3-2005

Performance Based Service Acquisition: A Quantitative Evaluation of Implementation Goals and Performance in the United States Air Force

Dylan D. Pope

PERFORMANCE BASED SERVICE ACQUISITION: A QUANTITATIVE EVALUATION OF IMPLEMENTATION GOALS AND PERFORMANCE IN THE UNITED STATES AIR FORCE

THESIS

Dylan D. Pope, Captain, USAF

AFIT/GSP/ENV/05M-05

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the United States Government.

AFIT/GSP/ENV/05M-05

PERFORMANCE BASED SERVICE ACQUISITION: A QUANTITATIVE EVALUATION OF IMPLEMENTATION GOALS AND PERFORMANCE IN THE UNITED STATES AIR FORCE

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Strategic Purchasing

Dylan D. Pope, BS

Captain, USAF

March 2005

AFIT/GSP/ENV/05M-05

PERFORMANCE BASED SERVICE ACQUISITION: A QUANTITATIVE EVALUATION OF IMPLEMENTATION GOALS AND PERFORMANCE IN THE UNITED STATES AIR FORCE

Dylan D. Pope, BS
Captain, USAF

Approved:

/signed/	8 March 2005
Curtis G. Tenney (Chairman)	date
/signed/	4 March 2005
Bryan J. Hudgens (Member)	date
/signed/	4 March 2005
David R. King (Member)	date

Abstract

Over the last 12 years, the percentage of the Department of Defense (DoD) budget spent on the procurement of services has risen consistently (Gansler, 2001). In an attempt to maximize cost savings in the rapidly growing services sector, the DoD established a Performance Based Service Acquisition (PBSA) strategy that focuses on evaluating contractor performance based on their ability to meet desired outcomes rather than the means to which the outcomes are obtained. In April 2000, Dr. Gansler, then Under Secretary of Defense for Acquisition, Technology and Logistics, issued a memorandum mandating that 50 percent of all eligible service acquisitions be awarded using PBSA methods by Fiscal Year (FY) 2005. While some studies (Ausnik, Camm, & Cannon, 2001; Ausnik, Baldwin, Hunter, & Shirley, 2002) have attempted to measure the potential increases in quality and cost savings, very little research has been focused on USAF implementation of PBSA and the progress and attainment of the PBSA goals.

Using multiple years of comprehensive data obtained from the Air Force Contract Reporting System, also known as the J001, this thesis extends on previous PBSA research (Lacey, 2004) and seeks to evaluate and analyze the current and expected future states of PBSA implementation in the USAF, including an assessment of current performance against PBSA goals, the development of forecasts of future performance against PBSA goals, and the evaluation of PBSA contract characteristics. A combination of descriptive statistics, forecasting, contingency tables, and regression were used to analyze the data, draw conclusions, and make recommendations for PBSA

implementation improvements. The results conclude that the USAF is not meeting interim PBSA goals and will most likely fall short of the FY 2005 PBSA goal. These results suggest that the goals may not have been reasonable and that the USAF has hit a natural plateau in PBSA use.

To my Wife

Acknowledgements

First and foremost, I would like to thank my wife for her love, support, and patience with my effort to complete this research. Next, I would like to thank Lieutenant Colonel Curtis Tenney, Major Bryan Hudgens, and Major Dave King for their feedback, support, and time. Finally, I would like to thank Mr. Brian Morris, HQ AFMC/PKV, for his support and sponsoring of this effort.

Dylan D. Pope

Table of Contents

Page

Page

Page

List of Figures

Figure Page

List of Tables

Table Page

Table Page

Performance Based Service Acquisition: A Quantitative Evaluation of Implementation Goals and Performance in the United States Air Force

I. Introduction

Overview

The use of Performance Base Service Acquisition (PBSA) for the acquisition of services has become increasingly prevalent in the United States Air Force (USAF) as a result of PBSA goals. These goals were mandated in an attempt to increase service quality and garner potential cost savings associated with the use of PBSA. While some studies (Ausnik, Camm, & Cannon, 2001; Ausnik, Baldwin, Hunter, & Shirley, 2002) have attempted to measure these potential increases in quality and cost savings, very little research (for one such study see Lacey, 2004) has been focused on USAF implementation of PBSA and the progress and attainment of the mandated PBSA goals.

Using multiple years of data, this thesis extends Lacey's research (Lacey, 2004) and seeks to evaluate and analyze the current and future states of PBSA implementation in the USAF, including an assessment of current performance against PBSA goals, the development of forecasts of future performance against PBSA goals, and the evaluation of PBSA contract characteristics. Additionally, this thesis will provide recommendations for PBSA implementation improvements in order to assist USAF leadership in making decisions based on the current state of PBSA.

Background

Over the last 12 years, the percentage of the Department of Defense (DoD) budget spent on the procurement of services has risen consistently (Gansler, 2001). In an attempt to increase cost savings in this rapidly growing procurement sector, the DoD established a performance based service acquisition strategy that focuses on evaluating contractor performance based on their ability to meet desired outcomes rather than the means to which the outcomes are obtained. In April 2000, Dr. Gansler, then Under Secretary of Defense for Acquisition, Technology and Logistics, issued a memorandum mandating that, at a minimum, 50 percent of all eligible service acquisitions, measured in both dollars and actions, be awarded using PBSA methods by Fiscal Year (FY) 2005.

In order to understand the potential benefits of PBSA, it is first important to understand the meaning and concepts of PBSA. The Guidebook for Performance-Based Services Acquisitions in the Department of Defense (PBSA Guidebook) defines PBSA as acquisition strategies, methods, and techniques that describe and communicate measurable outcomes rather than direct performance processes (DoD, 2001). Simply, PBSA asks contractors to meet a desired outcome rather than telling them how to meet the outcome. Federal Acquisition Regulation (FAR) Subpart 37.6 describes characteristics consistent with PBSA designated contracts. According to FAR Subpart 37.6, performance-based contracts or task orders exhibit the following characteristics:

(1) Describe requirements in terms of results required rather than the methods of performance of the work.
(2) Use measurable performance standards and quality assurance surveillance plans.

(3) Specify procedures for reduction of fee or reduction to price of a fixed price contract when services are not performed or do not meet contract requirements.
(4) Include performance incentives when appropriate.

Past research suggests that by utilizing these characteristics and describing requirements in terms of performance outcomes, beneficial outcomes or objectives will be achieved. For instance, in 1998 the Office of Federal Procurement Policy (OFPP), which is a central office that provides direction for procurement policy and the development of procurement systems, concluded a four year study on PBSA. According to the study, the utilization of PBSA reduced contract prices, improved customer satisfaction, and increased competition (OFPP, 1998). The PBSA Guidebook also suggests potential benefits of PBSA usage by listing the five objectives that the use of PBSA can help achieve. Quoting from the Guidebook, these five objectives are:

(1) Maximize Performance – By following its own best practices, a contractor can deliver the required service. Since the prime focus is on the end result, contractors can adjust their processes, as appropriate, throughout the life of the contract without the burden of contract modifications. This adjustment may be done as long as the delivered service (outcome) remains in accordance with the contract. The use of incentives further motivates contractors to furnish their best performance.
(2) Maximize Competition and Innovation – Encouraging innovation from the supplier base by using performance requirements maximizes opportunities for competitive alternatives in lieu of government-directed solutions. Since PBSA allows for greater innovation, it has the potential to attract a broader industry base.
(3) Encourage and Promote the Use of Commercial Services – The vast majority of service requirements are commercial in nature. Use of Federal Acquisition Regulation (FAR) Part 12 (Acquisition of Commercial Items) procedures provides great benefits by minimizing the reporting burden and reducing the use of government-unique contract clauses and similar requirements, which can help attract a broader industry base.

(4) Shift in Risk – When contractors become responsible for achieving the objectives in the work statement through the use of their own best practices and processes, much of the risk is shifted from the government to industry. Agencies should consider this reality in determining the appropriate acquisition incentives.
(5) Achieve Savings – Experience in both government and industry has demonstrated the use of performance requirements results in cost savings.

The interest in applying PBSA and realizing its benefits increases as the percentage of the DoD budget spent on services continues to grow. In 1991 the OFPP issued the first policy letter, Policy Letter 91-2, addressing PBSA. This policy letter established policy for the Government's acquisition of services by contract, emphasizing the use of performance requirements and quality standards in defining contract requirements, source selection, and quality assurance. Since the issuance of Policy Letter 91-2, multiple directives and guidance documents have been issued for both the Federal Government and the USAF. However, it was not until Dr. Gansler's (2000) memorandum on PBSA that the implementation of PBSA in the USAF began to take shape.

Problem

In order to evaluate the performance of PBSA implementation, USAF decision makers need to know the current state of PBSA in the USAF. Furthermore, USAF decision makers need to know whether or not mandated PBSA goals are currently being met and will be met in the future. Additionally, USAF leadership needs to know if these PBSA goals are reasonably attainable. Recent research on PBSA implementation in the DoD is limited, but one study (Lacey, 2004) suggests that the USAF is not on course to

meet mandated goals. However, Lacey's study is extremely exploratory, using only one year of USAF comprehensive data for analysis (Lacey, 2004).

Research Question

The over arching research question is, "What are the current and future expected states of PBSA implementation in the USAF?" This question was answered by conducting an evaluation and analysis of the current and future states of PBSA implementation in the USAF using archival data obtained from the Air Force Contract Reporting System, also known as the J001. The evaluation and analysis included the assessment of current performance against PBSA goals, forecasting of future performance against PBSA goals, the evaluation of PBSA contract characteristics, and recommendations for PBSA implementation improvement.

Investigative Questions

Because the research question for this study is so broad, several investigative questions were developed in an attempt to evaluate as many aspects of PBSA implementation as possible, including the reliability of the J001 database. The five investigative questions this study answers are:

IQ1. Is the J001 database, which is the source of government procurement data, reliable?

IQ2. Is the USAF meeting interim PBSA goals?

IQ3. Is the USAF on track to meet future mandated PBSA goals?

IQ4. Is the percentage of modifications coded PBSA equal to the percentage of non-modifications coded PBSA?

IQ5. Are any particular acquisition characteristics associated with PBSA use?

IQ5a. What are the antecedents to the use of PBSA?

IQ5b. What are the barriers to the use of PBSA?

Investigative question one was developed in order to ensure that the database from which the data for this study was extracted was reliable. Investigative questions two and three were developed in order to answer the obvious questions of whether or not the USAF is meeting interim and will meet future PBSA goals. Investigative question four was developed in order to see if PBSA percentages are consistent for new contract awards and modifications. This is important because a difference in the two percentages may imply that PBSA contracts are modified more or less often than non-PBSA contracts or that PBSA modifications are more or less costly than non-PBSA modifications. Lastly, investigative question five was developed in order to identify contract variables that may increase or decrease the probability of PBSA use.

Methodology

The first investigative question was formulated in order to ensure reliability of the data manually entered into the J001 database. The J001 is a database comprised of DD Form 350, Individual Contracting Action Report, information for all Air Force contracting actions exceeding $25,000. Investigative question 1 was answered by taking a sample of contracts coded PBSA in the J001 database and evaluating them against the four mandatory criteria for PBSA identified in the PBSA Guidebook.

Investigative questions 2 through 5 were answered by collecting data directly from the J001, for all USAF service contracts from FY 2001 through FY 2004. The data was analyzed using descriptive statistics, forecasting, contingency tables, and regression.

Proposed Contributions

By following the steps outlined above, this thesis will further the knowledge and understanding of the use of PBSA in the USAF. First, it will provide insight to the reliability of the J001 database. Secondly, it will allow USAF leadership to see how well the USAF is meeting interim mandated PBSA goals and progressing towards future goals. Additionally, this study will validate the establishment of mandated PBSA goals and help decision-makers establish better future goals. Lastly, the results from this study will help procurement personnel identify when to use PBSA.

Summary

This chapter presented the overall basic components of the research effort. First, the background to PBSA implementation in the USAF and how it has led to the formation of the problem statement, research questions, and subsequent investigative questions were explained. Next, a summary of current knowledge and methodology used to answer the investigative questions was presented. Lastly, the proposed contributions were addressed. The following chapter will provide a review of the literature relevant to PBSA, describing the evolution of PBSA within the Federal Government and the DoD.

II. Literature Review

Introduction

This chapter reviews the literature relevant to the creation, implementation, and evaluation of the Performance Based Service Acquisition (PBSA) initiative in the United States Air Force (USAF). Besides basic definitions and an explanation of PBSA, this chapter explains how past policy, directives, and regulations established by the Federal Government, Department of Defense (DoD), and the USAF have led to the current state of PBSA within the USAF acquisition and contracting community.

Federal Guidance

Federal Acquisition Regulation (FAR) Part 37 provides the policy and guidance for acquisition and management of service contracts. Although the FAR does not establish any objective PBSA goals, its contents do state that performance-based contracting is the preferred method of acquiring services and requires the use of it to the maximum extent practicable.

FAR Subpart 37.101 defines a service contract as, "a contract that directly engages the time and effort of a contractor whose primary purpose is to perform an identifiable task rather than to furnish an end item of supply (FAR Part 37)." Additionally, the regulation notes that services can be performed by either professional or nonprofessional personnel and on an individual or organizational basis. FAR Subpart 37.101 identifies the following disciplines where service contracts may be found:

(1) Maintenance, overhaul, repair, servicing, rehabilitation, salvage, modernization, or modification of supplies, systems, or equipment.
(2) Routine recurring maintenance of real property.
(3) Housekeeping and base services.
(4) Advisory and assistance services.
(5) Operation of Government-owned equipment facilities, and systems.
(6) Communications services.
(7) Architect-Engineering (see Subpart 36.6).
(8) Transportation and related services (see Part 47).
(9) Research and development (see Part 35).

It is worthy to note that, although included in the general list of services, research and development services (FAR Part 35), architect-engineering services (FAR Part 36), and transportation services (FAR Part 47) are governed by their respective FAR Parts in the event of inconsistencies in the FAR (FAR Part 37). This precedence issue can become particularly important in any attempt to determine if PBSA should be used for the acquisition of these services.

FAR Subpart 37.102 excludes specific service type contracts, including architect-engineering services, construction, utility services, and services that are identical to supply purchases, from performance-based contracts. In addition, FAR Subpart 37.102 establishes an order of precedence for contract types when acquiring services. The order of precedence established by FAR Subpart 37.102 for all service contracts is:

(1) A firm-fixed price performance-based contract or task order.
(2) A performance-based contract or task order that is not firm-fixed price.
(3) A contract or task order that is not performance-based.

This order of precedence suggests that the DoD's top priority is to award service contracts or task orders using PBSA and preferably using a FFP contract. The next priority suggested from this order of precedence is to use PBSA with non-fixed price contracts, such as cost reimbursement contracts. The "last resort" is to award contracts or

task orders that are not performance-based. Although this order of precedence provides only generalized guidance for the use of PBSA, it promotes the use of firm-fixed price (FFP) type contracts for PBSA. However, by identifying the use of performance-based contracts or task orders that are not FFP as a possible service contract option it can be inferred that not all PBSA contracts need to or can be FFP.

FAR Subpart 37.6 further promotes the use of FFP contracts for "services that can be defined objectively and for which the risk of performance is manageable (FAR Part 37)." This FAR Subpart also prescribes the policies and procedures for the use of PBSA, including but not limited to, the proper preparation of a PBSA Statement of Work (SOW), quality assurance, and the use of positive and negative performance incentives. Furthermore, according to FAR Subpart 37.6, PBSA contracts:

(1) Describe requirements in terms of results required rather than the methods of performance of the work.
(2) Use measurable performance standards and quality assurance surveillance plans.
(3) Specify procedures for reduction of fee or reduction to price of a fixed price contract when services are not performed or do not meet contract requirements.
(4) Include performance incentives when appropriate.

In 1974, Public Law 93-400 required the Office of Management and Budget, through its Office of Federal Procurement Policy (OFPP), to establish a system for collecting, developing, and disseminating procurement data, which took into account the needs of Congress, the Executive Branch, and the public (United States Congress, 1974). This law led to the creation of the Federal Procurement Data System (FPDS), now a requirement under FAR Subpart 4.6. The FPDS provides a comprehensive mechanism for assembling, organizing, and presenting contract placement data for the Federal

Government. Subsequently, the DoD created the Defense Contract Action Data System (DCADS) which transmits all DoD procurement data to the FPDS. In order to collect the appropriate data for the DCADS, the DoD created the DD Form 350, Individual Contracting Action Report, which is required for all delivery/task orders exceeding $25,000. The DD Form 350 includes information about not only the type of action, but also numerous other contractor socio-economic characteristics, such as business size and ethnic ownership. The USAF collects and transmits all DD Form 350 information to DCADS via the Air Force Contract Reporting System, also known as the J001. The DD Form 350 and the related procurement databases are valuable sources for information pertaining to how the DoD, and specifically the USAF, spends taxpayer money.

In 1991 the OFPP issued the first policy letter directed towards PBSA, Policy Letter 91-2. This letter established policy for the Government's acquisition of services by contract, emphasizing the use of performance requirements and quality standards in defining contract requirements, source selection, and quality assurance. The letter states,

> It is the policy of the Federal Government that (1) agencies use performance-based contracting methods to the maximum extent practicable when acquiring services, and (2) agencies carefully select acquisition and contract administration strategies, methods, and techniques that best accommodate the requirements (OFPP, 1991).

Once again, the preference for the use of FFP contracts rather than cost reimbursement contracts is emphasized for instances where services can be objectively defined and risk is manageable. However, the policy letter also clearly states that all contracts, regardless of contract type, shall include incentive provisions to ensure that contractors are rewarded for good performance and penalized for unsatisfactory performance. This provision adds to the more basic requirements of FAR Subpart 37.6, which never mandates the use of

fee or price reductions for unsatisfactory performance, but simply states to, "include performance incentives when appropriate (FAR Subpart 37.6)."

In the infancy of PBSA implementation, some agencies began to rely on contractors to perform certain functions in such a way as to raise questions about who was creating Government policy, the Government or private contractors (OFPP, 1992). In addition, the amount of control over contract performance being transferred to contractors began to be questioned. In light of this, the OFPP issued Policy Letter 92-1, establishing Executive Branch policy relating to service contracting and inherently governmental functions in order to avoid unacceptable transfer of official responsibility to Government contractors. Policy 92-1 specifically defined an inherently governmental function as:

> [A] function that is so intimately related to the public interest as to mandate performance by Government employees. These functions include those activities that require either the exercise of discretion in applying Government authority or the making of value judgments in making decisions for the Government. (OFPP, 1992)

The policy letter noted that while certain functions, such as facility maintenance and food services, may be performed by contractors, other functions, such as the command of combat troops may not. However, the policy letter made a point not to specify legally which functions are inherently governmental or define the factors used to make such a determination by using non-binding terminology, such as "may" or "might." This intentional lack of specifics in identifying inherently governmental functions may cause internal debate over the use of contractors to perform non-standard services, but it also allows governmental agencies the flexibility to use creative contracting methods,

including the use of PBSA, when acquiring services in order to meet mission requirements.

A 1993 Office of Management and Budget (OMB) directed agency review revealed that service contracting practices and capabilities were uneven across the Executive branch (OFPP, 1994). In response, the OFPP issued Policy Letter 93-1. This policy letter established Government-wide policy, assigned responsibilities, and provided guiding principles for Executive Departments and agencies in managing the acquisition and use of services. In addition, the policy letter uses the "best practices" concept to guide government agencies towards the use of a more results-oriented approach to service contracting. This "best practices" concept ultimately led to the creation of FAR Subpart 37.5, which allowed contracting officials, for the first time, legally to use practical techniques gained from experience to improve the procurement process (FAR Subpart 37.5).

In a further attempt to encourage the use of PBSA and a more results-oriented approach, in 1997 the OFPP distributed a PBSA checklist in order to aid in developing performance-based solicitations, contracts or task orders, and to assist in determining whether existing solicitations, contracts, or task orders may be appropriately classified as performance-based (OFPP, 1997). The checklist provides the minimum elements required for an acquisition to be considered PBSA. Once again, the OFPP purposefully made the checklist vague and open to interpretation in order to avoid infringing on the authority or discretion of contracting officers. Like FAR Subpart 37.6, the checklist identifies four minimum requirements for PBSA. These requirements are:

(1) Performance requirements that define the work in measurable and mission-related terms.
(2) Performance standards tied to the performance requirements.
(3) A Government quality assurance plan that describes how the contractor's performance will be measured against the performance standards.
(4) If the acquisition is either critical to agency mission accomplishment or requires relatively large expenditures of funds, positive and negative incentives tied to quality assurance plan measurements.

Although not exactly the same, these requirements are similar to the four PBSA criteria identified by FAR Subpart 37.6. Furthermore, the instructions within the checklist assert that the checklist is only one of many tools available to assist in the developing of PBSA contracts.

In 1998 the OFPP concluded a four year study of PBSA and published a report of its findings titled, "A Report on the Performance-Based Service Contracting Pilot Project." The study included twenty-six non-PBSA contracts, ranging from $100,000 to $325 million. These contracts, all of which were due to expire, were resolicited using PBSA methods. Before-and-after measurements were taken and the results clearly demonstrated PBSA's benefits (OFPP, 1998). According to the report, PBSA reduced contract prices an average of 15% at all price ranges and across all types of services. More importantly, PBSA was particularly effective when cost-reimbursement non-PBSA contracts were converted to FFP PBSA contracts. In the forward of the report Mr. Franklin Raines, OMB Director, encouraged agency officials to expand the use of and actively promote PBSA in order to capture the potential billions of dollars in savings (OFPP, 1998). Although this was yet another attempt to encourage the use of PBSA, it was the first influential directive supported by factual dollar savings data.

In the wake of the PBSA pilot project and its significant findings, the OFPP rushed to issue the "Guide to Best Practices for Performance-Based Service Contracting." Using the results from the PBSA pilot study as a foundation, the document contains suggested best practices derived from the experiences of contracting personnel in both the government and commercial sector. The document is not a mandatory regulation nor is it a "how to" manual, but it is a tool to assist in developing policies and procedures for implementing PBSA (OFPP, October 1998).

For the next few years, the Federal Government, outside of the DoD, provided little documented PBSA direction until March of 2001, when then OMB Deputy Director, Sean O'Keefe, issued a memorandum to all department heads and agencies urging them to make greater use of PBSA contracts. This memorandum established a goal for FY 2002 that, for all contract amounts over $25,000, no less than 20 percent of the total eligible service contracting dollars be awarded using PBSA techniques (O'Keefe, 2001). This marked the first officially documented PBSA goal established by the Federal Government, outside of the DoD.

The first documentation to require by law that the DoD meet a goal of 50% PBSA of services by FY 2005 was the National Defense Authorization Act (NDAA) for FY 2002, Sections 801-803. Section 801 of the NDAA covers management of the procurement of services and includes the requirement for data collection; including service purchased, total dollars, type of contract, business size, and the extent of competition; Section 802 establishes DoD PBSA performance goals (United States Congress, 2002). This section specifies the following minimum usage of performance

based purchasing using firm fixed prices for specific tasks, calculated on the basis of dollar value:

For FY 2003, a percentage no less than 25 percent
For FY 2004, a percentage no less than 35 percent
For FY 2005, a percentage no less than 50 percent
For FY 2011, a percentage no less than 70 percent

Lastly, Section 803 discusses the use of competition in all multiple award contracts above $100,000, reemphasizing the need for competition in the awarding of service contracts, specifically PBSA contracts.

In response to sections 801 through 803 of the NDAA for FY 2002, which established a series of requirements impacting the acquisition of services in the Department of Defense, Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Edward Aldridge, issued a memorandum to all secretaries of the military departments providing policy guidance and establishing a review structure and process for the acquisition of services in accordance with section 801(d) (Aldridge, 2002). The attachments to this memorandum include a review of Department of Defense acquisition of services, which is intended to outline the review policy for the acquisition of services and ensure service acquisitions are based on clear, performance-based requirements, that required outcomes are identified and measurable, and that the acquisitions are properly planned and administered to achieve intended results.

