



PROJECT AIR FORCE

- CHILD POLICY
- CIVIL JUSTICE
- EDUCATION
- ENERGY AND ENVIRONMENT
- HEALTH AND HEALTH CARE
- INTERNATIONAL AFFAIRS
- NATIONAL SECURITY
- POPULATION AND AGING
- PUBLIC SAFETY
- SCIENCE AND TECHNOLOGY
- SUBSTANCE ABUSE
- TERRORISM AND HOMELAND SECURITY
- TRANSPORTATION AND INFRASTRUCTURE

This PDF document was made available from www.rand.org as a public service of the RAND Corporation.

[Jump down to document](#) ▼

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world.

Support RAND

[Purchase this document](#)

[Browse Books & Publications](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore [RAND Project AIR FORCE](#)

View [document details](#)

Limited Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law as indicated in a notice appearing later in this work. This electronic representation of RAND intellectual property is provided for non-commercial use only. Permission is required from RAND to reproduce, or reuse in another form, any of our research documents for commercial use.

Report Documentation Page

*Form Approved
OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE APR 2004	2. REPORT TYPE	3. DATES COVERED -			
4. TITLE AND SUBTITLE Using a Spend Analysis to Help Identify Prospective Air Force Purchasing and Supply Management Initiatives		5a. CONTRACT NUMBER			
		5b. GRANT NUMBER			
		5c. PROGRAM ELEMENT NUMBER			
6. AUTHOR(S)		5d. PROJECT NUMBER			
		5e. TASK NUMBER			
		5f. WORK UNIT NUMBER			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Department of the Air Force, Strategic Planning Division, Directorate of Plans, Washington, DC, 20330		8. PERFORMING ORGANIZATION REPORT NUMBER			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		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 The original document contains color images.					
14. ABSTRACT see report					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 105	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

This product is part of the RAND Corporation documented briefing series. RAND documented briefings are based on research briefed to a client, sponsor, or targeted audience and provide additional information on a specific topic. Although documented briefings have been peer reviewed, they are not expected to be comprehensive and may present preliminary findings.

DOCUMENTED
BRIEFING

Using a Spend Analysis to Help Identify Prospective Air Force Purchasing and Supply Management Initiatives

Summary of Selected Findings

NANCY Y. MOORE, CYNTHIA COOK,
CLIFFORD GRAMMICH, CHARLES LINDENBLATT

DB-434-AF

April 2004

Prepared for the United States Air Force

Approved for public release; distribution unlimited



RAND PROJECT AIR FORCE

The research reported here was sponsored by the United States Air Force under Contract F49642-01-C-0003. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

ISBN: 0-8330-3582-7

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

RAND® is a registered trademark.

© Copyright 2004 RAND Corporation

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2004 by the RAND Corporation
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516
RAND URL: <http://www.rand.org/>
To order RAND documents or to obtain additional information, contact
Distribution Services: Telephone: (310) 451-7002;
Fax: (310) 451-6915; Email: order@rand.org

PREFACE

A growing body of research documents how innovative commercial firms are better managing their suppliers, supply base, and supply chains, and applying a number of best purchasing and supply management (PSM) practices, as recognized by research literature and practiced by innovative enterprises. These firms report that they have improved performance, reduced total costs, and limited risks through these practices.

This documented briefing summarizes research on how the Air Force might use an analysis of its spending to develop better PSM practices and to improve its relationships with suppliers. The research reported here was sponsored by the Directorate of Maintenance within the office of the Deputy Chief of Staff for Installations and Logistics (AF/ILM) and by the Air Force Deputy Assistant Secretary for Contracting (SAF/AQC). It is part of a larger project on Supporting and Evaluating Purchasing and Supply Management Demonstrations conducted within the Resource Management Program of RAND Project AIR FORCE.

This research should be of interest to all persons in the Air Force who might wish to adapt best PSM practices to Air Force operations, particularly support services managers and contracting officials who want to use spend analyses to improve PSM practices. Similar work for the Air Force and for the Office of the Secretary of Defense has been documented in:

Nancy Y. Moore, Laura H. Baldwin, Frank A. Camm, and Cynthia R. Cook, *Implementing Best Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*, Santa Monica, Calif.: RAND Corporation, DB-334-AF, 2002.

Lloyd Dixon, Nancy Moore, and Charles Lindenblatt, "The Stability of DoD-Supplier Relationships: An Exploratory Spend Analysis," Santa Monica, Calif.: RAND Corporation, unpublished research.

RAND Project AIR FORCE

RAND Project AIR FORCE (PAF), a division of the RAND Corporation, is the United States Air Force federally funded research and development center for studies and analyses. PAF provides the Air Force with independent analyses of policy alternatives affecting the development,

employment, combat readiness, and support of current and future aerospace forces. Research is performed in four programs: Aerospace Force Development; Manpower, Personnel, and Training; Resource Management; and Strategy and Doctrine.

Additional information about PAF is available on our web site at <http://www.rand.org/paf>.

CONTENTS

Preface.....	iii
Summary	vii
Acknowledgments	xi
Acronyms	xiii
1. INTRODUCTION	1
2. OVERVIEW OF SPEND ANALYSIS.....	6
3. INDICATORS TO TARGET PROSPECTIVE PSM INITIATIVE	30
4. INSIGHTS FOR SPECIFIC PSM IMPROVEMENTS.....	44
5. LESSONS FOR THE AIR FORCE	68
Appendix: Lessons Learned in Using DD350 Data for DoD Spend Analyses	75
Bibliography.....	85

SUMMARY

Best purchasing and supply management (PSM) practices as identified by academic and business literature and professional organizations offer many ways by which the Air Force can improve performance and save money by improving the management of existing resources, thereby freeing funds for other priorities. Such techniques include consolidating multiple contracts, particularly sole-source contracts, with existing providers, selecting the best providers and offering them longer contracts with broader scopes of goods and services, and working with selected strategic partners to improve quality, responsiveness, reliability, and cost. Because of the success that leading commercial firms have had improving their purchasing and supply management, the Air Force asked RAND to help it identify opportunities to apply best PSM practices.

A first step toward knowing which PSM practices to use in any particular purchasing situation is to conduct a spend analysis, or an analysis of expenditures along dimensions such as type of commodity or service and suppliers, numbers of contracts and expenditures, and other variables showing how current money is spent on goods and services. Private firms place high importance on such analyses; 80 percent of supply chain executives in a recent survey view a spend analysis as “very important” or “critical” to the success of their enterprise (Aberdeen, 2002). A spend analysis can help enterprises improve their purchasing practices in the areas where they are likely to produce the greatest benefit.

This documented briefing summarizes a high-level analysis of Air Force spending and suggests some activities the Air Force may wish to review, revise, or improve in its purchasing and supply management. There are many challenges to conducting an Air Force-wide spend analysis, primarily the lack of detailed, centralized data on all expenditures as well as questions about data quality for those data that are available. Nevertheless, the data that do exist point to many prospective sources of savings and performance improvements.

In FY02, 69 percent of the Air Force budget was spent on goods and services procured from other organizations. Continuing efforts to competitively source or privatize many noncore activities likely mean that purchases of goods and services will increase in importance. Concentrating on better management of purchases of goods and services

by strategically and actively managing suppliers and supplier capacity rather than the tactical procurement of particular items from external organizations can lead to a higher quality of goods and services procured at lower total cost from more responsive providers.

In this briefing, we show the potential benefits of a spend analysis for improving Air Force purchasing. We analyze the most complete centralized source available on Air Force expenditures, data on direct purchase transactions of \$25,000 or more, also known as DD350 data. Transactions in the DD350 data constitute 96 percent of all Air Force contract dollars spent directly (as opposed to intragovernmental transfers), or 47 percent of the total Air Force budget. These data provide information along many dimensions of interest, including how much and what the contract was for, purchase office code¹ issuing the contract, name of provider winning the contract, industry classification of purchases, number of solicitations and offers, and type of contract (e.g., sole-source or competitive).

The DD350 data provide detail on an enormous amount of goods and services that the Air Force purchases, totaling more than \$47 billion annually, in a wide range of industries (represented by nearly 1,200 Federal Supply Class codes) from a huge number of contractor ID codes (more than 10,000). There are several indicators in the DD350 data that the Air Force may wish to examine more closely in seeking greater purchasing and supply management efficiencies. These include:

- Nearly 240 purchase office codes. This indicates potential opportunities to consolidate duplicated purchasing efforts across the Air Force, reducing transaction costs, and realizing savings such as those from volume discounts. Further savings may be possible by consolidating purchases across the Department of Defense (DoD). (See pp. 31–32.)
- A large number of contracts for localized base operating support services, such as building maintenance, groundskeeping, and janitorial services. The Air Force may wish to consolidate these. Such consolidation might seem to adversely affect socioeconomic goals for small businesses, but in fact many small businesses themselves hold several such contracts and consolidation of these can help them grow and improve. (See pp. 38–39.)

¹ Because Air Force organizations can have more than one purchase office code, we specifically use, at the request of the Deputy Assistant Secretary for Contracting, the term “Purchase Office Code” instead of “purchasing office” or a similar variant.

- Operational procurement offices (i.e., offices that buy goods and services for Air Force bases or installations) executing more than 800 contracts per year, or in more than 200 Federal Supply Classes, or with more than 400 contractor codes. As a result, operational procurement personnel may have difficulty becoming expert with specific industries or contractors (See pp. 22–23.)
- More than one in three, or 34 percent, of contractor ID codes having multiple contracts with the Air Force.² Because many Air Force suppliers have multiple contractor ID codes, this actually underestimates the number of multiple contracts with the same company. For companies with multiple contracts, the Air Force is paying for the contractor’s repetitive bidding and contract administration costs through higher prices. (See pp. 34–35.)
- Many purchase office codes associated with the same contractor. Buyers indirectly pay each contractor’s administrative and any marketing costs associated with selling its services to more than one unit of the buying enterprise. The decentralized Air Force purchasing structure leads to nearly one in four, or 24 percent, of contractor ID codes selling to more than one Air Force purchase office code. (See pp. 36–37.)
- Contracts for goods or services available from only one supplier. Such sole-source contracts account for 46 percent of the dollars spent on DD350 contracts. Although sole-source contracts can be desirable, the opportunities for gaining leverage over sole suppliers may be limited. Still, the Air Force may be able to pursue performance improvements and cost savings with such suppliers. (See pp. 40–41.)

We explore several ways the Air Force can address purchasing and supply management challenges identified by the data. One of these involves “corporate contracts,” or the grouping of several individual, sole-source contracts with a company into one larger contract. A corporate contract lets the Air Force leverage its buying power for more favorable terms and conditions. The Air Force is currently consolidating some contracts with its largest corporate providers to obtain performance improvements and cost savings. It also may wish to lead efforts for DoD-wide corporate contracts with corporations (e.g., jet engine manufacturers) for which it

² Because many large enterprises have multiple business units and locations, it is standard in the commercial world and within DoD to give each location a separate number, called a “contractor ID code” in the DD350 data, and hence the term we use to describe purchases from a particular business unit and location.

makes most DoD purchases. For commodities procured more by other services, the Air Force may prefer to yield leadership on supplier relationships to other DoD branches.

A thorough spend analysis identifies not just opportunities for savings and performance improvements but also some of the risks that may be associated with using innovative purchasing and supply management practices, particularly those in situations where there is or are:

- Only one supplier or limited competition with few bidders
- Suppliers with financial problems
- Low or highly variable demand
- No contract
- No supplier performance incentives or commitment to improve
- Inadequate or poor past performance information
- Inappropriate scopes of work.

Some of these factors may be relatively simple to locate in existing spend data. Others must be researched more carefully using additional internal and external data sources. In particular, conducting a complete Air Force spend analysis would require information on the needs, preferences, and priorities of commodity users not available in the DD350 data. Because the Air Force needs to balance prospective savings, performance improvements, risks, socioeconomic and other goals, and other regulations not always present in the private sector, not all best commercial practices may be appropriate for it.

Because the DD350 data do not contain all elements needed for a complete Air Force spend analysis, conclusions drawn from them can only be speculative. An in-depth spend analysis would require combining multiple data sources; gathering and integrating additional data on suppliers, markets, internal Air Force requirements, and market factors; maintaining substantial computational capability and experts to process the numbers; and developing knowledgeable personnel to perform the analytical tasks from a service-wide perspective across all enterprises with which the Air Force does business.

ACKNOWLEDGMENTS

We gratefully acknowledge several individuals who helped us during the course of this research. Our first thanks are to Gen John Handy, Commander in Chief, U.S. Transportation Command, and Commander, Air Mobility Command, who, as Deputy Chief of Staff for Installations and Logistics, was the initial sponsor of our work. We thank him for his continuing interest and support of this research. LtGen Michael E. Zettler, AF/IL, and Timothy A. Beyland, then SAF/AQC, were also among the initial sponsors of this research. This work has continued and expanded under the sponsorship of BGen Robert Mansfield, formerly AF/ILS and then AF/ILI, and BGen Darryl Scott, formerly SAF/AQC. We also thank our action officers, Grover Dunn, formerly AF/ILM and now AF/ILI, and Col Mary Kringer, formerly of SAF/AQCO. We thank John Landers, from the General Services Administration, and Ray Morris, from the Washington Headquarters Services/Directorate for Information Operations and Reports (WHS/DIOR), who provided us with data, as well as Kathryn Ekberg, SAF/AQCP, who answered many of our early questions about the data. We also thank RAND colleagues Donna Fossum and Larry Painter, who gave us useful guidance about preparing the DD350 Individual Contracting Action Report (ICAR) data for analysis. We thank Mary Chenoweth for helping us refine our analyses and for her comments on draft versions of our briefing. In addition, we thank Carol Edwards and Judy Mele for updating our analyses using FY02 data. We also greatly appreciate the help of Cliff Grammich of the RAND Research Communications Group who helped make the document more user-friendly. Thanks also go to RAND colleague Laura Baldwin for her program review of this document and to Carol Zaremba for handling all the administrative details of publication. Last, we thank Susan Gates for her formal review and suggestions for improvement.

ACRONYMS

A&AS	Advisory and Assistance Services
AAC	Air Armament Center
ABSS	Automated Business Services System
ADP	Automatic Data Processing
ADPE	Automatic Data Processing Equipment
AFMC	Air Force Materiel Command
ALC	Air Logistics Center
ASC	Aeronautical Systems Center
CFM	Contractor Furnished Maintenance
CLIN	Contract Line Item Number
DFARS	Defense Acquisition Regulation Supplement
DFAS	Defense Finance and Accounting Service
DISA	Defense Information System
DLA	Defense Logistics Agency
DoD	Department of Defense
DUNS	Data Universal Numbering System
EDI	Electronic Data Interchange
ESC	Electronics System Center
FSC	Federal Supply Class
FY	Fiscal Year
GE	General Electric
GEAE	General Electric Aircraft Engines
GSA	General Services Administration
IT	Information Technology
MAJCOM	Major Command
MICAP	Mission Impaired Capability Awaiting Parts
MIPR	Military Interdepartmental Purchase Requests
NAICS	North American Industry Classification System
NSN	National Stock Number
P&W	Pratt & Whitney
PO	Purchase Orders
PPI	Producer Price Index
PSM	Purchasing and Supply Management
R&D	Research and Development
RDTE	Research, Design, Testing, and Evaluation
SAF/AQC	Air Force Deputy Assistant Secretary for Contracting
SAIC	Science Applications International Corporation
SCA	Service Contract Act
SDB	Small or Disadvantaged Business
SEC	Securities and Exchange Commission
SIC	Standard Industrial Classification
SMC	Space and Missile Systems Center
SSG	Standard Systems Group

UNICOR	Federal Prison Industries, Inc.
USAF	United States Air Force
USMC	United States Marine Corps
UTC	United Technologies Corporation
VA	Veterans Administration
WHS/DIOR	Washington Headquarters Services/Directorate for Information Operations and Reports

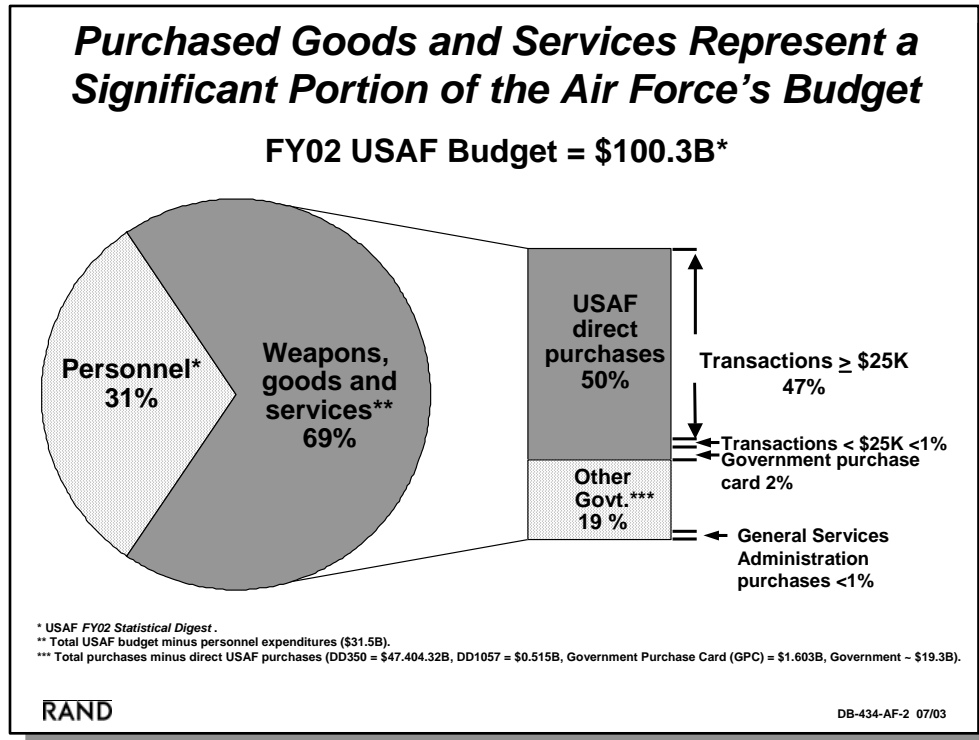
1. INTRODUCTION



***Using a Spend Analysis to Help Identify
Prospective Air Force Purchasing and
Supply Management Initiatives:
Summary of Selected Findings***

July 2003

The U.S. Air Force (USAF) faces an increasingly broad array of tasks calling for changing force structures and new weapon systems. Competing goals can make it difficult to decide which initiatives to fund most generously. In sum, the Air Force faces even greater pressure to make the most of its existing resources.



