



NATIONAL DEFENSE RESEARCH INSTITUTE

CHILDREN AND FAMILIES
EDUCATION AND THE ARTS
ENERGY AND ENVIRONMENT
HEALTH AND HEALTH CARE
INFRASTRUCTURE AND
TRANSPORTATION
INTERNATIONAL AFFAIRS
LAW AND BUSINESS
NATIONAL SECURITY
POPULATION AND AGING
PUBLIC SAFETY
SCIENCE AND TECHNOLOGY
TERRORISM AND
HOMELAND SECURITY

The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis.

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

Skip all front matter: [Jump to Page 1](#) ▼

Support RAND

[Purchase this document](#)

[Browse Reports & Bookstore](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore the [RAND National Defense Research Institute](#)

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. Unauthorized posting of RAND electronic documents to a non-RAND website is prohibited. RAND electronic documents are protected under copyright law. Permission is required from RAND to reproduce, or reuse in another form, any of our research documents for commercial use. For information on reprint and linking permissions, please see [RAND Permissions](#).

This report is part of the RAND Corporation research report series. RAND reports present research findings and objective analysis that address the challenges facing the public and private sectors. All RAND reports undergo rigorous peer review to ensure high standards for research quality and objectivity.



Findings from Existing Data on the Department of Defense Industrial Base

Nancy Y. Moore, Clifford A. Grammich, Judith D. Mele



NATIONAL DEFENSE RESEARCH INSTITUTE

Findings from Existing Data on the Department of Defense Industrial Base

Nancy Y. Moore, Clifford A. Grammich, Judith D. Mele

For more information on this publication, visit www.rand.org/t/rr614

Library of Congress Cataloging-in-Publication Data

ISBN: 978-0-8330-8704-1

Published by the RAND Corporation, Santa Monica, Calif.

© Copyright 2014 RAND Corporation

RAND® is a registered trademark.

Cover image by Mike Kiev/Thinkstock

Limited Print and Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited. Permission is given to duplicate this document for personal use only, as long as it is unaltered and complete. Permission is required from RAND to reproduce, or reuse in another form, any of its research documents for commercial use. For information on reprint and linking permissions, please visit www.rand.org/pubs/permissions.html.

The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Support RAND

Make a tax-deductible charitable contribution at
www.rand.org/giving/contribute

www.rand.org

Preface

Policymakers seek ways to ensure (or monitor) the health and effective management of the defense supplier base. To that end, members of the House Armed Services Committee plan to require that the Department of Defense (DoD) provide semiannual reports that include comprehensive and thorough information on the supplier base.

In response, the Office of the Secretary of Defense recently conducted a very large sector-by-sector, tier-by-tier survey of the supplier base; the survey was very detailed but, as with many surveys, it was workload-intensive and time-consuming to do. This report demonstrates how, using extant data rather than conducting additional surveys, DoD may gain the information it needs to respond to Congressional requests and better understand its supplier base. This could mitigate the need for additional surveys or allow DoD to focus surveys on issues for which there is no other way to gather information.

This report should be of interest to policymakers concerned with DoD acquisition, industrial-base policy, and small-business policy. It builds on RAND experience in analyzing data from the Federal Procurement Data System (FPDS) and System for Award Management (SAM, formerly the Central Contractor Registration) to provide insight on DoD's prime, or Tier 1, contractors and its relationships with them. It extends this work to the Federal Funding Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS) on Tier 2 suppliers, for which data first became available in 2010. Combining FPDS, SAM, and FSRS data can quickly and relatively inexpensively yield information for DoD on the Tier 1 and Tier 2 supplier base and provide the information the House Armed Services Committee seeks. Such data can also yield information on Tier 1 and Tier 2 suppliers by weapon system.

This research was conducted within the Acquisition and Technology Policy Center of the RAND National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community.

For more information on the Acquisition and Technology Policy Center, see <http://www.rand.org/nsrd/ndri/centers/atp.html> or contact the director (contact information is provided on the web page).