Realizing that agencies were making only moderate progress toward PBSA implementation, the OFPP established a PBSA interagency working group and published the results and finding in a July 2003 report titled, “Interagency Task Force on Performance-Based Service Acquisition.” The group was established in order to obtain a

broader understanding of the requirements of PBSA and to identify ways to increase PBSA usage (OFPP, 2003). As a result of their findings the group recommended modifying the FAR in order to increase flexibility in applying PBSA, modifying reporting requirements to ensure appropriate PBSA application, and improving the quality, currency, and availability of PBSA guidance. Although acting Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Michael Wynne did address these recommendations in an August 2003 memorandum, but as of March, 2005, none of the recommended modifications to the FAR have been published (Wynne, 2003). However, changes in reporting requirements and an increase in quality, currency, and availability of PBSA guidance has been implemented through the use of web-based technology.

While the OFPP and other federal government agencies were attempting to encourage and provide guidance for the use of PBSA within the government, the DoD and USAF were busy trying to align their directives and instructions with federal guidance in order to meet mandated PBSA requirements. These efforts are discussed in the following section of the chapter.

Department of Defense (DoD) and United States Air Force (USAF) Guidance

In an effort to promote PBSA within the Air Force acquisition and contracting community, the Principal Deputy Assistant Secretary of the Air Force for Acquisition Management published Air Force Instruction (AFI) 63-124 "Performance-Based Service Contracts" in 1999. Upon its release, AFI 63-124 replaced AFM 64-108 "Service Contracts" and AFI 63-504 "Quality Assurance Evaluator Program" as the governing

guidance for service contracting. This new AFI removed numerous mandated processes, empowering field personnel with the freedom needed to embrace agile acquisition and procurement transformation (DAF, 1999). This AFI revolutionized the expectations and methods of contracting for services in the USAF and aligned Air Force guidance with the PBSA initiatives established by the OFPP. This AFI was later amended in February of 2004 by way of an Interim Change to AFI 63-124. This interim change deleted Attachment 2 of AFI 63-124, the criteria for exemption to performance-based service contracts, leaving only the services listed under FAR Part 37.102 exempt from PBSA (DAF, 2004). This change not only increases the number of services eligible for PBSA, but also the percentage of dollars. At first glance, it seems as if this will help agencies meet PBSA goals, when in reality, it may make achievement of PBSA goals more difficult because more services are eligible, thus more services must be converted to PBSA.

In April 2000, the Under Secretary of Defense of Acquisition, Technology, and Logistics, Dr. Jacques Gansler, issued an official memorandum addressing the use of PBSA in the DoD. In this memorandum Dr. Gansler stated that the use of performance-based acquisition strategies for services was among his highest priorities (Gansler, 2000). This memorandum mandated that, at a minimum, 50 percent of service acquisitions, measured in both dollars and actions, be PBSA by FY 2005. From the memorandum it is unclear whether contract modification actions for service contracts should be used for the purpose of PBSA percentage calculations. At any rate, Dr. Gansler's goal was set forth nearly one year before any other federally mandated PBSA goals, suggesting that the DoD's implementation of PBSA was more advanced than other agencies. In addition to

the goals, the memorandum outlines policy guidance, implementation planning, training initiatives, and other department-wide PBSA initiatives in order to help guide agencies towards the accomplishment the PBSA goal.

In response to Dr. Gansler's requirements, the USAF issued its own "PBSA Implementation Plan." This plan provided guidance for identification of services eligible for PBSA including; maintenance, repair, operations and support, modifications, modernizations, and medical services (DAF, 2000). More importantly, the implementation plan established the requirement of tracking PBSA implementation progress through automated systems. This requirement of PBSA tracking is what allows researchers the opportunity to conduct quantitative studies and analysis on USAF implementation of PBSA.

The DoD issued The Guidebook for Performance-Based Services Acquisitions in the Department of Defense (PBSA Guidebook) in 2001 in order to help acquisition teams better understand the basic principles of PBSA, better implement performance-based strategies and methodologies into service acquisitions, and meet the goals set forth by Dr. Gansler's 2000 memorandum (DAF, 2001). Major topics include market research, developing a performance-based work statement and establishing measurable performance standards, incentives and remedies, contractor performance management, source selection considerations, and contract administration. The PBSA Guidebook also identifies the following minimum elements needed in order for an acquisition to be considered performance-based:

(1) Performance Work Statement – The performance work statement describes the requirement in terms of measurable outcomes rather than by means of prescriptive methods.

(2) Measurable Performance Standards – To determine whether performance outcomes have been met, measurable performance standards define what is considered acceptable performance.
(3) Remedies – Remedies are procedures that address how to manage performance that does not meet performance standards. While not mandatory, incentives should be used, where appropriate, to encourage performance that will exceed performance standards. Remedies and incentives complement each other.
(4) Performance Assessment Plan – This plan describes how contractor performance will be measured and assessed against performance standards. (Quality Assurance Plan or Quality Surveillance Plan).

As shown in Table 1, the criteria established by the PBSA Guidebook, although not exactly the same, parallel PBSA criteria established by other publications.

Table 1. *PBSA Criteria for PBSA Guidebook, PBSA Checklist, and FAR Part 37.6*

PBSA Guidebook	PBSA Checklist	FAR Part 37.6
1) The performance work statement describes the requirement in terms of measurable outcomes rather than by means of prescriptive methods.	1) Performance requirements that define the work in measurable and mission related terms.	1) Describe requirements in terms of results required rather than the methods of performance of the work.
2) To determine whether performance outcomes have been met, measurable performance standards define what is considered acceptable performance.	2) Performance standards tied to the performance requirements.	2) Use measurable performance standards and quality assurance surveillance plans.
3) Remedies are procedures that address how to manage performance that does not meet performance standards. While not mandatory, incentives should be used, where appropriate, to encourage performance that will exceed performance standards. Remedies and incentives complement each other.	3) A Government quality assurance plan that describes how the contractor's performance will be measured against the performance standards.	3) Specify procedures for reduction of fee or reduction to price of a fixed price contract when services are not performed or do not meet contract requirements.
4) This plan describes how contractor performance will be measured and assessed against performance standards.	4) If the acquisition is either critical to agency mission accomplishment or requires relatively large expenditures of funds, positive and negative incentives tied to quality assurance plan measurements	4) Include performance incentives when appropriate.

Lastly, the highlight of the guidebook is the "Top-Level Guiding Principles" section that summarizes the 49-page document into eleven bullets, emphasizing performance based methods and incentives based on well-defined results-oriented requirements.

In early 2003, the USAF issued The Management and Oversight of Acquisition of Services Process (MOASP), implementing section 801 of the NDAA for FY 2002. The guidance appoints the Air Force Program Executive Officer for Services (AFPEO/SV) (now the AFPEO for Combat & Mission Support (CM)) as the designated official to review all service acquisitions, except major weapon system and space program acquisitions (DAF, 2003). Additionally, the guidance states that the AFPEO/SV may delegate management and review responsibilities to Major Command (MAJCOM) designated officials, which then may further delegate these authorities. This verbiage becomes significant when determining what constitutes a performance-based service. If such determination is delegated to different agencies within different MAJCOMs, inconsistencies in PBSA determinations may surface.

In August 2003, a memorandum from the acting Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Michael Wynne, urged the Department of Defense to continue increasing the use of PBSA because such acquisitions provide significant benefit to the government (Wynne, 2003). Included in the memorandum are interim goals he asks each military department to work towards in an effort to meet the goal of awarding 50 percent of all contract actions and dollars using performance-based specifications by FY 2005. Mr. Wynne's PBSA goals were;

FY 2003	25 percent of dollars awarded
FY 2004	35 percent of dollars awarded
FY 2005	50 percent of dollars awarded

Although these goals were not legislated, they do offer a road map for expected PBSA progression for all military departments, including the USAF.

Over the last few years it looked as if the DoD was well on its way to implementing PBSA and meeting mandated goals. According to a 2002 GAO testimony by then Acting Director of Acquisition and Sourcing Management, Mr. William Woods, about 23 percent of eligible service contracts were reported to be performance-based during FY 2001 (Woods, 2002). However, in August 2003, Michael Wynne, claimed that the DoD is making progress towards FY 2005 goal of 50 percent of contract actions awarded using performance-based specifications due to the fact that in FY 2002 over 20 percent of the service requirements were awarded using performance-based specifications (Wynne, 2003). If both of these statements are correct, it shows that the DoD may have made minimal progress from FY 2001 to FY 2002, but still seems to have met the FY 2003 goal of 25 percent. However, recent research (Lacey, 2004) suggests that the FY 2005 goal of 50% will not be met by either the DoD or the USAF.

Other Literature

Previous research and commercial literature on PBSA is limited. However, the RAND Corporation's Project AIR FORCE division, which is an Air Force federally funded research and development center for studies and analysis, has conducted a few studies directed towards implementation, use, and effectiveness of PBSA.

The first study, titled, "Performance-Based Contracting in the Air Force: A Report on Experiences in the Field," was completed in January 2001 and looked at examples of successful USAF applications of PBSA. Twenty-two recently awarded contracts from "self-selected" bases that identified themselves as examples of successful implementation of PBSA practices were studied. The results concluded that most bases

were very happy with the performance selected using PBSA practices. However, only two bases attributed the success in obtaining contractor performance to the use of new acquisition practices. Additionally, changes in costs resulting from PBSA practices were difficult to determine because a) many of the new contracts' scope of work was different from the work in the old contracts, b) it is difficult to determine the accuracy of government cost estimates associated with an acquisition, and c) it is difficult to measure changes in internal costs, such as costs incurred in the preparation and administration of a contract using PBSA. (Ausnik, Camm, & Cannon, 2001)

The second study, titled, "Implementing Performance-Based Services Acquisition (PBSA): Perspectives from an Air Logistics Center and a Product Center," focused on the application of PBSA practices at program offices that support weapon systems, common subsystems, and special mission capabilities, rather than operational offices that mainly provide installation support services. Unlike installation support services that are traditionally commercial in nature and have widely accepted performance standards, many services purchased by program offices have limited opportunities for performance evaluation and determination of successful outcomes because many of the desired results of a service are not always known in advance. The study found that Air Logistic Centers and Product Centers are having difficulties satisfying the PBSA criteria described in AFI 63-124 for the use of "measurable performance standards" because they interpret the criteria to mean that a desired result must be known in advance in order to measure performance. However, research concluded that both Centers are using performance based approaches by successfully applying the other three criteria described in AFI 63-124. (Ausnik, Baldwin, Hunter, & Shirley, 2002)

Private Sector Literature

Private sector literature on performance-based service contracts is limited. This may be due to the fact that in the private sector, only 5 to 20 percent of the total external procurement budgets are used to procure services (Barry, 2003). This is a small percentage considering in FY 1999, the dollar amount spent by the DoD on services equaled the amount spent on supplies/systems (Gansler, 2001). Despite, the limited emphasis placed on private sector procurement of services, some guidance on performance-based contracts outside of the DoD does exist.

In an Inside Supply Management article from June 2003, Jack Barry reveals that's there is a private sector approach to building performance based-contracts that has been proven successful when contracting for several different types of services, including health/insurance, transportation, engineering, advertising and legal services. The article illustrates that an effective performance-based contract must identify the following key factors for success:

1) Baseline establishment
2) Escalators and audits
3) Incentives
4) Performance measures

Although not identical, these factors for success are similar to PBSA criteria identified for government procurement. Baseline establishment involves the development of a range of acceptable performance that is based on market research and historical trends in the industry. Performance should then be measured against these baselines, just as government PBSA contracts measure performance against established performance standards (Barry, 2004). Private incentives are similar to government incentives and

should entice the supplier to reduce costs. Barry notes that sharing of savings tends to be a strong incentive (Barry, 2004). The only factor that truly differs from government PBSA guidance is escalators and audits. Escalators include adjustment clauses that allow baseline prices to be readjusted upward or downward according to predetermined factors and indices (Barry, 2004). Auditing simply entails reviewing documentation associated with adjustment of costs.

In 2000, a commercial advisory firm, named Stqandish Group, traveled to four different cities and hosted a total of 14 workshops in an attempt to explore and answer the question, "Will performance-based contracts increase project success and reduce waste?" According to Stqandish Group forecasts, commercial firms and government agencies wasted over $100 billion in consulting fees during 2000 (Johnson, 2000). Although government agencies were included in the $100 billion figure, the firm's study focused specifically on the commercial sector of contracted services. While the study was unable to substantiate any of their findings quantitatively, the advisory firm did publish the information gathered from workgroup participants, including benefits of performance-based contracts and how to implement them. According to their research, implementing a performance-based contract is a five step process, which includes:

Step 1: Define project scope and objectives.
Step 2: Define success metrics.
Step 3: Establish baselines.
Step 4: Measure results.
Step 5: Implement incentives and penalties.

Once again, these steps are very similar to the process used by the government when establishing PBSA contracts, hinting that the same methods used by the government also apply to commercial purchasing practices.

Summary

This chapter described the literature relevant to the creation, implementation, and evaluation of PBSA. Besides basic definitions and explanations of PBSA, this chapter explained how past policy, directives, and regulations established by the Federal Government, Department of Defense (DoD), and the USAF have led to the current state of PBSA within the USAF acquisition and contracting community.

III. Methodology

Introduction

The purpose of this chapter is to explain the research methodology used to answer the question, "What are the current and expected future states of Performance Based Service Acquisition (PBSA) implementation in the United States Air Force (USAF)?" The majority of the data for this effort were extracted from the Air Force Contract Reporting System, also know as the J001. The J001 is a database comprised of DD Form 350, Individual Contracting Action Report, inputs for all Air Force contracting actions exceeding $25,000. This thesis evaluates and analyzes the current and expected future states of PBSA implementation in the USAF, including the assessment of current performance against PBSA goals, the forecasting of future performance against PBSA goals, and the evaluation of PBSA contract characteristics. This chapter includes the research problem, investigative questions, data gathering, data reliability, data analysis, and summary.

Research Problem

Since Dr. Gansler, then Under Secretary of Defense for Acquisition, Technology and Logistics, mandated that 50 percent of all eligible service acquisitions, measured in both dollars and actions, be awarded using PBSA methods by Fiscal Year (FY) 2005, little has been done to measure the implementation of PBSA or the progress towards Dr. Gansler's goal. In order to evaluate the performance of PBSA implementation, USAF decision-makers need to know the current state of PBSA in the USAF. Furthermore,

USAF decisions makers need to know whether or not mandated PBSA goals have been and will be met.

This study addresses the question: What is the current and future state of PBSA implementation in the USAF? Several investigative questions were developed to help answer this research question. The five investigative questions this study answers are:

IQ1. Is the J001 database, which is the source of government procurement data, reliable?

IQ2. Is the USAF meeting interim PBSA goals?

IQ3. Is the USAF on track to meet future mandated PBSA goals?

IQ4. Is the percentage of modifications coded PBSA equal to the percentage of non-modifications coded PBSA?

IQ5. Are any particular acquisition characteristics associated with PBSA use?

IQ5a. What are the antecedents to the use of PBSA?

IQ5b. What are the barriers to the use of PBSA?

These investigative questions were answered using descriptive statistics, forecasting, contingency tables, and regression.

Research Design

In order to properly address the research problem, two research designs were utilized in this study; a time series design using archival data and correlational research. A time series is a large series of observations made on the same variable consecutively over time (Shadish, Cook, Campbell, 2002). For this study numerous variables were observed over time, with an emphasis placed on PBSA contract coding. Just like many

other time series data, the data for this study came from an archive, the J001 database. Gaining access to archival data for research use can sometimes be difficult (Shadish, et.al., 2002). However, by having a sponsor (AFMC/PK) that was willing to grant access to the needed archival data, the researcher was confident that obtaining data from the archival database would not be an issue. This archival data extracted from the J001 database for FY 2001 through 2004 was the foundation for answering all five investigative questions.

Correlational research involves examining how differences in one characteristic or variable relate to differences in one or more other characteristics or variables (Leedy and Ormrod, 2001). In this type of research, surface relationships are examined without necessarily probing for the causal reasons underlying them (Leedy and Ormrod, 2001). A correlation is deemed to exist when the increase or decrease in one variable, results in a predictable increase or decrease of another variable (Leedy and Ormrod, 2001). Through the use of statistical tools, such as contingency tables and regressions, this study searched for correlations between PBSA and other contract variables.

Data Gathering

The majority of the data for this effort, and the data used to answer investigative questions two through five, were extracted from the Air Force Contract Reporting System, also know as the J001. The J001 is a database comprised of DD Form 350, Individual Contracting Action Report, inputs for all Air Force contracting actions exceeding $25,000. All DD Form 350 data that are input, collected, and transmitted is

considered primary data, which are often the most valid form of data (Leedy and Ormrod, 2001).

The data in the J001 database needed for this study was queried using Air Force Materiel Command's (AFMC) Contracting Business Intelligence System (CBIS), which receives updates from the J001. Identifying and extracting only the contracting actions that were services-related was done by isolating block B12A, Federal Stock Class (FSC) or Service (SVC) Code, on the DD Form 350. FY 2001 was the first year the form DD 350 contained a block for coding of PBSA. On the DD Form 350, block B12A is a four position alphanumeric code. All FSC codes contain only numeric designations, while all SVC codes start with an alpha designation. In order to extract only the SVC coded contracting actions, a search was conducted for all actions where B12A was between A000 and Z999. The resulting contracting actions, all of which were services-related, were extracted from the database and transferred to an excel document. While highly unlikely, it is possible some PBSA coded contracts used FSC codes by mistake. However, because of the low probability of occurrence, no attempt to extract these contracts was made.

Due to the size and complexity of the information contained on each DD Form 350, not all blocks on the form were extracted for analysis. Table 2 shows the variables extracted form the database.

Table 2. *DD Form 350 Variables Extracted from the J001 Database.*

B1A – Contract Number	B13F – Indefinite-Delivery Contract Use
B1C – Bundled Contract	C1 - Synopsis
B1D – Bundled Contract Exception	C2 – Reason Not Synopsized
B1E – Performance-Based Service Contract	C3 – Extent Competed
B3 – Action Date	C5 – Type of Contract
B4 – Completion Date	C8 – Solicitation Procedures
B6A – City or Place Code	C9 – Authority for Other Than Full & Open Competition
B8 - Obligated or Deobligated Dollars	
B10 – Multi-Year Contract	C14 – Commercial Items
B11 – Total Estimated Contract Value	D1A – Type of Entity
B12A – FSC or SVC Code	D1B – Women-Owned Business
B12D – NAICS Code	D1C – HUBZone Representation
B13A – Contract/Order	D1D – Ethnic Group
B13B – Type of Indefinite-Delivery Contract	D4A – Type of Set-Aside
B13E – Multiple Award Contract Fair Opportunity	D4B – Type of Preference
	D7 – SBIR Program

The researcher first reviewed all variables for applicability to this study. Variables were eliminated based not only on their pertinence to PBSA, but also their frequency of use. For example, Report Number and Recovered Material Clauses, were eliminated from consideration because both are seldom used and have no relationship to PBSA. Next, variables that are typically included in contracting metrics, such as type of service, dollar amount, business size, and contract type, were selected for extraction. Then I included socio-economic variables, such as Women-Owned Business, HUBZone Representation, and Ethnic Group. While these socio-economic variables are most likely not correlated with the use of PBSA, they were selected in order to check for any unusual or compelling relationships. Curiosity was the driver for extraction of a few variables. On the surface theses variables were expected to have no correlation to PBSA. However, no determination can be made until they are tested. These variables include Multiple Award

Fair Opportunity, Bundled Contract, and Bundled Contract Exception. Before finalizing the selection of variables, a member of the research committee reviewed and agreed that the variables identified by the researcher for extraction from the J001 database were appropriate.

Variable Descriptions

This section provides a description of possible responses and expected relationships to PBSA for each variable extracted from the J001 database. This information was obtained from the Contract Action Reporting System FY04 Training and Desk Guide (Office of Procurement Management, 2003). Because socio-economic variables, such as Type of Entity, Women-Owned Business, HUBZone Representation, Ethnic Group, Type of Set-Aside, Type of Preference, and SBIR Program, have no practical correlation to PBSA, no expected relationships were noted.

Contract Number. This is a 13-character alphanumeric designation procurement identification number. This variable is used for informational purposes only and was not tested for relationships with PBSA.

Bundled Contract. This variable is coded "Y" when the contract meets the definition of "bundled contract" and the contract value exceeds $5 million. This variable is coded "N" when code "Y" dose not apply. This variable was expected to have a negative correlation with PBSA use when coded "Y" because in order for a bundled contract to be performance-based, a majority of the consolidated contracts would have also had to be performance-based.

Bundled Contract Exception. If Bundled Contract is coded "N", this variable is left blank; otherwise one of the following codes is entered:

> Code A – The procurement is mission critical and the agency has determined that the consolidation of requirements is critical to the agency's mission.
> Code B – The agency used the OMB Circular A-76 process to determine that the consolidation of requirements is necessary and justified.
> Code C – Codes A and B do not apply

This variable was expected to have a negative correlation with the probability of PBSA because it's dependent on the coding of "Y" for Bundled Contract.

Action Date. The year, month, and day of fiscal obligation. Although descriptive in nature, it was expected that this variable, over time, would have a positive correlation with PBSA. This was expected because it was assumed that PBSA percentages were going to increase over time.

Completion Date. The year, month, and day of the last contract delivery or the end of the performance period. Although descriptive in nature, it was also expected that this variable, over time, would have a positive correlation with PBSA. This was expected because it was assumed that PBSA percentages were going to increase over time.

Obligated or Deobligated Dollars. This variable is the net amount of funds obligated or deobligated by the contracting action. This variable was expected to have a positive correlation with PBSA as the value increased. This was expected because the complex nature of PBSA contracts implies that the time and effort needed to establish a PBSA contract would not be done for smaller dollar contracts.

Mult-Year Contract. This variable is coded "Y" when the contracting action is a multi-year contract and coded "N" when code "Y" does not apply. It was expected that

this variable would have no correlation with PBSA because most multi-year contracts are avoided when at all possible.

Total Estimated Contract Value. This variable is the net amount of the total estimated contract value at the time of the initial contract. This includes placement of an indefinite-delivery or multi-year contract. Additionally, this variable includes the total estimated value of orders and option anticipated over the life of the contract. This variable was expected to have a positive correlation with PBSA for the same reasons indentified for Obligated or Deobligated Dollars.

FSC or SVC Code. This variable is the 4-characrter code that describes the contract effort. Each effort falls into one of three categories; Supplies, Services, or Research, Development, Test and Evaluation. This variable was expected to have a positive correlation with PBSA when general base services, such as grounds maintenance or custodial services, were selected. R&D services were expected to have a negative correlation with PBSA because of their seldom use of performance-based contracts in the past.

NAICS Code. This variable stands for the North American Industry Classification System (NAICS) and also helps identify the product of service. It is important to note that more than one code may apply. This variable was expected to act similar to FSC or SVC Code because it is a function of the FSC or SVC Code.

Contract/Order. This variable is coded using one of the following eight codes:

> Code 1 - Letter Contract. Code 1 is entered when the contracting action is a letter contract or a modification to a letter contract that has not been definitized.
> Code 3 - Definitive Contract. Code 3 is entered when the contracting action is the award or modification of a definitive contract or a modification that definitizes a contract.

Code 4 - Order under an Agreement. Code 4 is entered when the contracting action is an order or definitization of an order under an agreement other than a blanket purchase agreement.
Code 5 - Order under Indefinite-Delivery Contract. Code 5 is entered when the contracting action is an order, including a task or delivery order, under an indefinite-delivery contract awarded by a Federal agency, such as a GSA indefinite-delivery contract.
Code 6 - Order under Federal Schedule. Code 6 is entered when the contracting action is an order under a GSA or VA Federal Supply Schedule, or a call against a blanket purchase agreement established under a GSA or VA Federal Supply Schedule.
Code 7 – Blanket Purchase Agreement Order under Federal Schedule. Code 7 is entered when the contracting action is a BPA order under a GSA or VA Federal Supply Schedule.
Code 8 - Order from Procurement List. Code 8 is entered when the contracting action is an action placed with Federal Prison Industries (UNICOR) or a JWOD Participating Nonprofit Agency.
Code 9 - Award under FAR Part 13. Code 9 is entered when the contracting action, including an action in a designated industry group under the Small Business Competitiveness Demonstration Program, is an award using simplified acquisition procedures.