In FY02, the total Air Force budget was \$100.3 billion. More than two-thirds of that amount, or \$69 billion, was spent on weapons, goods, and services. The Air Force has the most control over this portion of its spend, and hence this is where it can most likely realize savings from improved purchasing and supply management (PSM) practices.³

Half of the total Air Force budget goes to direct purchases from organizations outside the government. This direct Air Force spend includes an enormous amount and variety of goods and services in a large number of industries. These include aircraft and other weapons systems, ammunition, spare parts, repair and base operating services, automatic data processing equipment, software, and other goods and services. Nearly all these expenditures are for contracts worth at least \$25,000. For such contracts, there is a substantial amount of data

³ For more on purchasing and supply management, see Dobler and Burt (1996); Ellram and Choi (2000); Chapman et al. (1998); and Flynn and Farney (2000). As Flynn and Farney note, although “the term *purchasing* has long been used to describe the functional role of those who own the process by which outside inputs are controlled . . . the term *supply management* is now often used to capture [a] more strategic role” for purchasing within an enterprise.

available for analysis. In this report, we examine these data and what they indicate for Air Force purchasing practices.

Key Questions

- **Where are there likely opportunities for the Air Force to apply best PSM practices?**
- **Does the Air Force have the necessary information to support the use of these practices?**
- **How can existing Air Force data be used to help identify these opportunities?**
- **What can the Air Force do to better support the application of best PSM practices?**

RAND

DB-434-AF-3 07/03

In determining how to apply best purchasing and supply management practices, the Air Force may wish to learn from commercial firms. As with the Air Force, commercial firms have had new reasons, such as increasing global competition, to make the most of their existing resources. The resulting increased reliance on outsourcing has led them to seek improvement in purchasing and supply management practices.

A growing body of research documents how innovative commercial firms are better managing their suppliers, supply base, and supply chains, and applying a number of best purchasing and supply management practices (Moore et al., 2002). These firms report that they have generated significant savings and measurable performance improvements from their efforts.

A first step toward improving purchasing and supply management is to conduct a spend analysis, or an analysis of expenditures along a number of dimensions, such as type of commodity and supplier, number of contracts and amount of expenditures, and other variables showing how

a firm currently spends its money on goods and services.⁴ Private firms place great value on such analyses; a recent survey of 157 supply chain executives revealed that 80 percent view spending analysis as “very important” or “critical” to their enterprise’s success (Aberdeen, 2002, p. 6). A spend analysis can help enterprises improve their purchasing practices in the areas where they are likely to produce the greatest benefit (Sawchuk, 2002).

A spend analysis can help the Air Force answer several questions that might help it target its purchasing and supply management initiatives.⁵ These include

- Where can the Air Force apply new purchasing and supply management practices to enhance and improve its performance (e.g., responsiveness, quality, reliability, flexibility, etc.)?
- Does the Air Force have the necessary data (e.g., centralized data on supply and management contracts) to support the use of these practices, and can the data it does have be used to identify opportunities for improvement?
- What can the Air Force do to better apply purchasing and supply management practices in procuring the goods and services that it needs?

In this report, we describe and provide an overview to our approach for a high-level spend analysis. We describe Air Force data available for such an analysis, review indicators of prospective Air Force opportunities for applying improved PSM practices, examine the insights available from the data that the Air Force already collects that are relevant to a spend analysis, and identify the lessons of greatest importance from current data. We selected the data, collected through the Air Force Contracting Data System, J001, on transactions of at least \$25,000, known as the “DD350” data (after the form used to report the contracts).

⁴ In fact, the Deputy Secretary of Defense recently assigned the Defense Procurement and Acquisition Policy office to lead an Integrated Process Team for reviewing the acquisition of services and completing a strategic spend analysis by September 15, 2003 (Wolfowitz, 2003).

⁵ Similarly, businesses are most likely to use a spend analysis to support their strategies for strategic sourcing, purchasing leverage, budgeting and planning, supplier performance, and supplier rationalization. See Aberdeen (2002), particularly p. 6.

2. OVERVIEW OF SPEND ANALYSIS

Outline

Overview of spend analysis

Indicators of prospective Air Force opportunities for applying PSM practices

Insights for the Air Force from data it already collects

Lessons for the Air Force

RAND

DB-434-AF-4 07/03

We begin with a description of a spend analysis and what the Air Force can learn from one. Second, we examine prospective opportunities that the Air Force has for applying better PSM practices, or areas it might want to examine more carefully to improve its supply strategies. Third, we offer some insights available from data that the Air Force already collects. Finally, we discuss steps the Air Force might take to better gather and analyze spend analysis data that can lead to improved PSM practices.

What Is a Spend Analysis?

An in-depth analysis of purchases

- By product or service, dollar value, number of contracts, supplier, purchasing organization, etc.

An in-depth evaluation of the supplier base

- By industry, firm, geography, risk, dependency, socio-economic factors, etc.

The application of analytical and benchmarking tools that link these analyses to help identify key indicators of prospective opportunities and current risks

RAND

DB-434-AF-5 07/03

First, a spend analysis is an evaluation of enterprise-wide

- Purchases, or what an enterprise is buying, including purchases by product or service, dollar value, number of contracts, supplier, and purchasing organization
- Supplier base, including suppliers by industry, firm, geography, risk, dependency or the percentage of business that a firm gets from a single customer, and socioeconomic variables.⁶

Although such an analysis can be time-consuming and labor-intensive, private enterprises have found that without a spend analysis it is difficult to identify prospective targets for applying better PSM practices, develop supply strategies for specific commodities, select the best suppliers, manage suppliers in a way to maximize rewards and minimize risks, and convince all senior leadership of the need to shift to best PSM practices and of the need for resources for the shift.

⁶ For a description of the characteristics, benefits, and challenges of three levels of spend analysis and their growing application in businesses, see Aberdeen (2002).

Spend analysis data can reveal targets of opportunity where altering purchasing practices could result in significant performance improvements or savings. Enterprises may have different divisions unknowingly buying from the same supplier. For example, within the Department of Defense (DoD), there are multiple contracts with a single firm for jet engine components, which may not be optimal. A spend analysis can identify such patterns and resulting opportunities to leverage buying power by consolidating contracts with and across suppliers.

A spend analysis combines analytical and benchmarking techniques (as developed by such consultants as Dun and Bradstreet and *Answerthink*) to help identify prospective opportunities and current risks in purchasing and supply management. Many enterprises classify or segment their purchases by dollar value (i.e., spend) or business volume (number of transactions or suppliers) of spend.⁷ More recently, innovative companies have begun to classify their spend by vulnerability (e.g., risk or exposure to market failure in procuring a good or service, strategic importance of purchased goods or service), and value (e.g., effect of a purchased good or service on overall costs or profits). Supply segmentation by vulnerability and value (also called positioning) is based on Modern Portfolio Theory for quantifying the relationships between risks and returns (Olsen and Ellram, 1997). Purchased goods and services with similar levels of vulnerability and value are grouped together for purposes of allocating purchasing resource and developing of supply strategies. For example, goods and services with the highest levels of vulnerability and value are often assigned the most senior/qualified personnel and most resources. These personnel then develop proactive supply strategies and adjust their sourcing approach and relationships to market and supplier conditions for the product or service. They also continually manage suppliers and the supply base.

In sum, a spend analysis integrates internal spend data and external supplier and market data and applies analytical and benchmarking techniques to help identify risks and opportunities for performance improvements and savings by applying best practices in purchasing and supply management. It reviews corporate family relationships to identify interrelated or duplicate suppliers. It can also be used to measure compliance with preferred vendor programs.

⁷ This is often called a Pareto or ABC analysis, because 70 to 80 percent of purchases may be concentrated in 10 to 20 percent of all goods and suppliers an enterprise uses.

RAND Approach to Spend Analysis

Reviewed literature on supply strategies including supply base stratification and spend analysis

Identified different sources of Air Force contracting and other data to “piece together” *total* spend

Identified indicators of prospective PSM benefits and risks

Analyzed data for prospective Air Force opportunities to apply best PSM practices

- Primary focus on the largest part of USAF spend - contract transactions \geq \$25K

Identified other information and analytic capabilities to help improve Air Force application of PSM practices

RAND

DB-434-AF-6 07/03

This research is a direct outgrowth of RAND research on the implementation of innovative PSM practices at commercial firms (Moore et al., 2002). The authors found that, among innovative private firms, spend analyses are emerging as a first step in developing supply strategies – a best PSM practice. As part of its effort to improve purchasing practices, the Air Force asked RAND to conduct a first-order spend analysis of Air Force data.

To examine how the Air Force might conduct a spend analysis, we first reviewed existing literature, interviewed managers at innovative firms, and gathered information at conferences for purchasing professionals. We then collected Air Force purchasing data to identify major components of total Air Force expenditures. In addition to the Air Force data, we also gathered DoD-wide data. Other DoD branches buy components similar to those the Air Force purchases (e.g., Navy purchases of aircraft engines). It may be that both the DoD and its individual branches can benefit from consolidating such purchases. There were some difficulties collecting this widely dispersed data, not all of which provided with equal fidelity information required for a spend analysis.

Once we put together as many major data components as possible (given project resources) on total Air Force expenditures, we analyzed the data for prospective opportunities to apply best PSM practices. For further in-depth analyses, we selected the data, collected through the Air Force Contracting Data System, J001, on transactions of at least \$25,000, known as the “DD350” data (after the form used to report the contracts). These data proved to be a rich source of information on Air Force purchases, although they had some problems. (See Appendix A for a discussion of quality issues in DD350 data.) We also identified areas where other information or analytic capabilities are needed to help the Air Force develop supply strategies and apply best PSM practices.

For our analyses, we tried to find data for intragovernment purchases made both within and outside the DoD. We found that these data are generally not collected in any central place within the buying or supplying organizations. They are available only within myriad Defense Financial Accounting Systems data, analysis of which was beyond the scope and resources of this project.⁸

⁸ Internal government providers have only a limited ability to identify Air Force or other DoD purchases and transfers. The most thorough data we found are from the General Services Administration (GSA), which, according to the GSA Federal Supply Service legacy system (FSS-19), provided the Air Force with about \$340 million of goods and services purchased from other firms in FY02. Without complete information on such purchases and transfers, it is impossible to do a complete analysis of all Air Force purchases. The GSA recently developed the capability to report “business” by major customer (i.e., service or agency). This should improve future spend analysis efforts.

Indicators of Prospective Rewards and Risks from Sourcing Decisions

Opportunities for savings

- Suppliers with multiple contracts
- Product or services with many suppliers
- Many independent buying organizations
- Cost growth exceeding PPI growth

Opportunities for performance improvement

- Varied/poor quality and delivery
- Long wait times
- Little information-sharing or supplier innovation
- Few multiyear contracts

Risks

- Only one supplier or limited competition/few bidders
- Suppliers with financial problems
- Low/variable demand
- No contract
- No supplier performance incentives or commitment to improve
- Inadequate/poor past performance information
- Inappropriate scales of work

RAND

DB-434-AF-7 07/03

Any sourcing decision has the potential to yield rewards or introduce risks to operations (Moore, 2002; Sawchuk, 2002). The rewards include opportunities for performance improvements and savings (Aberdeen, 2002). Risks arise in situations where overall performance could suffer as a result of issues related to supply chain or supplier performance, like delays in procurement of critical parts, variable quality of procured commodities, or increasing costs.

Opportunities for savings result from the potential for increased leverage, economies of scale or scope, and reduced transaction costs (Moore et al., 2002). A spend analysis that identifies suppliers with multiple contracts, similar products or services being provided by multiple suppliers, or different agencies purchasing identical goods or services offers evidence of prospective opportunities for savings through consolidation of purchases. A spend analysis finding supplier cost growth exceeding that of the Producer Price Index (PPI) indicates that a supplier may not be doing enough to control costs or to identify opportunities for savings (see Ellram, 2002, for an example of how John Deere measures cost savings relative to the PPI).

Opportunities for performance improvement are indicated by supplier performance data demonstrating varied or poor quality or delivery, long

wait times, little information-sharing or supplier innovation, and few multiyear contracts.⁹ Innovative suppliers may apply different strategies to different groups of customers, just as, for example, airlines provide better service to their most frequent flyers – and most profitable customers (Steel and Court, 1996).

Prospective sourcing risks can be indicated by cases with¹⁰

- Only one supplier or limited competition or substitution capabilities, which could lead to opportunistic behavior by suppliers (Williamson, 1985). Past reports of the Inspector General have documented opportunistic behavior by defense contractors, including overcharging or incorrectly billing for their work.
- Suppliers with financial problems, which may cause a supplier to go out of business or shirk on performance (due diligence regarding supplier finances and capabilities are among standard practices to prevent supplier problems or default).
- Low or variable demand making it difficult to find and retain good suppliers. (Suppliers prefer more stable workloads because highly variable workloads increase costs (Hahn, Kim, and Kim, 1986). Suppliers also need a stable amount of business to maintain specialized equipment, retain personnel, and otherwise continue operations.)
- No contract in place. Buyers may not stock low-demand goods, and some buyers such as the DoD may not have a contract in place to procure low-demand material. This can add time to the supply process when personnel have to identify one or more suppliers, go through the bidding process, select, negotiate, and finally establish a contract – all the while increasing the likelihood of permanently losing suppliers of unique DoD goods and services.

⁹ Short-term contracts often discourage suppliers from investing in performance improvements because the payback period may exceed contract length or otherwise be too short to cover their costs. Frequent contract rebidding also leads to a high supplier “churn” or turnover rate. This can affect quality as new suppliers have to learn anew specific contract requirements, interpret contract specification or work scope in new ways, and require time to develop and implement quality and process improvement practices, such as Total Quality Management, Statistical Process Control, or Six Sigma. In addition, short-term customers are likely to get a lower priority, and hence, responsiveness from new suppliers.

¹⁰ See Cox (2001a and 2001b) for more general discussion of these issues.

- No supplier performance incentives or commitment to improve, or a prescriptive, rather than an outcome-oriented, statement of work, which limits improvements. (The Air Force is in the process of developing more performance-based contracts.)
- Inadequate or poor past performance information, preventing identification of the most innovative firms.
- Inappropriate scopes of work, with contracts having too little or too much work, creating diseconomies of scope and leading to decreased performance or increased costs.

Some of these factors may be relatively simple to identify in existing data. Others must be researched more carefully using additional internal and external data sources.

Indicators showing prospective opportunities for savings or performance improvements or possible risks from applying best PSM practices can help in targeting such activities for PSM initiatives and tailoring supply strategies to specific circumstances. We examine in more detail opportunities the Air Force might find from indicators of prospective PSM rewards, including prospective savings indicated by products or services with many suppliers, suppliers with multiple contracts, many independent buying organizations purchasing the same good or service, and how potential benefits may be limited by sole source or reduced competition.

Data Availability and Quality Varies

Direct commercial purchases - \$49.5B in FY02

- Transactions \geq \$25K (96% of contract dollars) - DD350 data
 - Detailed information for each contract
- Transactions < \$25K (1% of contract dollars) - DD1057 data
 - Monthly summaries by purchase office
- Government purchase card transactions (3% of dollars and growing)
 - Monthly purchases by card “owner”

Intragovernment purchases ~ \$19.3B in FY02

- A lot of detective work required to identify \$9.6B in FY99 to DLA, GSA, TRANSCOM, DFAS, DISA
- RAND unable to identify and quantify some intragovernmental purchases

RAND

DB-434-AF-8 07/03

Collecting data for a spend analysis is not simple, particularly when data sources are not centralized, do not cover all purchases, and do not provide the fidelity needed for a good spend analysis. All this is true of Air Force purchasing data.