Contents

Preface	iii
Summary	vii
Acknowledgments	xi
Abbreviations	xiii
 CHAPTER ONE	
Data on the DoD Supply Base	1
 CHAPTER TWO	
Data Coverage and Some Overall Findings on Data Quality and Specific Uses	9
 CHAPTER THREE	
Findings on Contractor Subaward Data	19
 CHAPTER FOUR	
Industry Subaward Data	27
 CHAPTER FIVE	
Weapon System Subaward Data	39
 CHAPTER SIX	
Natural Disaster Risk Data	51
 CHAPTER SEVEN	
Conclusions and Recommendations	57
References	61

Summary

Members of Congress and other policymakers have been seeking ways to ensure (or monitor) the health and effective management of the defense supplier base. In response, the Department of Defense (DoD) launched a Sector-by-Sector, Tier-by-Tier assessment to better understand and quantify the defense industrial base. One part of this initiative includes extensive surveys of about 5,000 companies that provide defense goods and services.

Given the time and expense of such surveys, as well as diminishing budgets, DoD could benefit from faster and cheaper ways to learn about the industrial base from existing data, which are more comprehensive than that in a survey sample and are continually collected to enable tracking of trends. This report explores how DoD can gain information on its industrial base by combining data that the federal government already collects. It demonstrates through sample analyses that such data could answer questions that policymakers may have on DoD-wide suppliers, contractors, industries, weapon systems, and supply-chain risks.

Sources of Data

The federal government has a number of systems that contain data on prime contractors, sub-contractors, and their locations.

All businesses seeking prime contracts from the federal government must register in the System for Award Management (SAM). SAM registrants must provide information on their annual revenue, number of employees, and the industries in which they seek to provide goods and services.

The Federal Procurement Data System—Next Generation (FPDS-NG) contains contract actions for all federal purchases above the \$3,000 micropurchase threshold. Contract-action data contain the dollar value of the total award and the specific obligation for the action, industry and product and service codes for the goods and services being procured, and other contractor characteristics, including locations.

The U.S. Geological Survey provides natural-hazard data for the contiguous United States on earthquakes, hurricanes, tornadoes, and floods by ZIP code area. These data can help identify places where DoD goods and services are provided and that may present a supply risk.

The relatively new Federal Funding Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS) provides data on contract subawards. Its reporting requirements have expanded over time, so that now prime contracts with a value greater than or equal to \$25,000 must report subawards (exempting contractors with annual revenue of less than \$300,000).

The U.S. Census Bureau provides data on businesses and their distribution within different industries both in its quinquennial Economic Census and in its annual “Statistics of U.S. Businesses.” Comparing these data with those on DoD procurement can reveal how DoD purchases reflect existing marketplaces.

DoD has several additional data sources that can yield information on its defense industrial base. The Federal Logistics Data on Portable Media provides information by National Stock Number (NSN) on the entity managing each item and selected characteristics associated with its supply. The Active Contract File of the Defense Logistics Agency links NSNs to contract numbers and order quantities. The services have similar systems. Unfortunately, DoD data, although extensive, may be delayed for one or more reasons. FPDS-NG data, for example, are subject to a delay of 150 days, and other sources of data may require special permission for access.

Findings on Data Quality and Specific Uses

FPDS and FSRS data indicate that coverage of the FSRS has increased over time. By fiscal year (FY) 2012, nearly 33 percent of contracts were subject to the reporting requirement, accounting for more than 99 percent of dollars. Obligations made under multiyear contracts written before the FSRS subaward reporting requirement was put in place are decreasing over time, and the proportion of obligated dollars with FSRS reporting requirements is increasing over time as new contracts are awarded.

Many reportable contracts, that is, contracts that have been awarded since the creation of the FSRS, are not in the system. We found that many of these were written by the Far East Engineering District for construction or maintenance of overseas facilities, which are likely to have foreign subcontractors. We also found many reportable, large weapon-system contracts without FSRS data. This suggests that offices awarding these contracts should check the subcontracting plan submitted by the prime contractors to verify whether there have been any subawards and should require that prime contractors promptly report the subawards they have made.

Our overall analyses also identified several data-quality issues. These largely stem from the fact that many data systems depend on contracting personnel for providing some data elements and any errors that are made can take time to correct.