This variable was expected to have negative correlation with PBSA when coded "4", "5", "6", "7", or "8." This was expected because PBSA contracts are rarely used when placing an order off of an existing contract.

Type of Indefinite-Delivery Contract. This variable is coded using one of the following three codes when Contract/Order is coded "Order" for the variable Indefinite-Delivery Contract:

Code A – The action pertains to a requirements contract.
Code B – The action pertains to an indefinite-quantity contract.
Code C – The action pertains to a definite-quantity contract.

Because indefinite delivery contracts are seldom PBSA, it was expected that this variable would have a negative correlation with PBSA use.

Multiple Award Contract Fair Opportunity. This variable is coded using one of the following five codes:

Code A - Fair Opportunity Process. Code A is entered when the delivery or task order was issued pursuant to a process that permitted each contract awardee a fair opportunity to be considered.
Code B - Urgency. Code B is entered when the agency need is so urgent that providing a fair opportunity would result in unacceptable delays.
Code C - One/Unique Source. Code C is entered when only one contract awardee is capable of providing the supplies or services at the level or quality required because the supplies or services are unique or highly specialized.
Code D - Follow-On Contract. Code D is entered when the order was issued on a sole-source basis in the interest of economy and efficiency as a logical follow-on to an order already issued under the contract.
Code E - Minimum Guarantee. Code E is entered when it was necessary to place an order to satisfy a minimum amount guaranteed to the contractor.

This variable was expected to have a positive correlation with PBSA when "A" was coded because, according to the literature, PBSA increases competition, thus enhancing fair opportunity processes.

Indefinite-Delivery Contract Use. This variable is coded using one of the four following codes if Type of Indefinite-Delivery Contract was coded and the action is the initial placement of an indefinite-delivery contract:

Code A – The contract can be used Government-wide.
Code B – The contract can be used within the DoD only.
Code C – The contract can be used within the department only.
Code D – The contract can be used by the contracting office only.

Because indefinite delivery contracts are seldom PBSA, it was expected that this variable would have a negative correlation with PBSA use.

Synopsis. This variable is coded using one of the three following codes:

Code A – Only a synopsis of the proposed action was prepared.
Code B – A combined synopsis/solicitation of the proposed action was prepared.
Code N – A synopsis was not prepared.

This variable was expected to have a negative correlation with PBSA when coded "N" because PBSA is best used in competitive circumstances. Not preparing a synopsis limits the notification of upcoming solicitations, thus limiting competition.

Reason Not Synopsized. This variable is left blank unless Synopsis is coded "N." If Synopsis is coded "N" then this variable is coded using one of the three following codes:

Code A – The action was not synopsized due to urgency.
Code B – The action was not synopsized because the acquisition was made through another means that provided access to the notice of the proposed action through a single, Government-wide point of entry.
Code Z – The action was not synopsized due to some other reason.

This variable was expected to have a negative correlation with PBSA because not synopsizing results in limited competition.

Extent Competed. This variable is coded using one of the four following codes:

Code A – The action was competed.
Code B – The action is not available for competition.
Code C – The action is a follow-on to competed action.
Code D – The action was not competed.

Because PBSA is best used in competitive circumstance, codes "A" and "C" for this variable were expected to have a positive correlation with PBSA and codes "B" and "D" were expected to have a negative correlation.

Type of Contract. This variable identifies the type of contract utilized for the action and is coded using one of the 12 following codes:

Code A - Fixed-Price Redetermination.
Code J - Firm-Fixed-Price.
Code K - Fixed-Price Economic Price Adjustment.
Code L - Fixed-Price Incentive.
Code M - Fixed-Price-Award-Fee.
Code R - Cost-Plus-Award-Fee.

Code S - Cost Contract.
Code T - Cost-Sharing.
Code U - Cost-Plus-Fixed-Fee.
Code V - Cost-Plus-Incentive-Fee.
Code Y - Time-and-Materials.
Code Z - Labor-Hour.

It was expected that this variable would have a positive correlation with PBSA when coded "J" because firm-fixed price contracts have been identified in the literature as the ideal contract types for PBSA. Conversely, all the cost-plus contract types were expected to have a negative correlation with PBSA because the use of these types of contracts is discouraged and not conducive to PBSA methods.

Solicitation Procedures. This variable is left blank if the action is pursuant simplified acquisition procedures or is an order or call under a Federal schedule. Otherwise, the variable is coded using one of the following nine codes:

Code A - Full and Open Competition Sealed Bid.
Code B - Full and Open Competition--Competitive Proposal.
Code C - Full and Open Competition--Combination.
Code D - Architect-Engineer.
Code E - Basic Research.
Code F - Multiple Award Schedule.
Code G - Alternative Sources.
Code K - Set-Aside.
Code N - Other than Full and Open Competition.

Because PBSA is best used in competitive circumstance, codes "B" and "C" for this variable were expected to have a positive correlation with PBSA and code "N" was expected to have a negative correlation. Additionally, PBSA is not appropriate for sealed bidding and is not required for architect-engineering services; therefore codes "A" and "D" were also expected to have a negative correlation with PBSA.

Authority for Other Than Full and Open Competition. This variable is left blank unless Solicitation Procedures is coded "N." If Solicitation Procedures is coded "N" then one of the following 14 codes is used:

Code 1A - Unique Source.
Code 1B - Follow-On Contract.
Code 1C - Unsolicited Research Proposal.
Code 1D - Patent or Data Rights.
Code 1E - Utilities.
Code 1F - Standardization.
Code 1G - Only One Source--Other.
Code 2A - Urgency.
Code 3A - Particular Sources.
Code 4A - International Agreement.
Code 5A - Authorized by Statute.
Code 5B - Authorized Resale.
Code 6A - National Security.
Code 7A - Public Interest.

Because PBSA is best used in competitive circumstance this variable was expected to have a negative correlation with PBSA.

Commercial Items. This variable is coded "Y" for yes or "N" for no depending on the inclusion of FAR clause 52.212-4, Contract Terms and Conditions—Commercial Items, in the contract. If this clause is in the contract then the action was awarded as a commercial item and thus is code "Y." Because commercial items cover such a broad range of services, the researcher was unsure what effect, if any, this variable would have on PBSA.

Type of Entity. This variable describes the type of business entity the action was awarded to and is coded using one of the following 11 codes:

Code A - Small Disadvantaged Business (SDB) Performing in U.S.
Code B - Other Small Business (SB) Performing in U.S.
Code C - Large Business Performing in U.S.
Code D - JWOD Participating Nonprofit Agency.

Code F - Hospital.
Code L - Foreign Concern or Entity.
Code M - Domestic Firm Performing Outside U.S.
Code T - Historically Black College or University (HBCU).
Code U - Minority Institution (MI).
Code V - Other Educational.
Code Z - Other Nonprofit.

Women-Owned Business. This variable identifies whether or not the contractor identifies themselves as a women-owned business and is coded "Y" for yes, "N" for no, or "U" for uncertified.

HUBZone Representation. This variable identifies whether or not the contractor represented that it is a HUBZone small business concern and is coded "Y" for yes and "N" for no.

Ethnic Group. This variable identifies the ethnic group for the contractor, if applicable. This variable is left blank unless the action is with a small disadvantaged business. Otherwise one of the following seven codes is used:

Code A - Asian-Indian American.
Code B - Asian-Pacific American.
Code C - Black American.
Code D - Hispanic American.
Code E - Native American.
Code F - Other SDB Certified or Determined by SBA.
Code Z - No Representation.

Type of Set-Aside. This variable identifies the type of set-aside used and is coded using one of the following 11 codes:

Code A - None.
Code B - Total SB Set-Aside.
Code C - Partial SB Set-Aside.
Code D - Section 8(a) Set-Aside or Sole Source.
Code E - Total SDB Set-Aside.
Code F - HBCU or MI - Total Set-Aside.
Code G - HBCU or MI - Partial Set-Aside.

Code H - Very Small Business Set-Aside.
Code J - Emerging Small Business Set-Aside.
Code K - HUBZone Set-Aside or Sole Source.
Code L - Combination HUBZone and 8(a).

Type of Preference. This variable identifies the type pf preference given to small businesses and is coded using one of the following five codes:

Code A - None.
Code B - SDB Price Evaluation Adjustment--Unrestricted.
Code C - SDB Preferential Consideration--Partial SB Set-Aside.
Code D - HUBZone Price Evaluation Preference.
Code E - HUBZone Price Evaluation Preference and SDB Price Evaluation Adjustment.

SBIR Program. This variable identifies whether or not the action is related to the Small Business Innovation Research (SBIR) Program and if so, what phase of it. This variable is coded using the following four codes:

Code A - Not a SBIR Program Phase I, II, or III.
Code B - SBIR Program Phase I Action.
Code C - SBIR Program Phase II Action.
Code D - SBIR Program Phase III Action.

Data Reliability

Despite its wide use, the J001 and other federal procurement databases have been proven to have their flaws. A 2003 report from the General Accounting Office (GAO) noted, "FPDS data are inaccurate and incomplete (Woods, 2003)." For instance, in the 2001 review the GAO found that the value of contracts awarded to HUBZone firms could have been hundreds of millions of dollars different than reported (Woods, 2003). They also found instances where multiple orders were reported as a single transaction. For instance, an order reported as $11,443,000 should have been reported as 87 separate

actions at or below $25,000 (Woods, 2003). Because of these inaccuracies, the GAO has been unable to assess the implementation of procurement programs and limited its reliance on FPDS data. The GAO found similar inaccuracies with the Department of Defense's data system, which feeds information into FPDS. However, in the report no details were given on the specifics of the DoD's inaccuracies.

Of the problems noted in the GAO findings, none specifically pertained to the use or coding of PBSA. The only remark suggesting possible problems with proper coding of PBSA actions included, "In some cases, those processing the data did not have a complete understanding of the information requirements." This remark suggests that some contracting actions may or may not be being coded PBSA accurately. Another GAO report further supports the possibility of inappropriate coding of federal procurement data by noting there are inconsistencies in the interpretation of the definition of performance based contracts (Woods, 2002). In addition, personal experiences by the researcher suggest that time constraints, pressure to meet procurement goals, and a general lack of emphasis on proper coding may also attribute to inaccuracies in the databases.

Builders of the input system for the DD Form 350 realized that there was a possibility for user error when inputting procurement information. In order to counter this, the system has built-in error checking capability. For instance, if block B1C, Bundled Contract, is coded "N" for no, the system will not allow you to code an exception in block B1D, Bundled Contract Exception. Although this coding check capability does not account for subjective coding decisions, it does add to the overall reliability of the data.

Data Analysis

AFI 63-124, the guiding document for USAF PBSA, states that all services contracts over the Simplified Acquisition Threshold (SAT), which has been listed at $100,000 during the years pertaining to this study, are eligible for PBSA, excluding the services listed in FAR Subpart 37.102 (DAF, 2004). The services excluded from PBSA use include architect-engineering services, construction, utility services, and services that are identical to supply purchases (FAR Part 37). Because these services are not eligible for PBSA and none of them were coded PBSA, they were removed from the J001 data by identifying and deleting the corresponding service code categories. All services, with the exception of R&D type services, and construction work are broken up into the 23 major categories listed in Appendix A. Each category has been assigned a four position code, also known as SVC code, starting with a letter followed by three numbers. The letter identifies the major category and the numbers identify the specific service within each category. All contracts that have a SVC code that begins with the alpha designation "C" are architect and engineering service contracts. All contracts that have a SVC code that begins with the alphanumeric designations "S1" are utility service contracts. All contracts that have a SVC code that begins with the alpha designation "Y" are construction contracts. Accordingly, all actions where block B12A, FSC or SVC, began with C, S1, or Y were removed. After removing all exempt services, the remaining contracting actions, all of which were greater than $100K and not excluded under FAR Subpart 37.102, were analyzed.

The data were analyzed using descriptive statistics, forecasting, regression, and contingency tables. The following sections describe how these methods were used to answer the five investigative questions.

Investigative Question 1. In order to determine the reliability of the J001, and answer investigative question 1, a stratified random sample of PBSA contract files were obtained from three different contracting offices located at Wright-Patterson Air Force Base (WPAFB). These offices included 88 ABW/PK, AFRL Det 1/PK, and ASC/PK. These three offices were selected because they each perform a different contracting function for the USAF. The 88th ABW/PK is an operational contracting squadron that primarily supports base operations; ASC/PK supports a variety of weapon systems related requirements, and AFRL Det 1/PK contracts primarily for research and development (R&D) efforts. Together these offices handle a wide variety of contracts, from standard firm fixed price base custodial contracts to complex cost reimbursable R&D contracts to major weapon-system related contracts.

The goal was to evaluate at least 30 randomly selected contracts from each office. In order to ensure an appropriate amount of contracts were selected from each office, the contracts were first stratified. Using the data from the J001, all PBSA coded contract data from each office was identified using each office's unique Department of Defense Activity Address Code (DoDAAC) and office code. The DoDAAC is an alpha numeric designation that is always the first six designations of a contract number and is usually the same for all contracts in a particular office. The office code is a unique alpha numeric designation identifier that helps track actions performed by a particular office and is required when completing a form DD 350.

Once the contract data for each office was identified, extracted, and sorted by date of action, a random sample for each office was generated using a random number generator software program tool. Those contracts randomly selected were requested for review. In some instances the contracting offices were unable to locate a contract file because they were a) already staged away in storage at a different location, b) currently being used, c) classified, or d) simply unable to be located. In these instances, a replacement contract from the randomized list was identified and substituted.

The stratified sample of service contracts coded PBSA in the J001 was then evaluated against the four PBSA contract criteria identified in The Guidebook for Performance-Based Services Acquisitions in the Department of Defense (PBSA Guidebook). The criteria identified in the PBSA Guidebook were selected in lieu of the four PBSA criteria identified in the Federal Acquisition Regulation (FAR) because, unlike the FAR, the PBSA Guidebook criteria is a minimum mandatory requirement and was published by Dr. Gansler, the same person that established the FY 2005 goal that 50% of all services be performance based. According to the PBSA Guidebook, in order for an acquisition to be considered performance-based, it must meet the following minimum requirements:

(1) Performance Work Statement – The performance work statement describes the requirement in terms of measurable outcomes rather than by means of prescriptive methods.
(2) Measurable Performance Standards – To determine whether performance outcomes have been met, measurable performance standards define what is considered acceptable performance.
(3) Remedies – Remedies are procedures that address how to manage performance that does not meet performance standards. While not mandatory, incentives should be used, where appropriate, to encourage performance that will exceed performance standards. Remedies and incentives complement each other.

(4) Performance Assessment Plan – This plan describes how contractor performance will be measured and assessed against performance standards. (Quality Assurance Plan or Quality Surveillance Plan).

All evaluations were conducted by the researcher, who is Level II Certified in Contracting through the Acquisition Professional Development Program, and considered a subject matter expert in PBSA. For the purposes of this study, contracts were evaluated on the existence of the four PBSA factors mentioned above. A contract was determined to be correctly coded PBSA if it contained all four PBSA criteria, even if not named exactly as stated in the PBSA Guidebook. For instance, a Statement of Work (SOW) that described the requirement in terms of measurable outcomes was considered to meet the first criteria of the PBSA Guidebook, even though it was not named a Performance Work Statement (PWS). A contract was determined to be incorrectly coded PBSA if it did not meet one or more of the four PBSA criteria. Because determining when performance incentives are appropriate is so subjective and the use of incentives is so infrequent, the third PBSA criterion, "Remedies," was assumed to have been correctly applied for all PBSA contracts.

Additionally, all PBSA coded contracts from AFRL were evaluated, not using the criteria identified in the PBSA Guidebook, but using the determinations made in AFRL's Management and Oversight of Acquisition of Services Processes (MOASP). Prior to May 7, 2004, all Research and Development (R&D) contracts had followed the requirements for supplies (AFRL, 2004). However, because AFRL's R&D requirements are inherently performance-based, they drafted their own MOASP describing how they meet the principles of AFI 63-124. AFRL's MOASP was approved by the Air Force Program Executive Officer for Combat & Mission Support (AFPEO/CM) and authority

to act as the Designation Official for the management and oversight of all services acquisitions within AFRL was delegated to the AFRL commander. Therefore, as of May 7 2004, all AFRL R&D contracts are considered services and coded PBSA in accordance with the approved AFRL MOASP. (DAF, AFRL MOASP, 2003)

Under the AFRL MOASP, R&D contracts meet the principles of AFI 63-124 because:

1) Contractor written SOWs in response to Government issued objectives, describe work in terms of what the required output is rather than how the work is to be performed.
2) Oversight between the objective and outcome is accomplished through the selection of appropriate reporting requirements, such as Contract Data Requirements Lists (CDRLs), Program Management Reviews (PMRs), Technical Management Reviews (TMRs), electronic management information systems, and interaction between the contractor and the government.
3) Deliverables may be final reports, prototypes, other hardware or software, etc.

The sample of AFRL contract files were evaluated against these criteria in the same manner the other offices' contracts were evaluated.

Lastly, all PBSA service contracts for Contractor Engineering and Technical Services (CETS) covered by AFI 21-110, *Engineering and Technical Services*, were evaluated in accordance with Supplement 1 to AFI 63-124, which states that the surveillance requirements of AFI 63-124 do not apply (DAF, Sup 1, 1999). AFMC MOASP dated February 2004 rescinded this exception. Therefore, all CETS contracts prior to February 2004 were evaluated on only one criteria; the existence of a performance work statement that described the requirement in terms of measurable outcomes rather than by means of prescriptive methods.

Once the contract evaluations were complete, a large sample, one-tailed test about a population proportion was used to statistically test the reliability of the sample and answer the question of whether PBSA coded contracts are coded consistent with the minimum mandatory criteria identified in the PBSA Guidebook (McClave, et al., 2001). Ideally all PBSA contracts would be coded correctly. However, like any other process there are bound to be mistakes, or defects, in coding of contracts. Because of this, an acceptable threshold was established. The researcher felt that PBSA coding could be considered reliable if less than 10% of the PBSA contracts were coded incorrectly.

Inferences about population proportion, or percentages, can be made in the context of the probability, p, of success or failure for a binomial distribution (McClave, et al., 2001). For this study p represented the percentage of PBSA contracts that did not meet the mandatory minimum criteria identified in the PBSA Guidebook. Additionally, p_o represented the hypothesized percentage of PBSA contracts that did not meet the mandatory minimum criteria identified in the PBSA Guidebook and was equal to .10.

The sample proportion is simply the sample mean of the outcomes of the trials. According to the Central Limit Theorem, the sample mean is approximately normally distributed for large samples. Therefore, the standard normal z was able to be used for the test statistic:

$$\text{Test Statistic: } z = \frac{\text{Sample proportion} - \text{Null hypothesized proportion}}{\text{Standard deviation of sample proportion}}$$

$$= \frac{\hat{p} - p_o}{\sigma_{\hat{p}}}$$

The symbol $\sigma_{\hat{p}}$ equals $\sqrt{\frac{pq}{n}}$, where pq is estimated by $p_o q_o$, $q_o = 1 - p_o$, and n is the sample size.

However, before conducting any type of hypothesis test, the researcher had to check to determine whether the sample size was large enough to use the normal approximation for the sampling distribution of the sample proportion, $\hat{p}$ (McClave, et al., 2001). In order to use the large sample test of hypothesis about a population proportion, the sample size must be large enough that interval $p_o \pm 3\sigma_{\hat{p}}$ does not include 0 or 1. This ensures that the sample size is large enough to assume that the normal distribution will provide a reasonable approximation of $\hat{p}$ (McClave, et al., 2001). As long as this interval is completely contained in the interval 0 to 1, the normal approximation for the sampling distribution of $\hat{p}$ is reasonable. If at least 30 samples from each of the three offices were evaluated, the total number of samples, n, would be equal to 90. With 90 samples and a p_o of .10, interval $p_o \pm 3\sigma_{\hat{p}}$ equals .10 ± .095 or (.005 and .195), both of which do not include 0 or 1.

Finally, in order to statistically test the reliability of the DD Form 350 data and answer the question of whether or not PBSA coded contracts are coded consistent with the minimum mandatory criteria identified in the PBSA Guidebook, the following null and alternate hypotheses were established (Bain and Englehardt, 1987):

Null hypothesis #1 (H_{o1}): $p \geq .10$
Alternate hypothesis #1 (H_{a1}): $p < .10$

For this test an alpha (α) of .01 was used. α represents the significance level, or the probability of rejecting the null hypothesis when it is in fact true, also known as a Type I

error (McClave, et al., 2001). Using the standard normal distribution, the appropriate rejection region for the specified value of α was found. Using α = .01, the one-tailed rejection region is:

Rejection region: $z < -z_{.01} = -2.33$

Therefore, the null hypothesis was rejected if the value of the test statistic, z, was less than -2.33, thus falling in the rejection region.

Investigative Question 2. In order to answer investigative question 2, the following hypotheses were established:

Null hypothesis #2 (H_{o2}): The USAF is meeting interim PBSA goals.
Alternate hypothesis #2 (H_{a2}): The USAF is not meeting interim PBSA goals.

The actual percentage of eligible dollars awarded using PBSA were compared to the interim PBSA goals established by the acting Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Michael Wynne. Mr. Wynne's goals did not address the percentage of actions PBSA, only the percentage of dollars PBSA. These interim PBSA goals are included below.

FY 2003	25 percent of dollars awarded
FY 2004	35 percent of dollars awarded

The following sub-hypotheses were established in order to address the goals for each FY and assist in determining whether to accept or reject null hypothesis #2:

Null hypothesis #2_a (H_{o2a}): FY 2003 Actual % of Dollars PBSA ≥ 25 %.
Alternate hypothesis #2_a (H_{a2a}): FY 2003 Actual % of Dollars PBSA < 25%.
Null hypothesis #2_b (H_{o2b}): FY 2004 Actual % of Dollars PBSA ≥ 35 %.
Alternate hypothesis #2_b (H_{a2b}): FY 2004 Actual % of Dollars PBSA < 35%.

Because the data represents the whole population of PBSA eligible contracts, if during any year the actual percentage of eligible dollars awarded using PBSA were less than the interim PBSA goals then the null hypothesis was rejected.

Investigative Question 3. Forecasting using simple linear regression and a two-period moving average were used in order to answer investigative question 3. Because the number of data points (4) was limited, the researcher opted to use more than one forecasting method. Despite the use of two forecasting methods, the significance of the forecasts was expected to be limited due to the few data points available.

With simple linear regression a straight-line model is used to relate a times series, Y_t, to time, t (McClave, et al., 2001). For this study Y_t was the percentage of PBSA dollars or actions and t was the FY. Using this model, a least squares line can be calculated and used to forecast future values of Y_t (McClave, et al., 2001). The straight-line model is as follows:

$$E(Y_t) = \beta_0 + \beta_1 t$$

Where β_0 is the intercept and β_1 is a population parameter. This model can be fitted using the method of least squares, where the sum of squared errors between the predicted and actual values is smaller than any other straight-line model (McClave, et al., 2001). The least squares model looks identical to the straight-line model, except for least square estimators are substituted for the population parameters. The least square model is as follows:

$$E(Y_t) = \hat{\beta}_0 + \hat{\beta}_1 t$$

Moving averages forecast for future time periods using the mean of past observations (Makridakis, Wheelwright, & McGee, 1978). With a two-period moving average, only the mean of the last two observations is use to forecast for the value of the next time period (Makridakis, Wheelwright, & McGee, 1978). For this study, the mean of the percentages for FY 2003 and 2004 will be used to forecast the percentage for FY 2005.