The best data are on Air Force direct purchases from commercial firms. These totaled \$49.5 billion in FY02.¹¹ The most complete information on direct purchases is the DD350 data on transactions of \$25,000 or more,

¹¹ Because of resource and time constraints, we analyze data for only one year. Contracts can be consolidated over time to realize additional savings from economies of scale and batch or lot buys (or purchases of large numbers of items whose subsequently reduced per-item cost helps offset startup costs). The multiyear deal the Air Force has negotiated with Boeing for support of the C-17 aircraft is one example of such consolidation, in which additional costs are incurred in one year to reduce costs in future years. The Air Force may pursue many other such consolidation opportunities. On large complex service contracts, for example, suppliers may spend hundreds of thousands of dollars on bidding alone; a multiyear contract can help contractors spread these costs over the life of the contract and provide services to the Air Force at a reduced price.

which make up 96 percent of contract dollars.¹² For these purchases, the Air Force has a great deal of information useful to a spend analysis, including how much and what the contract was for, which purchase office code issued the contract, which provider won the contract, industry classifications of purchases, number of solicitations and offers, and type of market (e.g., sole source or competitive). Although DD350 data offer considerable detail, they have some problems, such as missing or incorrect data or inadequate data fidelity for some elements that limit their value. For example, we found transactions with miscodes for Federal Supply Class (FSC), weapon system code, and business size. Furthermore, the DD350 does not allow multiple responses for individual items; hence, complex contracts for goods and services involving more than one FSC or weapon system will only have one FSC or weapon system listed for the transaction. (See Appendix A for a more thorough discussion of our DD350 analyses and the data quality problems encountered.) Despite these errors and limitations, the DD350 data can be used to make the case for implementing best PSM practices and targeting prospective areas to apply them, but they should not be used to make final decisions to develop specific supply strategies without additional data validation, cleaning, enhancement, and analyses by substantive experts and manual resolution of anomalies.

Other sources of DoD direct purchasing data are far less rich. For transactions of less than \$25,000, which make up less than 1 percent of Air Force contract dollars, only monthly summaries on the number of contracts issued by each purchase office code, the total amount of purchases, and the number of small or disadvantaged businesses receiving contracts are available. For government purchase card transactions, which make up about 3 percent of direct purchases, only information on purchasers, amount of purchase, and merchant code is available. The number of transactions and dollars spent using purchase cards is growing and making up an increasing portion of the total spend. This may reduce the fidelity of future spend analyses.

We assume that the remaining Air Force funds spent on goods and services, totaling \$19.3 billion in FY02, are for intragovernment purchases. These would include fees paid to the Defense Logistics Agency (DLA), to the General Services Administration (GSA), or to other military services (e.g., payments for the use of facilities under the control

¹² Our breakdown of direct commercial purchases by contracts of at least \$25,000, by contracts less than \$25,000, and by government purchase cards does not add up to 100 percent because of rounding errors.

of other DoD branches). We were able, with significant effort, to track \$9.6 billion of such purchases in FY99 but were unable to identify or quantify the remainder.¹³ Because of the difficulties in identifying variables needed for a spend analysis of intragovernmental purchases or commercial purchases of less than \$25,000, we focus this research on commercial purchases exceeding \$25,000, while noting the need for more detailed data on other purchases.

¹³ AFMC/PKV used AFMC's Automated Business Services System (ABSS) database to estimate AFMC FY01 Military Interdepartmental Purchase Requests (MIPRs). Because the ABSS is not mandatory for the Air Logistics Centers to use and it is not used by the Standard Systems Group (SSG) and some small detachments, FY01 MIPR spend is understated. Nevertheless, they identified over \$3.1 billion (20,000 individual line items/records) in MIPRs for AFMC in FY01 of which \$734 million was mandatory or "reimbursable" categories (i.e., fuels, funding, printing, R&D, test, vehicles, and utilities) that were excluded from detailed analysis. AFMC assigned categories to the data based on line item descriptions, nature of service organization, and nature of requesting organization. The top five categories of AFMC MIPR spend representing 74 percent of nonmandatory dollars were Information Technology (IT)(17 percent), Unknown (16 percent), Advisory and Assistance Services (A&AS) (16 percent), research and development (R&D) (16 percent), and materials/equipment/parts (10 percent). \$346 million or 9.7 percent of all nonmandatory MIPRs went to GSA (Morris, 2003)

Summary of FY02 Air Force Transactions \geq \$25K Reveals Complexity of Air Force Purchases

Prospective target areas

- \$47.4B in purchases
- 235 purchase office codes
- 21,093 contracts
- 10,130 contractor ID codes
- 1,167 FSC codes

Prospective challenges

	<u>% of \$</u>	<u>% of contracts</u>
• Sole-source contracts	46	31
• Three or more bids	21	32
• Small business contracts	12	54
• Set-aside contracts	4	12

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-9 07/03

Accounting for most of the dollars that the Air Force spends on weapons, goods, and services, and nearly all of the dollars spent on direct commercial purchases, the DD350 data provide a broad overview of all Air Force purchases. They show that a large array of “buyers” (represented by more than 200 purchase office codes¹⁴) procure goods and services for the Air Force through an enormous number of contracts (more than 21,000 for goods and services costing at least \$25,000) with a large number of contractors (represented by more than 10,000 contractor ID codes) in a very wide range of industries (represented by nearly 1,200 FSC codes, a more finely grained federal government indicator of industries than the North American Industry Classification System, or NAICS codes) producing goods and services ranging from janitorial services to computers and weapons.

The DD350 data also help outline challenges that the Air Force faces in implementing best PSM practices. Sole-source and single-source

¹⁴ For data collection purposes, the Department of Defense assigns codes to each unique purchasing (or contracting) activity. Because there can be more than one purchasing activity and hence code at a location, SAF/AQC specifically requested that we use the term “purchase office code,” which is also the name of the data element in the DD350 data, rather than “purchasing office” or a similar variant in our briefings and reports.

contracts or those for goods and services for which there is only one qualified supplier or for which the Air Force has developed a single supplier account for nearly half of all DD350 contract dollars, but only about one in four of the total number of contracts for goods and services. (Sole- and single-source contracts are not differentiated in the database; hence, our discussion of statistics on sole-source contracts can also include single-source contracts.) This means that the Air Force is purchasing many goods and services that may not be subjected to competition or substitution, thereby limiting the bargaining power the Air Force has in procuring them. Nevertheless, some innovative PSM techniques could still be applied.¹⁵ Single-source contracts themselves may be desirable even when there are credible substitutes for the procured goods and services if such contracts encourage the supplier to cooperate in cost reduction and performance improvement initiatives. Potential failures such as loss of production at one facility can be overcome in several ways; for example, Honda of America uses single sources, but requires dual facilities to limit its vulnerability from losing the production at one facility. (For a discussion of Japanese, American, and Korean sourcing practices, including single-source contracts, see Dyer, Cho, and Chu, 1998.)

Almost half of individual Air Force contracts for goods and services costing at least \$25,000 are with small businesses. These contracts account for only 12 percent of contract dollars spent for goods and services. This indicates that the Air Force may be incurring a large proportion of its transaction costs on a relatively small proportion of its spend. About one in four contracts the Air Force has with small businesses, or 12 percent of all DD350 contracts, are set-aside contracts for small and disadvantaged businesses. Because of the socioeconomic goals it also pursues, the Air Force may face some challenges in introducing best PSM practices such as supply base rationalization and consolidation of suppliers. Implementing these practices can result in much larger contracts and can reduce the number of Air Force suppliers by half or more, including small and disadvantaged businesses that may not be able to provide the larger scope of services required in consolidated contracts or to partner with other firms both large and small

¹⁵ For example, "If a supplier makes the part only for Lockheed Martin, they naturally increase the price...if a certain supplier is not providing the level of savings desired and is bidding on other spend areas or business units, because it is cross-business, the Strategic Sourcing Solutions group can leverage that information and work with the supplier" (Hannon, 2004).

to do so. We will later review some ways that PSM can be improved while continuing to fulfill socioeconomic goals.

USAF Currently “Segments” Its Spend by Type of Purchase Office

<u>Commodity</u>	<u>Purchase Office</u>
Weapons	AFMC/AAC, ASC, ESC, SMC
Sustainment	AFMC/PK, ALCs
Operations	MAJCOMs/LGC
DoD consumables	DLA
Government generics	GSA
Small contracts and purchase cards	MAJCOMs/functionals

RAND

DB-434-AF-10 07/03

The Air Force already does some general segmentation of its spend by assigning responsibility for different kinds of purchases to different offices. (See Steele and Court, 1996, for a thorough discussion of the spend segmentation process and its use in developing supply strategies, and Dyer, Cho, and Chu, 1998, for an example of spend segmentation in the automotive industry.) Weapons purchases are primarily made by Air Force Materiel Command (AFMC) organizations such as the Air Armament Center (AAC), the Aeronautical Systems Center (ASC), the Electronics System Center (ESC), as well as the Space and Missile Systems Center (SMC) within the Air Force Space Command. Sustainment purchases, or purchases of goods and services supporting Air Force weapons, are primarily made by AFMC contracting personnel at the Air Logistics Centers (ALCs). Purchases of goods and services for supporting operations are made primarily by the individual major commands (MAJCOMs) and their contracting personnel (LGC). Purchases of many consumable goods and services, or supplies that are consumed in use (e.g., ammunition, clothing, food, fuel, medicines, nonreparable parts), are made primarily through the DLA, and generic government goods such as office supplies are purchased primarily through the GSA. Contract purchases for goods and services costing less than \$25,000 are made primarily by the major commands and their

contracting offices, and government purchase card purchases are primarily made by functionals within the major commands.

FY02 Contracting Workload Varied Among Air Force Purchase Office Codes and Spend Segments

- **235 Air Force purchase office codes**
- **Sustainment and operational offices write more contracts to more contractors in more FSC codes**
 - **Complex weapons systems contracts require more effort and expertise**

	Weapons	Sustainment	Operational	Other
No. of purchase office codes	45	36	117	37
Total dollars spent, \$M	19,387	10,354	13,132	4,532
Average spend, \$M	431	288	112	122
Maximum, \$M	3,715	1,523	1,405	1,061
Average no. of contracts	28	121	137	77
Maximum	146	545	829	276
Average no. of FSC Codes	11	26	61	14
Maximum	49	84	206	68
Average no. of contractor ID codes	21	59	102	56
Maximum	108	300	461	196

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-11 07/03

Examining Air Force purchases by different segments of its spend, both direct and indirect, as defined by commodity type and costs, risks of provision, competitiveness of market, and other variables also examined in private spend analyses, and the offices responsible for them further illustrates purchasing and supply management issues (for more definitions and formal discussions of spend analyses, see Steel and Court, 1996; and Dyer, Cho, and Chu, 1998). Buyers purchasing weapon systems spend the most total dollars, whereas buyers purchasing goods and services for sustainment of these systems or to support operations write more contracts. Procurement activities for weapons systems account for larger purchases and are usually done by offices with staffs of military or civilian personnel from higher ranks or grades. Offices purchasing operational goods and services tend to purchase a much wider variety of goods and services and have staffs from lower ranks and grades with more narrow training.

In FY02, the average weapons purchase office code had only 28 contracts for goods and services costing at least \$25,000, whereas the average sustainment purchase office code had 121 such contracts and the average operational purchase office code also had 137 such contracts. Some sustainment and operational purchase office codes handled more than

500 such contracts; no weapons purchase office code handled more than 150 such contracts. (Information on purchase office code size or number of personnel is not readily available.)

Sustainment and operational procurement personnel dealt with a far greater range of industries and contractors than weapons procurement personnel. The average weapons purchase office code had contracts in only 11 industries, as designated by FSC codes, whereas the average sustainment purchase office code had contracts in 26 industries, and the average operations purchase office code had contracts in 61 industries. Some operational purchase office codes had contracts in more than 200 industries, but no weapons purchase office code had contracts in more than 50 industries.

The average weapons purchase office code had contracts with 21 contractors, as identified by contractor ID codes, whereas the average sustainment purchase office code had contracts with 59 contractors, and the average operational purchase office code dealt with 102 contractor ID codes. Some sustainment and operational purchase office codes dealt with 300 or more contractors, but few weapons purchase office codes dealt with more than 100 contractor ID codes.

One implication of this pattern is the difficulty operational procurement personnel are likely to have becoming experts on the industries and contractors with which they must deal. Anecdotal evidence suggests that—despite expectations that they will research best industry practices—personnel may not have much time to do thorough industry research and to find ways to reach better deals for the Air Force. Rather, much of their time is spent merely identifying suppliers and writing contracts. This prevents them from becoming more knowledgeable about the industries in which they buy goods and services or the companies with which they do business.

Data Issues

Additional data used in these analyses:

- DoD-wide DD350 data file for non-Air Force purchases
- Dun & Bradstreet DUNS file linking contractor ID codes to the parent firm ID code
- Financial data of suppliers (to determine the percentage of their business with the Air Force and DoD)
- Master file of Air Force purchasing offices and guidelines for segmenting spend by category

Data challenges:

- Linking Air Force contract data to NSNs
 - No single Air Force data file links NSNs to contracts
 - Very few contracts have NSNs as CLINs
- No data on contracts of < \$25K, purchase cards, or other government transactions

RAND

DB-434-AF-12 07/03

In addition to the Air Force DD350 data, we gathered other data to enhance the quality of this spend analysis. First, we acquired the DoD-wide DD350 data. This helped us identify other DoD purchasers for commodities such as jet engine components and the possibilities for consolidating such purchases. Second, we obtained the DoD Dun & Bradstreet file linking defense contractor ID codes to their parent companies. Identifying total purchases made from any particular company can be difficult because many DoD suppliers have multiple divisions, names, locations, and contractor ID codes. By using the DoD Dun & Bradstreet file, we were able to aggregate DD350 purchases for each parent company and identify the leading providers of all Air Force goods and services as well as those for some key commodities. Nevertheless, such data must be interpreted cautiously. Mergers, acquisitions, and sales make the relationship between subsidiaries, their locations, and parent companies a moving target, leading to errors such as those we found in the Dun & Bradstreet file that the DoD uses to link subsidiaries to parent companies, including an error linking a totally unrelated subsidiary to a large parent firm.

We also used publicly available Securities and Exchange Commission (SEC) data to determine the Air Force and DoD percentage of their top

suppliers' sales. This helps us learn the importance of the Air Force and the DoD to their leading suppliers and to determine whether the Air Force and the DoD are significant or minor customers for these firms.

We were not able, within project resources, to get additional data to address some of our most pressing data challenges. Among these challenges is the difficulty in linking contract data to National Stock Numbers (NSNs), or numbers for specific parts used in maintenance and repairs—a level of detail often reached in the private sector. The contracts database provides only very general information on the type of good or service purchased, and very few contracts have Contract Line Item Numbers (CLINs) that specify the NSNs covered by the contract. Without matching contracts with procurement of particular parts, we cannot easily link available data on weapon system and supply chain performance to contracts for the purchases of goods and services. This makes it difficult to determine the effect of contract, supplier, and supply chain performance on weapon system availability. It is similarly challenging, without very intensive labor, to link to particular contracts and suppliers data on backorders or parts not in stock but required to restore equipment to mission-capable status.

As previously noted, there is also no easy way to obtain contract purchase or expenditure data for a spend analysis on purchases of goods and services costing less than \$25,000, or on goods and services procured with purchase cards or intragovernment transactions.

Further Analysis Requires Substantial Information and Expertise

User needs, preferences, priorities

Markets

- **Leading suppliers**
- **Bundling practices**
- **Terms and conditions**
- **Performance measurement and incentives**

Technology

- **Latest processes, materials, innovations**

Potential suppliers

- **Management style (e.g., centralized or autonomous units)**
- **Breadth of core competencies**
- **Synergy of goods and services**

RAND

DB-434-AF-13 07/03

Conducting a complete Air Force spend analysis would require substantial additional information and analysis, including the needs, preferences, and priorities of the ultimate users of the goods and services and other information beyond that available in the DD350 data. As mentioned above, DD350 transactions have missing and incorrect as well as inadequate data. Many of these errors and anomalies, such as the wrong coding of a weapon system, require review by experts to catch and correct. Research is needed on leading suppliers, reasons for their poor or superior performance, conditions of their contracts, and how they typically group goods and services for purchase. Such information can help purchasers to structure contract requirements to reflect leading industry practice and attract the best suppliers to bid. Because DoD and Air Force buyers need to balance prospective savings, performance improvements, risks, socioeconomic and other goals, and other regulations that are not always present in the private sector, not all best commercial practices may be appropriate in a government or military setting. This does not mean, however, that all such practices should not be explored.

Knowing the practices and processes typical to the industry, particularly the latest technology and innovations, will enable the purchaser to select

a supplier who does not lag the rest of the field. Knowing how much suppliers are investing in new technology also helps to ensure that the supplier will remain technologically superior.

