 6, an integrated measurement development procedure was constructed based on the analysis of the literature. The secondary intent of the research was to determine whether this measurement development procedure could be grounded in private industry practice at Pract & WHitney. The study found that, although most of the steps in the integrated approach were followed, the first step, establish a measurement team, was not. Only two of the twelve department managers interviewed had followed measurement development procedures similar to the integrated approach. The answer to the first question fulfills ASD's need for a

departmental performance measurement development procedure that they can use to begin to further their Total Quality efforts. The second answer provided examples of white-collar measures, grounded most of the integrated procedure, and provided numerous ideas for further research.

Appendix A: Sample Letter

Appendix A is an example of the letter sent to Pratt & Whitney to introduce the subject to the person acting as the interview coordinator and to set the parameters for the types of managers needed for the interviews.

To whom it may concern:

1. I would like to interview department managers for the purpose of determining what types of department performance measurement techniques they use and how these techniques were developed.
2. For the purpose of our discussion, we will use the definition that a department is the lowest (on the organization chart) organized group of people working under the same mission and toward the same goals. An example would be a program office within the Air Force, or a financial branch assigned to a particular project. The managers must be from areas specializing in white-collar efforts, that is, there is no hardware production as an output of their department.
3. This research is to support a thesis on the topic of departmental measurement, specifically, how to develop useful measures of performance within a white-collar environment. I am currently enrolled in the graduate degree program at the Air Force Institute of Technology. These

interviews will provide data for the thesis research effort. The initial interview questions are attached. What I am looking for is a trend within your company on how to develop measures of performance within a department.

4. After completion of the thesis, I would be happy to provide a copy of it to anyone within the your company participating in the research, should they so desire.

5. I will call you to set up the interview schedules. If you have any questions prior to that time, please call me at 513-255-4437 (work) or at 513-438-8025 (home). Thank you.

Sincerely,

1 atch:

Interview Questions

(see Appendix B)

KIRK H. RUMSEY, Capt, USAF

Appendix B: Interview Questionnaire

Introduction

- Who I am, where I'm from.
- This effort is for a thesis study.
- I am looking for your opinions. There is no attribution, no wrong answers.
- Do you want a copy of the results?

QUESTIONNAIRE

1. Can you tell me about the program of which you are in charge?
 - What types of duties does your department perform?
 - How many people work for you?
2. What are your department's primary products/services?
3. Who are the customers for each product?
4. How do you measure the performance of your department?
 - Do you have a single measure of performance, or many?
 - What, specifically, do you measure?
 - Examples?
 - Who receives these performance measurement indicators?
 - What do you do with these measures?
5. How did you arrive at these measures?
 - Were they dictated from the upper level?
 - Did you work with the members of your department?
 - Did you work with your customer(s)?
 - Do they work?
 - Are they reviewed?
 - Would you change them if you could? If so, how?

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Vita

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