Using the simple liner regression model, moving averages, and the following hypotheses, the researcher forecasted for the percentage of PBSA dollars and actions for FY 2005:

> Null hypothesis #3 (H_{o3}): The USAF will meet the mandated FY 2005 goal of 50% of all eligible service dollars and actions awarded using PBSA.
> Alternate hypothesis #3 (H_{a3}): The USAF will not meet the mandated FY 2005 goal of 50% of all eligible service dollars and actions awarded using PBSA.
>
> Null hypothesis #3_a (H_{o3a}): The FY 2005 % of dollars PBSA $\geq$ 50%
> Alternate hypothesis #3_a (H_{a3a}): The FY 2005 % of dollars PBSA < 50%
>
> Null hypothesis #3_b (H_{o3b}): The FY 2005 % of action PBSA $\geq$ 50%
> Alternate hypothesis #3_b (H_{a3b}): The FY 2005 % of actions PBSA < 50%

If either forecasted percentage of dollars or actions PBSA for FY 2005 was less than 50%, then the null sub-hypothesis was rejected. If any of the null sub-hypotheses were rejected then null hypothesis #4 was also rejected.

Investigative Question 4. In order to answer investigative question 4, the following hypotheses were established:

> Null hypothesis #4_A ($H_{o4\ dollars}$): The percentage of modifications, measured in dollars, coded PBSA is equal to the percentage of non-modifications, measured in dollars, coded PBSA.
> Alternate hypothesis #4_A ($H_{a4\ dollars}$): The percentage of modifications, measured in dollars, coded PBSA is not equal to the percentage of non-modifications, measured in dollars, coded PBSA.

Null hypothesis #4_B ($H_{o4\ actions}$): The percentage of modifications, measured in actions, coded PBSA is equal to the percentage of non-modifications, measured in actions, coded PBSA.
Alternate hypothesis #4_B ($H_{a4\ actions}$): The percentage of modifications, measured in actions, coded PBSA is not equal to the percentage of non-modifications, measured in actions, coded PBSA.

Because the whole population was used when computing the percentages, there was no need to use a statistical test to determine a difference between modifications and non-modifications. The researcher decided that a 5 percent difference of either dollars or actions in any FY was significant. Therefore, the decision to accept or reject the null hypothesis was determined by comparing the percentage of modifications coded PBSA to the percentage of non-modifications coded PBSA for FY 2001 through FY 2004. In order to make this comparison, the following sub-hypotheses were established for each FY:

Null hypothesis #4_a ($H_{o4a\ 2001dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_a ($H_{a4a\ 2001dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_a ($H_{o4a\ 2001actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_a ($H_{a4a\ 2001actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_b ($H_{o4b\ 2002dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_b ($H_{a4b\ 2002dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_b ($H_{o4b\ 2002actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_b ($H_{a4b\ 2002actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_c ($H_{o4c\ 2003dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_c ($H_{a4c\ 2003dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_c ($H_{o4c\ 2003actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_c ($H_{a4c\ 2003actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_d ($H_{o4d\ 2004dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_d ($H_{a4d\ 2004dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
Null hypothesis #4_d ($H_{o4d\ 2004actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
Alternate hypothesis #4_d ($H_{a4d\ 2004actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%

If the difference for any year was greater than 5 percent, then the null hypothesis for that year was rejected. If any of the null sub-hypotheses were rejected then null hypothesis #4 was also rejected.

Investigative Question 5. Contingency tables and logistic regression were used to answer investigative question 5. However, before running any analysis, the variables extracted from the J001 database were evaluated on their likeliness of producing significant correlational results. Immediately, three variables were eliminated from further analysis because their data is primarily descriptive in nature. These variables were Action Date, Completion Date, and City or Place Code. All remaining variables were analyzed.

All nominal variables were tested for dependency with PBSA using contingency tables. Contingency tables are a statistical model used for multi-nomial data and provide a determination of dependence (McClave, et al., 2001). Therefore, the two continuous variables in the data set, Obligated or Deobligated Dollars and Total Estimated Contract Value, were not tested using this statistical tool. Contingency tables provide observed counts of occurrences, expected counts of occurrences, frequencies for each cell, row, and column, probabilities for each cell, row, and column. Contingency tables are constructed by listing all the possible outcomes of one variable as rows in a table and the possible outcomes of the other variable as columns, then finding the frequency and probability for each cell. The cell frequencies and probabilities are then summed across both rows and columns. The sums are placed in the margins, the values of which are called marginal frequencies and marginal probabilities (McClave, et al., 2001). The lower right hand corner value contains the sum of the row and column marginal frequencies and marginal probabilities. The sum of the marginal frequencies must be equal to N, the total number of trials, and the sum of the marginal probabilities must be equal to 1 (McClave, et al., 2001). Conservative sources maintain that cells that have an expected value of 5 or

less must be removed because they will cause inconsistencies in the table (McClave et al., 2001). However, others (Cochran, 1954) maintain that data does not need to be removed as along as at least 80% of the expected cell counts are 5 or more and no expected cell count is less than 1.

The chi-square (χ^2) statistic is a test statistic used to analyze count data (McClave, et al., 2001) Using χ^2, a determination of dependency between two classifications can be made (McClave, et al., 2001). For this study the two classifications were the contract variable PBSA and a particular contract variable of interest. Each contract variable, or classification, was tested against PBSA in order to determine dependency. If the two variables are dependent, knowing one should increase the probability of knowing the other. In order to test for dependency, the following hypotheses were established:

Null hypothesis #6 (H_{o6}): Variable "x" and PBSA are independent
Alternate hypothesis #6 (H_{a6}): Variable "x" and PBSA are dependent

The test was conducted for each nominal variable. However, before accepting or rejecting the null hypothesis, a chi-square alpha (χ^2_α) needed to be established. For this test an alpha of .01 was used. The next thing needed in determining χ^2_α was the degrees of freedom (df). The following equation was used to calculate the df for each variable:

$$df = (r-1)(c-1)$$

Where r equals the number of rows and c equals the number of columns in the contingency table. Using a χ^2 table, a χ^2_α for each variable was established based on each variable's df and an α of .01. Finally, χ^2 and χ^2_α were compared. If χ^2 was greater than χ^2_α the null hypothesis of independence was rejected and the alternate hypothesis of dependence was accepted. (McClave, et al., 2001)

Lastly, it is important to note that while contingency tables can determine dependency between two classifications, they do not establish the extent of the dependency or the existence of a causal relationship between the two classifications (McClave, et al., 2001).

The continuous variables and all the variables that were found to be dependent with PBSA using contingency tables were further analyzed using logistic regression. Logistic, also known as categorical, regression is performed when data is both quantitative and qualitative in nature and the dependent variable has only two possible outcomes (binary) (McClave, et al., 2001). The dependent variable in this study, which is whether a contract action is PBSA, is qualitative and has only two possible outcomes, "Y" for yes or "N" for no. It is common to use the terms success and failure for these types of binary responses (Agresti and Finlay, 1997). With the exception of Obligated or Deobligated Dollars and Total Estimated Contract Value, all other independent variables are qualitative and can be described in binary or multi-nomial form.

When the dependent variable is binary, the probability, *p*, that the dependent variable, y, is response level j is estimated by dividing the total sample count, n, into the total of each response level n_j, and is written:

$$P_j=n_j/n$$

This model serves the same role for a binary response as the sample mean does for continuous models. (McClave, et al., 2001)

Ordinary least squares regression models the mean of the response variable. With a binary response variable, the model describes how the proportion of successes depends on the independent variables (Agresti and Finlay, 1997). Pi (π) usually denotes the true

proportion of successes and also represents the probability that a randomly selected subject has a success response that varies according to the dependent variables (Agresti and Finlay, 1997). The logistic regression model is:

$$\text{Log}\,(\pi/(1-\pi)) = \alpha + \beta X + \varepsilon$$

Where $[\pi/(1-\pi)]$ is the odds ratio, α is the intercept, β is the parameter of the dependent variable, X, and ε is the error. In this model, as π increases from 0 to 1, the odds ratio increases from 0 to ∞ and the logit increases from $-\infty$ to ∞ (Agresti and Finlay, 1997). Additionally, a π value greater than .5 has a positive logit value and π values less than .5 have a negative logit value (Agresti and Finlay, 1997).

The null hypothesis that $\beta = 0$ and the independent variable, X, has no effect on the probability, π, of a success, can be tested using either a z test statistic, which is the estimate of β divided by the standard error, or the square of the z statistic, which is called the Wald statistic (Agresti and Finlay, 1997). The Wald statistic can be used in this instance because it has a χ^2 distribution with df = 1 and and the same P-value as the z statistic. Rejection of the null hypothesis results in acceptance of the alternate hypothesis that $\beta \neq 0$. In order to test each variable in this study, the following hypotheses were established:

> Null hypothesis #5 (H_{o5}): The parameter for variable "x" equals zero.
> Alternate hypothesis #5 (H_{a5}): The parameter for variable "x" does not equal zero.

The determination to accept or reject the null hypothesis was based on each computed χ^2 and corresponding α value. For this test, the significance level was set at .01.

Another test frequently used is the likelihood-ratio test. This test can be used to compare two models by testing that the extra parameters in the complete model equal zero (Agresti and Finlay, 1997). Negative log-likelihood is the negative sum of logs of the observed probabilities. The negative log-likelihood plays the same role as sums of squares does for continuous data, but for categorical data (Agresti and Finlay, 1997).

Twice the value of the negative log-likelihood (-log*likelihood*) also has a distribution that is approximately a χ^2 distribution (Agresti and Finlay, 1997). Therefore, the χ^2 test can be used to test the null hypothesis that removing all the variables from the model leaves the likelihood of observing the sample unchanged. This test is analogous to the F-test for R^2 in multiple regression which tests whether or not the improvement in the model associated with the additional variables is statistically significant (Agresti and Finlay, 1997). If we are able to reject the null hypothesis, we have evidence that at least one of the variables does have an effect on the response.

R^2 (U), the uncertainty coefficient, measures the total uncertainty that is attributed to the model and is calculated using the following formula:

$$R^2\,(U) = \frac{-\log likelihood(difference)}{-\log likelihood(reduced)}$$

Negative log-likelihood (difference) is the difference between the likelihood using the full model and the likelihood using a model with no variables. Negative log-likelihood (reduced) is likelihood using no variables in the model. R^2 (U) values must be between 0 and 1. An R^2 (U) of 1 means that the factor completely predicts the categorical response; an R^2 (U) of 0 means there is no gain by using the model over using fixed responses

(McClave, et al., 2001). It is important to note that high R^2 (U) values are rare in categorical models (JMP, 2003).

Validity and Reliability

Validity and reliability of a measurement instrument influence the probability that you will obtain statistical significance in your data analysis, and the extent to which you can draw meaningful conclusions from your data (Leedy and Ormrod, 2001). While efforts were made to make this study as valid and reliable as possible, there are still some validity and reliability concerns.

The validity pertains to the accuracy, meaningfulness, and credibility of the research effort as a whole (Leedy and Ormrod, 2001). Most texts separate validity into two categories; internal and external.

Internal validity is the extent to which a researcher can draw an accurate conclusion about relationships within the data based on the research design (Leedy and Ormrod, 2001). Because the data from the J001 was not personally gathered, but rather queried from an existing database, there is little that can be done to counter any internal validity concerns, the largest being construct validity. Construct validity is the extent to which an instrument measures a characteristic that cannot be directly observed, but must be inferred (Leedy and Ormrod, pg 98). Personal experience by the researcher suggests that time constraints, pressure to meet procurement goals, and a general lack of emphasis on proper coding may attribute to inaccuracies in PBSA coding in the J001. Although this study does not measure these influences, it does test and analyze the extent of

possible validity concerns by evaluating a sample of PBSA coded contracts against the PBSA criteria identified in the PBSA Guidebook.

External validity is the extent to which a study's results apply to situations beyond the study itself (Leedy and Ormrod, 2001). Two areas of this study have external validity concerns. First, the contracts evaluated from the three WPAFB contracting offices represent only a sample of PBSA coded contracts. While this study does not contend that the sampled PBSA contracts from these three offices are a proper representation of all PBSA contracts in the USAF, the study does maintain that the contracts evaluated are a reasonable representation and sample of all the PBSA coded contracts in those respective offices. Secondly, because only the services above $100,000 not excluded from PBSA use were analyzed in this study, results and conclusions drawn from this study do not apply to services less than or equal to $100,000 or services excluded from PBSA use. Although services falling in these categories are not required to be procured using PBSA techniques, these techniques are encouraged and sometimes used when it is deemed applicable. How and if these actions differ from eligible actions is unknown. However, because many of these actions are relatively insignificant in dollar amount compared to the entire sum of the actions, it is assumed they would have little to no effect on the cumulative calculations.

The reliability of a measurement instrument is the extent to which it yields consistent results when measuring characteristics that have not changed (Leedy and Ormrod, 2001). The proven analysis tools of logistic regression and contingency tables do not hinder the reliability of the study, but there are some reliability concerns with the data in the J001 database. The two previously mentioned GAO reports alluded to these

reliability concerns within all government procurements databases. While it is impossible to counter any subjective decisions incorrectly made by individuals inputting data into the database, it is possible to assess the reliability, which is done by sampling PBSA coded contracts. However, because the sample only looks at PBSA, the reliability of other DD350 characteristics is not accounted for.

Summary

Chapter 3 discusses the research problem, investigative questions, data gathering, data reliability, data analysis, and validity and reliability. Chapter 4 will address the results and analysis, findings based on the results and analysis, and any conclusions that can be drawn from the findings.

IV. Results and Analysis

Introduction

This chapter describes the research results and answers to each of the five investigative questions. Referenced throughout the chapter are multiple appendices that provide more detailed breakouts of the research results. Included in these appendices are spreadsheets that separate PBSA actions and dollars by Service Category, Type of Contract, and Type of Entity. These appendices can be found at the end of this thesis.

Data Analysis

Investigative Question 1. In order to answer investigative question 1, the following hypotheses were established:

Null hypothesis #1 (H_{o1}): $p \geq .10$
Alternate hypothesis #1 (H_{a1}): $p < .10$

Although the goal was to evaluate only 30 PBSA contracts from each of the three offices, the researcher managed to evaluate a total of 102 contracts; 36 from AFRL Det 1/PK, 34 from 88ABW/PK, and 32 from ASC/PK. Of the 102 contracts evaluated, 3 were determined not to meet the minimum mandatory criteria identified in the PBSA Guidebook. Therefore, the z test statistic was calculated using n = 102 and $\hat{p}$ = 3/102, or 0.029. Substituting the values into the test statistic, a z value of -2.38 was obtained.

$$\text{Test Statistic: } z = \frac{\hat{p} - p_o}{\sigma_{\hat{p}}}$$

$$= \frac{.029 - .1}{\sqrt{\frac{(.1)(.9)}{102}}}$$

$$= -2.38$$

Because the calculated z value is less than -2.33, which is the cut-off for the rejection region, the null hypothesis is rejected. Therefore, there is sufficient evidence at the .01 level of significance to indicate that, for the three offices sampled, fewer than 10% of the PBSA contracts were coded incorrectly. Even though this test can only be generalized to the three offices the samples were drawn from, the results indicate that there may not be systematic problems in PBSA coding throughout the USAF.

Investigative Question 2. In order to answer investigative question 2, the following hypotheses were established:

Null hypothesis #2 (H_{o2}): The USAF is meeting interim PBSA goals.
Alternate hypothesis #2 (H_{a2}): The USAF is not meeting interim PBSA goals.

Additionally, the following sub-hypotheses were established in order to assist in answering investigative question 2.

Null hypothesis #2_a (H_{o2a}): FY 2003 Actual % of Dollars PBSA $\geq$ 25 %.
Alternate hypothesis #2_a (H_{a2a}): FY 2003 Actual % of Dollars PBSA < 25%.

Null hypothesis #2_b (H_{o2b}): FY 2004 Actual % of Dollars PBSA $\geq$ 35 %.
Alternate hypothesis #2_b (H_{a2b}): FY 2004 Actual % of Dollars PBSA < 35%.

Table 3 displays that in Fiscal Year (FY) 2003 the USAF exceeded the interim goal of 25% by awarding over 32% of its contracts using PBSA, a difference of over 7%. However, for FY 2004 the USAF awarded only 28.75% of its contracts using PBSA; when compared to the goal of 35%, the USAF was over 6% below the interim goal.

Table 3. *The Percentage of Dollars PBSA Actual Compared to the Percentage of Dollars PBSA Goal for Fiscal Years (FY) 2003 and 2004.*

Percentage of Dollars PBSA	FY03	FY04
Actual	32.27	28.75
Goal	25	35
Difference	7.27	(6.25)

The results conclude that the USAF did not meet the FY 2004 goal, and is not meeting interim PBSA goals. Therefore, null hypothesis #2 is rejected.

These numbers are better illustrated using Figure 1 below. Included in this figure is the percentage of dollars PBSA from FY 2001 through FY 2004, as well as the 50% PBSA goal for FY 2005. For the first three years there was a distinct upward trend in the percentage of actual dollars awarded using PBSA. However, in FY 2004 the trend was broken and there was a noticeable drop in the actual PBSA percentage.

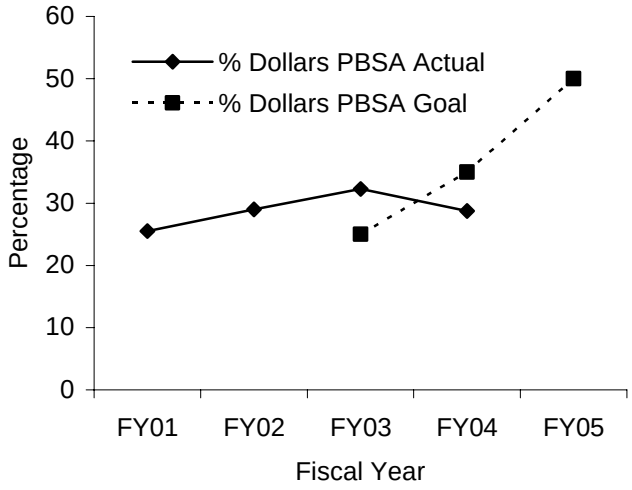

Figure 1. The percentage of actual dollars PBSA and the goal for percentage of dollars PBSA as a function of Fiscal Year.

Further analyzing the data using the summary tables included in Appendices C, D, E, and F, additional interesting phenomena were discovered. For instance, Figure 2

shows that during FY 2004, not only did the percentage of PBSA dollars decline, but so did the cumulative PBSA dollars and cumulative total dollars. Thus, PBSA awards included a smaller percentage of a smaller total dollars awarded. Although it is uncertain what caused this phenomenon, it may be associated with the reason for a decrease in the PBSA percentage during FY 2004.

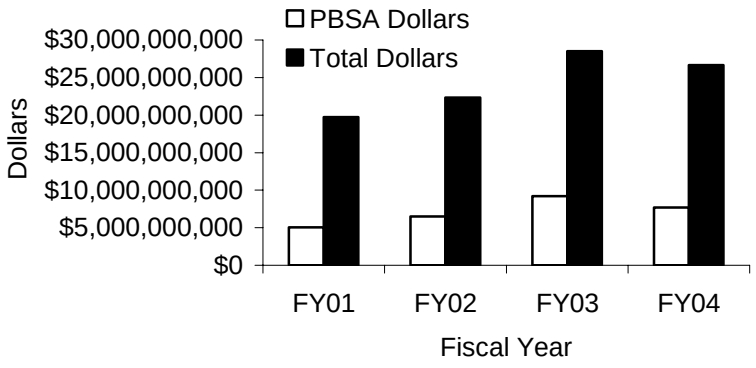

Figure 2. PBSA dollars and total dollars as a function of Fiscal Year.

Additionally, when analyzing the data by variable Type of Contract, it is interesting to note that contracts coded L (Fixed Price Incentive), M (Fixed Price Award Fee), R (Cost Plus Award Fee), Y (Time and Materials), and Z (Labor Hour) or left blank, all had a decrease in the percentage of dollars PBSA for FY 2004 (see Figure 3). The decrease in Cost Plus Award Fee contracts is the most significant because in FY 2004, these types of contracts accounted for over 25% of the total eligible dollars. All the other contracts that realized a decrease in the percentage of dollars PBSA for FY 2004 each accounted for less than 9% of the total eligible dollars.

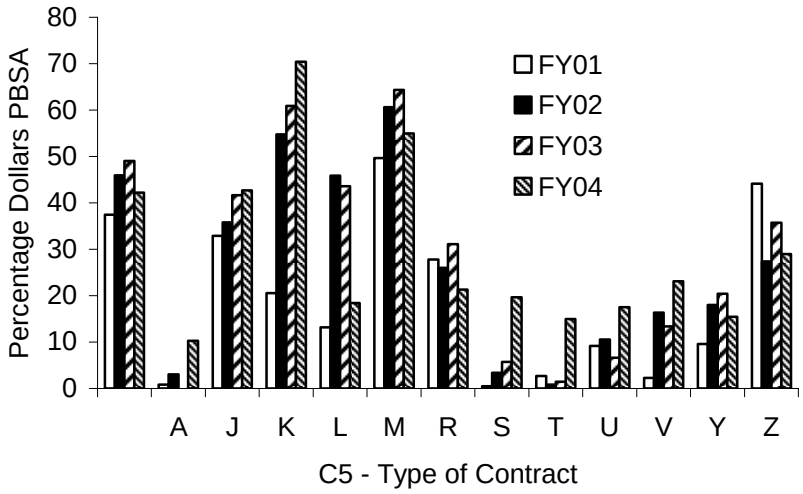

Figure 3. Percentage of total dollars PBSA by Type of Contract.

Surprisingly, contracts coded J (Firm Fixed Price) and U (Cost Plus Fixed Fee), which together account for over 45% of all eligible dollars during FY 2004, both managed to increase their percentage of dollars PBSA. Unfortunately, these increases could not overcome the effect of the percentage decreases in the other contract types.

Investigative Question 3. In order to answer investigative question 3, the following hypotheses were established:

> Null hypothesis #3 (H_{o3}): The USAF will meet the mandated FY 2005 goal of 50% of all eligible service dollars and actions awarded using PBSA.
> Alternate hypothesis #3 (H_{a3}): The USAF will not meet the mandated FY 2005 goal of 50% of all eligible service dollars and actions awarded using PBSA.
>
> Null hypothesis #3_a (H_{o3a}): The FY 2005 % of dollars PBSA $\geq$ 50%
> Alternate hypothesis #3_a (H_{a3a}): The FY 2005 % of dollars PBSA < 50%
>
> Null hypothesis #3_b (H_{o3b}): The FY 2005 % of action PBSA $\geq$ 50%
> Alternate hypothesis #3_b (H_{a3b}): The FY 2005 % of actions PBSA < 50%

The JMP outputs in Figures 4 and 5 summarize the least squares fit of the linear regression models to the percentage dollars and actions PBSA.

Summary of Fit

RSquare	0.367858
RSquare Adj	0.051787
Root Mean Square Error	2.678479
Mean of Response	28.89007
Observations (or Sum Wgts)	4

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	8.349715	8.34971	1.1638
Error	2	14.348495	7.17425	Prob > F
C. Total	3	22.698209		0.3935

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	25.659414	3.280453	7.82	0.0160
FY	1.2922627	1.197852	1.08	0.3935

Figure 4. JMP printout of least squares fit to percentage of dollars PBSA.

Summary of Fit

RSquare	0.788726
RSquare Adj	0.683089
Root Mean Square Error	3.295191
Mean of Response	28.58397
Observations (or Sum Wgts)	4

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	81.07211	81.0721	7.4664
Error	2	21.71657	10.8583	Prob > F
C. Total	3	102.78868		0.1119

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	18.517191	4.035769	4.59	0.0444
FY	4.0267135	1.473654	2.73	0.1119

Figure 5. JMP printout of least squares fit to percentage of actions PBSA.

As expected, neither model was very predictive, as evident by the low F statistic values and high P-values. The percentage drop for FY 2004 and the use of only four data points to build these models, both had a negative effect on the establishment of a good trend line. However, despite the models limitations, they were still used to forecast for the percentage of dollars and actions PBSA for FY 2005.

Using the calculated intercept and parameter coefficients, the following models were established:

% Dollars PBSA = 25.6594 + 1.2922 * Year
% Actions PBSA = 18.5172 + 4.0267 * Year

By substituting 5 in for the variable Year, the following forecasted PBSA percentages were calculated:

% Dollars PBSA = 32.12
% Actions PBSA = 38.65

Figures 6 and 7 provide a better illustration of the linear regression lines plotted with the actual PBSA percentages.