Information on potential suppliers, their management, and their competencies also helps the purchaser make the best supplier selection. Contracts with highly centralized firms may be an appropriate target for consolidation. Contracts may not be as easily consolidated with a firm such as General Electric that has very autonomous business units for quite distinct products, such as jet engines, plastics, and medical equipment. A thorough spend analysis also requires information on the core competencies of and synergies within a firm.

Spend Analysis Must Take into Account Valid Motives for Current Purchases

A strong rationale may underlie current ways of purchasing many goods and services. For example,

- **Need for diverse requirements, unique specifications, or standardization**
- **Lack of economies of scale or scope or tradeoffs among them**
- **Separate pots of funding**
- **Payoffs from competition may not recover initial investment to develop additional sources**
- **Independent supplier business units**
- **Political pressures for specific suppliers**

Data analysis is necessary, but not sufficient for selecting PSM initiatives – “The devil is in the details”

RAND

DB-434-AF-14 07/03

Personnel conducting a spend analysis must realize that existing practices were not developed in a vacuum. There may be valid reasons for the current ways of purchasing goods and services. These must be fully researched and understood before new PSM practices are used to develop a supply strategy and applied to a specific purchase.

Potential limits to using many best PSM practices may include unique requirements limiting opportunities for consolidation. Air Force grounds maintenance needs, for example, include irrigation in the southwest and snow removal in the northeast. The Air Force Academy, for example, needs refuse collection on weekends because of the athletic events held there.

In some cases, there may be no opportunities to improve purchasing and supply management. There may be no benefits from economies of scale or scope,¹⁶ different sources of funds that cannot be consolidated, initial

¹⁶ There may, for example, be no economies of scale available in grounds maintenance, because of the site-specific nature of the service, but there may be economies of scope available in which grounds maintenance is included with another facility support service. Conversely, there may be economies of scale available in elevator service contracts, particularly for several locations, but little economy of scope available unless

investment requirements that would exceed the benefits for developing a second source of goods or services, suppliers with independent business units that cannot consolidate contracts, and political pressures for specific types of suppliers. Hence, significant research, analysis, data validation, cleaning and enhancement, and other activities beyond just an analysis of contracts are required before best PSM practices can be confidently applied to develop purchase and supply strategies, select suppliers, and negotiate contracts for specific groups of goods and services.

prospective facility management service suppliers have their own elevator support contract with terms equal to or better than those the Air Force or DoD could get directly.

3. INDICATORS TO TARGET PROSPECTIVE PSM INITIATIVES

Outline

Overview of spend analysis

Indicators of prospective Air Force opportunities for applying PSM practices

Insights for the Air Force from data it already collects

Lessons for the Air Force

RAND

DB-434-AF-15 07/03

Although DD350 data do not suffice for a complete Air Force spend analysis, they do make a good case for implementing best PSM practices and indicate prospective opportunities for the application of PSM practices. These include consolidating contracts for the same good or service, within the same commodity group, with the same commercial firm, or across different purchase office codes.

Having Many *Contracts* in the Same Federal Supply Class Indicates Prospective Contract Leverage Targets

FSC	# Ctrx	% POs	# Ctr ID Codes	% Ctrx Sole Srce	\$M	% \$ Sole Srce	# PO Cds
Passenger air charter service	770*	97	38	<1	353	<1	2
Maintenance/other miscellaneous buildings	483	23	349	35	243	23	72
RDTE/other defense-applied research	449	<1	269	3	310	1	21
Office furniture	403	24	256	2	95	1	91
Maintenance/office buildings	387	23	302	33	196	51	74
Automated data processing equipment (ADPE) system configuration	344	33	277	19	342	4	76
Other professional services	331	39	273	37	306	23	66
Other automated data processing (ADP) and telecommunications	330	16	277	20	485	8	39
Gas turbines and jet engines aircraft and components	329	17	105	27	2,084	73	5
Airframe structural components	311	47	133	58	1,137	69	26

Source: FY02 DoD-wide DD350 data.

*745 are coded as purchase orders against master solicitations.

RAND

DB-434-AF-16 07/03

One particular indicator of a target for PSM improvement is a large number of *contracts* in a federal supply class. FSC codes offer a more finely grained indicator of a particular group of goods and services than the broader NAICS codes. Here, we review, for the FSCs in which the Air Force has the most contracts,

- # Ctrx, or the number of contracts for each FSC
- % POs, or the percentage of contracting actions that are actually purchase orders, some of which may be off master solicitations
- # Ctr ID Codes, or the number of different contractor ID codes for these contracts
- % Ctrx Sole Srce, or the percentage of the number of contracts that are sole-source contracts
- \$M, or the total money spent on these contracts in millions of dollars
- % \$ Sole Srce, or the percentage of dollars spent on contracts coded as sole source
- # PO Cds, or the number of different purchase office codes

Large numbers of contracts for similar goods or services might indicate opportunities for consolidating contracts for similar goods and services. In areas such as maintenance or RDTE (research, design, testing, and evaluation activities), the Air Force has hundreds of contracts with hundreds of suppliers. The large number of contracts for airframe structural components may be a prospective contract leverage target, particularly since 58 percent of these contracts are coded as sole-source contracts, representing 69 percent of all contract dollars for this commodity. Similarly, 73 percent of the contract dollars, and 27 percent of the contracts, for the \$2.1 billion of gas turbines and jet engines the Air Force purchased in FY02 are in sole-source contracts, indicating another prospective contract leverage target. Additional contract leverage targets may exist for commodities with high numbers of contractor ID or purchasing office codes.

DD350 data on numbers of contracts alone do not always indicate prospective contract leverage targets. Our research found, for example, that 97 percent of the "contracts" for passenger air charter service are actually purchase orders issued against master solicitations. Clearly contextual knowledge of data is needed for any spend analysis.

Having Many *Dollars* in the Same Federal Supply Class Indicates Prospective Contract Leverage Targets

	FSC	\$M	% POs	# Ctr ID Codes	% Ctrx Sole Srce	# Ctrx	% \$ Sole Srce	# PO Cds
1	Aircraft fixed wing	10,648	2	39	68	123	67	20
2	Gas turbines and jet engines aircraft and components	2,084	17	105	27	329	73	5
3	Miscellaneous items	1,453	53	147	18	167	96	52
4	Systems engineering services	1,311	6	174	66	271	74	48
5	Airframe structural components	1,137	47	133	58	311	69	26
6	Air charter for things	1,043	6	29	2	53	<1	3
7	RDTE/aircraft-engine/manufacturing development	944	0	11	68	19	32	9
8	Bombs	933	18	11	79	28	17	4
9	Engineering technical services	787	7	188	31	218	34	61
10	Space vehicles	766	0	14	38	16	5	6

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-17 07/03

Here we review the commodities for which the Air Force spends the most money. A large number of *dollars* spent in the same FSC can also indicate targets for cost and performance improvements. The Air Force, not surprisingly, spends more money on procuring fixed wing aircraft than on goods or services from any other FSC code. Although the complexity of these systems and the great deal of specific customer expertise required by these systems may limit opportunities for best PSM practices, there may be other opportunities to generate performance improvements or savings, perhaps by agreeing to help contractors improve and share any cost savings with them.

The Air Force spends less than one-fourth as many dollars on the second largest FSC category, gas turbine and jet engine components, but it uses nearly three times as many contracts to do so. This area is the focus of recent RAND research evaluating implementation of PSM practices for the Air Force.

Having Contractor ID Codes with Many Contracts in FY01 Indicates Prospective Leverage Opportunities

Contractor ID Codes w/ Multiple	%	Avg # ≥ 2	Max*	Air Force Concerns
Contracts	34	4	197**	Indirectly paying contractor's bidding/contract administrative costs
Purchase offices codes	24	4	80	Indirectly paying contractor's marketing costs
FSC codes	31	4	56	Contractor's core competencies? <ul style="list-style-type: none"> • # 1 or 2 in industry? • Investing in improvements?

Underestimates - many firms have multiple contractor ID codes.

Source: FY02 DoD-wide DD350 data.

*Contracts: Southwest Airlines; purchase office codes: Dell Computers; FSC codes: Science Applications International Corporation (SAIC).

**Purchase orders against a master contract rather than individual contracts.

RAND

DB-434-AF-18 07/03

Contracting inefficiency may also occur when the customer is buying goods or services from the same company using multiple contracts. Each different contract involves transaction costs. Having many different contracts lessens the opportunities for economies of scale or scope.

The chart above shows that 34 percent of the contractor ID codes from which the Air Force buys goods or services appear in multiple *contracts*. For contractor ID codes having more than one Air Force contract ("Avg # ≥ 2 "), the average number of contracts held is four, with a contractor ID code held by Southwest Airlines having 197 "contracts." As mentioned above, these are actually purchase orders against a master solicitation, but there are other cases of contractor ID codes being linked to multiple contracts in which the Air Force pays for the contractor's duplicated bidding and contract administration costs through higher prices. In FY00, for example, a contractor ID code held by UNICOR (Federal Prison Industries, Inc.) was linked to 212 separate contracts.

Having many purchase office codes associated with the same contractor is another indicator of inefficiency. Among Air Force contractor ID codes, 24 percent have contracts with more than one Air Force buyer as identified by purchase office codes. Among contractors dealing with more than one Air Force buyer, the average number of contracts issued is

four, with Dell Computers having contracts with 80 Air Force purchase office codes. In FY00, UNICOR had contracts with 55 Air Force purchase office codes. When the same contractor has contracts with different offices of the same purchaser, the purchaser, whether a private enterprise or a public purchaser such as the Air Force, incurs indirect marketing costs of each contractor in selling services to more than one activity of the purchaser. (Many defense contractors have a large number of retired DoD personnel who sell to various DoD organizations.) In addition, purchasers may find it more difficult, and costly, to manage unnecessarily large numbers of contracts with the same provider.

Another question arises when the same contractor sells many different goods or services. Nearly one-third, or 31 percent, of Air Force contractor ID codes are associated with more than one FSC code. That is, these sellers are providing goods and services in multiple industries. Buyers should make sure that a particular supplier has competencies in producing the various goods and services it is providing. Science Applications International Corporation (SAIC) provides goods and services to the Air Force from 56 FSC codes, representing a tremendously wide range of industries. Whether it has industry-leading expertise in all these areas is a valid matter for investigation.

As we will see in considering PSM improvements the Air Force might undertake with its largest contractors, the above analysis actually underestimates the number of multiple contracts with the same company, as well as the higher indirect costs the Air Force may be incurring from multiple contracts with the same provider, because many Air Force suppliers have multiple contractor ID codes.

Having the *Same Supplier* with Multiple Contracts* Indicates Prospective Leverage Opportunities

	Ctrx	# Sole Source	#s M	% \$ Sole Source	# Ctr ID Code	# PO Cds
Northrop Grumman Corporation	361	207	2,135	70	66	125
Lockheed Martin Corporation	319	187	10,224	68	66	90
The Boeing Company	283	165	8,695	34	40	84
Honeywell International Inc	249	184	451	60	35	47
Raytheon Company	241	146	1,855	58	43	74
United Technologies Corporation	230	152	1,707	90	28	31
Southwest Airlines, Co	197**	0	12	0	1	1
Federal Prison Industries, Inc	149	0	22	0	8	52
British Aerospace Plc	148	92	359	53	28	49
Goodrich Corporation	132	85	176	91	23	22
Miami Air International, Inc	118	1	28	<1	1	1

Source: FY02 DoD-wide DD350 data.
 *A moving target because of ongoing acquisitions, sales, and mergers.
 **All are purchase orders against a master solicitation.

RAND

DB-434-AF-19 07/03

Private sector firms are significantly reducing the number of contracts they have with the same supplier to reduce transaction costs and leverage their spend with the supplier in a way that may not have been visible before conducting a spend analysis. Here, we examine specific firms with large numbers of dollars and contracts with the Air Force. Many of these firms also have a large number of sole- or single-source contracts, or contracts in which a firm is the sole provider of a specific good or service or for which the Air Force has developed a single supplier. Consolidating these into a smaller number of larger contracts may yield economies of scale or scope, reduce transaction costs for both buyers and suppliers, and better leverage spending. Because larger contracts typically get more attention from suppliers, consolidation may also result in better performance. (Consolidation could be limited by requirements for competition. However, where there is only a single source, competition rules do not apply.)

The contractor with the largest number of Air Force contracts, and the supplier receiving the most contract dollars, is Northrop Grumman. Of its contracts with the Air Force, 57 percent are sole source, representing 70 percent of its contract dollars. Large numbers of contractor ID and purchase office codes linked to Northrop Grumman indicate that Air

Force purchases from the firm are fragmented and that consolidation of some purchases might realize benefits and savings. The large number of dollars Northrop Grumman is receiving in sole-source contracts may also indicate fruitful opportunities for consolidation. Similarly, 59 percent of Lockheed Martin's contracts with the Air Force, representing 68 percent of its \$10.2 billion in contract revenues from the Air Force, are sole source for which consolidation might realize some benefits and savings.

Such data, however, do not always indicate prospective targets for PSM improvements with a particular firm. The Southwest Airlines and Miami Air International "contracts" are actually purchase orders against a master solicitation with the company, which helps reduce transaction costs for the Air Mobility Command and for Southwest Airlines and Miami Air International and establishes appropriate security procedures regarding movement of military personnel.

Suppliers with multiple contracts are also a changing target for PSM improvements because of ongoing acquisitions, sales, and mergers. The data for Northrop, for example, changed after its acquisition of Litton and changed again after its acquisition of TRW.

Many Buyers Making Similar Purchases Indicate Prospective High Purchasing Costs

FSC Codes	# Purchase Office Codes	Total # Contracts	# Contractors	Total (\$ Millions)
Office furniture	91	403	256	95
Radio and TV communications equipment except airborne	79	141	92	114
Miscellaneous communications equipment	77	246	185	255
Custodial-janitorial services	77	208	156	148
ADPE system configuration	76	344	277	342
Trash/garbage collection services-including portable sanitation services	74	129	93	51
Maintenance/office buildings	74	387	302	196
Maintenance/other miscellaneous buildings	72	483	349	243
Maintenance/other administration and services buildings	69	296	224	102
ADP software	68	298	255	211

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-20 07/03

Here we examine how the Air Force procures particular goods and services through many different purchase office codes. Just as each individual contract issued involves distinct costs, each separate purchaser has distinct transaction costs.

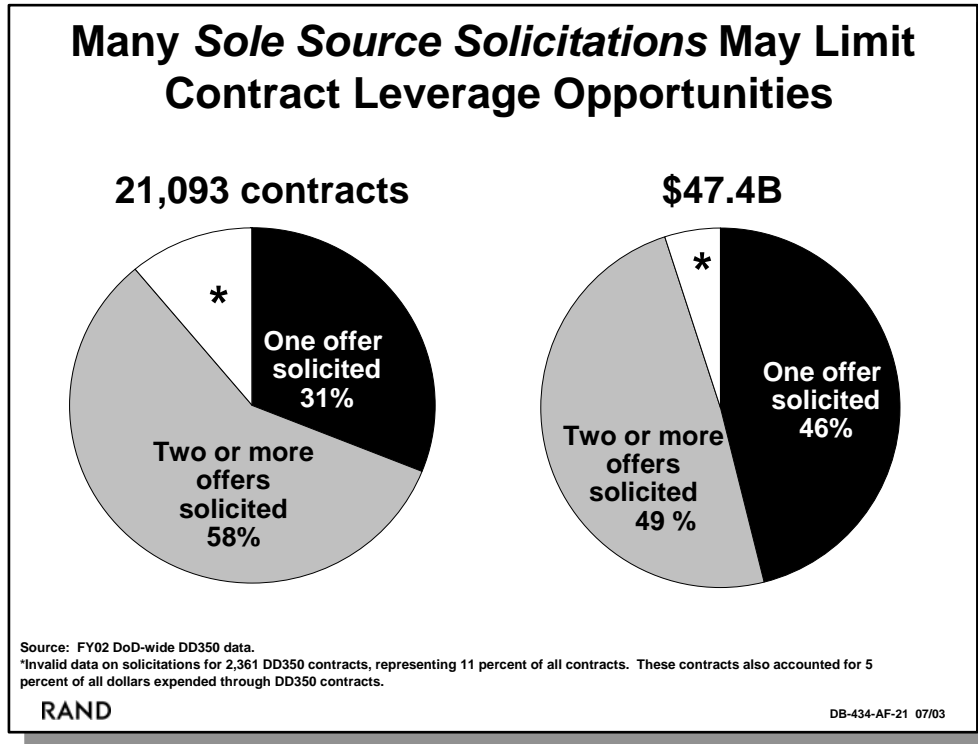
The costs for researching the best suppliers, soliciting contracts, selecting from among them, structuring the relationship, writing and issuing the contract, and managing suppliers can be substantial. Performing the market research necessary to develop expertise in various industries can be time consuming and costly. Thus, dispersing the responsibility for purchasing can lead to redundant costs and inefficiencies in contracting.

Multiple purchase office codes buying goods or services in the same FSC may indicate that the Air Force has opportunities to realize lower transaction costs, greater efficiencies, and substantial economies of scale and scope by consolidating its purchasing efforts.