Nevertheless, although these data, as with many new reporting systems, require caution in interpreting, they also offer unique perspectives. As we discuss below, they include information relevant to subcontracting plans, industries in lower tiers of the supply base, hidden dependencies for certain suppliers, and even natural disasters for which the federal government assumes risks. We note each of these below.

Findings on Contractor Subawards

Data on contractor subawards reveal both important information on current subcontractors and subcontracting plans and some data-quality issues that need to be addressed.

The FSRS’s detailed information on a specific contract’s subcontracting can be used to verify a contractor’s subcontracting plan. For example, when analyzing data for Lockheed

Martin, we found that 8 percent of its subcontractors were not registered. Among those that were registered, 52 percent were small businesses. Many of these small businesses were owned by disadvantaged individuals, by women, or by service-disabled veterans.

Some firms may appear multiple times in a listing of FSRS subawards. This is because some large companies comprise multiple contractors with multiple Data Universal Numbering System numbers. Analysts seeking to identify all elements of a firm in the supply base, and its importance to DoD, need to aggregate across such multiple entries.

Several contractors reported FSRS subawards to their subcontractors that exceeded the value of their reportable FPDS prime-contract awards: That is, the FSRS indicates that they awarded more in subcontracts than the FPDS indicates they received in prime contracts. One possible explanation for this anomaly is FSRS subawards being reported before FPDS prime-contract awards, which have a 90-day delay in public reporting for new awards.

Findings on Industry Subawards

FSRS data can help identify the lower-tier supply bases within particular industries. Identifying these can be problematic, because industries for subawards need not be in the same industry as those for prime-contract awards. Nevertheless, the data do offer some valid information on current supply bases, particularly on the reliance some prime contractors and subcontractors may have on the federal government.

Our analysis of subcontractors in Guided Missile and Space Vehicle Manufacturing, for example, found that parent firms for 10 subcontractors receive more than 25 percent of their average annual prime contract and subcontract revenue from the federal government. Leading purchasing textbooks recommend that buyers purchase no more than 30 percent of any supplier's entire capacity, with many recommending no more than 15 percent, to guard against the buyer potentially putting a supplier out of business in the event of order cancellations resulting from economic downturn, product discontinuation, or switching to another supplier. Although this may be difficult to do in many defense sectors, purchasing very large amounts of a supplier's capacity can still represent a source of supply risk.

For several subcontractors, we calculate FPDS and FSRS revenues that exceed those reported to the SAM. Possible explanations for such anomalies may include establishment of new firms, reporting of SAM revenues in incorrect units, reporting of revenue only for a local facility, or new federal government revenue exceeding previous total revenues.

Small businesses were quite prevalent among subcontractors for Guided Missile and Space Vehicle Manufacturing, accounting for about half the supply base in this industry. More than one in five such businesses were owned by women, disadvantaged individuals, or service-disabled veterans, although the proportion of small-business revenues these businesses received was considerably smaller.

Findings on Weapon System Subawards

We found 12 weapon systems with more than 10 subcontractors each recorded in the FSRS. Among these, we selected the Trident II Missile for more detailed illustrative analyses. In addi-

tion to having the second-highest number of subcontractors, it has the fifth-most subaward dollars and the third-most subcontracts among weapon systems.

Altogether, 33 prime contractors for Trident received more than 25 percent of their prime contract plus subcontract revenue from federal sources, as did eight subcontractors. (A few firms received revenues from both Trident prime contracts and subcontracts.) All such firms could be at risk if their total federal revenue fell substantially, with risks possibly carrying over to Trident and other supply chains. Several subcontractors also reported federal revenues exceeding the total revenue they reported to the SAM, indicating a need to update SAM data.

Findings on Natural Disaster Risks

In addition to risks that may result to buyers or suppliers from overreliance on any single supplier, external causes may also pose risks to supply chains. Integrating procurement data and data on natural disasters can help identify some of these. For example, overlaying maps of supplier locations with those of natural-disaster occurrences can identify where natural disasters may disrupt future supply. Many suppliers are located in hurricane-, earthquake-, or tornado-prone regions. Identifying the specific parts produced in these zones, and either acquiring safety stocks of these or requiring that suppliers have business continuity plans, can help mitigate supply-chain risks there.