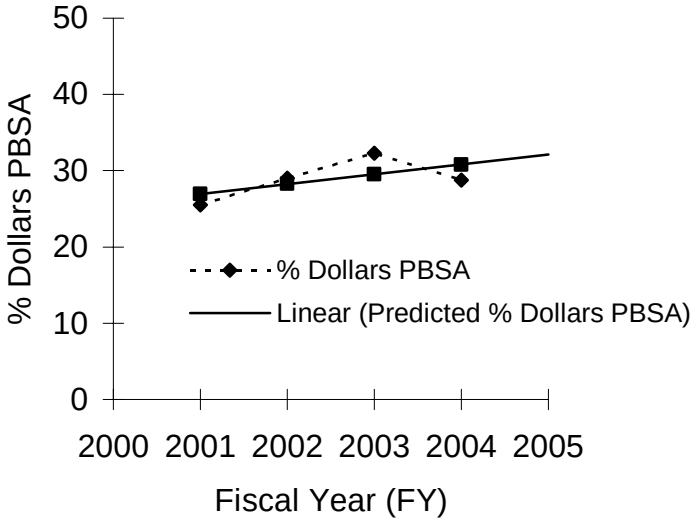

Figure 6. The percentage of dollars PBSA and the liner regression line for percentage of dollars PBSA as a function of Fiscal Year.

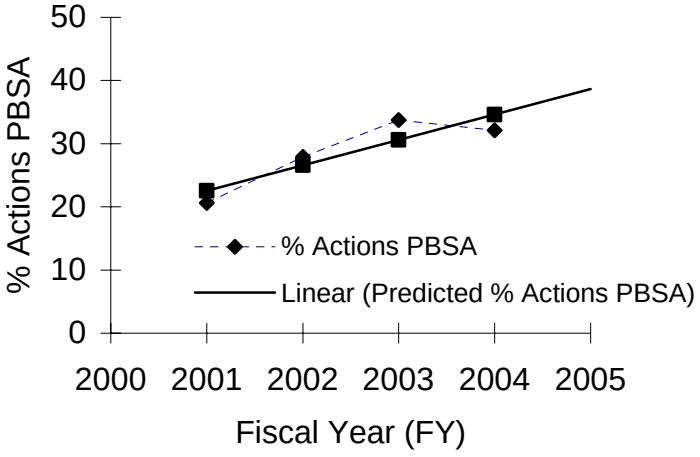

Figure 7. The percentage of actions PBSA and the liner regression line for percentage of actions PBSA as a function of Fiscal Year.

Obviously the PBSA percentages for both dollars and actions are well below the goal of 50%, thus resulting in the rejection of the null hypotheses for both PBSA dollars and actions.

Assuming the FY 2004 percentages were anomalies, the FY 2004 data points were removed and new regression models were built. The JMP outputs in Figures 8 and 9 summarize the least squares fit of the linear regression models to the percentage dollars and actions PBSA, excluding FY 2004.

Summary of Fit

RSquare	0.999649
RSquare Adj	0.999297
Root Mean Square Error	0.089255
Mean of Response	28.93533
Observations (or Sum Wgts)	3

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	22.665665	22.6657	2845.16
Error	1	0.007966	0.0080	Prob > F
C. Total	2	22.673631		0.0119

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	22.202473	0.136339	162.85	0.0039
FY	3.3664272	0.063113	53.34	0.0119

Figure 8. JMP printout of least squares fit to percentage of dollars PBSA, excluding FY 2004.

Summary of Fit

RSquare	0.995859
RSquare Adj	0.991718
Root Mean Square Error	0.59805
Mean of Response	27.4144
Observations (or Sum Wgts)	3

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	86.016080	86.0161	240.4945
Error	1	0.357663	0.3577	Prob > F
C. Total	2	86.373743		0.0410

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	14.298294	0.913536	15.65	0.0406
FY	6.5580515	0.422885	15.51	0.0410

Figure 9. JMP printout of least squares fit to percentage of actions PBSA, excluding FY 2004.

Removing the data point for FY 2004 significantly increased the reliability of the models, as evident by the higher F statistic values and lower P-values. Using these models, the percentage of dollars and actions PBSA for FY 2005 were calculated.

Using the calculated intercept and parameters coefficients, the following models were established:

% Dollars PBSA = 22.2025 + 3.3664 * Year
% Actions PBSA = 14.2983 + 6.5580 * Year

By substituting 5 in for the variable Year, the following forecasted PBSA percentages were calculated:

% Dollars PBSA = 39.03
% Actions PBSA = 47.09

Again, the PBSA percentages for both dollars and actions are below the goal of 50%, thus resulting in the rejection of the null hypotheses for both PBSA dollars and actions.

A 2-period moving average was also used to forecast for FY 2005 PBSA percentages. Using this method, the following forecasted percentages for FY 2005 were calculated:

% Dollars PBSA = 30.51
% Actions PBSA = 32.91

Assuming the FY 2004 percentages were anomalies, the FY 2004 data points were removed and new percentages were calculated for FY 2004 and 2005 using a 2-period moving average. Using this method the following forecasted percentages for FY 2004 and 2005 were calculated:

FY 2004 % Dollars PBSA = 30.64
FY 2004 % Actions PBSA = 30.82

FY 2005 % Dollars PBSA = 30.54
FY 2005 % Actions PBSA = 32.39

The removal of the FY 2004 percentages resulted in only a small change in the forecasted percentages for FY 2005. Again, the PBSA percentages for both dollars and actions are below the goal of 50%, thus resulting in the rejection of the null hypotheses for both PBSA dollars and actions. Table 4 summarizes all forecast results for FY 2005.

Table 4. *Summary of Forecast Results.*

Forecasting Method	FY 2005 Forecast	
	% Actions PBSA	% Dollars PBSA
Linear Regression	38.65	32.12
Linear Regression (w/out FY 2004)	47.09	39.03
Moving Average	32.91	30.51
Moving Average (w/out FY 2004)	32.39	30.54

All forecasted PBSA percentages for FY 2005, measured in both dollars and actions, were below the goal of 50% and resulted in the rejection of the null hypothesis.

Investigative Question 4. In order to answer investigative question 4, the following hypotheses were established:

> Null hypothesis #4 ($H_{o4\ dollars}$): The percentage of modifications, measured in dollars, coded PBSA is equal to the percentage of non-modifications, measured in dollars, coded PBSA.
> Alternate hypothesis #4 ($H_{a4\ dollars}$): The percentage of modifications, measured in dollars, coded PBSA is not equal to the percentage of non-modifications, measured in dollars, coded PBSA.
>
> Null hypothesis #4 ($H_{o4\ actions}$): The percentage of modifications, measured in actions, coded PBSA is equal to the percentage of non-modifications, measured in actions, coded PBSA.
> Alternate hypothesis #4 ($H_{a4\ actions}$): The percentage of modifications, measured in actions, coded PBSA is not equal to the percentage of non-modifications, measured in actions, coded PBSA.

Additionally, the following sub-hypotheses were established in order to assist in answering investigative question 4:

> Null hypothesis #4_a ($H_{o4a\ 2001dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_a ($H_{a4a\ 2001dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_a ($H_{o4a\ 2001actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_a ($H_{a4a\ 2001actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_b ($H_{o4b\ 2002dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_b ($H_{a4b\ 2002dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_b ($H_{o4b\ 2002actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_b ($H_{a4b\ 2002actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_c ($H_{o4c\ 2003dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_c ($H_{a4c\ 2003dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_c ($H_{o4c\ 2003actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_c ($H_{a4c\ 2003actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_d ($H_{o4d\ 2004dollars}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_d ($H_{a4d\ 2004dollars}$): |PBSA Mod %-PBSA Non-mod %| > 5%
> Null hypothesis #4_d ($H_{o4d\ 2004actions}$): |PBSA Mod %-PBSA Non-mod %| ≤ 5%
> Alternate hypothesis #4_d ($H_{a4d\ 2004actions}$): |PBSA Mod %-PBSA Non-mod %| > 5%

A summary of the results broken out for each year in both dollars and actions is displayed in Tables 5 and 6 below.

Table 5. *The Percentage of Modification Dollars PBSA Compared to the Percentage of Non-Modification Dollars PBSA for Fiscal Years (FY) 2001, 2002, 2003 and 2004.*

Percentage of PBSA Dollars	FY01	FY02	FY03	FY04
Modifications	25.51	25.60	29.31	22.32
Non-Modifications	25.56	32.77	34.57	35.08
Difference (Absolute Value)	0.04	7.17	5.26	12.75

Table 6. *The Percentage of Modification Actions PBSA Compared to the Percentage of Non-Modification Actions PBSA for Fiscal Years (FY) 2001, 2002, 2003 and 2004.*

Percentage of PBSA Actions	FY01	FY02	FY03	FY04
Modifications	21.55	27.96	33.61	32.45
Non-Modifications	20.17	27.88	33.78	31.92
Difference (Absolute Value)	1.39	0.08	0.17	0.54

These calculations are better illustrated using line graphs. Figure 10 shows that the percentage of modifications coded PBSA, measured in actions, was almost identical to the percentage of non-modifications coded PBSA. Figure 11 shows that the percentage of modifications coded PBSA, measured in dollars, was more than 5% less than the percentage of non-modifications coded PBSA for FYs 2002, 2003, and 2004. Therefore, the null hypothesis in dollars is rejected, but the null hypothesis in actions cannot be rejected.

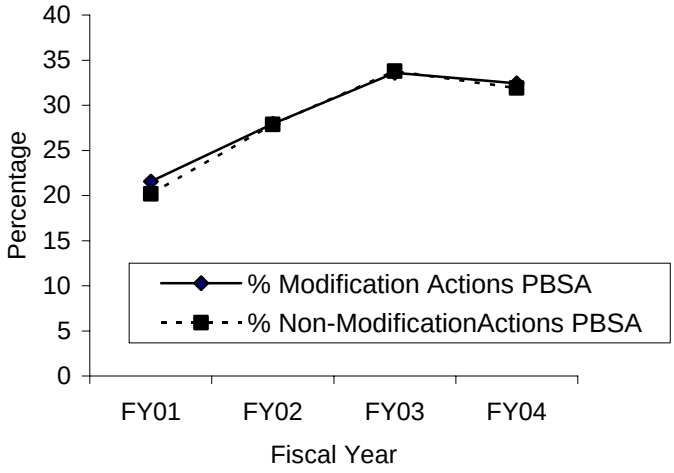

Figure 10. The percentage of modifications PBSA and percentage of non-modifications PBSA, measured in actions, as a function of Fiscal Year.

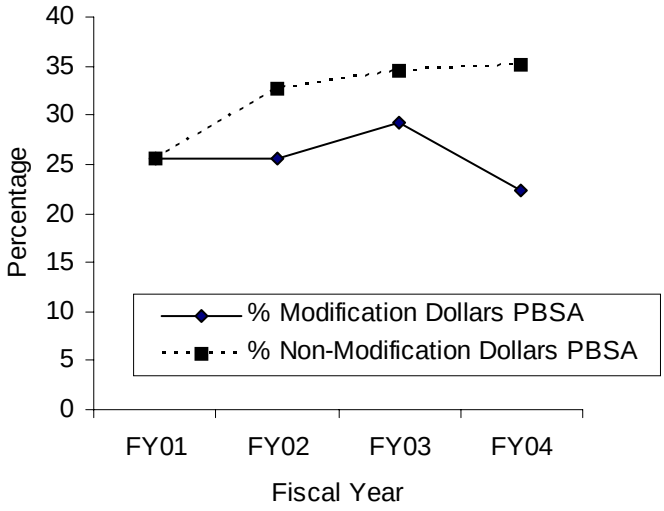

Figure 11. The percentage of modifications PBSA and percentage of non-modifications PBSA, measured in dollars, as a function of Fiscal Year.

Further analysis of the data revealed additional interesting phenomena. Figure 12 illustrates how the dollar amount per PBSA modification has decreased each year, while the dollar amount per non-PBSA modifications has increased the last three years.

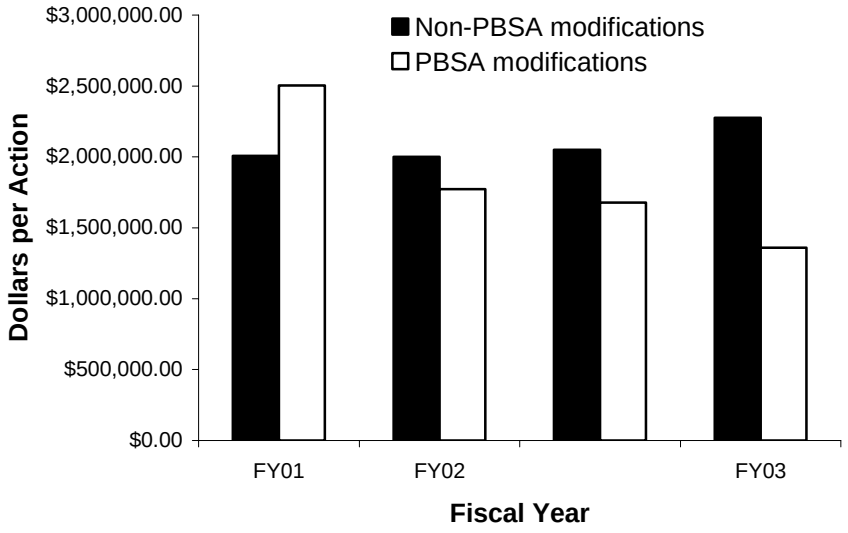

Figure 12. The dollars per action for all PBSA modifications and non-PBSA modifications, as a function of Fiscal Year.

Conversely, Figure 13 illustrates how the dollar amount per PBSA non-modification, which are new PBSA contracts, has been greater than non-PBSA non-modifications each year.

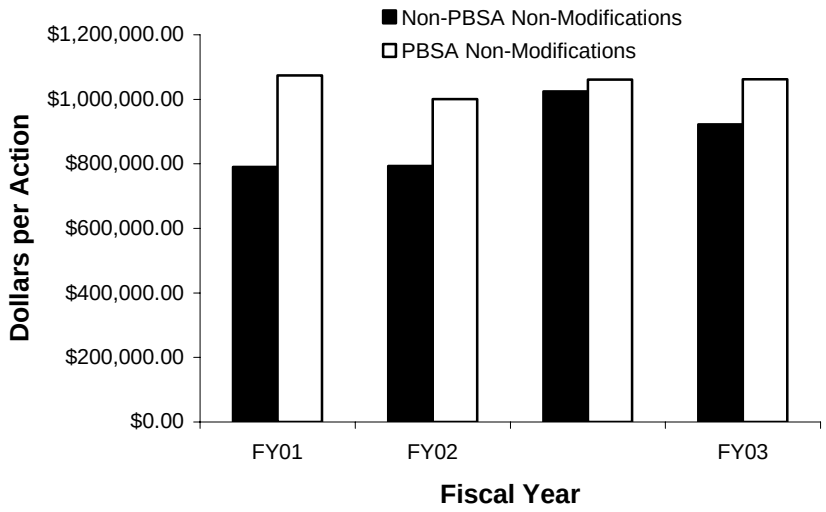

Figure 13. The dollars per action for all PBSA non-modifications and non-PBSA non-modifications, as a function of Fiscal Year.

Investigative Question 5. The following hypotheses were established in order to answer investigative question 5:

> Null hypothesis #6 (H_{o6}): Classification "x" and PBSA are independent
> Alternate hypothesis #6 (H_{a6}): Classification "x" and PBSA are dependent

Dependency was determined using contingency tables. All classifications, except one, were found to be dependent, thus supporting the rejection of the null hypothesis. Multi-Year Contract was the only classification that yielded a chi-square (χ^2) value that was smaller than chi-square alpha (χ^2_α), thus not falling in the rejection region. Again, it is important to note that contingency tables were unable to determine dependency for some classifications because expected cell counts were less than 1. These classifications included FSC or SVC Code, NAICS Code, and Authority for Other than Full and Open Competition. Table 7 summarizes the results from the contingency table analysis. Printouts of all the contingency tables can be found in Appendix G.

Table 7. *Summary of Contingency Tables*

Classification	χ^2	χ^2_α	df	Prob> χ^2	Results
B1C – Bundled Contract	124.58	6.64	1	<.0001	Dependent
B1D – Bundled Contract Exception	230.56	11.34	3	<.0001	Dependent
B10 – Multi-Year Contract	0.07	6.63	1	.7877	Independent
B13A – Contract/Order	1790.86	18.48	7	0.0000	Dependent
B13B – Type of Indefinite-Delivery Contract	122.42	11.34	3	<.0001	Dependent
B13E – Multiple Award Contract Fair Opportunity	10017.72	15.09	5	0.0000	Dependent
B13F – Indefinite-Delivery Contract Use	2112.51	13.28	4	0.0000	Dependent
C1 - Synopsis	1479.44	11.34	3	<.0001	Dependent
C2 – Reason Not Synopsized	603.47	13.28	4	<.0001	Dependent
C3 – Extent Competed	796.09	13.28	4	<.0001	Dependent
C5 – Type of Contract	4549.71	26.22	12	<.0001	Dependent
C8 – Solicitation Procedures	3405.04	21.67	9	0.0000	Dependent
C14 – Commercial Items	2816.34	9.21	2	0.0000	Dependent
D1A – Type of Entity	2334.19	24.73	11	0.0000	Dependent
D1B – Women-Owned Business	1089.73	11.34	3	<.0001	Dependent
D1C – HUBZone Representation	563.87	9.21	2	<.0001	Dependent
D1D – Ethnic Group	397.33	18.48	7	<.0001	Dependent
D4A – Type of Set-Aside	1304.75	20.09	8	<.0001	Dependent
D4B – Type of Preference	1066.71	11.34	3	<.0001	Dependent
D7 – SBIR Program	1275.33	13.28	4	<.0001	Dependent

For single response variables, such as Bundled Contract, a result of "Dependent" means that there is dependence between the variable being coded "Yes" or "No" and PBSA being coded "Yes" or "No." For multi-response variables, such as Contract/Order, a result of "Dependent" means that there is dependence between the variable's possible responses and PBSA being coded "Yes" or "No." However, contingency tables only determine dependency between two classifications, not the extent of the relationship. Because of this, contingency tables were used to help narrow down the classifications

used for logistic regression. Unfortunately, only one classification, Multi-Year Contract, was independent, thus excluded from further analysis.

Logistic regression was also used to answer investigative question 5. The following hypotheses were established:

> Null hypothesis #5 (H_{o5}): The parameter for variable "x" equals zero.
> Alternate hypothesis #5 (H_{a5}): The parameter for variable "x" does not equal zero.

As depicted in Table 8, logistic regression yielded the same χ^2 values calculated using contingency tables. This was expected because the logistic regression models were built using only one independent variable and a dependent variable, PBSA. This is similar to contingency tables, which test the dependency between only two variables. Based on the χ^2 and associated P-values, the null hypotheses for all variables, except Obligated or Deobligated Dollars, are rejected. The null hypothesis for Obligated or Deobligated Dollars is not rejected, because the P-value of .9928 is clearly larger than the significance level of .01.

Table 8. *Summary of Logistic Regression*

Variable	χ^2	Prob> χ^2	R^2 (U)
B1C – Bundled Contract	124.58	<.0001	0.0013
B8 - Obligated or Deobligated Dollars	.000081	0.9928	0.0000
B13A – Contract/Order	1790.86	0.0000	0.0193
B13B – Type of Indefinite-Delivery Contract	122.42	<.0001	0.0013
B13E – Multiple Award Contract Fair Opportunity	10017.72	0.0000	0.1081
B13F – Indefinite-Delivery Contract Use	212.51	0.0000	0.0228
C1 - Synopsis	1479.44	<.0001	0.0160
C3 – Extent Competed	796.09	<.0001	0.0086
C5 – Type of Contract	4549.71	0.0000	0.0491
C14 – Commercial Items	28.16	0.0000	0.0304
D1B – Women-Owned Business	1089.73	<.0001	0.0118
D1C – HUBZone Representation	563.87	<.0001	0.0061
D1D – Ethnic Group	397.33	<.0001	0.0043
D4A – Type of Set-Aside	1304.75	<.0001	0.0141
D4B – Type of Preference	1066.71	<.0001	0.0115
D7 – SBIR Program	1275.33	<.0001	0.0138

In addition to χ^2 and associated P-values, logistic regression also calculated R^2 (U) values for each variable. As shown in Table 8, the highest R^2 (U) value obtained was .1081 for Multiple Award Contract Fair Opportunity, which also yielded the highest χ^2 value using contingency tables. The lowest R^2 (U) value obtained was .0000 for Obligated or Deobligated Dollars. This means that the single variable model with the most explanatory power is the model that includes the variable Multiple Award Contract Fair Opportunity and the single variable model with the least explanatory power is the model that includes the variable Obligated or Deobligated Dollars. It is important to note that some of the variable responses were classified as unstable, meaning that a regression model could not be established. Variables that had unstable responses included Bundled Contract Exception, FSC or SVC Code, NAICS Code, Reason Not Synopsized,

Solicitation Procedures, Authority for Other than Full and Open Competition, and Type of Entity.

In an attempt to build a model for prediction of PBSA, the 15 variables classified as stable in logistic regression were cumulatively tested against the independent variable PBSA. When using all 15 stable variables, an R^2 (U) of .2019 was obtained. Unfortunately, many of the parameter estimates for the variable responses in the model were identified as being biased. This indicates that there are one or more linear dependencies in the design and the linear combination of these factors exactly duplicates another factor's value (JMP, 2003). These variables included Type of Set-Aside, Type of Preference, Women-Owned Business, Type of Contract, Extent Competed, Synopsis, and Contract/Order. Consequently all of these variables were removed from the model. With both the unstable and biased variables removed from the model an R^2 (U) of .1615 was obtained. Table 9 summarizes these results.

Table 9. *Summary of Logistic Regression Model*

Variable	χ^2	Prob> χ^2	R^2 (U)
Model w/out Unstable or Biased Variables	15425.8	0.0000	0.1615

This model includes a total of 7 independent variables. The parameter estimates for the variable responses included in this model can be found in Appendix H. The Wald statistic χ^2 value was used to test the significance of the model. The χ^2 value and associated P-value support the rejection of the null hypothesis that the parameter estimates are equal to zero.

Separate regressions were also run for each independent variable against the dependent variable, PBSA. Parameter estimates for each variable response were

calculated using logistic regression and tested using the null and alternate hypotheses. The probability of PBSA for each response was calculated by substituting the parameter estimate and intercept values into the logistic regression formula. These results are displayed in Tables 10 through 25.