Analyzing purchases by FSC, we find the Air Force has hundreds of contracts with hundreds of contractors providing office furniture or custodial and janitorial services. Although these contracts involve relatively small amounts of money, they may present opportunities to realize savings or performance improvements by reducing transactions

costs and by attracting and selecting better suppliers. Many of these contracts are for services that are performed on Air Force installations. Having fewer contractors with longer terms might make it easier to assure security.

Such centralized approaches can be tailored to particular needs (Moore et al., 2002). Although many private enterprises centralize their purchasing activities, some centralize the development of their supply strategies and the management of their supplier relationships but decentralize their execution (e.g., by placing purchase orders against central agreements), whereas others may have the business unit with the most expertise or strategic need for the good or service establish the supplier relationship with participation from other business units that may also need the same goods or services from the same supplier. In some cases, unique local requirements may demand local purchasing and control, yet even here some centralization (and PSM improvements) may be possible. For example, many enterprises have national food service agreements yet allow each location to devise menus for local tastes and incomes.



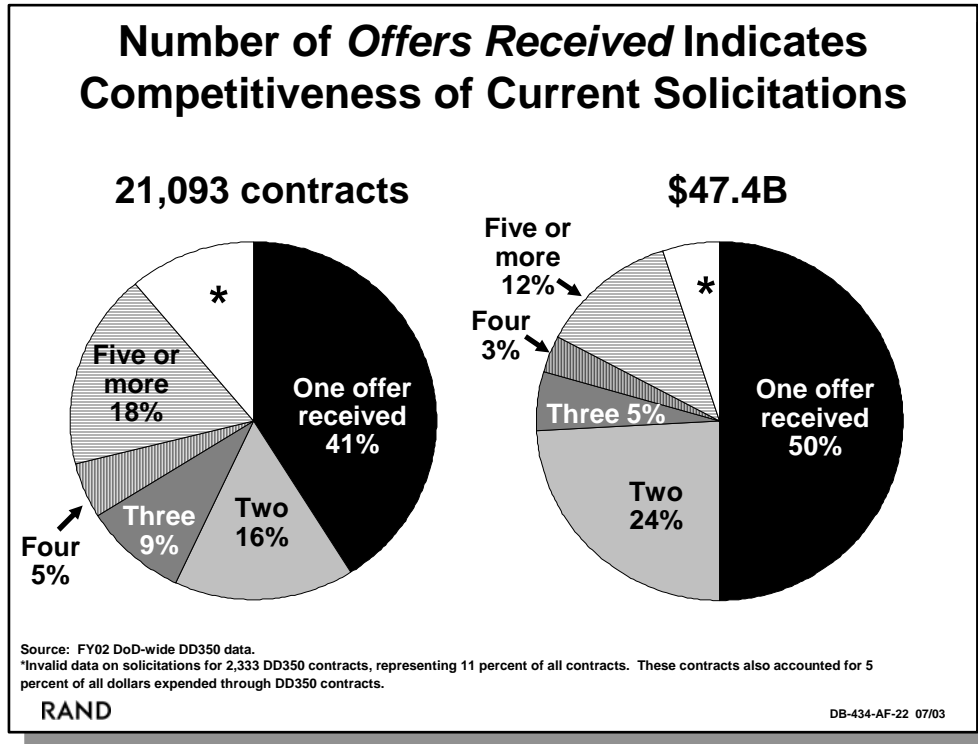
A great number of Air Force contracts are for goods or services where only one supplier is judged to have the required capability. These single- or sole-source contracts account for 31 percent of Air Force DD350 contracts and 46 percent of total dollars spent (there were invalid data for 2,361 contracts in FY02). Without competition or reasonable substitutes, the opportunities for gaining leverage over such suppliers may be limited. They may be reluctant to reduce costs or improve performance if such efforts require investment on their part and if the Air Force has no alternative source. (Some suppliers, however, may welcome the opportunity to serve their customers better, to gain further business, or even to attract other customers.)

Nevertheless, the Air Force may have opportunities for cost savings in sole-source contracts. It can consolidate multiple sole-source contracts or negotiate a multiyear contract with the same sole-source supplier, reducing transaction costs for both the supplier and the Air Force.¹⁷

¹⁷ Some regulations limit contract length. The Service Contract Act limits contract length to five years. In addition, Federal Acquisition Regulations note “Unless otherwise approved in accordance with agency procedures, the total of the basic and option periods shall not exceed 5 years in the case of services, and the total of the basic

Given a larger volume of assured business and lower administration costs, suppliers may be willing to offer price breaks. Furthermore, now that acquisition reform permits past performance to be considered in source selection, the Air Force may be able to use a firm's interest in bidding for competitive business to encourage better performances on its sole-source contracts. In particular, because defense firms with sole-source contracts also have competitive contracts, the Air Force could use performance on the latter to improve performance on the former (on which some suppliers may have engaged in opportunistic behavior).

and option quantities shall not exceed the requirement for 5 years in the case of supplies" (Part 17.204, paragraph e). The "AFMC Award Fee and Award Term Guide" (HQ AFMC Directorate of Contracting, 2000), notes conditions under which award term contracts may extend beyond the five-year limit: "Award term may also be applied with Service Contract Act (SCA) contracts and extend the contract beyond the five year limitation. Department of Labor (DoL) Regulation (29 CFR 4.143 – Effects of changes or extensions of contracts, generally) treats extending terms of contracts pursuant to an option clause or otherwise – so that the contractor furnishes services over an extended period of time rather than being granted extra time to fulfill his original commitment – as a new contract in respect to the SCA's provisions. Therefore, modifications to add additional contract term to a basic contract or to extend a contract-ordering period are appropriate to extend a service contract falling under the SCA past the five-year limitation. A new or revised wage determination, however, must be inserted into the contract for the new term in order to be in compliance with the SCA."



Statistics on the number of offers received by the Air Force to provide it with goods and services underscore the limited opportunities it may have in seeking PSM improvements.

More than two in five, or 41 percent, of Air Force solicitations for goods and services costing at least \$25,000 received only one offer (on contracts for which data on number of offers received are available).¹⁸ Most, or 57 percent, received no more than two offers.

Half, or 50 percent, of Air Force dollars spent on goods and services costing at least \$25,000 was spent on solicitations for which only one offer was received. Nearly three-fourths of such dollars, or 74 percent, was spent on solicitations that received no more than two offers.

It appears that for many of the goods and services that it seeks, the Air Force must shop in a marketplace that is not very competitive. The Air Force may need to seek special ways to purchase goods and services in these less competitive markets or work on strategies to build competition

¹⁸ We do not know whether all these solicitations were open, unrestricted solicitations on which any firm could bid.

(e.g., undertake performance-based services acquisition or encourage continuous improvement by linking performance on all past contracts to selection criteria for new contracts).

4. INSIGHTS FOR SPECIFIC PSM IMPROVEMENTS

Outline

Overview of spend analysis

Indicators of prospective Air Force opportunities for applying PSM practices

Insights for the Air Force from data it already collects

Lessons for the Air Force

RAND

DB-434-AF-23 07/03

In this section, we examine more specific examples of supplier and commodity analyses that the Air Force may wish to undertake to explore opportunities for PSM improvement while maintaining its socioeconomic goals.

Contract Consolidation: One Key Practice for Performance Improvements and Savings

Consolidate existing single-source contracts with firms

Consolidate related competitive purchases and award to best providers

- Where economies of scale or scope can reduce transaction costs
- Within and across related FSC codes

Benefits

- Increase leverage, reduce transactions costs, gain economies of scale / scope, promote investment, flexibility, and tailoring
- Enable development of deep expertise on particular industries

All consolidation or “bundling” must be done in accordance with legal requirements for competition and socioeconomic goals

RAND

DB-434-AF-24 07/03

Contract consolidation offers the Air Force one means by which to improve performance and realize savings. Developing corporate or commodity contracts are two means of contract consolidation.

In developing a corporate contract, buyers look for examples where they can consolidate many single-source contracts with the same supplier into fewer longer-term contracts. This can help to reduce transaction, management, and marketing costs for both buyers and sellers.

Developing a commodity contract, or consolidating contracts for the same or similar goods and services, can have the same effect and give the buyer increased leverage. Depending on the particular goods and services, buyers may be able to consolidate contracts within a commodity group, at a particular site, or for a particular weapon. All consolidation or leveraging must be done in accordance with legal requirements for competition and socioeconomic goals, which may limit the ability of the purchaser to consolidate certain contracts.

The consolidation of similar types of purchases can yield economies of scale and scope, increase purchasing leverage, reduce transaction costs, and result in contracts, investments, and services tailored more specifically to buyers' needs. (For more general discussion on contract

consolidation in the federal government, see Baldwin, Camm, and Moore, 2001.)

Socioeconomic Goals Are Not Necessarily a Constraint

Prospective options

- **Identify best SDBs and develop partnerships to help them grow and improve further**
- **Consolidate multiple existing contracts with SDBs to reduce transaction costs**
 - **30% of small business contractor ID codes had 2 or more contracts in FY02 (average = 3.6, maximum = 115)**
- **Consolidate Air Force SDB contracts according to capabilities of firms to give them bigger contracts and reduce transaction costs**

Source: FY02 DoD-wide DD350 data.

DB-434-AF-25 07/03

Socioeconomic goals do not necessarily present a problem to improving purchasing performance; indeed, many best PSM practices are quite compatible with socioeconomic goals. Many small and disadvantaged businesses (SDBs) are excellent performers. Although the number of SDB contracts is measured, the primary DoD goal is the percentage of dollars spent at SDBs. Conceivably, larger, longer-term contracts could be awarded to the best performing SDBs.

One approach the Air Force could pursue in introducing PSM improvements with SDBs is to identify the best and develop partnerships to help them grow and improve. This is similar to what many commercial purchasers already do. Many commercial firms introducing PSM improvements have made commitments to help SDBs grow and prosper while maintaining stringent performance requirements. Although such enterprises may grow to the point that they are no longer *small*, they help commercial purchasers maintain their commitment to supplier diversity.

The Air Force already has opportunities to consolidate multiple contracts with small businesses and reduce transaction costs for both sides. Analysis of the contracting data shows that many small businesses (30

percent) with Air Force contracts have two or more such contracts. The Air Force can examine more closely the goods and services that SDBs can provide and consolidate them in such a way that SDBs can handle larger contracts.

What the Air Force Can Learn from *Corporate Analyses of Spend Data*

Total spend and percentage of sales with specific firms

- **Requires additional data linking contracts to parent firm and financial data**

Sole-source contracts for prospective consolidations within contractor ID codes or parent firm

- **Actual consolidations require additional knowledge**
 - **Degree of independence of different divisions within firm (i.e., between contractor ID numbers)**
 - **Best terms and conditions and bundling practices for different industries**
 - **Special user requirements**

RAND

DB-434-AF-26 07/03

The Air Force can learn a great deal from analyses of its spend data by supplier, including the total spend and percentage of sales at particular firms – important information for understanding its buying leverage. This type of analysis requires additional data linking individual contracts and contractor ID numbers to parent firms, as well as company financial data, often available from the SEC.

The Air Force knows which of its contracts are sole source and therefore which might offer consolidation opportunities without concern for violating some competitive bidding requirements.¹⁹ Other consolidations

¹⁹ The Competition in Contracting Act of 1984 requires “full and open competition.” This can limit the ability of federal agencies to bundle requirements and reduce their supply base if contract consolidation would limit the pool of bidders so that the requirement cannot be filled at the lowest possible price. Because bidders can form alliances of several smaller, specialty firms, to bid for work that is beyond the capabilities of any one of them, consolidated contracts do not necessarily have to conform to the capabilities of individual firms. The Small Business Reauthorization Act of 1997 introduces new policy for federal agencies that wish to consolidate contracts requirements for goods and services. It specifies that if a consolidated workload is likely to be unsuitable for direct award to a small business, an agency must demonstrate that the consolidation is necessary and justified, based on “measurably substantial”

may also be legally possible when there are clear benefits. Actual consolidations will require additional knowledge, including the organizational structure of suppliers, market research on the best terms and conditions within specific industries, and user requirements that may either require or prevent consolidation.

The following analyses on past and prospective Air Force purchasing actions are purely speculative. The companies in question may be the most appropriate suppliers of the goods and services they sell to the Air Force. Rather than critiquing Air Force performance, we attempt to show the thinking that goes into a spend analysis, the further questions a spend analysis can raise, and the input such analyses can provide to actual purchasing decisions.

benefits to the federal government or to meet mission requirements. These benefits can be broadly defined to include cost savings, quality improvements, reduction in acquisition cycle times, better terms and conditions, or any other benefit.

Largest Air Force Contractors in FY02 by Spend*

Name	USAF \$ Millions	% \$ Sole Source	# of Contracts	% Ctrx Sole Source	# Pur. Offs. Codes	# FSC Codes	# Ctr ID Codes	% Total Sales to USAF
Lockheed Martin	10,224	68	319	59	90	133	66	40
Boeing	8,695	34	283	58	84	113	40	16
Northrop Grumman	2,135	70	361	57	125	143	66	13
Raytheon	1,855	58	241	61	74	100	43	11
United Technologies	1,707	90	230	66	31	72	28	6
TRW	1,223	6	64	27	50	50	21	7
L-3 Communications Holding	906	82	109	56	47	63	27	27
North American Airlines	622	0	1	0	1	2	1	n/a
General Dynamics	529	28	113	49	63	47	24	4
DyneCorp	477	<1	23	4	21	22	8	21
Aerospace	473	100	1	100	1	1	1	91

Source: FY02 DoD-wide DD350 data.

*A moving target because of ongoing acquisitions, sales, and mergers. Many of these companies have multiple business units selling to the USAF in FY02. Data on value of total sales are not publicly available for North American Airlines, a privately held company.

RAND

DB-434-AF-27 07/03

Here, we rank the largest Air Force contractors by spend in FY02 and discuss some of the issues that a spend analysis suggests for them. In FY02, the Air Force purchased \$10.2 billion dollars of goods and services from Lockheed Martin using 319 contracts. Most of this work is performed under sole-source contracts. This high number of contracts for an enormous amount of goods and services may be a good subject for further analysis. Consolidating some of these contracts into larger ones might yield savings, although some contracts, such as those for major weapons systems, may not be suitable for consolidation. Lockheed Martin may want to reduce its own transaction costs of negotiating and managing all these separate contracts. Also, because the Air Force is Lockheed Martin's largest customer, representing 65 percent of the firm's sales, it may have reasonable leverage.

The broad distribution of Lockheed Martin's contracts across different purchase office codes, industrial sectors, and goods and services may limit consolidation opportunities. The data indicate there are 66 Lockheed Martin contractor ID codes with contracts written by 90 Air Force purchase office codes. These contracts span industries with 133 different FSC codes. Some industries may be more amenable to contract consolidation than others. Contracts for management services, for

example, may be easier (or more difficult) to consolidate than contracts for aircraft or missiles.

The initial analysis of the data can lead to further questions. For example, Lockheed Martin is involved in many different industry sectors. Can a single company maintain a “core competency” in so many areas? Although Lockheed may be well managed and able to serve all of its sectors, this diversity may merit further examination to ensure that the Air Force is relying on Lockheed only for those products it is best able to provide. (To be sure, many leading firms providing goods in widely divergent industries, such as General Electric, divest units that are not leaders in their field.)

On the other hand, General Dynamics depends much less on the Air Force than Lockheed Martin, with only 7 percent of its sales to the service. This may mean that General Dynamics will be less responsive to Air Force needs, since it can turn to its other sales outside the Air Force as an alternative. (Nevertheless, the fact that General Dynamics relied on DoD for 52 percent of its sales in FY02 may make it more responsive to DoD needs generally.)

Corporate Contract Example: *United Technologies*

One of USAF's ten largest contractors

- 230 USAF contracts totaling \$1,707M, 6% of company sales
- Many are sole source - 152 contracts, \$1,541M
- Purchases dispersed across 31 USAF purchase office codes

UTC has varied business lines

- **Defense/aerospace**
 - Hamilton Sundstrand
 - Pratt & Whitney
 - Sikorsky Aircraft Corp.
- **Building supply/maintenance**
 - Carrier Corporation
 - Otis Elevator

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-28 07/03

To cite another example of how the Air Force may implement PSM improvements with its largest suppliers, we note the case of United Technologies Corporation (UTC). UTC is one of the top ten Air Force contractors as measured by dollars, selling more than \$1.7 billion of goods and services to the Air Force, accounting for 6 percent of total company sales. Most UTC contracts with the Air Force (67 percent by number and 77 percent by sales) are sole-source contracts. These contracts are spread across 31 Air Force purchase office codes.

United Technologies' subsidiaries operate a wide variety of businesses. Hamilton Sundstrand produces aerospace power and industrial products. Pratt & Whitney produces the F100 engine for the F-15 and F-16 fighters, the F117 for the C-17 transport, the F119 for the F-22, and the F135 for the Joint Strike Fighter. It also provides parts and repair and other services for these engines. Sikorsky manufactures military helicopters, including the Black Hawk and Comanche. Carrier manufactures air conditioners and Otis manufactures and repairs elevators. These widely different products may be difficult to consolidate into single contracts – it is likely unadvisable, for example, to consolidate a contract for air conditioning service with one for jet engines – but

larger, consolidated contracts within each of these business units might yield savings or performance improvements.