Conclusions and Recommendations

Our analyses demonstrate that existing data sources can help DoD gain visibility on its suppliers and their suppliers. Knowing that this information can be obtained from existing data, even though the quality of some data sources needs to be improved in some ways, may minimize the need to spend the time and effort involved in conducting surveys of these firms, or may limit the uses of surveys to topics for which no other data sources are available.

We found that FSRS subaward data are being gathered, particularly as new awards subject to subcontract reporting are made. As contracts expire and requirements to report subawards expand to more obligated dollars, the FSRS data will eventually cover the vast majority of Tier 2 subcontractors. At the same time, FPDS, FSRS, and SAM data are all subject to input errors, which DoD may seek to correct. DoD corrects the errors it finds, but it can take time to discover them.

We recommend that DoD encourage and verify that prime contractors with reportable contracts report their subawards. We also recommend that DoD work to improve the quality of prime contractor and subcontractor data, including, for example, requiring that they frequently update information on their average annual revenue in the SAM and then verify that they have done so. Finally, we recommend that analyses be expanded with other data, such as that on supplier financial risks and their susceptibility to natural disasters at their place of performance, as well as that for key weapon-system parts. By ultimately relying on 100 percent of data on transactions, evolving data systems may be able to provide DoD more information on its industrial base than any new and possibly expensive surveys would. DoD could then limit its use of surveys to obtain additional data elements not available in existing data systems, complementing existing sources.

Acknowledgments

This work leverages the efforts of several earlier and ongoing research projects. We thank Ed Keating and Tim Bonds for their support of some earlier FSRS analyses on the Abrams tank, analyses that formed the initial foundation for this analysis. We thank Elvira Loredó and Lisa Miyashiro for their analyses of supply risks for the Air Force and Mary Chenoweth for her analyses of supply risks for the Army. We especially thank Cynthia Cook and Irv Blickstein for their support of this effort. Finally, we thank Donna Mead for her help in preparing this document for publication, Patricia Bedrosian for editing the document, and our reviewers, Ed Keating and Megan McKernan, for their insights and comments.

Abbreviations

BMDS	Ballistic Missile Defense System
CAGE	Commercial and Government Entity
CCR	Central Contractor Registration
DLA	Defense Logistics Agency
DoD	Department of Defense
DUNS	Data Universal Numbering System
eSRS	Electronic Subcontracting Reporting System
FFATA	Federal Funding Accountability and Transparency Act
FPDS	Federal Procurement Data System
FPDS-NG	Federal Procurement Data System—Next Generation
FSRS	FFATA Subaward Reporting System
FY	fiscal year
HASC	House Armed Services Committee
JSF	Joint Strike Fighter
LCMC	Life Cycle Management Command
LCS	Littoral Combatant Ship
MLRS	Multiple Launcher Rocket System
NAICS	North American Industry Classification System
NSN	National Stock Number
OEM	original equipment manufacturer
PRON	Procurement Request Order Number
PSC	Product and Service Code

S2T2	sector-by-sector, tier-by-tier
SAM	System for Award Management
SDB	small disadvantaged business
SUSB	Statistics of U.S. Businesses
USGS	U.S. Geological Survey

Data on the DoD Supply Base

Findings from Existing Data on the DoD Industrial Base

Nancy Y. Moore, Clifford A. Grammich,
and Judith D. Mele

2014



1

With more than \$350 billion in annual purchases, the Department of Defense (DoD) has a very large supply base. Some of its purchases are for common goods and services used by other enterprises, and others are unique to DoD or at least to the defense industry.

As DoD's budget shrinks, concern is rising regarding the effects of reduced purchases on key DoD suppliers over time, particularly those that are subcontractors to prime contractors and on which DoD has limited or no visibility. Better understanding its industrial base can help DoD better use it and identify new and innovative suppliers within it (Gansler, 2011). Members of Congress and other policymakers have also been seeking ways to ensure (or monitor) the health and effective management of the defense supplier base (House Armed Services Committee [HASC] Panel on Business Challenges in the Defense Industry, 2012).