Table 10. *Summary of Bundled Contract Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.1058595	0.0729567	2.11	0.1468	
Bundled Contract [N]	-0.784822	0.0729567	115.72	<.0001	0.2909

Table 11. *Summary of Obligated or Deobligated Dollars Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.8857118	0.0080113	12223	0.0000	
Obligated or Deobligated Dollars	-7.626e-12	8.454e-10	0.00	0.9928	2.92E-01

Table 12. *Summary of Contract/Order Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.998353	0.0358911	773.74	<.0001	
Contract/Order [1]	-0.7217959	0.1237749	34.01	<.0001	0.1518
Contract/Order [3]	-0.2074712	0.0380209	29.78	<.0001	0.2304
Contract/Order [4]	-0.9436227	0.0952635	98.12	<.0001	0.1254
Contract/Order [5]	0.18104332	0.0371747	23.72	<.0001	0.3063
Contract/Order [6]	0.79224635	0.0405313	382.07	<.0001	0.4486
Contract/Order [7]	-0.0414182	0.1740474	0.06	0.8119	0.2611
Contract/Order [8]	1.10775159	0.0975163	129.04	<.0001	0.5273

Table 13. *Summary of Type of Indefinite-Delivery Contract Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.0211204	0.0219221	2169.6	0.0000	
Type of Indefinite-Delivery Contract [A]	0.07728689	0.0275839	7.85	0.0051	0.2801
Type of Indefinite-Delivery Contract [B]	0.22509695	0.023591	91.04	<.0001	0.3108
Type of Indefinite-Delivery Contract [C]	-0.3855376	0.0624557	38.11	<.0001	0.1967

Table 14. *Summary of Multiple Award Contract Fair Opportunity Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.090934	0.0655989	1.92	0.1657	
Multiple Award Contract Fair Opportunity [A]	-1.474946	0.0720001	419.65	<.0001	0.1728
Multiple Award Contract Fair Opportunity [B]	-0.3685983	0.3081339	1.43	<.0001	0.3870
Multiple Award Contract Fair Opportunity [C]	-0.7424187	0.0658268	60.02	<.0001	0.3029
Multiple Award Contract Fair Opportunity [D]	0.33541685	0.0849517	15.59	<.0001	0.5608
Multiple Award Contract Fair Opportunity [E]	3.23880086	0.0906054	1277.8	<.0001	0.9588

Table 15. *Summary of Indefinite-Delivery Contract Use Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.6769128	0.0327053	428.38	<.0001	
Indefinite-Delivery Contract Use [A]	0.13168575	0.0836275	2.48	0.1153	0.3669
Indefinite-Delivery Contract Use [B]	-0.4508388	0.0864576	27.19	<.0001	0.2445
Indefinite-Delivery Contract Use [C]	0.06102411	0.0671189	0.83	0.3632	0.3507
Indefinite-Delivery Contract Use [D]	0.62824516	0.036076	303.26	<.0001	0.4878

Table 16. *Summary of Synopsis Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.8755429	0.0112263	6080.5	0.0000	
Synopsis [A]	0.0127636	0.0133898	0.91	0.3405	0.2967
Synopsis [B]	-0.2978881	0.0262107	129.17	<.0001	0.2362
Synopsis [N]	-0.3812092	0.0168928	509.24	<.0001	0.2215

Table 17. *Summary of Extent Competed Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.1004947	0.0540626	414.36	<.0001	
Extent Competed [A]	0.31589528	0.0544904	33.61	<.0001	0.3133
Extent Competed [B]	0.07087583	0.0582072	1.48	0.2234	0.2631
Extent Competed [C]	-0.4739783	0.0757671	39.13	<.0001	0.1715
Extent Competed [D]	-0.3875817	0.0582598	44.26	<.0001	0.1842

Table 18. *Summary of Type of Contract Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.0594573	0.0427791	613.34	<.0001	
Type of Contract [A]	-0.8376623	0.4049809	4.28	0.0386	0.1304
Type of Contract [J]	0.3953269	0.0440563	80.52	<.0001	0.3398
Type of Contract [K]	0.83916138	0.0951713	77.75	<.0001	0.4451
Type of Contract [L]	-0.0684458	0.0946795	0.52	0.4697	0.2445
Type of Contract [M]	0.91469634	0.0821388	124.01	<.0001	0.4638
Type of Contract [R]	0.33138718	0.0501084	43.74	<.0001	0.3256
Type of Contract [S]	-0.8601807	0.0717832	143.59	<.0001	0.1279
Type of Contract [T]	-1.3640221	0.2600419	27.51	<.0001	0.0813
Type of Contract [U]	-0.922947	0.0485074	362.02	<.0001	0.1210
Type of Contract [V]	0.4370051	0.0771864	32.05	<.0001	0.3492
Type of Contract [Y]	-0.1065667	0.0497674	4.59	<.0001	0.2375
Type of Contract [Z]	0.39199958	0.0804276	23.76	<.0001	0.3390

Table 19. *Summary of Commercial Items Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.4863992	0.0107112	2062.1	0.0000	
Commercial Items [N]	-0.6438603	0.0120437	2858	0.0000	0.2441
Commercial Items [Y]	0.39160175	0.016669	551.91	<.0001	0.4763

Table 20. *Summary of Women-Owned Business Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.714826	0.0198109	1301.9	<.0001	
Women-Owned Business [N]	-0.2731451	0.0207879	172.65	<.0001	0.2713
Women-Owned Business [U]	0.05253677	0.0498592	1.11	0.2920	0.3402
Women-Owned Business [Y]	-0.2850085	0.034124	69.76	<.0001	0.2689

Table 21. *Summary of HUBZone Representation Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob> χ^2	Prob PBSA
Intercept	-1.111624	0.0182761	3699.6	0.0000	
HUBZone Representation [N]	-0.029883	0.0203999	2.15	0.1430	0.2420
HUBZone Representation [Y]	-0.317349	0.0349925	82.25	<.0001	0.1932

Table 22. *Summary of Ethnic Group Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.1986828	0.0246557	2363.6	0.0000	
Ethnic Group [A]	-0.0632047	0.0971424	0.42	0.5153	0.2206
Ethnic Group [B]	0.31302413	0.0597238	27.47	<.0001	0.2920
Ethnic Group [C]	0.21764375	0.0483839	20.23	<.0001	0.2726
Ethnic Group [D]	-0.2523166	0.0520292	23.52	<.0001	0.1898
Ethnic Group [E]	-0.1670177	0.045031	13.76	0.0002	0.2033
Ethnic Group [F]	-0.3618537	0.0961776	14.16	0.0002	0.1735
Ethnic Group [Z]	-0.0550928	0.0636474	0.75	0.3867	0.2220

Table 23. *Summary of Type of Set-Aside Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.1581767	0.050894	517.87	<.0001	
Type of Set-Aside [A]	0.19917358	0.0516292	14.88	0.0001	0.2770
Type of Set-Aside [B]	0.36304191	0.0553928	42.95	<.0001	0.3110
Type of Set-Aside [C]	-0.210333	0.1277981	2.71	0.0998	0.2028
Type of Set-Aside [D]	-0.1492011	0.0564274	6.99	0.0082	0.2129
Type of Set-Aside [E]	-0.1824305	0.1418217	1.65	0.1983	0.2074
Type of Set-Aside [F]	-0.6467775	0.2793333	5.36	0.0206	0.1412
Type of Set-Aside [K]	-0.0391031	0.1176526	0.11	0.7396	0.2319
Type of Set-Aside [L]	-0.2833379	0.2151878	1.73	0.1879	0.1913

Table 24. *Summary of Type of Preference Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-0.9750136	0.3291877	8.77	0.0031	
Type of Preference [A]	-0.0079431	0.329244	0.00	0.9808	0.2723
Type of Preference [B]	-0.1235974	0.8803583	0.02	0.8883	0.2500
Type of Preference [D]	-0.634264	0.5552866	1.30	0.2534	0.1666

Table 25. *Summary of SBIR Program Response Parameter Estimates and Probability of PBSA*

Response	Estimate	Standard Error	χ^2	Prob>χ^2	Prob PBSA
Intercept	-1.3166613	0.0930408	200.26	<.0001	
SBIR Program [A]	0.35851964	0.0932893	14.77	0.0001	0.2772
SBIR Program [B]	-0.4535634	0.3104716	2.13	0.1440	0.1455
SBIR Program [C]	-0.3433492	0.1012258	11.51	0.0007	0.1597
SBIR Program [D]	-0.6444348	0.2210532	8.50	0.0036	0.1233

The null hypothesis is rejected for all responses with P-values < .01. This means that the selection of these particular responses do not change the probability of an action being PBSA. For all other responses, where the null hypothesis was rejected, a positive parameter estimate value signifies an increase in the probability of an action being PBSA

when that particular response is chosen. A negative value signifies a decrease in the probability of an action being PBSA. A majority of the parameter estimates were negative. When a response parameter estimate added with its corresponding intercept parameter estimate, resulted in a positive value, the probability of that action being PBSA was greater than .5. Conversely, when a response parameter estimate added with its corresponding intercept parameter estimate, resulted in a negative value, the probability of that action being PBSA was less than .5.

By far, the most positively influential response variable is Multiple Award Contract Fair Opportunity response "E" with a parameter estimate of 3.2388 and a probability of PBSA of .9588. This means when response "E" is selected, the probability of that action being PBSA is almost 96%. Response "E" is Minimum Guarantee and is coded when it was necessary to place an order to satisfy a minimum amount guaranteed to the contractor. The next most positively influential response variable is Contract/Order response "8" with a parameter estimate of 1.1078 and probability of PBSA of .5273. This means when response "8" is selected, the probability of that action being PBSA is over 52%. Response "8" is Order from Procurement List and is entered when the contracting action is an action placed with Federal Prison Industries (UNICOR) or a JWOD Participating Nonprofit Agency.

The most negatively influential response variable is Type of Contract response "T," with parameter estimate of -1.36402 and a probability of PBSA of .0813. This means when response "T" is selected, the probability of that action being PBSA is 8.13%. Response "T" is the designation for a Cost-Sharing contract The next most negatively influential response variable is Multiple Award Contract Fair Opportunity response "A"

with a parameter estimate of -1.4749 and a probability of PBSA of .17228. This means when response "A" is selected, the probability of that action being PBSA is 17.23%. Response "A" is Fair Opportunity Process and is entered when the delivery or task order was issued pursuant to a process that permitted each contract awardee a fair opportunity to be considered.

Summary

This chapter presented and discussed the research results. A sample of PBSA contracts taken from three contracting offices were found to be consistent with the minimum criteria identified in the PBSA Guidebook, suggesting that there may not be a systematic problem with PBSA coding. Using descriptive statistics, it was concluded that the USAF is not meeting interim PBSA goals and the percentage of modification dollars coded PBSA is not equal to the percentage of non-modification dollars coded PBSA. Additionally, forecasting suggested that the USAF will not meet the FY 2005 goal of 50% of all actions and dollars PBSA. Lastly, contingency tables and logistic regression identified dependent variables and variable responses that increase and decrease the probability of an action being PBSA. Chapter 5 will discuss the conclusions and recommendations stemming from these results, address the limitations of the study, and make suggestions for future research.

V. Conclusions and Recommendations

Introduction

The purpose of this study was to evaluate and analyze the current and expected future states of Performance Based Service Acquisition (PBSA) implementation in the United States Air Force (USAF) in order to assist USAF leadership in making PBSA implementation decisions. This chapter outlines the conclusions drawn from the results of this study and offers recommendations for PBSA implementation improvements. Also included in this chapter are the limitations of the study and suggestions for future research.

Conclusions and Recommendations

A total of five investigative questions were established in order to answer and address the over arching research question of, "What are the current and expected future states of PBSA implementation in the USAF?"

Conclusions - Investigative Question 1. Is the J001 database, which is the source of government procurement data, reliable? The answer to this question is still unknown. However, this research concludes that the coding of PBSA contracts for the 88 ABW/PK, AFRL Det 1/PK, and ASC/PK is reliable and consistent with the minimum mandatory criteria identified in The Guidebook for Performance-Based Services Acquisitions in the Department of Defense (PBSA Guidebook). While this determination of reliability cannot be generalized statistically to the entire J001 database, it does indicate that there may not be systematic problems with PBSA coding. For PBSA coding, these results are

contrary to past GAO findings that suggest federal procurement data is unreliable (Woods, 2003). Additionally, the results imply that the J001 database may not be as inaccurate as initially reported.

Recommendations – Investigative Question 1. Because the results suggest that there may not be a systematic problem with PBSA coding in the J001 database, it is recommended that the USAF increase utilization of the J001 database for PBSA performance tracking. Many organizations rely on self-reports from other agencies when compiling PBSA metrics. From the researcher's personal experience, these self-reports, many times, differ from what was actually coded on the DD Form 350. In addition, this self-reports take time and money to generate. Utilizing the J001 database may ultimately be the most accurate and efficient means of measuring PBSA performance and should be used to the maximum extent practicable.

Conclusions - Investigative Question 2. Is the USAF meeting interim PBSA goals? The answer to this question is no. The USAF was on track and had met all interim PBSA goals established by the acting Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Michael Wynne, through FY 2003. This was large in part due to the fact that goals were set low and were easily attainable. However, in FY 2004 the percentage of dollars awarded using PBSA significantly dropped and was well below the FY 2004 goal of 35 percent.

The decrease in PBSA percentages implies several possible alternatives. First, the decrease implies that the emphasis on PBSA in waning. Now in its fourth year, PBSA implementation may not be as much of as hot topic as it was upon initial start-up.

Conversely, the decrease in PBSA percentages may imply that there has been an increase in education, training, and awareness of PBSA techniques and application and contracting personnel are better at determining which contracts should use PBSA. Of the 3 incorrectly coded PBSA contracts sampled in this study, 2 of them were awarded during the first 2 years of PBSA implementation. This suggests that PBSA coding may be becoming more accurate as years progress. As PBSA coding becomes more accurate, fewer incorrectly coded contracts may be contributing to PBSA percentages. The decrease in PBSA percentages during FY 2004 may not be as significant due to the fact that the percentages during the previous years may have been over inflated with incorrectly coded PBSA contracts.

Lastly, the decrease in PBSA percentages may imply that the USAF has hit a natural plateau in PBSA. The literature shows no rationale for establishment of the interim PBSA goals, other than progression towards the FY 2005 goal of 50%. The commercial sector emphasizes PBSA very little due to the small percentage of dollars attributed to the procurement of services (Barry, 2003). Maybe it is impractical to expect PBSA percentages greater than 35%. The results show that achieving 20% to 30% PBSA for both actions and dollars is possible. However, at what point are services that may not be suitable for PBSA being forced into PBSA methods for the sake of meeting mandated goals? Because of this, the question that surfaces is, "Were these goals reasonable and attainable to begin with?" This research suggests that they weren't.

Recommendations – Investigative Question 2. It is recommended that the USAF leadership reinvigorate the emphasis on the use of PBSA. This can be done by simply increasing PBSA communication up and down the chain of command. While there are

endless methods to communicate the emphasis, leadership could significantly increase organizational awareness of PBSA by continually posting current PBSA percentages and PBSA percentage goals for each organization or agency.

It is also recommended that USAF leadership revaluate PBSA goals. Instead of establishing blanket percentage goals for all services actions, percentages should be established only for contract characteristics representing a large percentage of the total dollars or actions and a high probability of being PBSA. For instance, it may not be as important to reach a goal of 50% of all PBSA dollars for Cost Plus Incentive Fee contracts when these type of contracts accounted for less than 2% of the total dollars for FY 2004 and are seldom used with PBSA. However, it may be important to focus on the percentage of PBSA dollars for Firm Fixed Price contracts since they accounted for the largest percentage of total dollars for FY 2004, at over 36%, and, when compared to other responses, have a relatively high probability of PBSA at 33%. This will lead to focused PBSA efforts directed at areas that make the most sense for PBSA use and are the most fiscally influential. While this may not lead to the achievement of 50% of all actions and dollars PBSA, it can lead to the maximizing of PBSA efforts in the areas that represent the largest percentage of total dollars.

Conclusions - Investigative Question 3. Is the USAF on track to meet future mandated PBSA goals? The answer to this question is no. Even though there were only four data points, several forecasting methods were used. Using liner regression and moving averages, forecasts of the percentage actions and dollars PBSA for FY 2005 were calculated. All forecasts indicate that the USAF will fall well short of the 50% PBSA goal for FY 2005. Although the forecasting models used were questionable, the

graphical evidence illustrates a trend line falling well short of 50% for FY 2005. There was clearly an upward trend in the percentages of PBSA prior to FY 2004, possibly meaning that the decrease in FY 2004 was an anomaly and an upward trend may resume for FY 2005. However, in order to make a truly reliable forecast more data points would need to be included in the models.

These results support Lacey's (2004) suspicion that the USAF will not meet the FY 2005 goal of 50% PBSA. Similarly to the conclusions for investigative question 2, the results imply that the goal may not have been reasonable or attainable to begin with and that the USAF may have hit a natural plateau in PBSA.

Recommendations - Investigative Question 3. Similar to investigative question 1, it is recommended that USAF leadership reinvigorate the emphasis on PBSA use and revaluate PBSA goals.

Conclusions - Investigative Question 4. Is the percentage of modifications coded PBSA equal to the percentage of non-modifications coded PBSA? The answer to this question is no. While the number of actions is relatively equal, the percentage of dollars PBSA for modifications is significantly smaller than the percentage of dollars PBSA for non-modifications. Additionally, the cost per PBSA modification has decreased each year and been less than the cost per non-PBSA modifications every year. Conversely, the cost per PBSA non-modification has been greater than the cost per non-PBSA non-modification. These results imply that new PBSA contracts, on average, cost more than non-PBSA contracts, but result in modifications that, on average, cost less than non-PBSA modifications.

Recommendations - Investigative Question 4. It is recommended that, when deciding whether to award a contract using PBSA techniques, contracting personnel take into consideration that future modifications to PBSA contracts may cost less than non-PBSA contracts. With less money being spent on modifications to PBSA contracts, a large percentage of future funds can be used to fund the procurement of new services or supplies.

Conclusions - Investigative Question 5. Are any particular acquisition characteristics associated with PBSA use? The answer to this question is yes. Contingency tables clearly indicated that there are numerous contract characteristics that are dependent with PBSA, confirming Lacey's (2004) ascertains. However, contingency tables are unable to determine the extent of the dependencies.

Logistic Regression was able to identify which variable responses are significant and whether they increase or decrease the probability of an action being PBSA. Numerous variables were found to be significant, but very few of the variable responses increased the probability of an action being PBSA above 50 percent.

These results imply that PBSA is a complex type of contract that can be used in various types of contracting circumstances. Predicting when to use PBSA can not easily be done by knowing one, two, or even "x" corresponding variables. The use of PBSA should not be eliminated as a possibility simply because a certain variable response is selected. While some responses may increase, such as Multiple Award Contract Fair Opportunity response "E," or decrease the probability of PBSA, such as Type of Contract response "T," none guarantee or completely eliminate the possibility of PBSA use.

Recommendations - Investigative Question 5. It is recommended that contracting personnel look at all variables surrounding an acquisition when determining whether to use PBSA techniques. The use of PBSA should not be dependent on the selection of a single variable response. The results of this study show that there are numerous dependencies and correlations between contract characteristics and PBSA. PBSA determination based on a single response should be avoided.

Study Limitations

Just like any research, there are some limitations to this study. Factors that contributed to these shortcomings included funding limitations, time constraints, and practicality.

The first limitation to this research is the reliability of the J001 database. Although a sample of PBSA contracts was taken and evaluated against the minimum mandatory PBSA criteria, it did not represent PBSA contracts throughout the USAF, only the three offices from which it was taken. Therefore, the reliability of the J001 database across the USAF is still unknown. An effort was made to select different types of contracting offices, which work with different types of services contracts. However, the sample was unable to account for every demographic in USAF contracting. Additionally, while the results yielded from this sample were satisfactory, the results from a sample taken from the entire USAF may significantly differ, thus yielding a contradictory determination of the reliability of the J001 database.

The second limitation of this study is the fact that when evaluating the sampled contracts against the minimum mandatory PBSA criteria, the quality of the PBSA service

contracts was not taken into account. For instance, a PBSA service contract that contained well thought-out, specific, and easily measured performance evaluation measurements was considered the same as a contract that met the bare minimum requirements for PBSA classification. Because of this, it is not known if better quality PBSA contracts differ from minimum quality PBSA contracts, and thus yield different results.

Another limitation of the study is the use of forecasting methods to forecast FY 2005 percentages. Because there was only four years of data to build a predictive model, the linear regression and 2-period moving average models established and used to forecast were not optimal. Significance of the models was limited, but they did provide an illustration of the general trend of the data.

Future Research

With so little research conducted in this field and still so many questions to be answered, the prospects for future research are plentiful. Some of these research ideas stem from questions that surfaced from the results of this study, while some are simply questions that have yet to be answered.

The first opportunity for future research is to confirm this study's results that the J001 database is truly reliable, not only for the PBSA contracts at the three contracting offices sampled at Wright-Patterson AFB, OH, but for all contracts across the entire USAF. This could be done by taking a sample of PBSA coded contracts from the entire pool of PBSA contracts and evaluating them against the minimum mandatory PBSA criteria, similarly to the way in which investigative question 1 in this study was answered.

Careful stratification of the sample would need to be taken in order to ensure all USAF demographics were properly represented. Not until this type of sample is evaluated and tested, will USAF leadership truly know the reliability of PBSA coding in the J001 database.

The next opportunity for future research would be to further the logistic regression analysis performed in this study by building a comprehensive model for prediction of PBSA using contracts variable responses. It was apparent during this study that there are numerous variables that are dependent with PBSA. Using this study's results as a foundation, the research could solidify which variable responses, if any, when combined, significantly increase the probability of a contracting action being PBSA. This could be done by using other functional forms or combinations of variables. The establishment of a predictive model may lead to underlying relationships with PBSA that are transparent on the surface. However, any model would have to be evaluated for practical significance in order to provide any benefit to contracting personnel.

The next possible research effort would be to evaluate what is causing the fluctuation in PBSA percentages for different contract types from year to year. The results from this study clearly show significant changes in PBSA percentages for particular contract variables, such as Type of Contract, from year to year. Why these changes are occurring and what is causing them is unknown. Some of these fluctuations may be insignificant because of the small percentage of the total dollars or actions the response may represent, and not be worth investigation. Investigating the fluctuation of variable responses that account for a large percentage of the total dollars may reveal the

true cause of the decline in PBSA percentages in FY 2004 and lead to the true driver of PBSA use.

The next opportunity for future research would be to study the relationship between service codes and PBSA use. By identifying which individual service codes increase and decrease the probability of PBSA and account for the largest percentage of total dollars and/or actions, USAF leadership could gain a better understanding of what services do and do not facilitate the use of PBSA techniques. Using this information, focused PBSA goals for individual service codes could be established.

Another possible area of study would be the evaluation of cost savings associated with use of PBSA. Of course, studies (OFPP, 1998) have concluded there are benefits are associated with PBSA use. However, no recent studies have shown how much the USAF is saving, if any, by implementing and using PBSA. If the USAF is not saving any money or gaining any quality by implementing and using PBSA, why spend the time and resources on PBSA training and the achievement of PBSA goals? Additionally, if the USAF is achieving cost savings from PBSA, how does quality of the PBSA contracts affect the savings? This study did not account for quality differences between PBSA contracts, as all PBSA contracts were deemed to be equal. It would be interesting to know if better quality PBSA contracts yield more savings and/or better results than PBSA contracts that only meet the minimum PBSA criteria.

Conclusion

The USAF has made tremendous strides in the implementation of PBSA. However, it is still falling short of interim goals and will most likely fall short of the

mandated FY 2005 goal. However, the question of whether these goals were reasonable or attainable still remains unanswered. Since the USAF has no equal in the commercial sector for comparison, it is impossible to know if such goals are reachable or if the USAF has hit a natural plateau in PBSA use never experienced by any other organization. Instead of trying to convert everything to PBSA, USAF leadership should focus on maximizing PBSA in areas that are practical and fiscally influential to the overall percentage of total dollars, such as Firm Fixed Price type contracts. While this may result in an overall percentage of PBSA less than 50%, it will lead to more efficient use of personnel and resources.