Air Force contracts with UTC span different major categories of purchases, from weapon systems to sustainment and operational purchases. Sustainment offices have the most contracts with UTC. Altogether, the Air Force purchases goods and services from 29 UTC contractor codes. Air Force purchases from UTC are primarily for aircraft gas turbines and jet engine aircraft components, as well as for maintenance and repair service for engines, turbines, and components. If Air Force contracts with UTC were to be consolidated between different purchase office codes, the office responsible for buying the most of any particular item could be given authority over that purchase.

Air Force and DoD FY02 Contracts with *Pratt & Whitney*

	Air Force	DLA	Navy	Army	Total*
Contracts					
#	110	18	22	1	147
\$M	1,649	66	811	1	2,527
% sales	22	1	11	<<1	33
Sole source					
#	56	9	17	1	79
\$M	1,496	65	208	1	2,367
Purchase office codes					
#	15	4	15	1	35
FSC codes					
#	39	29	23	1	67
Contractor ID codes					
#	13	6	8	1	16

Source: DoD-wide DD350 data assigned to buyer by transactions.
* Numbers may not add because of rounding and purchases off the same contract.

RAND

DB-434-AF-29 07/03

Broader possibilities for Air Force leadership in best PSM practices in purchases of goods and services used throughout the DoD are shown in statistics on contracts with Pratt & Whitney, a UTC subsidiary. Although these data show purchases by the Air Force accounting for most DoD purchases from Pratt & Whitney, as well as 22 percent of all sales by Pratt & Whitney, they also show a number of purchases by the Navy and the DLA.

Top FSC Codes with Many Pratt & Whitney FY02 DoD Contracts

FSC Code	Total No. of Contracts	% Sole Source (% ctrx)	Air Force	DLA	Navy
Gas turbines and jet engines, aircraft and components	58	74	52	4	6
RDTE/aircraft-applied research	25	0	25	0	0
Airframe structural components	7	14	0	7	0
Technical repair services/aircraft components and accessories	7	86	5	0	2
RDTE/other defense-applied research	6	0	6	0	0
RDTE/aircraft-demonstration/valid	6	67	5	0	1
Miscellaneous engine accessories, aircraft	5	100	2	2	2
Aircraft maintenance and repair shop specialized equipment	4	100	3	0	1
Valves, nonpowered	4	100	4	0	0
Pipe and tube	4	100	2	2	1

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-30 07/03

Analyzing broader DoD purchases from Pratt & Whitney by federal supply class shows that more than one-third of the contracts with the firm are for the category that includes gas turbine and jet engines. A large number are also for technical repair and maintenance. These contracts are sole-source contracts, but still may offer some opportunities for PSM improvements. For example, one airline we researched found that combining its repair services with purchases for repair components or spare parts reduced its total combined costs. The Air Force is the leading DoD purchaser for most of these goods and services, making it the logical choice to lead PSM improvements with Pratt & Whitney for the military.

Time-Series Data Show Shift in DoD Purchases from Pratt & Whitney*

	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02**
Total									
# Contracts	94	199	269	260	250	209	209	147	147
\$M	83	794	1,552	1,205	1,239	1,621	1,301	1,968	2,527
Air Force									
# Contracts	75	175	213	183	187	162	155	108	110
\$M	65	770	1,506	1,025	825	1,412	1,203	1,737	1,649
DLA									
# Contracts	5	4	30	55	42	25	39	26	18
\$M	1	<1	1	4	4	3	4	14	66
Navy									
# Contracts	12	14	23	20	18	19	12	12	22
\$M	16	18	45	176	409	205	93	216	811
USMC									
# Contracts	0	1	0	0	0	0	0	0	0
\$M	0	4	0	0	0	0	0	0	0
Army									
# Contracts	2	5	3	2	3	3	3	1	1
\$M	2	2	<1	<1	1	2	1	1	1

Source: FY94-FY02 DoD-wide DD350 data.

Note: Numbers may not add because of rounding. Change in format and standards for contractor ID codes in FY94 and FY95.

*A moving target because of reorganizations, mergers, acquisitions, and sales.

**Change in analysis from aggregating by contract to aggregating by transactions.

RAND

DB-434-AF-31 07/03

The transfer in the mid-1990s of item management for weapons system consumable parts to the DLA has had a perceptible effect on DoD spending patterns with Pratt & Whitney. In FY94, the Air Force was responsible for 78 percent of DoD purchases (as measured in dollars) with Pratt & Whitney, and the DLA was responsible for 1 percent. In FY02, the Air Force was responsible for 65 percent, and the DLA was responsible for 3 percent. The shift in management of weapon system consumables to DLA may have reduced Air Force leverage with Pratt & Whitney; at the same time, the relatively low value of the DLA purchases is unlikely to have given it much leverage with Pratt & Whitney.

At a minimum, these data indicate that the Air Force, the Navy, and DLA should work together to introduce PSM improvements in acquiring Pratt & Whitney goods and services. Indeed, the Air Force is starting to include DLA and other DoD organizations in some of its PSM initiatives.

Data Suggest Prospective Savings from United Technologies Corporate Contracts

35% of sole-source contracts are for sustainment (133 of 382)

- Pratt & Whitney has 43

UTC is also a major supplier to DoD

- 706 total DoD contracts for \$3,607M, or 13% of company sales
 - 62 contracts (5 Air Force) for airframe structural components
 - 43 contracts (20 Air Force) for generators and generator sets, electrical
- Air Force is the biggest buyer in some federal supply classes
 - 54 of 65 contracts for gas turbines and jet engines aircraft components
 - 1 of 1 contracts for maintenance and repair of engines, turbines, and components

Prospective option: Combine Pratt & Whitney sole-source contracts with other DoD organizations to leverage spend and reduce purchasing costs

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-32 07/03

Air Force contract data suggest that corporate contracts with UTC subsidiaries may yield savings or performance improvements. In particular, a corporate contract with Pratt & Whitney, which holds 43 of the 133 UTC sole-source sustainment contracts, might yield savings or performance improvements for the Air Force. Indeed, the Air Force recently negotiated such a contract for replacement parts.

For corporations from which the Air Force is the largest DoD purchaser, the Air Force may wish to lead DoD-wide efforts to realize savings from corporate contracts. For companies with which the Air Force has only a small number of all DoD contracts, it may wish to yield to the leadership of other DoD branches in negotiation of a corporate contract, if they are using best PSM practices. The DD350 data indicate that the Air Force already procures services from master contracts held by other services, and that other services likewise procure services through master contracts held by the Air Force. There are likely to be more such arrangements as the DoD adopts more PSM practices.

Similarly, the Air Force may wish to lead efforts to consolidate contracts across the DoD for goods and services in some federal supply classes such as engines where it makes most of the DoD purchases and it has developed a core competency. For example, the Air Force has created a

Commodity Council for procuring jet engine bearings and is working with DLA to reduce the current 333 contracts with over 160 different vendors, most of whom are third-party distributors (and add another layer of management and overhead as well as another contact point for purchasers to maintain).²⁰ For goods and services most commonly purchased by other military branches, the Air Force may wish to yield leadership to the service that has the most experience.

²⁰ There are only five manufacturers of these bearings, although some purchases must go through the engine OEM which holds the design patent for the bearings.

What the Air Force Can Learn from *Commodity Analyses of Spend Data*

Potential opportunities for contract consolidation within and across

- Purchasing offices
- Federal supply classes
- DoD

Competitiveness of market to assess opportunities for exerting leverage to get improved performance

Expected benefits of applying best PSM practices to selected sourcing category groups by benchmarking, where possible, against innovative firms' purchasing practices and results

RAND

DB-434-AF-33 07/03

The Air Force can also learn a great deal from analyzing spend data by commodity groups. If many purchase office codes are purchasing the same commodity, or if there are many separate contracts for the same commodity, the Air Force may be able to consolidate these purchases into fewer contracts and benefit from economies of scale with its suppliers as well as reducing its transaction costs. Economies of scope may also be available from consolidating contracts across FSCs and purchase office codes.

Data on the number of firms with Air Force contracts in an industry can indicate the competitiveness of a particular industry. This is critical to assessing opportunities for exerting leverage to gain improved performance.

Data on the prospective benefits of applying best PSM practices to selected sourcing category groups may be obtained by benchmarking current practices and results against the most innovative firms' purchasing. Private sector firms typically buy goods and services by related commodity groups or subgroups (FSC codes may prove either too broad or narrow for such grouping). Some of this information is

available publicly.²¹ The benefits to the DoD may not match the experience of the most innovative firms, however, because of differing goals as well as legal and policy constraints in the military.

Two examples aimed at describing the prospective benefits of a commodity analysis follow.

²¹ See for example benchmarking studies done by the Center for Advanced Purchasing Studies, available at <http://www.capsresearch.org/listof.html>.

Air Force Was Largest FY02 Buyer of *Gas Turbines and Jet Engines, Aircraft, and Components*

	Air Force	Navy	Army	USMC	DLA	Total
Contracts						
#	329	136	51	15	625	1,133
\$M	2,084	602	413	1	405	3,505
Sole source						
#	90	85	25	4	133	316
\$M	1,526	547	369	<1	327	2,770
Purchase office* codes						
#	5	23	5	1	2	36
Contractor ID #s						
#s	105	61	27	8	203	294
Small businesses						
#	151	46	11	6	452	668
\$M	89	15	<1	<1	59	164

Source: FY02 DoD-wide DD350 data.

Note: Numbers may not add because of rounding.

*Purchasing offices do not sum because some purchase offices buy on contracts from several different services.

RAND

DB-434-AF-34 07/03

As we noted above, gas turbines and jet engine components (FSC 2840) are the second-highest spend commodity that the Air Force purchases. The Air Force accounts for more than one in four (329 of 1,133) contractors for this commodity and more than half the dollars spent (\$2.084 billion of \$3.505 billion). In FY02, nearly three-fourths of the Air Force money spent on this commodity was spent through sole-source contracts. These contracts are written by five Air Force purchase office codes and a total of 36 DoD purchase office codes.

This may be an appropriate target for a PSM innovation strategy. Although there are only a few buyers involved in purchase of this commodity, there are many contractors involved (105 contractor ID codes for Air Force purchases and 294 such codes for all DoD purchases), suggesting some further opportunities for supplier and contract consolidation. Nevertheless, the high number of small businesses holding these contracts indicates possible legal or political difficulty in contract consolidation, and the large amount of money spent for this commodity on sole-source contracts may indicate limited opportunity to switch suppliers (or limited opportunity for using such a possibility to gain leverage with existing suppliers).

**Top 5 Gas Turbines and Jet Engines
Aircraft and Components Suppliers in FY02**

	Contracts	#	# Sole Source	\$M	% \$ Sole Source	% Total FSC \$
1	United Technologies Corp	54	39	1,158	90	33
2	General Electric Company Inc	25	20	366	97	10
3	CFM International	2	2	99	100	3
4	Dynamic Gunver Technologies	30	2	40	2	1
5	Rolls Royce Plc	5	5	27	100	1
	Total	116	68	1,690	90	48
DoD						
1	United Technologies Corp	65	45	1,276	90	36
2	General Electric Company Inc	65	48	1,159	95	33
3	Lockheed Martin Corp	2	1	271	0	8
4	Rolls Royce Plc	27	21	172	94	5
5	Honeywell International Inc	15	13	163	100	5
	Total	174	128	3,041	85	87

Source: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-35 07/03

Air Force spending for gas turbines and jet engines is remarkably concentrated. Two firms, United Technologies Corporation (Pratt & Whitney), and General Electric (General Electric Aircraft Engines, or GEAE) receive 43 percent of the Air Force dollars spent on this commodity as well as 69 percent of all DoD dollars spent on this commodity. The Air Force might be able to consolidate some of its 59 sole-source contracts with these two firms into a few corporate contracts. Similarly, DoD might be able to consolidate its 93 sole-source contracts with these two firms into a smaller number of corporate contracts. Consolidation could leverage the government's purchasing power, perhaps making the contractors more responsive on all contracts, and reduce transaction costs. The Air Force now has corporate contracts with Pratt & Whitney and GE, but they do not cover all goods and services purchased from either company.

Time-Series Analysis of Spend for Jet Engine Components Shows DoD Purchasing Trend

	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02
Total									
#	816	790	911	962	1,163	1,081	1,170	1,011	1,133
\$M	2,533	1,864	2,152	1,865	2,173	3,072	3,084	3,591	3,505
USAF									
#	537	518	559	588	482	424	413	255	329
\$M	1,927	1,112	1,645	1,120	1,355	1,776	1,879	2,137	2,084
DLA									
#	53	63	126	255	557	522	599	613	625
\$M	12	13	35	78	156	265	289	331	405
Navy									
#	202	163	177	118	107	92	86	110	136
\$M	584	662	292	524	468	866	678	759	602
Army									
#	24	60	63	35	42	58	84	51	51
\$M	12	76	180	143	194	165	238	364	413
USMC									
#	0	2	0	0	0	5	10	11	15
\$M	0	<1	0	0	0	<1	1	1	1
Other									
#	21	0	1	1	0	0	0	0	0
\$M	-3	0	<<1	<1	0	0	0	0	0

Source: FY94-FY02 DoD-wide DD350 data, FSC 2840.

Note: Numbers may not add because of rounding.

RAND

DB-434-AF-36 07/03

The shift in management of weapon system consumable items to DLA has caused a shift in the distribution of DoD spending for jet engine components. In FY94, the Air Force had 537 contracts for purchasing this commodity, through which 76 percent of DoD dollars for it were spent; the DLA had 53 contracts for these components, through which less than 1 percent of DoD dollars were spent on the commodity. In FY02, the number of Air Force contracts had decreased to 329, through which 59 percent of DoD dollars for this commodity were spent, whereas the number of DLA contracts had increased to 625, through which 12 percent of DoD dollars were spent. These trends, resulting in the overall DoD spend being fragmented among a greater number of buyers and contracts, are contrary to best PSM practices.

History of C-5 Coded Contracts for Transactions \geq \$25K

	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02
Total									
# Ctrx	207	212	180	142	150	135	461	513	433
\$M	84	156	147	100	138	217	217	202	266
Air Force									
# Ctrx	207	212	180	142	150	135	148	155	202
\$M	84	156	147	100	138	217	185	160	232
DLA									
# Ctrx	0*	0*	0*	0*	0*	0*	318	360	232
\$M	0	0	0	0	0	0	32	42	34

Source: FY94-FY02 DoD-wide DD350 data for contract transactions > \$25K split by reporting component: 5700 = AF, 97AS = DLA.
*DLS did not include weapon system codes on any of its DD350 purchase transactions until FY00.

RAND

DB-434-AF-37 07/03

As the above time series of spending for C-5 aircraft illustrates, trend (and all other) data must be interpreted cautiously. Here, for example, we see that no DLA contracts or purchases were coded for C-5 parts before FY00. Yet, the transfer of the management of weapon system consumable parts to DLA took place in the mid-1990s. Thus, it is likely the DLA purchased such parts before FY00, but they were not coded correctly in the DD350 database.

The years for which data are available on DLA purchases of these parts indicate that 13 percent of C-5 coded purchases are now spread over a relatively large number of contracts, particularly within the DLA since transfer of management of weapon system consumable parts to it. Air Force purchases for the C-5 have been reduced from virtually all those for DoD to about 85 percent of DoD purchases. Thus, the transfer of management of weapon system consumables to DLA in the mid-1990s appears to have fragmented and reduce overall DoD leverage for C-5 purchases; this action also appears contrary to leading commercial practices seeking to consolidate spending and reduce the total number of suppliers and contracts.

Commodity Example: Office Furniture

403 USAF contracts for \$95M, 1,622 DoD contracts for \$274M

- Relatively few sole source (8 USAF for \$1M, 180 DoD for \$8M)
- Some small business (40% USAF \$s, 35% DoD \$s)
- Top five contractors have 39% of total USAF \$s, 43% of DoD \$s
- Knoll Inc. largest USAF (12% \$s), UNICOR (Federal Prisons Industries, Inc.) largest DoD (15% \$s) provider
 - Preference to use UNICOR limits use of best PSM practices
 - Significant “maverick” buying suggests UNICOR may not meet user cost, quality, functionality, or responsiveness needs

Prospective option: when UNICOR does not meet user requirements

- Establish “umbrella” contracts with best value providers
 - Use online marketplace for purchase orders
- Post customer satisfaction

Sources: FY02 DoD-wide DD350 data.

RAND

DB-434-AF-38 07/03

Another good for which the Air Force may wish to develop one or more strategic supplier relationships is office furniture. The Air Force has a very diffuse spend for office furniture, which is not surprising given the nearly universal need of enterprises for it. In FY02, the Air Force issued 403 contracts for \$95 million in office furniture; the entire DoD issued 1,622 contracts for \$274 million. There are very few sole-source contracts for office furniture and few dollars are spent at small businesses. This segment is relatively unconcentrated, with the top five contractors receiving about half of the total dollars in this category. The largest contractors for both the Air Force and the DoD receive less than a fifth of the dollars spent on office furniture.