To better understand its supply base, in 2002 DoD launched a new initiative called the Sector-by-Sector, Tier-by-Tier (S2T2) assessment. The S2T2 project "seeks to better understand and quantify the complexity of the defense industrial base [by] collect[ing] data, prepar[ing]

analyses, and guid[ing] DoD investments and policy choices to recognize the complexity of the industrial base” (Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, 2012, p. 9).

One S2T2 track involves extensive surveys conducted by the Department of Commerce Bureau of Industry and Security for DoD. DoD initially picked five programs in six industrial sectors (aircraft, ground systems, missiles, missile defense, services, and shipbuilding), tried to determine how many firms (including lower-tier suppliers) were working in them, and, eventually, surveyed about 5,000 companies to develop an industry baseline. The S2T2 initiative has subsequently launched additional, more narrowly focused surveys of the U.S. space industrial base, of the command, control, communications, computers, intelligence, surveillance, and reconnaissance supply-chain networks, and of the infrastructure for Underwater Acoustic Transduction Systems.¹

Such surveys are one-time samples that can be costly and take time to field and assess. Given such time and expense, diminishing budgets, and a need to track changes over time, DoD could benefit from alternative, faster, and cheaper ways to learn about the industrial base and how to continually monitor it using existing data.

¹ For more on these surveys, see U.S. Department of Commerce (undated).

Outline

- Background: data sources and availability
- Findings
 - DoD-wide
 - Contractors
 - Industries
 - Weapon systems
 - Supply-chain risks
- Conclusions and recommendations

RAND

2

This annotated briefing explores information DoD can gain on its industrial base from data the federal government already collects. We begin this chapter with background on sources of data relevant to the DoD industrial base and their availability. In subsequent chapters, we present some sample analyses of what these data can illustrate regarding the industrial base across DoD, as well as findings by contractor, industry, and weapon systems. We also present some illustrative analyses of what existing data can say about extraordinary supply-chain risks. We conclude with some overall observations and recommendations for future analyses (Chart 2).

Federal Sources of Data

- System for Award Management (formerly Central Contractor Registration)
- Federal Procurement Data System
- U.S. Geological Survey hazard data
- Federal Funding Accountability and Transparency Act Subaward Reporting System
- U.S. Census Bureau

RAND

3

The federal government has a number of systems that contain data on prime contractors, subcontractors, and their locations. We discuss five principal sources here (Chart 3).

First, all businesses seeking prime contracts from the federal government must register in the System for Award Management (SAM), formerly the Central Contractor Registration (CCR). SAM/CCR registrants must provide information on their annual revenue and number of employees for the past three years for the parent firm, which helps the government determine the size of the firm for small-business preference programs. Reporting revenue and number of employees for separately operating contractors of the firm is optional, hence, that information is reported by some firms and not others. Information on local revenue is not available in public-use SAM data. Firms list industries as defined by North American Industry Classification System (NAICS) codes in which they claim to be capable of providing goods and services to the federal government, although they may also bid for contracts in other industries.

The SAM data include the Data Universal Numbering System (DUNS) number for each contractor. DoD contractors also list their unique DoD-assigned and -maintained Commercial and Government Entity (CAGE) codes. Federal contracting data use DUNS numbers for contract actions and subawards whereas DoD logistics systems use CAGE codes for contractors.² If linkages are available, these codes can be used to link contractors to their parent firms.

Second, the Federal Procurement Data System—Next Generation (FPDS-NG) contains contract actions for all federal purchases above the \$3,000 micropurchase threshold. Contract-action data contain the dollar value of the total award and the specific obligation for the action. Such data also have the contract number, NAICS code for the industry in which the goods or

² The federal government uses the term subaward to refer to subcontracts and subgrants awarded by federal prime contract and grant awardees.

services are being provided, Product and Service Code (PSC, a more finely grained indicator than the NAICS code) for the good or service provided, contractor DUNS number, contractor name, contractor socioeconomic status (including whether the contractor is a small business, and, if a small business, whether it is owned by disadvantaged individuals, women, or service-disabled veterans), the contracting office placing the contract action, and the place of performance where goods are made or services provided.