Appendix A: Service Code Categories

B. Special Studies & Analysis – Not R&D
C. Architect & Engineering Services
D. Automatic Data Processing & Telecommunication Services
E. Purchase of Structures or Facilities
F. Natural Resources & Conservation Services
G. Social Services
H. Quality Control, Testing & Inspection Services
J. Maintenance, Repair & Rebuilding of Equipment
K. Modification of Equipment
L. Technical Representative Services
M. Operation of Government-Owned Facilities
N. Installation of Equipment
P. Salvage Services
Q. Medical Services
R. Professional, Administrative & Management Support Services
S. Utilities & Housekeeping Services
T. Photographic, Mapping, Printing & Publication Services
U. Educational & Training Services
V. Transportation, Travel & Relocation Services
W. Lease or Rental of Equipment
X. Lease or Rental of Facilities
Y. Construction of Structures & Facilities
Z. Maintenance, Repair or Alteration of Real Property

Appendix B: Summary of Percentage of Actions and Dollars PBSA by Fiscal Year

FY 2001			
	Total	**PBSA**	**% PBSA**
Dollars	$19,733,040,849	$5,038,331,141	25.53%
Actions	15714	3239	20.61%

FY 2002			
	Total	**PBSA**	**% PBSA**
Dollars	$22,310,837,208	$6,471,973,020	29.01%
Actions	18500	5162	27.90%

FY 2003			
	Total	**PBSA**	**% PBSA**
Dollars	$28,511,634,144	$9,199,368,959	32.27%
Actions	21943	7401	33.73%

FY 2004			
	Total	**PBSA**	**% PBSA**
Dollars	$26,649,991,736	$7,663,018,554	28.75%
Actions	20581	6605	32.09%

Appendix C: Summary of Percentage of Actions and Dollars PBSA for Service Category, Type of Contract, and Type of Entity for Fiscal Year 2001

FY 2001							
	Total		PBSA		% PBSA		
B12A - Service Category	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars of Total
A	$8,949,600,040	4053	$1,472,290,609	236	16.45%	5.82%	45.35%
B	$323,351,090	355	$39,381,294	50	12.18%	14.08%	1.64%
D	$810,075,362	1008	$251,945,817	343	31.10%	34.03%	4.11%
E	$0	0	$0	0	0.00%	0.00%	0.00%
F	$43,189,084	81	$7,234,215	26	16.75%	32.10%	0.22%
G	$22,675,781	22	$127,072	1	0.56%	4.55%	0.11%
H	$45,715,319	27	$1,540,286	5	3.37%	18.52%	0.23%
I	$0	0	$0	0	0.00%	0.00%	0.00%
J	$1,599,715,391	1734	$227,989,005	269	14.25%	15.51%	8.11%
K	$861,485,895	584	$67,917,913	22	7.88%	3.77%	4.37%
L	$655,351,291	258	$607,736,150	171	92.73%	66.28%	3.32%
M	$595,101,263	311	$322,396,915	170	54.18%	54.66%	3.02%
N	$25,612,730	64	$7,022,123	20	27.42%	31.25%	0.13%
O	$0	0	$0	0	0.00%	0.00%	0.00%
P	$21,974,678	47	$3,381,878	8	15.39%	17.02%	0.11%
Q	$14,457,567	31	$2,426,559	9	16.78%	29.03%	0.07%
R	$2,883,200,951	2851	$933,254,934	928	32.37%	32.55%	14.61%
S	$628,812,172	819	$312,262,807	414	49.66%	50.55%	3.19%
T	$50,781,733	81	$9,435,215	19	18.58%	23.46%	0.26%
U	$169,087,643	278	$45,850,191	54	27.12%	19.42%	0.86%
V	$809,544,498	705	$708,031,511	467	87.46%	66.24%	4.10%
W	$72,957,987	61	$15,664,421	19	21.47%	31.15%	0.37%
X	$10,870,353	20	$2,442,226	8	22.47%	40.00%	0.06%
Z	$1,139,480,021	2324	$0	0	0.00%	0.00%	5.77%
Total	$19,733,040,849	15714	$5,038,331,141	3239	25.53%	20.61%	100.00%

FY 2001							
	Total		PBSA		% PBSA		
C5 - Type of Contract	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$911,955,691	1539	$341,675,527	578	37.47%	37.56%	4.62%
A - Firm Fixed Price Redeterm	$132,953,058	23	$1,099,964	2	0.83%	8.70%	0.67%
J - Firm Fixed Price	$7,121,978,511	7027	$2,342,189,011	1704	32.89%	24.25%	36.09%
K - Fixed Price Econ Price Adj	$221,571,764	133	$45,583,739	52	20.57%	39.10%	1.12%
L - Fixed Price Incentive	$545,378,522	137	$71,840,788	18	13.17%	13.14%	2.76%
M - Fixed Price Award Fee	$168,635,400	127	$83,696,954	43	49.63%	33.86%	0.85%
R - Cost Plus Award Fee	$6,382,828,278	1162	$1,775,037,365	278	27.81%	23.92%	32.35%
S - Cost Contract	$613,186,136	400	$3,015,009	11	0.49%	2.75%	3.11%
T - Cost Sharing	$21,574,975	50	$575,084	3	2.67%	6.00%	0.11%
U - Cost Plus Fixed Fee	$1,916,305,108	3174	$175,533,215	204	9.16%	6.43%	9.71%
V - Cost Plus Incentive Fee	$379,635,498	96	$8,770,228	8	2.31%	8.33%	1.92%
Y - Time and Materials	$1,135,150,468	1573	$109,080,298	222	9.61%	14.11%	5.75%
Z - Labor Hour	$181,887,440	273	$80,233,959	116	44.11%	42.49%	0.92%
Total	$19,733,040,849	15714	$5,038,331,141	3239	25.53%	20.61%	100.00%

FY 2001							
	Total		PBSA		% PBSA		
D1A - Type of Entity	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$911,955,691	1539	$341,675,527	578	37.47%	37.56%	4.62%
A - Small Disadvantaged in U.S.	$1,269,886,249	2314	$350,000,693	453	27.56%	19.58%	6.44%
B - Other Small in U.S.	$1,635,130,149	2768	$239,884,021	392	14.67%	14.16%	8.29%
C - Large in U.S.	$13,751,598,800	7404	$3,448,422,796	1429	25.08%	19.30%	69.69%
D - JWOD Nonprofit Agency	$121,546,408	179	$38,409,844	67	31.60%	37.43%	0.62%
F - Hospital	$575,590	2	$575,590	2	100.00%	100.00%	0.00%
L - Foreign Concern/Entity	$433,639,071	670	$100,734,073	153	23.23%	22.84%	2.20%
M - Domestic Firm Outside U.S.	$384,562,295	240	$113,036,133	122	29.39%	50.83%	1.95%
T - Historically Black College	$898,356	6	$0	0	0.00%	0.00%	0.00%
U - Minority Institution	$5,054,257	16	$447,997	2	8.86%	12.50%	0.03%
V - Other Educational	$167,561,977	379	$3,143,090	11	1.88%	2.90%	0.85%
Z - Other Nonprofit	$1,050,632,006	197	$402,001,377	30	38.26%	15.23%	5.32%
Total	$19,733,040,849	15714	$5,038,331,141	3239	25.53%	20.61%	100.00%

Appendix D: Summary of Percentage of Actions and Dollars PBSA for Service Category, Type of Contract, and Type of Entity for Fiscal Year 2002

FY 2002							
	Total		PBSA		% PBSA		
B12A - Service Category	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars of Total
A	$9,384,582,101	4833	$911,685,245	279	9.71%	5.77%	42.06%
B	$493,684,925	463	$65,451,003	85	13.26%	18.36%	2.21%
D	$863,411,994	1181	$404,155,906	543	46.81%	45.98%	3.87%
E	$9,069,698	9	$3,030,064	6	0.00%	0.00%	0.04%
F	$84,659,024	135	$18,042,034	27	21.31%	20.00%	0.38%
G	$15,761,156	24	$543,637	3	3.45%	12.50%	0.07%
H	$49,354,140	28	$5,992,026	12	12.14%	42.86%	0.22%
I	$0	0	$0	0	0.00%	0.00%	0.00%
J	$1,842,423,172	2065	$454,181,233	490	24.65%	23.73%	8.26%
K	$408,947,473	300	$46,903,111	34	11.47%	11.33%	1.83%
L	$901,123,782	240	$574,938,293	181	63.80%	75.42%	4.04%
M	$682,583,799	391	$483,219,157	268	70.79%	68.54%	3.06%
N	$34,621,212	84	$10,683,024	23	30.86%	27.38%	0.16%
O	$0	0	$0	0	0.00%	0.00%	0.00%
P	$19,886,640	41	$2,309,136	6	11.61%	14.63%	0.09%
Q	$17,871,097	44	$7,323,191	28	40.98%	63.64%	0.08%
R	$3,561,532,312	3391	$1,330,224,061	1368	37.35%	40.34%	15.96%
S	$856,956,221	976	$513,004,856	591	59.86%	60.55%	3.84%
T	$43,995,336	84	$22,218,156	41	50.50%	48.81%	0.20%
U	$236,157,686	336	$98,147,150	107	41.56%	31.85%	1.06%
V	$1,569,942,101	1288	$1,487,411,634	1026	94.74%	79.66%	7.04%
W	$83,375,503	75	$25,179,471	32	30.20%	42.67%	0.37%
X	$10,902,510	20	$7,330,632	12	67.24%	60.00%	0.05%
Z	$1,139,995,326	2492	$0	0	0.00%	0.00%	5.11%
Total	$22,310,837,208	18500	$6,471,973,020	5162	29.01%	27.90%	100.00%

FY 2002							
	Total		PBSA		% PBSA		
C5 - Type of Contract	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,084,860,282	1947	$498,603,796	867	45.96%	44.53%	4.86%
A - Firm Fixed Price Redeterm	$57,239,870	15	$1,754,112	3	3.06%	20.00%	0.26%
J - Firm Fixed Price	$8,730,084,054	8059	$3,125,975,698	2814	35.81%	34.92%	39.13%
K - Fixed Price Econ Price Adj	$85,923,869	123	$47,077,487	50	54.79%	40.65%	0.39%
L - Fixed Price Incentive	$799,491,111	154	$366,573,315	38	45.85%	24.68%	3.58%
M - Fixed Price Award Fee	$265,178,410	191	$160,831,283	97	60.65%	50.79%	1.19%
R - Cost Plus Award Fee	$6,287,966,577	1479	$1,634,430,280	461	25.99%	31.17%	28.18%
S - Cost Contract	$651,836,670	449	$22,087,011	21	3.39%	4.68%	2.92%
T - Cost Sharing	$24,691,965	51	$197,104	1	0.80%	1.96%	0.11%
U - Cost Plus Fixed Fee	$2,289,395,582	3790	$241,046,273	240	10.53%	6.33%	10.26%
V - Cost Plus Incentive Fee	$413,727,372	227	$67,516,249	32	16.32%	14.10%	1.85%
Y - Time and Materials	$1,465,221,100	1787	$263,380,346	475	17.98%	26.58%	6.57%
Z - Labor Hour	$155,220,346	228	$42,500,066	63	27.38%	27.63%	0.70%
Total	$22,310,837,208	18500	$6,471,973,020	5162	29.01%	27.90%	100.00%

FY 2002							
	Total		PBSA		% PBSA		
D1A - Type of Entity	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,084,860,282	1947	$498,603,796	867	45.96%	44.53%	4.86%
A - Small Disadvantaged in U.S.	$1,360,607,365	2682	$425,063,809	661	31.24%	24.65%	6.10%
B - Other Small in U.S.	$1,803,197,694	3127	$528,897,624	753	29.33%	24.08%	8.08%
C - Large in U.S.	$15,521,075,218	8709	$4,326,819,042	2264	27.88%	26.00%	69.57%
D - JWOD Nonprofit Agency	$152,352,594	205	$77,507,811	111	50.87%	54.15%	0.68%
F - Hospital	$499,828	2	$499,828	2	100.00%	100.00%	0.00%
L - Foreign Concern/Entity	$402,719,220	694	$132,047,363	214	32.79%	30.84%	1.81%
M - Domestic Firm Outside U.S.	$580,988,101	409	$241,634,219	179	41.59%	43.77%	2.60%
T - Historically Black College	$1,763,791	8	$287,447	1	16.30%	12.50%	0.01%
U - Minority Institution	$17,356,716	33	$274,592	1	1.58%	3.03%	0.08%
V - Other Educational	$516,808,652	476	$22,292,128	29	4.31%	6.09%	2.32%
Z - Other Nonprofit	$868,607,747	208	$218,045,361	80	25.10%	38.46%	3.89%
Total	$22,310,837,208	18500	$6,471,973,020	5162	29.01%	27.90%	100.00%

Appendix E: Summary of Percentage of Actions and Dollars PBSA for Service Category, Type of Contract, and Type of Entity for Fiscal Year 2003

FY 2003							
	Total		PBSA		% PBSA		
B12A - Service Category	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars of Total
A	$9,575,552,634	4891	$726,215,589	181	7.58%	3.70%	33.58%
B	$635,771,064	546	$186,191,421	242	29.29%	44.32%	2.23%
D	$1,000,332,031	1398	$512,450,598	683	51.23%	48.86%	3.51%
E	$17,874,639	19	$7,076,060	9	0.00%	0.00%	0.06%
F	$49,870,022	97	$7,885,775	14	15.81%	14.43%	0.17%
G	$18,334,219	23	$0	0	0.00%	0.00%	0.06%
H	$1,801,001,078	54	$16,121,674	21	0.90%	38.89%	6.32%
I	$0	0	$0	0	0.00%	0.00%	0.00%
J	$2,492,334,950	2135	$615,362,382	543	24.69%	25.43%	8.74%
K	$462,965,382	247	$132,624,877	63	28.65%	25.51%	1.62%
L	$956,229,751	269	$673,143,323	185	70.40%	68.77%	3.35%
M	$745,981,152	407	$554,254,254	317	74.30%	77.89%	2.62%
N	$30,266,779	84	$5,471,967	21	18.08%	25.00%	0.11%
O	$0	0	$0	0	0.00%	0.00%	0.00%
P	$17,695,575	39	$10,290,523	17	58.15%	43.59%	0.06%
Q	$25,675,207	62	$20,859,248	44	81.24%	70.97%	0.09%
R	$4,247,421,424	4089	$1,782,642,691	1805	41.97%	44.14%	14.90%
S	$1,360,555,553	1133	$1,047,016,864	856	76.96%	75.55%	4.77%
T	$45,953,984	82	$12,823,609	25	27.91%	30.49%	0.16%
U	$298,889,044	300	$138,853,352	120	46.46%	40.00%	1.05%
V	$2,699,981,982	2249	$2,623,676,457	2059	97.17%	91.55%	9.47%
W	$45,448,357	104	$28,455,510	51	62.61%	49.04%	0.16%
X	$20,448,343	32	$2,024,638	6	9.90%	18.75%	0.07%
Z	$1,963,050,974	3683	$95,928,147	139	4.89%	3.77%	6.89%
Total	$28,511,634,144	21943	$7,663,018,554	7401	26.88%	33.73%	100.00%

FY 2003							
	Total		PBSA		% PBSA		
C5 - Type of Contract	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,549,124,081	2527	$759,373,566	1257	49.02%	49.74%	5.43%
A - Firm Fixed Price Redeterm	$1,282,309	4	$0	0	0.00%	0.00%	0.00%
J - Firm Fixed Price	$10,816,371,305	10277	$4,506,576,657	4268	41.66%	41.53%	37.94%
K - Fixed Price Econ Price Adj	$105,365,465	137	$64,154,948	67	60.89%	48.91%	0.37%
L - Fixed Price Incentive	$1,004,835,015	195	$437,987,462	75	43.59%	38.46%	3.52%
M - Fixed Price Award Fee	$311,762,857	217	$200,655,058	101	64.36%	46.54%	1.09%
R - Cost Plus Award Fee	$7,718,613,781	1600	$2,402,707,218	622	31.13%	38.88%	27.07%
S - Cost Contract	$1,020,315,505	603	$58,632,040	73	5.75%	12.11%	3.58%
T - Cost Sharing	$19,603,510	39	$287,210	1	1.47%	2.56%	0.07%
U - Cost Plus Fixed Fee	$2,673,019,694	3944	$177,020,743	172	6.62%	4.36%	9.38%
V - Cost Plus Incentive Fee	$1,327,641,370	284	$177,422,181	134	13.36%	47.18%	4.66%
Y - Time and Materials	$1,872,012,961	1978	$381,820,710	587	20.40%	29.68%	6.57%
Z - Labor Hour	$91,686,291	138	$32,731,166	44	35.70%	31.88%	0.32%
Total	$28,511,634,144	21943	$9,199,368,959	7401	32.27%	33.73%	100.00%

FY 2003							
	Total		PBSA		% PBSA		
D1A - Type of Entity	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,549,124,081	2527	$759,373,566	1257	49.02%	49.74%	5.43%
A - Small Disadvantaged in U.S.	$1,969,279,080	3412	$639,129,131	882	32.45%	25.85%	6.91%
B - Other Small in U.S.	$1,977,648,257	3570	$610,972,697	886	30.89%	24.82%	6.94%
C - Large in U.S.	$19,455,047,911	10000	$5,748,012,382	3506	29.55%	35.06%	68.24%
D - JWOD Nonprofit Agency	$182,285,964	234	$109,845,413	155	60.26%	66.24%	0.64%
F - Hospital	$0	0	$0	0	0.00%	0.00%	0.00%
L - Foreign Concern/Entity	$547,313,160	913	$163,695,701	263	29.91%	28.81%	1.92%
M - Domestic Firm Outside U.S.	$1,136,008,192	531	$719,790,367	342	63.36%	64.41%	3.98%
T - Historically Black College	$7,857,520	10	$292,398	1	3.72%	10.00%	0.03%
U - Minority Institution	$23,619,055	27	$278,684	1	1.18%	3.70%	0.08%
V - Other Educational	$741,796,964	513	$41,179,254	46	5.55%	8.97%	2.60%
Z - Other Nonprofit	$921,653,960	206	$406,799,366	62	44.14%	30.10%	3.23%
Total	$28,511,634,144	21943	$9,199,368,959	7401	32.27%	33.73%	100.00%

Appendix F: Summary of Percentage of Actions and Dollars PBSA for Service Category, Type of Contract, and Type of Entity for Fiscal Year 2004

FY 2004							
	Total		PBSA		% PBSA		
B12A - Service Category	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars of Total
A	$10,189,430,033	5287	$1,055,063,639	1217	10.35%	23.02%	38.23%
B	$514,726,664	521	$173,605,864	216	33.73%	41.46%	1.93%
D	$1,170,926,890	1422	$485,624,303	550	41.47%	38.68%	4.39%
E	$15,361,540	22	$5,624,880	6	0.00%	0.00%	0.06%
F	$23,748,131	59	$7,619,569	20	32.08%	33.90%	0.09%
G	$14,839,169	20	$0	0	0.00%	0.00%	0.06%
H	$44,170,851	56	$4,628,299	11	10.48%	19.64%	0.17%
I	$0	0	$0	0	0.00%	0.00%	0.00%
J	$2,787,632,290	2202	$438,504,910	325	15.73%	14.76%	10.46%
K	$370,755,305	238	$103,485,248	42	27.91%	17.65%	1.39%
L	$918,150,538	274	$309,530,630	126	33.71%	45.99%	3.45%
M	$802,913,906	389	$351,133,681	210	43.73%	53.98%	3.01%
N	$15,911,123	54	$1,651,236	6	10.38%	11.11%	0.06%
O	$0	0	$0	0	0.00%	0.00%	0.00%
P	$12,632,205	27	$2,082,612	2	16.49%	7.41%	0.05%
Q	$33,328,602	107	$11,528,181	35	34.59%	32.71%	0.13%
R	$4,387,159,765	4174	$1,495,270,742	1757	34.08%	42.09%	16.46%
S	$1,288,053,619	1023	$902,777,998	525	70.09%	51.32%	4.83%
T	$35,925,233	77	$7,637,980	17	21.26%	22.08%	0.13%
U	$255,153,508	367	$85,236,097	78	33.41%	21.25%	0.96%
V	$2,250,437,179	1611	$2,182,552,287	1385	96.98%	85.97%	8.44%
W	$23,590,619	66	$9,953,067	14	42.19%	21.21%	0.09%
X	$16,633,739	36	$1,451,198	2	8.72%	5.56%	0.06%
Z	$1,478,510,827	2549	$28,056,133	61	1.90%	2.39%	5.55%
Total	$26,649,991,736	20581	$7,663,018,554	6605	28.75%	32.09%	100.00%

FY 2004							
	Total		PBSA		% PBSA		
C5 - Type of Contract	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,835,247,266	2603	$774,622,087	1157	42.21%	44.45%	6.89%
A - Firm Fixed Price Redeterm	$5,694,130	4	$584,248	1	10.26%	25.00%	0.02%
J - Firm Fixed Price	$8,320,539,039	8644	$3,551,485,090	2770	42.68%	32.05%	31.22%
K - Fixed Price Econ Price Adj	$57,612,003	81	$40,581,918	42	70.44%	51.85%	0.22%
L - Fixed Price Incentive	$533,700,092	156	$98,393,381	26	18.44%	16.67%	2.00%
M - Fixed Price Award Fee	$251,423,539	157	$138,131,128	80	54.94%	50.96%	0.94%
R - Cost Plus Award Fee	$6,822,988,443	1419	$1,455,474,240	482	21.33%	33.97%	25.60%
S - Cost Contract	$1,348,607,615	831	$265,036,550	187	19.65%	22.50%	5.06%
T - Cost Sharing	$21,750,240	32	$3,261,066	9	14.99%	28.13%	0.08%
U - Cost Plus Fixed Fee	$4,059,934,898	4299	$710,685,413	1225	17.50%	28.49%	15.23%
V - Cost Plus Incentive Fee	$1,138,326,852	295	$263,135,801	141	23.12%	47.80%	4.27%
Y - Time and Materials	$2,152,576,133	1885	$332,187,028	432	15.43%	22.92%	8.08%
Z - Labor Hour	$101,591,486	175	$29,440,604	53	28.98%	30.29%	0.38%
Total	$26,649,991,736	20581	$7,663,018,554	6605	28.75%	32.09%	100.00%

FY 2004							
	Total		PBSA		% PBSA		
D1A - Type of Entity	Dollars	Actions	Dollars	Actions	Dollars	Actions	% Dollars by Total
Blank	$1,835,247,266	2,603	$774,622,087	1,157	42.21%	44.45%	6.89%
A - Small Disadvantaged in U.S.	$1,708,032,459	3023	$434,865,318	603	25.46%	19.95%	6.41%
B - Other Small in U.S.	$2,222,974,939	3625	$817,337,558	1188	36.77%	32.77%	8.34%
C - Large in U.S.	$17,160,563,691	9136	$4,492,855,188	2958	26.18%	32.38%	64.39%
D - JWOD Nonprofit Agency	$185,737,008	203	$46,138,363	66	24.84%	32.51%	0.70%
F - Hospital	$0	0	$0	0	0.00%	0.00%	0.00%
L - Foreign Concern/Entity	$569,502,895	742	$155,959,853	230	27.39%	31.00%	2.14%
M - Domestic Firm Outside U.S.	$1,059,490,953	399	$663,788,582	201	62.65%	50.38%	3.98%
T - Historically Black College	$258,409	2	$119,999	1	46.44%	50.00%	0.00%
U - Minority Institution	$29,367,435	46	$2,590,740	9	8.82%	19.57%	0.11%
V - Other Educational	$858,241,084	583	$213,364,499	106	24.86%	18.18%	3.22%
Z - Other Nonprofit	$1,020,575,597	219	$61,376,367	86	6.01%	39.27%	3.83%
Total	$26,649,991,736	20581	$7,663,018,554	6605	28.75%	32.09%	100.00%

Appendix G: Contingency Tables

Bundled Contract	PBSA		
Count / Total % / Col % / Row %	N	Y	
N	54260 70.71 99.87 70.90	22267 29.02 99.38 29.10	76527 99.73
Y	71 0.09 0.13 33.65	140 0.18 0.62 66.35	211 0.27
	54331 70.80	22407 29.20	76738

Bundled Contract Exception	PBSA		
Count / Total % / Col % / Row %	N	Y	
?	54287 70.74 99.92 70.87	22309 29.07 99.56 29.13	76596 99.81
A	1 0.00 0.00 5.88	16 0.02 0.07 94.12	17 0.02
B	10 0.01 0.02 14.49	59 0.08 0.26 85.51	69 0.09
C	33 0.04 0.06 58.93	23 0.03 0.10 41.07	56 0.07
	54331 70.80	22407 29.20	76738

Multi-Year Contract	Count / Total % / Col % / Row %	PBSA N	PBSA Y	
	N	54325	22404	76729
		70.79	29.20	99.99
		99.99	99.99	
		70.80	29.20	
	Y	6	3	9
		0.01	0.00	0.01
		0.01	0.01	
		66.67	33.33	
		54331	22407	76738
		70.80	29.20	

Contract/Order	PBSA		
Count Total % Col % Row %	N	Y	
1	352 0.46 0.65 84.82	63 0.08 0.28 15.18	415 0.54
3	20675 26.94 38.05 76.96	6191 8.07 27.63 23.04	26866 35.01
4	768 1.00 1.41 87.47	110 0.14 0.49 12.53	878 1.14
5	26104 34.02 48.05 69.37	11528 15.02 51.45 30.63	37632 49.04
6	4714 6.14 8.68 55.13	3836 5.00 17.12 44.87	8550 11.14
7	99 0.13 0.18 73.88	35 0.05 0.16 26.12	134 0.17
8	173 0.23 0.32 47.27	193 0.25 0.86 52.73	366 0.48
9	1446 1.88 2.66 76.23	451 0.59 2.01 23.77	1897 2.47
	54331 70.80	22407 29.20	76738