Government organizations are required to procure UNICOR (Federal Prison Industries, Inc.) products, made by federal prisoners, whenever possible. This preference limits the use of best PSM practices. The significant amount of “maverick” buying from other furniture suppliers (including the Air Force buying from Knoll Inc., the largest provider of office furniture to the service in FY02) suggests that UNICOR’s performance may be lagging in one or more ways (e.g., cost, quality, functionality, or responsiveness). The proper response to this maverick buying may not be to clamp down on it, but to examine why it exists.

One prospective option for dealing with situations where suppliers such as UNICOR do not meet user requirements is to establish several “umbrella” relationships with the best-value providers in this industry. Since office furniture has little technical complexity, an online marketplace might serve purchaser needs while keeping transaction costs low. The ability to post customer feedback online could result in better performance from contractors as they try to build their reputation as quality suppliers.

5. LESSONS FOR THE AIR FORCE

Outline

Overview of spend analysis

Indicators of prospective Air Force opportunities for applying PSM practices

Insights for the Air Force from data it already collects

Lessons for the Air Force

RAND

DB-434-AF-39 07/03

We conclude by reviewing the most important lessons the Air Force can draw from this illustrative, high-level analysis of a major portion of its spend.

Lessons of Most Importance to the Air Force

Difficult to piece together *total* Air Force spend

Existing systems contain many indicators of prospective savings, risks, and challenges

However

- **Data quality varies widely, e.g.,**
 - **Inadequate data on purchases < \$25,000 and government purchase card transactions**
 - **No central data source on intragovernment purchases**
- **Difficult to link customer information (e.g., user demand, MICAP, backorder data) to sustainment contracts**
 - **Need a master file linking NSNs to contracts**
- **Not all necessary information in data systems**
 - **Air Force customer and internal factors such as organizational readiness and capabilities**
 - **Outside data on industries, best suppliers, technologies**

RAND

DB-434-AF-40 07/03

This first-order examination of Air Force DD350 purchases reveals many indicators of potential PSM opportunities and challenges. A complete analysis of all Air Force direct purchases was not feasible, however, since the availability and fidelity of the data for all Air Force purchases vary widely, particularly for purchases of less than \$25,000 and those made using a government purchase card. Furthermore, there is no central data source providing information on intragovernmental transactions.

Critically, there is no easy way to link customer information on such issues as user demand, so-called MICAP orders for parts to restore equipment to mission capable status, or backordered items, to particular contracts. The Air Force also has no central database that consolidates supplier performance information (AFMC is currently working on creating such a database for its purchases). This may make it more difficult to assess the performance of particular suppliers. As mentioned above, most data on weapon system performance use National Stock Numbers (NSNs) for specific parts while most data on purchases use contract numbers. Developing a data file linking NSNs to contracts would help remedy this gap.

Finally, the Air Force must incorporate outside data – including comparative data on costs, quality, responsiveness, and other measures of performance, as well as on the financial condition of the supplier, and possible substitutes for the commodity or provider²² – in its spend analysis to truly educate itself on how to best structure supplier relationships. Linking research on industries and their practices, the best suppliers and their capabilities, and the latest technologies to spend data will help improve purchasing outcomes.

²² See Ellram (2002) for a list of internal and external sources of cost information.

Air Force Needs a Centralized Spend Analysis Capability

Take a strategic, Air Force-wide perspective

- Explore other DoD opportunities
- Drill down for special user and strategy analyses

Develop familiarity with data and how to use them

- Strengths and weaknesses
- Best sources of different information
- Combine multiple large data sources
 - Requires substantial computational capability

Partner with users and PSM teams

- Additional information gathering
 - Internal Air Force and external market factors
- Knowledgeable people to make judgments

RAND

DB-434-AF-41 07/03

An in-depth spend analysis has a number of requirements, including combining multiple data sources; gathering and integrating additional data on suppliers, markets, internal military requirements, and market factors; developing knowledgeable personnel and equipment for processing and analyzing the numbers. This requires a strategic perspective encompassing all Air Force purchasing activities, and, in many cases, other DoD purchasing activities as well.

Several spend analyses have been conducted recently by different organizations within the Air Force. These need to be broadened. Currently the Air Force Materiel Command Directorate of Contracting (AFMC/PK) does spend analyses for Air Force-managed sustainment items, but these do not include Air Force spending on operational or DLA-managed items or other Air Force funds spent within DoD. Each air logistics center (ALC) also analyzes the spend it manages. Further, these analyses cannot link contractor ID codes to their parent firm. (By contrast, Dun & Bradstreet advertises how its database and spend analyses can help enterprises identify opportunities for aggregating spending across organizations and better leverage purchasing dollars.) In fact, we found that a number of Air Force contracting personnel did not know the name of the parent firm of the business unit with which

they are contracting. Focusing too narrowly and not including as broad a range as possible in a spend analysis may reduce the prospective benefit from innovative PSM practices.

Analysts must also consider special strategies and user needs. They must know the strengths, weaknesses, and context of their own data and be able to link external data to spend data in searching for opportunities to improve performance. Combining existing contracting and user data will be a complex and challenging task. Currently, no one organization within the Air Force, or even within the DoD as a whole, has responsibility for all the necessary tasks. To provide the greatest benefits, and to make sure that the different tasks are appropriately completed, RAND recommends that the Air Force centralize capability for generating spend data and analyses. This can help eliminate duplication and minimize the cost of creating such capability.

Centralizing data for spend analyses will help maximize performance across the Air Force. Sharing information on negative experiences with particular suppliers can help other parts of the Air Force avoid similar bad outcomes. Sharing information on excellent performance can make it easier to locate top performing suppliers both large and small. Suppliers may work harder to improve their performance if they know it will affect their ability to obtain additional business. Aggregating purchases across the entire DoD may lead to even lower prices, higher quality, and more responsive performance as the leverage from a larger contract increases the importance of the Air Force work to the supplier.

Although most industry experts argue for centralization, there can be valid requirements for diversity that cannot be met through centralized agreements. Centralization can also introduce larger problems in the event of contract failure (Steel and Court, 1996). One approach will not fit all situations. Spend data must therefore be considered carefully to include all diverse requirements of a customer and not used blindly to consolidate all contracts.

Centralizing the spend data analysis function will help create a core team of experts familiar with existing data, their limitations, and how to get the most out of data analysis. These experts can support local purchasing organizations, alerting them to prospective opportunities for consolidating requirements (within legal and policy boundaries) and to suppliers whose performance has been excellent or unresponsive.

A central clearinghouse for spend data and information about suppliers could improve contracting activities throughout the Air Force. A

centralized function may also be able to better make the case for collecting different kinds of data and for developing systems to improve the functionality of data the Air Force already collects. This may include, for example, linking NSNs to contracts and weapons, bringing together related performance and contracting information. This could help provide industry-wide information on related groups of goods and services. In addition, it could provide critical information allowing all interactions with suppliers to start from a consistent, strategic perspective on service-wide objectives and requirements.

Although centralized organizations, such as DLA and GSA, aggregate government and DoD purchases, our analysis of DoD-wide DD350 data suggests that there may be additional opportunities for consolidation of the spend, but we caution that it must be done very carefully and intelligently. Analysis of time-series data on the transfer of some Air Force purchasing to DLA (e.g., consumable jet engine components) actually fractured the relationship with some suppliers (e.g., Pratt & Whitney). That consolidation should probably be led by the organization with the most technical knowledge, the most experience in using and purchasing the goods or services being considered for consolidation, and the most leverage or strongest relationships with suppliers. Continuing analysis of Air Force and DoD-wide purchasing patterns may identify other opportunities for savings or performance improvements. Although there is no one complete source of information on all Air Force purchases of goods and services, the DD350 and related data do offer a great deal of high-level information and are an excellent starting point for additional analyses.

Summary

Spend analysis

- **A useful tool for targeting PSM initiatives**
- **The Air Force is a target-rich environment**
- **Additional intelligence is needed to finalize targets**

Maximizing the rewards and managing the risks of Air Force PSM initiatives

- **Requires a strategic, cross-functional approach**
- **Cannot be done using a tactical, functional approach**

RAND

DB-434-AF-42 07/03

The benefits of a spend analysis have been proven by the many commercial firms that have used it for targeting their PSM initiatives. Analyzing available data on Air Force and DoD purchasing indicates that there may be many targets for the application of best PSM practices.

Although our initial spend analysis revealed a number of potential areas for improvement, additional data, research, and intelligence are needed before targets for best PSM practices can be finalized, much less a supply strategy developed and supplier selected. Conducting a detailed spend analysis and incorporating all required data are only the first steps toward adopting best PSM practices.

The actual development of supply strategies and strategic supplier relationships must be done using a strategic, cross-functional, cross-enterprise approach, which may require some organizational restructuring within the Air Force. Air Force purchasing has typically used a tactical, functional, local approach without a broader view on improving overall Air Force performance and costs. Only by combining all purchasing-related activities will the best decisions be made, the cost and performance opportunities from best PSM practices be maximized, and the risks managed. The Air Force has started to move in this direction with Air Force Materiel Command development of a spend analysis tool and the creation of Commodity Councils for buying several commodities.

APPENDIX

LESSONS LEARNED IN USING DD350 DATA FOR DOD SPEND ANALYSES

The Air Force, along with the other services and the defense agencies, collects data on its purchases for transactions equal to or greater than \$25,000 using the DoD Form 350, Individual Contract Action Report which is fed into the DD350 Contract Action Reporting System, J001.²³

These data are sent to DoD, which consolidates them across the services and defense agencies. The DoD Washington Headquarters Services/Directorate for Information Operations and Reports (WHS/DIOR) manages the Individual Contracting Action Report database which was primarily used for current analyses. This information is available in electronic form at (<http://web1.whs.osd.mil/peidhome/guide/procoper.htm>).

RAND analysis of over four years of DD350 data²⁴ suggests that the Air Force will likely face similar challenges as it undertakes a spend analysis to evaluate its purchases in a search for performance improvements and savings. These challenges include:

- Data quality
 - Data consistency within a contract number
 - Appropriate interpretation of “correcting” records
- The lack of detailed information on purchases and on intra-governmental transfers of less than \$25,000
- Specific challenges of the DD350 data such as:
 - The lack of information on supplier performance and spend data

²³ See AFI 64-105, Contract Reporting and Contract Profit Reporting System, 1 August 2000.

For an online reference to J001 and DD350 reporting, see <http://www.safaq.hq.af.mil/contracting/reporting/AQCI/references.html>.

²⁴ In the document, we describe an analysis of FY02 data. The problems we have uncovered with the data were generated by the analysis of a number of years' worth of purchasing information.

– The need to scrub the data before analyzing; caveat emptor for those who ignore this

OVERALL THOROUGHNESS AND QUALITY

Lack of Information on Small Purchase and Intragovernmental Transfers

A complete analysis of Air Force data should include purchases made from all private sector sources, including large and small direct contracts, government purchase card data, and intragovernmental transactions. The Air Force does not have a single source of data cataloguing all of its purchases. Rather, the data come from several information sources depending on the type of purchase and sources of funds. For example, internal Air Force contracting and budget offices can identify where they spend their money by large budget category or type of purchase category, but they cannot provide detail by industry or supplier that provided the goods or services.

Government purchase cards give purchasers a great deal of freedom from onerous contracting regulations, but they hinder spend analysis and discourage PSM kinds of innovation for these types of purchases. Users can go to local retailers for items needed immediately, but transactions' costs involved in the users' time, transportation, and so forth are difficult to measure. Commercial practice for small purchases suggests that improving purchase card practices can result in substantial savings. We were not able to assess the potential benefit for the Air Force.²⁵ Government purchase card data are currently available either in summary form or by cardholder and transaction. The data do not have information on what was purchased, only the merchant code from which the purchase was made. In some cases, the general category of what was purchased

²⁵ The challenge is to efficiently and effectively collect the necessary information on small purchases to negotiate enterprise-wide contracts with major distributors or retailers to leverage purchases. For example, some companies have negotiated volume discounts with such providers as Grainger, Corporate Express, and Office Depot. Approved catalogs are placed on the company's web page, where employees can use their purchase cards to buy many of the goods and services they need off prenegotiated contracts. The web page keeps track of all purchases to accurately determine total spend in various categories and with various suppliers.

may be inferred from the merchant code but not if the merchant provides a broad range of goods and services. Access to the data is tightly controlled. Acquiring and analyzing purchase card data were beyond the scope of this project, hence, we were unable to determine the extent of potential savings from PSM innovation or where such efforts would be best made (e.g., deciding whether to develop an electronic mall).

Intragovernment purchases make up a larger and possibly even more obscure spend category. Information on intragovernmental transfers is much less readily available than for government purchase cards and contract transactions below \$25,000. It is difficult to get details on Air Force purchases from other services and the defense agencies because the information is not routinely collected into a centralized data system, thus one has to call either every Air Force organization making the type of purchase or every office in the supplying organization (e.g., about 60 offices to get total Air Force spend with the Army Corps of Engineers).

Other PSM Assessment Challenges

The DD350 was not designed for doing detailed spend analyses. Indeed, most commercial firms initially have to pull information from a variety of data systems to do their spend analyses. That said, the DD350 data can provide a lot of useful information for doing spend analyses. DD350 contains individual contracting actions of \$25,000 or greater and includes contractor and contracting office code information but there are some gaps that limit its use for a spend analysis that links to customer service. For example, it is difficult to link internal customer information, such as demands, mission impaired capability awaiting parts (MICAP), and backorder data, to contracts.

Another data challenge is that specific contracts for particular items from individual contractors cannot easily be linked to NSN²⁶ that are not in the DD350 data. Therefore, it takes great effort to establish links between the weapon system, NSN, and contract number. It would be very helpful to have a single data source that is actively maintained and deemed fairly accurate and that has these linkages for weapon system support.

²⁶ We matched Air Force (e.g., J041 and G072D) and DLA data to J001/DD350 data to link contract data to logistic performance data but got relatively few matches, particularly for DLA. We assume that many of DLA's transactions are below the \$25,000 threshold and therefore are not included in DD350.

Information on supplier finances, users' requirements and preferences, and suppliers industries and practices must be obtained from external sources.

SPECIFIC DEFICIENCIES OF THE DD350 SPEND DATA

Lack of Linkages and Certain Other Identifiers

Developing this analysis required looking outside the DD350 contracting data for relevant information. Contract office addresses were obtained from the DoD contracting website.²⁷

The DD350 data identify suppliers by a Contractor Identification Number. Each corporate location or primary facility has its own ID code. Many large corporations, however, particularly those with multiple locations or divisions or past acquisitions and mergers, have more than one contractor ID code. This means that simple statistical analyses of DD350 data can fail to reveal true contracting totals for large organizations. DD350 contains a variable called the ultimate parent code that links contractor ID codes to parent firms.

Unfortunately, this field is often left blank in the Air Force J001 System. Organizations within the same corporation may have very different names that would be difficult to associate without additional information. The DoD-wide DD350 file available from WHS/DIOR has more complete data on the ultimate parent Data Universal Numbering System (DUNS)²⁸ number variable, but even here with mergers and acquisitions, some firms in a single year have more than one ultimate parent DUNS code. The ultimate parent DUNS numbers for large firms that acquired a number of other firms such as Lockheed Martin, Boeing, and Northrop Grumman have been relatively stable since FY97, when contractor ID codes replaced the contractor establishment codes. Thus, to aggregate contractor ID codes to their parent corporation, we used the ultimate parent DUNS

²⁷ Department of Defense WHS/DIOR website, <http://web1.whs.osd.mil>. Click on "Procurement," then "Guidance and Data," then the PDF or XLS file, depending on the format in which you want the information.

²⁸ The Dun & Bradstreet Data Universal Numbering System or DUNS number is a unique nine-digit identification code used to reference single-business entities, while linking corporate family groups together. It is an internationally recognized common company identifier in electronic data interchange (EDI) and global electronic commerce transactions.

numbers, which we retrieved from a Dun & Bradstreet DUNS file supplied by DoD in support of this research.²⁹

We matched the DUNS file with DD350 to link all contracts with parent firms. Given the large numbers of mergers and acquisitions (e.g., Honeywell with AlliedSignal, Northrop Grumman acquiring Litton, Newport News and TRW), if there is no access to a recent DUNS file, then published lists of top ten contractors by dollar value can help in determining the largest contractors. Industry directories, such as *Hoover's Company Profiles* and *FIS Online*, can then be used to learn the names of all related organizations, subsidiaries, and so forth of these parent companies. This information can then be matched to the DD350 contracting data, to aggregate individual contracts to each parent company. Company web pages can also be used to verify proper linkages.

The SAF/AQC website offers a DUNS query site that allows a user to input a firm name with address and it will supply the most current DUNS number.³⁰ Of course, since these numbers change as companies merge and acquire other firms, any historical analysis will necessarily have to scrub these numbers to update them to the most current relationships.