Third, the U.S. Geological Survey (USGS) provides natural-hazard data for the contiguous United States on earthquakes, hurricanes, tornadoes, and floods by ZIP code (U.S. Geological Survey, 2013). We use these to identify places of performance for DoD goods and services that may have supply-chain risk.

Fourth, the Federal Funding Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS) provides data on contract subawards. Launched in July 2010, the FSRS has phased in requirements for reporting subawards (Federal Funding Accountability and Transparency Act Subaward Reporting System, undated). It initially required that prime contracts with a total value of \$20 million or more report such subawards by the end of the month in which they were made. The reporting threshold dropped to prime contracts valued at least at \$550,000 in October 2010 and to those valued at least at \$25,000 in March 2011. Contractors with total annual revenue less than \$300,000 in the past year are exempt from subaward reporting requirements.

For those subawards it reports, the FSRS data include the DUNS number of the subcontractor and the amount of the subcontract. The data also include the NAICS code associated with the subaward, which may be the NAICS code for the prime contract, the NAICS code for the subcontract, or the primary NAICS code for the subcontractor. Because contractors may register as many as 1,000 NAICS codes, their primary NAICS code may be unrelated to the NAICS code for the goods or services subcontracted.

Fifth, the U.S. Census Bureau provides data on businesses and their distribution within different industries (as defined by NAICS codes) over time. Its quinquennial “Economic Census,” conducted in years ending in 2 or 7, provides employee and revenue data for firms and establishments by industry (U.S. Census Bureau, undated-a). Fully processing the results of the Economic Census can take two years or longer; we therefore use tabulations based on 2007 results for this analysis, because 2012 results were not available at the time of this research.

The Census Bureau also annually produces “Statistics of U.S. Businesses” (SUSB). These data contain, by industry, the number of firms, establishments, employees, and annual payroll (U.S. Census Bureau, undated-b). More dynamic SUSB data include information on firm births, deaths, expansions, and contractions.

Additional DoD Sources of Data

- Federal Logistics Data on Portable Media
- Defense Logistics Agency Active Contract File
- Army
- Air Force
- Navy

RAND

4

DoD has its own additional data sources on its purchases. We note five of these here (Chart 4).

First, the Federal Logistics Data on Portable Media, provided by the Defense Logistics Agency (DLA), provides information by National Stock Number (NSN) on the entity managing the NSN, part/reference number, supplier, CAGE code, freight, interchangeability and substitutability, and other characteristics (Defense Logistics Agency, Logistics Information Service, undated-b).

Second, the DLA's Enterprise Business System has an Active Contract File (Defense Logistics Agency, undated-a). This links NSNs to contract numbers, CAGE codes, and order quantities. The services have similar logistics data systems that link orders' NSNs to contracts.

Third, the Army has a Contracting Business Intelligence System with data on the progress of contract actions, including what has been purchased. Fourth, the Air Force Materiel Command has a Strategic Sourcing Analysis Tool similar to the Army Contracting Business Intelligence System. Fifth, the Navy is implementing a Logistics Information Technology Strategic Plan both ashore and for operational forces.

Ideally, the systems for each service will ultimately yield additional, readily available information on linking required materials to the DoD industrial base.

Data Availability Issues

- Prime-contract award data subject to 150-day delay
- Parent firm data contingent on SAM registration and access
- Subaward data contingent on award of new prime contract for which reporting is required
- DLA data use requires Memorandum of Understanding
- Service data access requires permission

RAND

5

Not all of the data are readily available for public use. This means that some purchases cannot be analyzed until several months after they have been made (Chart 5).

For security reasons, the public release of FPDS-NG prime contract–action data for new contracts is delayed by 90 days. In addition, administration time of about 60 days is needed to update the data after the 90-day security delay has expired. Thus, there is about a 150-day delay in the public release of prime contract–action data after a contract action is taken.

The public version of SAM provides supplier information by CAGE code only; FPDS-NG or FSRS data use DUNS numbers. This makes it very challenging to link contractors to their parent firm. In addition, although prime contractors must register in the SAM, there is no requirement that government subcontractors do so. As a result, information on average annual revenue data may not be available for some subcontractors.