Type IDIQ		PBSA		
	Count Total % Col % Row %	N	Y	
	?	26046 33.94 47.94 71.87	10195 13.29 45.50 28.13	36241 47.23
	A	6368 8.30 11.72 71.99	2478 3.23 11.06 28.01	8846 11.53
	B	21174 27.59 38.97 68.91	9552 12.45 42.63 31.09	30726 40.04
	C	743 0.97 1.37 80.32	182 0.24 0.81 19.68	925 1.21
		54331 70.80	22407 29.20	76738

Multiple Award Fair Op		PBSA		
	Count Total % Col % Row %	N	Y	
	?	48895 63.72 89.99 74.63	16618 21.66 74.16 25.37	65513 85.37
	A	4380 5.71 8.06 82.72	915 1.19 4.08 17.28	5295 6.90
	B	19 0.02 0.03 61.29	12 0.02 0.05 38.71	31 0.04
	C	451 0.59 0.83 69.71	196 0.26 0.87 30.29	647 0.84
	D	408 0.53 0.75 43.92	521 0.68 2.33 56.08	929 1.21
	E	178 0.23 0.33 4.12	4145 5.40 18.50 95.88	4323 5.63
		54331 70.80	22407 29.20	76738

Indefinite Delivery Contract Use		PBSA		
	Count Total % Col % Row %	N	Y	
	?	47869 62.38 88.11 74.02	16801 21.89 74.98 25.98	64670 84.27
	A	276 0.36 0.51 63.30	160 0.21 0.71 36.70	436 0.57
	B	383 0.50 0.70 75.54	124 0.16 0.55 24.46	507 0.66
	C	498 0.65 0.92 64.93	269 0.35 1.20 35.07	767 1.00
	D	5305 6.91 9.76 51.22	5053 6.58 22.55 48.78	10358 13.50
		54331 70.80	22407 29.20	76738

Synopsis		PBSA		
	Count Total % Col % Row %	N	Y	
	?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
	A	31636 41.23 58.23 70.32	13350 17.40 59.58 29.68	44986 58.62
	B	3773 4.92 6.94 76.38	1167 1.52 5.21 23.62	4940 6.44
	N	14165 18.46 26.07 77.85	4031 5.25 17.99 22.15	18196 23.71
		54331 70.80	22407 29.20	76738

Reason Not Synopsized	Count Total % Col % Row %	PBSA N	 Y	
	?	40166 52.34 73.93 68.61	18376 23.95 82.01 31.39	58542 76.29
	A	454 0.59 0.84 80.21	112 0.15 0.50 19.79	566 0.74
	B	202 0.26 0.37 84.17	38 0.05 0.17 15.83	240 0.31
	C	111 0.14 0.20 78.17	31 0.04 0.14 21.83	142 0.19
	Z	13398 17.46 24.66 77.68	3850 5.02 17.18 22.32	17248 22.48
		54331 70.80	22407 29.20	76738

Extent Competed	Count / Total % / Col % / Row %	PBSA: N	PBSA: Y	
	?	43	23	66
		0.06	0.03	0.09
		0.08	0.10	
		65.15	34.85	
	A	41238	18817	60055
		53.74	24.52	78.26
		75.90	83.98	
		68.67	31.33	
	B	4900	1750	6650
		6.39	2.28	8.67
		9.02	7.81	
		73.68	26.32	
	C	1241	257	1498
		1.62	0.33	1.95
		2.28	1.15	
		82.84	17.16	
	D	6909	1560	8469
		9.00	2.03	11.04
		12.72	6.96	
		81.58	18.42	
		54331	22407	76738
		70.80	29.20	

Type of Contract	PBSA		
Count Total % Col % Row %	N	Y	
?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
A	40 0.05 0.07 86.96	6 0.01 0.03 13.04	46 0.06
J	22451 29.26 41.32 66.02	11556 15.06 51.57 33.98	34007 44.32
K	263 0.34 0.48 55.49	211 0.27 0.94 44.51	474 0.62
L	485 0.63 0.89 75.55	157 0.20 0.70 24.45	642 0.84
M	371 0.48 0.68 53.61	321 0.42 1.43 46.39	692 0.90
R	3817 4.97 7.03 67.44	1843 2.40 8.23 32.56	5660 7.38
S	1991 2.59 3.66 87.21	292 0.38 1.30 12.79	2283 2.98
T	158 0.21 0.29 91.86	14 0.02 0.06 8.14	172 0.22
U	13366 17.42 24.60 87.89	1841 2.40 8.22 12.11	15207 19.82
V	587 0.76 1.08 65.08	315 0.41 1.41 34.92	902 1.18
Y	5507 7.18 10.14 76.24	1716 2.24 7.66 23.76	7223 9.41
Z	538 0.70 0.99 66.09	276 0.36 1.23 33.91	814 1.06
	54331 70.80	22407 29.20	76738

Solicitation Procedures	PBSA		
Count Total % Col % Row %	N	Y	
?	6993 9.11 12.87 60.89	4491 5.85 20.04 39.11	11484 14.97
A	934 1.22 1.72 84.83	167 0.22 0.75 15.17	1101 1.43
B	19574 25.51 36.03 76.02	6173 8.04 27.55 23.98	25747 33.55
C	195 0.25 0.36 80.91	46 0.06 0.21 19.09	241 0.31
D	3 0.00 0.01 100.00	0 0.00 0.00 0.00	3 0.00
E	4984 6.49 9.17 91.67	453 0.59 2.02 8.33	5437 7.09
F	481 0.63 0.89 84.39	89 0.12 0.40 15.61	570 0.74
G	40 0.05 0.07 63.49	23 0.03 0.10 36.51	63 0.08
K	8687 11.32 15.99 73.77	3088 4.02 13.78 26.23	11775 15.34
N	12440 16.21 22.90 61.23	7877 10.26 35.15 38.77	20317 26.48
	54331 70.80	22407 29.20	76738

Commercial Items		PBSA		
	Count Total % Col % Row %	N	Y	
	?	5006 6.52 9.21 55.83	3961 5.16 17.68 44.17	8967 11.69
	N	45035 58.69 82.89 75.59	14544 18.95 64.91 24.41	59579 77.64
	Y	4290 5.59 7.90 52.37	3902 5.08 17.41 47.63	8192 10.68
		54331 70.80	22407 29.20	76738

Type on Entity	PBSA		
Count Total % Col % Row %	N	Y	
?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
A	8832 11.51 16.26 77.26	2599 3.39 11.60 22.74	11431 14.90
B	9871 12.86 18.17 75.41	3219 4.19 14.37 24.59	13090 17.06
C	25092 32.70 46.18 71.18	10157 13.24 45.33 28.82	35249 45.93
D	422 0.55 0.78 51.40	399 0.52 1.78 48.60	821 1.07
F	0 0.00 0.00 0.00	4 0.01 0.02 100.00	4 0.01
L	2159 2.81 3.97 71.51	860 1.12 3.84 28.49	3019 3.93
M	735 0.96 1.35 46.55	844 1.10 3.77 53.45	1579 2.06
T	23 0.03 0.04 88.46	3 0.00 0.01 11.54	26 0.03
U	109 0.14 0.20 89.34	13 0.02 0.06 10.66	122 0.16
V	1759 2.29 3.24 90.16	192 0.25 0.86 9.84	1951 2.54
Z	572 0.75 1.05 68.92	258 0.34 1.15 31.08	830 1.08
	54331 70.80	22407 29.20	76738

Woman-Owned Business	PBSA		
Count Total % Col % Row %	N	Y	
?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
N	46464 60.55 85.52 72.87	17300 22.54 77.21 27.13	63764 83.09
U	702 0.91 1.29 65.98	362 0.47 1.62 34.02	1064 1.39
Y	2408 3.14 4.43 73.10	886 1.15 3.95 26.90	3294 4.29
	54331 70.80	22407 29.20	76738

HUBZone Representation	PBSA		
Count Total % Col % Row %	N	Y	
?	35628 46.43 65.58 68.23	16589 21.62 74.03 31.77	52217 68.05
N	16766 21.85 30.86 75.80	5354 6.98 23.89 24.20	22120 28.83
Y	1937 2.52 3.57 80.67	464 0.60 2.07 19.33	2401 3.13
	54331 70.80	22407 29.20	76738

Ethnic Group	Count / Total % / Col % / Row %	PBSA N	PBSA Y	
	?	45530 59.33 83.80 69.63	19856 25.88 88.62 30.37	65386 85.21
	A	385 0.50 0.71 77.94	109 0.14 0.49 22.06	494 0.64
	B	868 1.13 1.60 70.80	358 0.47 1.60 29.20	1226 1.60
	C	1587 2.07 2.92 72.73	595 0.78 2.66 27.27	2182 2.84
	D	1882 2.45 3.46 81.02	441 0.57 1.97 18.98	2323 3.03
	E	2598 3.39 4.78 79.67	663 0.86 2.96 20.33	3261 4.25
	F	500 0.65 0.92 82.64	105 0.14 0.47 17.36	605 0.79
	Z	981 1.28 1.81 77.80	280 0.36 1.25 22.20	1261 1.64
		54331 70.80	22407 29.20	76738

Type of Set-Aside		PBSA		
	Count Total % Col % Row %	N	Y	
	?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
	A	37237 48.52 68.54 72.29	14272 18.60 63.69 27.71	51509 67.12
	B	5229 6.81 9.62 68.89	2361 3.08 10.54 31.11	7590 9.89
	C	279 0.36 0.51 79.71	71 0.09 0.32 20.29	350 0.46
	D	6151 8.02 11.32 78.71	1664 2.17 7.43 21.29	7815 10.18
	E	214 0.28 0.39 79.26	56 0.07 0.25 20.74	270 0.35
	F	73 0.10 0.13 85.88	12 0.02 0.05 14.12	85 0.11
	K	298 0.39 0.55 76.80	90 0.12 0.40 23.20	388 0.51
	L	93 0.12 0.17 80.87	22 0.03 0.10 19.13	115 0.15
		54331 70.80	22407 29.20	76738

Type of Preference		PBSA		
	Count Total % Col % Row %	N	Y	
	?	4757 6.20 8.76 55.21	3859 5.03 17.22 44.79	8616 11.23
	A	49556 64.58 91.21 72.77	18544 24.17 82.76 27.23	68100 88.74
	B	3 0.00 0.01 75.00	1 0.00 0.00 25.00	4 0.01
	D	15 0.02 0.03 83.33	3 0.00 0.01 16.67	18 0.02
		54331 70.80	22407 29.20	76738

		PBSA		
	Count Total % Col % Row %	N	Y	
SBIR Program	?	5055 6.59 9.30 55.82	4001 5.21 17.86 44.18	9056 11.80
	A	46746 60.92 86.04 72.27	17932 23.37 80.03 27.73	64678 84.28
	B	47 0.06 0.09 85.45	8 0.01 0.04 14.55	55 0.07
	C	2362 3.08 4.35 84.03	449 0.59 2.00 15.97	2811 3.66
	D	121 0.16 0.22 87.68	17 0.02 0.08 12.32	138 0.18
		54331 70.80	22407 29.20	76738

Any row with an “?” indicates that no code was selected for that variable for that particular action.

Appendix H: Parameter Estimates for Logistic Regression Model without Unstable or Biased Variables.

Parameter Estimates

Term	Estimate	Std Error	ChiSquare	Prob>ChiSq
Intercept	1.15945266	0.1493497	60.27	<.0001
B1C - Bundled Contract [N]	-1.0217948	0.0742649	189.30	<.0001
B13B - Type of Indefinite-Delivery Contract [A]	0.11027158	0.029991	13.52	0.0002
B13B - Type of Indefinite-Delivery Contract [B]	0.00593461	0.0269594	0.05	0.8258
B13B - Type of Indefinite-Delivery Contract [C]	-0.2293267	0.0658999	12.11	0.0005
B13E - Multiple Award Contract Fair Opportunity [A]	-1.4259021	0.0733505	377.90	<.0001
B13E - Multiple Award Contract Fair Opportunity [B]	-0.3498394	0.3140916	1.24	0.2654
B13E - Multiple Award Contract Fair Opportunity [C]	-0.6077224	0.0975302	38.83	<.0001
B13E - Multiple Award Contract Fair Opportunity [D]	0.37374773	0.0867607	18.56	<.0001
B13E - Multiple Award Contract Fair Opportunity [E]	3.24672216	0.0928443	1222.9	<.0001
B13F - Indefinite-Delivery Contract Use [A]	0.0541297	0.089726	0.36	0.5463
B13F - Indefinite-Delivery Contract Use [B]	-0.2464587	0.0939629	6.88	0.0087
B13F - Indefinite-Delivery Contract Use [C]	0.36786891	0.0720396	26.08	<.0001
B13F - Indefinite-Delivery Contract Use [D]	0.07654513	0.0420865	3.31	0.0689
C14 - Commercial Items [N]	-0.4662438	0.072445	41.42	<.0001
C14 - Commercial Items [Y]	0.94984336	0.0739473	164.99	<.0001
D1C - HUBZone Representation [N]	0.11716142	0.0222081	27.83	<.0001
D1C - HUBZone Representation [Y]	-0.2752741	0.0397144	48.04	<.0001
D1D - Ethnic Group [A]	0.12115866	0.1018073	1.42	0.2340
D1D - Ethnic Group [B]	0.32562806	0.0639912	25.89	<.0001
D1D - Ethnic Group [C]	0.20367995	0.0518348	15.44	<.0001
D1D - Ethnic Group [D]	-0.259404	0.0562419	21.27	<.0001
D1D - Ethnic Group [E]	0.07389066	0.0475593	2.41	0.1203
D1D - Ethnic Group [F]	-0.5987701	0.1075247	31.01	<.0001
D1D - Ethnic Group [Z]	-0.000672	0.0673468	0.00	0.9920
D7 - SBIR Program [A]	-0.0412664	0.1044959	0.16	0.6929
D7 - SBIR Program [B]	-0.3835844	0.3166887	1.47	0.2258
D7 - SBIR Program [C]	-0.2049099	0.1111629	3.40	0.0653
D7 - SBIR Program [D]	-0.5647882	0.2275421	6.16	0.0131

For log odds of H/M

Bibliography

Agresti, Alan and Barbara Finlay. *Statistical Methods for the Social Sciences (3rd Edition).* New Jersey: Prentice Hall, 1997.

Air Force Research Laboratory (AFRL), Air Force Material Command. Memorandum on the File for R&D Services Determination for Both New and Existing Efforts. Wright-Patterson AFB OH 26 July 2004.

Aldridge, Edward, C. Under Secretary of Defense for Acquisition, Technology and Logistics. Acquisition of Services Memorandum. 31 May 2002.

Ausnik, John, Frank Camm, and Charles Cannon. "Performance-Based Contracting in the Air Force: A Report on Experiences in the Field," *RAND Report*. DB-342-AF. Santa Monica CA. 2001.

Ausink, John, Laura H. Baldwin, Sarah Hunter, and Chad Shirley. "Implementing Performance-Based Services Acquisitions (PBSA): Perspective from an Air Logistics Center and a Product Center," *RAND Documented Briefing Report.* DB-388-AF. Santa Monica CA. 2002.

Bain, Lee, J. *Introduction to Probability and Mathematical Statistics.* Boston: Duxbury Press, 1987.

Barry, Jack. "Performance-Based Service Contracts," *Inside Supply Management*, 14:10 (June 2003).

Beyland, Timothy. Air Force Program Executive Officer for Combat and Mission Support. Delegation of Responsibilities as the Designated Official for AF Research Laboratory Services Acquisitions Memorandum. 13 May 2004.

Cochran, W. G. "Some Methods for Strengthening the Common Chi-Squared Tests," *Biometrics*, 10: 417-451 (December 1954).

Department of Defense. *Guidebook for Performance Based Services Acquisition (PBSA) in the Department of Defense.* Washington: GPO, March 2001.

Department of the Air Force. *Performance Based Service Contracts (PBSC).* AFI 63-124. Washington: HQ USAF, 1 April 1999.

Department of the Air Force. *Performance Based Service Contracts (PBSC).* AFI 63-124, Supplement 1. Washington: HQ USAF, 1 April 1999.

Department of the Air Force. *Performance Based Service Acquisitions: Implementation Plan.* Washington: HQ USAF, June 2000.

Department of the Air Force. *Management and Oversight of Acquisition of Services Process (MOASP).* AFI 63-124. Washington: April 2003.

Department of the Air Force. *AFMC Management and Oversight of Acquisition of Services Process (MOASP).* Washington: HQ USAF, April 2003.

Department of the Air Force. *AFRL Management and Oversight of Acquisition of Services Process (MOASP).* Washington: HQ USAF, April 2003.

Department of the Air Force. *Performance Based Service Acquisition (PBSA).* AFI 63-124 (Revised). Washington: HQ USAF, 11 February 2004.

Federal Acquisition Regulation, Part 4, Administrative Matters, Washington: Government Printing Office (as of May 2003). 3 August 2004. http://farsite.hill.af.mil/.

Federal Acquisition Regulation, Part 35, Research and Development Contracting, Washington: Government Printing Office (as of May 2003). 3 August 2004. http://farsite.hill.af.mil/

Federal Acquisition Regulation, Part 36, Construction and Architect-Engineer Contracting, Washington: Government Printing Office (as of May 2003). 3 August 2004. http://farsite.hill.af.mil/

Federal Acquisition Regulation, Part 37, Service Contracting, Washington: Government Printing Office (as of May 2003). 3 August 2004. http://farsite.hill.af.mil/

Federal Acquisition Regulation, Part 47, Transportation, Washington: Government Printing Office (as of May 2003). 3 August 2004. http://farsite.hill.af.mil/

Gansler, Jacques. Under Secretary of Defense for Acquisition, Technology and Logistics. Performance-Based Services Acquisition (PBSA) Memorandum. 5 April 2000.

Gansler, Jacques. Under Secretary of Defense for Acquisition, Technology and Logistics. Forward to Guidebook for PBSA in the DoD. 2 January 2001.

JMP, The Statistical Discovery Software. Version 5.1. Computer software. SAS Institute, Inc., Cary NC, 1989-2003.

Johnson, James H. "How to Succeed with Performance-Based Contracts," *Software Magazine,* 20:44 (October 2000).

Lacey, Fred J. *Performance Based Service Acquisition (PBSA): A Dynamic Look at PBSA in the Air Force.* MS Thesis, AFIT/GAQ/ENV/04M-06. School of

Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 2004.

Leedy, Paul D. and Jeanne E. Ormrod. *Practical Research: Planning and Design* (7th Edition). New Jersey: Prentice Hall, 2001.

Makridakis, Spyros, Steven C. Wheelwright, Victor E. McGee. *Forecasting Methods and Application* (2nd Edition). New York: John Wiley & Sons, 1978.

McClave, James T., P. George Benson, and Terry Sincich. *Statistics for Business and Economics* (8th Edition). New Jersey: Prentice Hall, 2001.

O'Keefe, Sean, Deputy Director, Office of Management and Budget. Performance Goals and Management Initiatives for the FY 2002 Budget Correspondence. M-01-15. 9 March 2001.

United States Congress. *Policy on Procurement of Property and Services.* Public Law 93-400. Washington: GPO, 30 August 1974.

United States Congress. *National Defense Authorization Act of 2002.* Public Law 107-107. Washington: GPO, 2002

Office of Federal Procurement Policy (OFPP), U.S. Executive Office of the President, Policy Letter 91-2 on Service Contracting to the Heads of Executive Agencies and Departments. Washington: U.S. Government Printing Office, April 1991.

Office of Federal Procurement Policy (OFPP), U.S. Executive Office of the President, Policy Letter 92-1 on Inherently Governmental Functions to the Heads of Executive Agencies and Departments. Washington: U.S. Government Printing Office, September 1992.

Office of Federal Procurement Policy (OFPP), U.S. Executive Office of the President, Policy Letter 93-1 on Management Oversight of Service Contracting to the Heads of Executive Agencies and Departments. Washington: U.S. Government Printing Office, May, 1994.

Office of Federal Procurement Policy (OFPP), Office of Management and Budget U.S. Executive Office of the President. PBSC Checklist, 8 August, 1997.

Office of Federal Procurement Policy (OFPP), Office of Management and Budget U.S. Executive Office of the President. A Report on the Performance-Based Service Contracting Pilot Project, May 1998.

Office of Federal Procurement Policy (OFPP), Office of Management and Budget U.S. Executive Office of the President. A Guide to Best Practices for Performance-Based Service Contracting, October 1998.

Office of Federal Procurement Policy (OFPP), Office of Management and Budget, U.S. Executive Office of the President. Interagency Task Force on Performance-Based Service Acquisition, July 2003.

Office of Procurement Management. Contract Action Reporting System FY04 (DCARS) Training and Desk Guide, October 2003.

Woods, William T. Director, Acquisition and Sourcing Management, United States General Accounting Office. Statements Before the Subcommittee on Technology and Procurement Policy, 7 March 2002.

Woods, William T. Director, Acquisition and Sourcing Management, United States General Accounting Office. Reliability of Federal Procurement Data Correspondence, 30 December 2003.

Wynne, Michael W. Acting Under Secretary of Defense for Acquisition, Technology and Logistics. Performance-Based Service Acquisitions Memorandum. 19 August 2003.

Vita

Captain Dylan D. Pope graduated from Riverside Polytechnic High School in Riverside, California in June, 1996. He received his Bachelor of Science in Management from the United States Air Force Academy in 2000, and was commissioned a second lieutenant in the United States Air Force in May, 2000.

His first assignment was at the 9th Contracting Squadron, Beale Air Force Base, California. In August 2003, he entered the Graduate School of Engineering and Management at the Air Force Institute of Technology as a Strategic Purchasing Student. Upon graduation, he will be assigned to the Ogden Air Logistics Center, Hill Air Force Base, Utah.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From – To)*
21-03-2005	**Master's Thesis**	Aug 2003 – Mar 2005

4. TITLE AND SUBTITLE

Performance Based Service Acquisition: A Quantitative Evaluation of Implementation Goals and Performance in the United States Air Force

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Pope, Dylan, D., Captain, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/ENV)
2950 Hobson Way
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER

AFIT/GSP/ENV/05M-05

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HQ AFMC/PKV
Attn: Mr. Brian Morris
4375 Chidlaw Rd., Rm S208
WPAFB OH 45433-5006 DSN: 787-6811

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

In an attempt to maximize cost savings in the rapidly growing services sector, the DoD established a Performance Based Service Acquisition (PBSA) strategy that focuses on evaluating contractor performance based on their ability to meet desired outcomes rather than the means to which the outcomes are obtained. In April 2000, Dr. Gansler, then Under Secretary of Defense for Acquisition, Technology and Logistics, mandated that 50 percent of all eligible service acquisitions be awarded using PBSA methods by FY 2005. Since then very little research has been focused on USAF implementation of PBSA and the progress and attainment of the PBSA goals. Using multiple years of data this thesis seeks to evaluate and analyze the current and expected future states of PBSA implementation in the USAF. A combination of descriptive statistics, forecasting, contingency tables, and regression were used to analyze the data, draw conclusions, and make recommendations for PBSA implementation improvements. The results conclude that the USAF is not meeting interim PBSA goals and will most likely fall short of the FY 2005 PBSA goal. These results suggest that the goals may not have been reasonable and that the USAF has hit a natural plateau in PBSA use.

15. SUBJECT TERMS
Acquisition, Contracted Services, Contracts, Procurement

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
REPORT	**ABSTRACT**	**c. THIS PAGE**			Curtis G. Tenney, LtCol, USAF (ENV)
U	**U**	**U**	**UU**	145	**19b. TELEPHONE NUMBER** *(Include area code)* (937) 255-3636, ext 4799; e-mail: curtis.tenney@afit.edu

Standard Form 298 (Rev: 8-98)
Prescribed by ANSI Std. Z39-18