Coding Errors

As we analyzed the DD350 data, we uncovered a number of coding errors. We found that some records have the contract number in the "Modification/Order Number" data element instead of the "Contractor Name" data element. One group of contract numbers in 1999 had 42 out of 2,908 records like this. For these records, it appears that the purchase order number had been switched with the contract number. This type of data coding error can lead to overestimating the number of contracts, because the contract numbers might match another contract number with a different delivery order or purchase order. This type of coding error can also affect the quality of a spend analysis on expenditures by each military service.

²⁹ Department of Defense WHS/DIOR.

³⁰ <http://www.safaq.hq.af.mil/contracting/reporting/AQCI/references.html> and click on FPDC DUNS query.

To aggregate spend by weapon systems, we used what was the Program, System, or Equipment Code through FY00 and became the Weapon System Code in FY01 (Variable B12C of the DD350 form). We found that some contracts/transactions were miscoded. After correcting for these errors on two contracts, our second-highest vendor by dollar value dropped off our “top ten” F100 vendor list.

QUESTIONABLE OR MISTAKEN CODING

There were also instances of questionable or mistaken coding. For example, in one year, a contract for nearly a half-million dollars was coded as Standard Industrial Classification [SIC]³¹ code 2111, or cigarettes. The FSC code for this contract was J111, office building maintenance. The name of the contractor supports the latter coding (as does the fact that the Air Force does not buy cigarettes).

Transposed SICs

We found cases in which the SIC indicated appears to be incorrect. For example, we did a match to see which types of FSC codes would be coded in a given SIC as a way to validate the data. In examining all SIC codes within FSC Code 2840, “Gas Turbines and Jet Engines,” the largest FSC code within SIC 3724, “Aircraft Engines and Engine Parts,” we noted six SIC codes, of which two – “Lime” and “Miscellaneous Personal Services, NEC” – could be miscoded. The entries for lime, with SIC code 3274, appears to be a transposition of numbers for aircraft engines and engine parts, which has the SIC code 3724.

Missing Data

As we were conducting the spend analysis, we observed that some data elements were missing significant data, either because the data were not required to be collected for all contracts or because of inconsistencies in the data entry process.

Examples include the data elements for number of offers solicited and number of offers received, in years before FY01. DFARS 253 regulations indicate that the former should be left blank if the origin of the contract is outside DoD or NASA, and that both data elements should be left blank in the cases when the original contract resulted

³¹Note that NAICS codes replaced SIC codes in FY01 data.

from a solicitation issued before April 1, 1985, or when the contract/order field is coded as an order/call under Federal Schedule (GSA or Veterans Administration Federal Supply Schedule).

Similarly, data relating to business size, measured by the number of employees or average annual gross revenue, are required only of small businesses that are part of demonstration test programs. Not having this type of information could affect the ability of the analysis to present a complete picture of the role of sole-source contracts and the performance of DoD contractors by varying business sizes.

“Dirty” Data

The DD350 also contains “dirty” data, where information had been incorrectly recorded or input. For example, when looking at the DoD small business spend, we found that some large firms that had been coded as small or disadvantaged businesses, and some cases in which small firms were coded as large businesses. Similarly, we found questionable contract numbers that do not adhere to the standard 13 alphanumeric character format; these errors will affect any spend analysis if not corrected.

FSC-Related Issues

Other limitations on the DD350 data involve the FSCs. We found a number of contracts that covered products or services within more than one FSC, but the DD350 data system allows the reporting of only the dominant FSC. This could lead to an incorrect estimation of the actual number of dollars contracted for a particular category of product or service.

Single FSC – for Multiple Products and Services Contract

In pulling together multiyear summaries for a few FSCs, we saw a dramatic increase in expenditures for wheels and brakes between FY99 and FY00. As we looked deeper, we saw that this increase was largely caused by a few very large contracts with defense contractors that had not previously had contracts in that FSC. We found that the contracts with those firms are for more than just wheels and brakes and that the coded FSC does not represent the scope of what was on the contract.

Forced Choice FSC

In another case, we noticed some very large contracts with FedEx and Emery coded with an FSC for passenger air charter service. Since these firms are not known for providing passenger air charter service, and we did not find them in this FSC in the FY99 data, we initially thought these were mistakes in DD350 input. Consultation with the Air Mobility Command, however, revealed that the contracts are not awarded to FedEx and Emery themselves but rather to the Federal Express Teaming Arrangement and the Emery Worldwide Airlines Arrangement. There apparently are numerous carriers in each team, and since some fly both cargo air charter and passenger air charter, one has to make a decision on which FSC to enter, and passenger air charter was selected. The need for such decisions has obvious effects on a spend analysis for a given FSC over time.

Purchase Instrument Analysis Issue

We found that all types of purchase instruments are included within the DD350 database. For example, purchase orders are a different type of instrument from a contract. Some purchase orders such as those for passenger air charter are off master solicitation agreements and thus overstate the number of independent contract actions.

SERVICE ANALYSIS VS. DOD-WIDE ISSUES

Another issue arose regarding service-specific versus DoD-wide expenditures. When splitting the DoD-wide spend by its component services, and comparing this component spend with Air Force data, different answers emerge when the transactions are aggregated to individual contracts, because the services sometimes make purchases on another service's contracts. By contrast, the service-supplied database contains all the individual contracting actions – subsequently collapsed into individual contracts – in which the specific service was involved but does *not* include contracting actions involving other agencies' buying off the service's contracts. At the individual transaction level, one code represents the reporting agency or buys made by that service. For the Air Force, this code is 5700 and it is in both the Air Force and DoD-wide data. For more detailed spend analyses we have used this code to identify the Air Force's exact spend on selected contracts and used individual transaction data from the DoD-wide database.

The Air Force effectively segments its spend by the assignment of purchase office codes. Thus, it is possible to roughly segment the Air Force's total spend into categories of weapons, sustainment, operational, and other spends. (In the other services, purchase office codes are not segmented functionally, and any attempt to analyze their spends by type of purchase would be very difficult, if not impossible, within current limitations of the DD350 data.)

CONCLUSION

Despite its limitations, the DD350 is very useful for beginning a spend analysis and provides an overall look at a large percentage of the products and services that the Air Force buys and from whom it buys them. As we have illustrated, the Air Force can learn a lot about how many contracts it has in different FSCs, with different suppliers (particularly very large and diverse suppliers such as United Technologies Corp.), and written by different contractor ID codes. In addition, it can learn whether those contracts were set-asides or small business contracts, whether they were classified as sole-source contracts, and how many offers were received for the solicitation. However, users of DD350 data for spend analyses should carefully scrub the data before analyzing them to locate inconsistencies and incomplete fields. This importance of data scrubbing increases as the analysis moves from the Air Force as a single organization to entities or weapon systems within the Air Force. The DD350 is unrivaled in the type of top-level contract information it provides, but because hundreds of individuals complete these forms, errors will occur and will need to be culled out commensurate to the level of analysis required. That is, the DD350 is very good for helping the Air Force target prospective improvement initiatives, but it must be supplemented with additional data to make sound sourcing decisions.

BIBLIOGRAPHY

- Aberdeen Group, Inc., "Spend Visibility: Maximizing Value in Strategic Sourcing, An Executive White Paper," August 2002, available at <http://www.aberdeen.com/2001/research/08022766.asp> (as of July 1, 2003).
- Aberdeen Group, Inc., and Penton Media, Inc., "The Spending Analysis Benchmark Report: Dissecting a Corporate Epidemic," January 2003, available at <http://www.dnb.com/pdfs/communities/purchasing/AberdeenProductProfile.pdf>.
- AFI 64-105, Contract Reporting and Contract Profit Reporting System, 1 August 2000.
- Anderson, Matthew G., "Maximizing the Value of Procurement Activities in Your Organization," Mercer Management Consulting, Supply Chain Management Practice, 2000, available at <http://www.mercermc.com/supplychain/>.
- Baldwin, Laura H., Frank Camm, and Nancy Y. Moore, *Federal Contract Bundling: A Framework for Making and Justifying Decisions for Purchased Services*, Santa Monica, Calif.: RAND Corporation, MR-1224-AF, 2001.
- Bensaou, M., "Portfolios of Buyer-Supplier Relationships," *Sloan Management Review*, Vol. 40, No. 4, Summer 1999, pp. 35-44.
- Burt, D. N., and M. F. Doyle, "Strategic Materials Management," in Renado Fiocca and Ivan Snehota (eds.), *Research-Development in International Industrial Marketing and Purchasing, Proceedings of 6th IMP Conference*, Vol. 2, 1990, pp. 304-325.
- Carter, Joseph, "Development of Supply Strategies," in Joseph L. Cavinato and Ralph G. Kauffmann, eds., *The Purchasing Handbook: A Guide for the Purchasing and Supply Professional*, 6th ed., McGraw Hill, 1999.
- Center for Advanced Purchasing Studies, available at <http://www.capsresearch.org/listof.html>.
- Chapman, Timothy L., Jack J. Dempsey, Glenn Ramsdell, and Michael R. Reopel, "Purchasing and Supply Management: No Time for 'Lone Rangers,'" *Supply Chain Management Review*, Vol. 1, No. 4, Winter 1998, pp. 64-71.

- Chenoweth, Mary, "Air Force F100 Purchasing and Supply Management Demonstration: Lessons Learned from Spend Analyses," Santa Monica, Calif.: RAND Corporation, unpublished research.
- Cox, Andrew, "Understanding Buyer and Supplier Power: A Framework for Procurement and Supply Competence," *The Journal of Supply Chain Management*, Spring 2001a.
- Cox, Andrew, "Managing with Power: Strategies for Improving Value Appropriation from Supply Relationships," *The Journal of Supply Chain Management*, Spring 2001b.
- Department of Commerce, Bureau of the Census, "1997 NAICS and 1987 SIC Correspondence Tables," available at <http://www.census.gov/epcd/www/naicstab.htm>.
- Department of Defense, *A Quick Guide to the DFARS, DFARS Subpart 253.204-70, DD Form 350, Individual Contracting Action Report*, available at <http://farsite.hill.af.mil/reghtml/regs/far2afmcfars/fardfars/dfars/dfars253.htm>.
- Department of Defense Washington Headquarters Service/Directorate for Information Operations and Reports (WHS/DIOR), available at <http://web1.whs.osd.mil/peidhome/guide/mn02/mn02.htm>.
- Department of Defense Washington Headquarters Service/Directorate for Information Operations and Reports (WHS/DIOR), available at <http://siad-nt3000.dior.whs.mil/discoservlet/oracle.disco3iv.Disco3iv?us=discoveru&pw=discoveru&db=siadprod&wb=Purchase-Office-Info-Search>.
- Dixon, Lloyd, Nancy Moore, and Charles Lindenblatt, "The Stability of DoD – Supplier Relationships: An Exploratory Spend Analysis," Santa Monica, Calif.: RAND Corporation, unpublished research.
- Dobler, Donald W., and David N. Burt, *Purchasing and Supply Management*, New York: McGraw-Hill, 1996.
- Dowlathshahi, Shad, "Bargaining Power in Buyer-Supplier Relationships," *Production and Inventory Management Journal*, First Quarter 1999.
- Dunn, Jim, "The Matrix: Assessing Your Spend in the New Frontier," *iSource Business*, August 2001.
- Dyer, Jeffrey H., "How Chrysler Created an American Keiretsu," *Harvard Business Review*, Vol. 74, No. 4, July 1996, pp. 42-56.

- Dyer, Jeffrey H., Dong Sung Cho, and Wujin Chu, "Strategic Supplier Segmentation: The Next 'Best Practice' in Supply Chain Management," *California Management Review*, Vol. 40, No. 2, Winter 1998, pp. 57-77.
- Ellram, Lisa M., *Strategic Cost Management in the Supply Chain: A Purchasing and Supply Management Perspective*, Tempe, Ariz.: CAPS Research, August 2002.
- Ellram, Lisa M., and Thomas Y. Choi, *Supply Management for Value Enhancement*, Tempe, Ariz.: Institute for Supply Management, 2000.
- Fitzgerald, Kevin R., "For Superb Supplier Development – Honda Wins!" *Purchasing*, Vol. 119, No. 4, September 21, 1995, pp. 32-40.
- Flynn, Anna E., and Sam Farney, *The Supply Management Leadership Process*, Tempe, Ariz.: Institute for Supply Management, 2000.
- Goldfeld, Charles, *Supplier Strategies*, West Palm Beach, Fla.: PT Publications, Inc., 1999.
- Hahn, Chan K., Hyoo H. Kim, and Iong S. Kim, "Costs of Competition: Implications for Purchasing Strategy," *Journal of Purchasing and Materials Management*, Vol. 22, No. 3, Fall 1986, pp. 2-7.
- Hamel, G., and C. K. Prahalad, "Strategic Intent," *Harvard Business Review*, May-June 1989, pp. 63-76.
- Hannon, David, "Lockheed Martin: Negotiators Inc." *Purchasing*, February 5, 2004.
- HQ AFMC Directorate of Contracting, Wright Patterson AFB, Ohio, 2000.
- John Deere and Company, "Sourcing Strategies," Deere & Company Supply Management, 1997.
- Kaufman, Allen, Craig W. Wood, and Gregory Theyel, "Collaboration and Technology Linkages: A Strategic Supplier Typology," *Strategic Management Journal*, Vol. 21, 2000, pp. 649-663.
- Kraljic, Peter, "Purchasing Must Become Supply Management," *Harvard Business Review*, September 1983.
- Leclere, Bernard, *Developing a Strategic Sourcing Organization*, Institute for International Research Strategic Sourcing Management Conference, New Orleans, La., February 9-11, 1998.

- Minahan, Tim, "AlliedSignal Soars by Building Up Suppliers," *Purchasing*, Vol. 123, No. 4, September 18, 1997, pp. 38-48.
- Moore, Nancy Y., Laura H. Baldwin, Frank A. Camm, and Cynthia R. Cook, "Buying to Improve Performance: Implementation Lessons from Innovative Commercial Firms," Santa Monica, Calif.: RAND Corporation, unpublished research.
- Moore, Nancy Y., Laura H. Baldwin, Frank A. Camm, and Cynthia R. Cook, *Implementing Best Purchasing and Supply Management Practices: Lessons from Innovative Commercial Firms*, Santa Monica, Calif.: RAND Corporation, DB-332-AF, 2002.
- Moore, Nancy Y., and Robert Bickel, "Developing Tailored Supply Strategies: One Approach Does Not Fit All," Santa Monica, Calif.: RAND Corporation, unpublished research.
- Moore, Nancy Y., Frank A. Camm, and Laura H. Baldwin, "Strategic Sourcing: Bundling Policies and Practices of Leading Firms," Santa Monica, Calif.: RAND Corporation, unpublished research.
- Morris, Brian D., "MIPR Analysis Targets of Opportunity," HQ AFMC/PK briefing, January 28, 2003.
- O'Conner, Brian J., "Developing Procurement Strategies for Successful Supply Chain Management Operations," *Proceedings of the Fifth Annual "Performance Measurement for the Purchasing Function" Conference*, Institute of International Research, Boston, Mass., June 2000.
- Olsen, Rasmus Friis, and Lisa M. Ellram, "A Portfolio Approach to Supplier Relationships," *Industrial Marketing Management*, Vol. 26, No. 2, March 1997, pp. 101-113.
- Owens, Gregory, Oliver Vidal, Rick Toole, and Donovan Favre, "Strategic Sourcing: Aligning Procurement Needs with Your Business Goals," in John Gattorna, ed., *Strategic Supply Chain Alignment: Best Practices in Supply Chain Management*, Gower, England: Andersen Consulting, 1988, pp. 285-301.
- Prahalad, C. K., and Gary Hamel, "The Core Competence of the Corporation," *Harvard Business Review*, May/June 1990, pp. 79-91.
- Rajagopal, Shan, and Kenneth N. Bernard, "Strategic Procurement and Competitive Advantage," *International Journal of Purchasing and Materials Management*, Fall 1993.

- Sawchuk, Chris, "Determining How to Measure the Success of Your Strategic Sourcing Initiative to Highlight Areas for Improvement," paper presented at the Institute for International Research Strategic Sourcing Conference, Chicago, Ill., June 25, 2002.
- Stallkamp, Thomas T., "Chrysler's Leap of Faith: Redefining the Supplier Relationship," *Supply Chain Management Review*, Summer 1998, pp. 16-23.
- Steel, Paul, and Brian Court, *Profitable Purchasing Strategies: A Manager's Guide for Improving Organizational Competitiveness Through the Skills of Purchasing*, London: McGraw-Hill, 1996.
- Tang, Christopher S., "Supplier Relationship Map," *International Journal of Logistics: Research and Applications*, Vol. 2, No. 1, pp. 39-56.
- U.S. Air Force, *FY02 Statistical Digest*, available at www.saffm.af.mil/FMC/statdigets/digest.html.
- Williamson, Oliver E., *The Economic Institutions of Capitalism*, New York: Free Press, 1985.
- Wolfowitz, Paul D., Deputy Secretary of Defense, "Acquisition of Services Review," Memorandum, February 6, 2003.