The availability of subcontractor data is contingent on the award of new prime contracts for which subaward reporting is required. Multiyear contracts that were written before the subaward requirement need to include such a requirement when they are renewed, so that their subawards will be reported. Subaward data are also contingent on contractors actually reporting subawards. As we will discuss, some large contracts that very likely have subawards report no subawards.

DLA requires a Memorandum of Understanding before it will release detailed Active Contract File data with details on all DLA contracts, including awards below the \$3,000 threshold for reporting to the FPDS-NG. The DLA memorandum includes a requirement that it review all analyses before they may be shared. Finally, the services must grant permission for accessing their sustainment data systems, which can be used to link contractors and their contracts to specific weapon-system parts.

Altogether, current federal and DoD data can offer several insights into the DoD industrial base. These are likely to grow over time. Nevertheless, currently there are some limitations to these data, some of which will be removed over time but others are likely to remain.

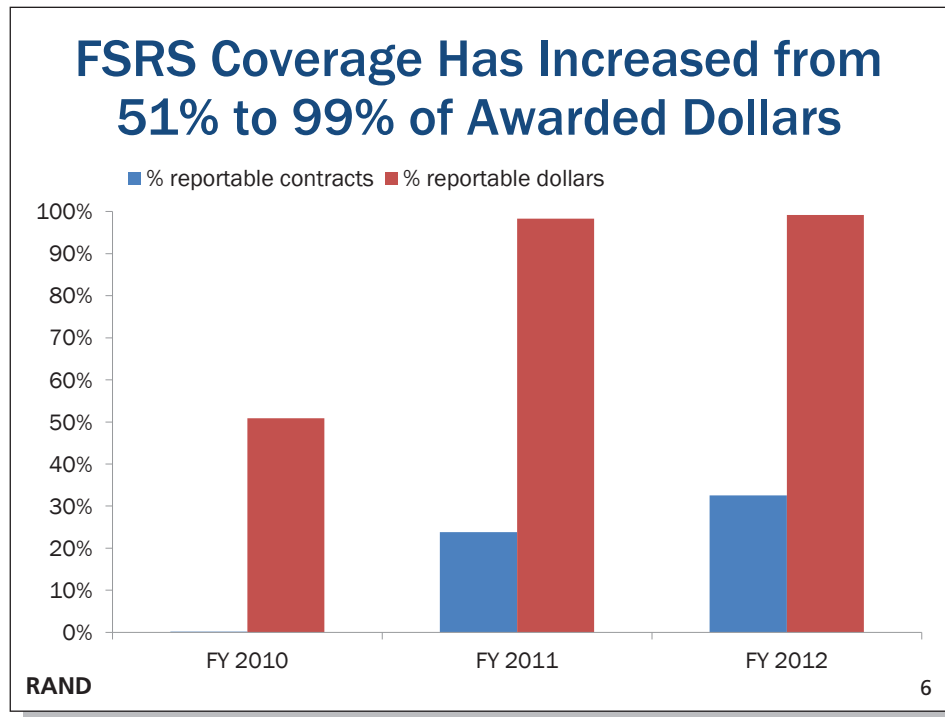
We turn next to some overall findings available in current data, including the share of DoD contract spending that is currently in the FSRS.

Data Coverage and Some Overall Findings on Data Quality and Specific Uses

Given that the FSRS subaward reporting requirements are fairly new, the phasing-in of such requirements from July 2010 to March 2011, and that contracts can span a number of years, the proportion of contracts subject to the subaward reporting requirement will increase over time. In this chapter, we review the proportion of contracts that have FSRS information and the issues these raise for analyses of the industrial base.

The FSRS reporting threshold is based on the total award of the contract. As noted, an award, particularly a very large one, can span a number of years. We determined whether a prime contract meets the FFATA reporting threshold by examining the initial data entry for each contract written in a given fiscal year (FY). If the data field “BaseAndAllOptionsValue” was greater than the reporting threshold value at the time the contract was written, we identified the contract as FSRS-reportable.

We found that the Award Amount field in the FPDS was not always completed. We therefore searched across recent contract actions to identify the contract award total value for these preliminary analyses. DoD may need to pay additional attention to assuring that the total award value of contracts appears in the first contract actions and that the Award Amount field is populated on subsequent contract actions.



We analyzed FPDS data from FY 2010 through FY 2012 to identify the percentages of contracts and contract dollars reportable to the FSRS over time (Chart 6). We found that, for contracts awarded (i.e., written) in FY 2010, less than 1 percent of contracts were subject to the reporting requirement, then \$20 million, but these accounted for more than 50 percent of contract dollars. By FY 2012, when the reporting threshold was \$25,000, nearly 33 percent of contracts were subject to the reporting requirement, accounting for more than 99 percent of dollars. That is, each year has higher proportions of contract obligations from reportable contracts that may have subawards and subcontract dollars. The FSRS, in other words, is evolving toward a near-complete picture of DoD prime contract and not a partial picture as evident in survey data.

Obligations on Older Multi-year Contracts Limit Recent Reporting

FY 2012	Awarded		Obligated	
	Total	Percentage Reportable	Total	Percentage reportable
Contracts	351,299	33	475,336	30
Dollars (millions)	254,588	99	360,865	39

RAND

7

Although virtually all contract dollars *awarded* in FY 2012 were reported to the FSRS, only 39 percent of contract dollars *obligated* for that year were (Chart 7). The remaining contract dollars (less the 1 percent of FY 2012 dollars awarded on contracts that were less than \$25,000 and exempt from FSRS reporting) were on older contracts not required to be reported to the FSRS. As these older contracts expire, the percentage of obligated contract dollars that are reportable to the FSRS will grow.

It was beyond the resources of this study to analyze the expiration dates of contracts with FY 2012 obligations that are above the minimum \$25,000 threshold and not reported to the FSRS. Such an analysis would show how fast the FSRS reporting requirement will cover most DoD obligations.

Many Large Contracts Have No Reported Subawards

Award Value	Total Reportable Contracts	Contracts Without Subaward data
≥ \$10 billion	12	10
≥ \$1 billion and < \$10 billion	31	28
≥ \$500 million and < \$ 1 billion	43	41
≥ \$100 million and < \$ 500 million	271	242

RAND

8

We identified all contracts awarded between FY 2010 and FY 2012 that were above the threshold for reporting to the FSRS. We grouped these into two categories for analysis: those with subawards reported and those without subawards reported.

All prime contractors other than those with average annual revenue of less than \$300,000 are to report subawards to the FSRS. However, we found no mention of a penalty in the FSRS legislation or on the FSRS web page for failure to report.

In Chart 8, we show the number of contracts reportable to the FSRS but without subaward data. Altogether, we found 321 contracts reportable to the FSRS without subaward data—including 38 worth more than \$1 billion awarded and 10 with more than \$10 billion awarded. We consider it unlikely that such contracts have no subawards. We next explore some possible reasons for this lack of subaward data.¹

¹ We did not explore one possible reason for the lack of subaward data: these contracts might not have had clauses requiring reporting of such data. Nevertheless, as *Christian v. United States* ruled, “[i]f a mandatory clause that implements *fundamental procurement policy* [emphasis added] is omitted from the contract without a deviation,” it is effectively included in the contract (Nash et al., 2007, p. 521). That is, under the Christian Doctrine, “clauses required by regulation to be included in government contracts will be read into the contract whether or not physically included in the contract, unless a proper DEVIATION [caps in original] from the regulation has been obtained” (Nash et al., 2007, p. 94).

Many Reportable Contracts Not in FSRS Data Were for Far East

Awarded (\$ millions)	PSC	Contractor
37,657	CONSTRUCT/OTHER RESIDENTIAL BLDGS	ETEC E&C LIMITED
31,457	CONSTRUCTION OF TROOP HOUSING FACILITIES	FINE CONSTRUCTION CO., LTD.
30,339	CONSTRUCTION OF TROOP HOUSING FACILITIES	SAMSUNG C&T CORPORATION
17,942	CONSTRUCTION OF OTHER UTILITIES	LIM KWANG ENGINEERING & CONSTRUCTION CO., LTD.
17,188	CONSTRUCT/OTHER RESIDENTIAL BLDGS	CENTRAL CONSTRUCTION CO., LTD.
16,316	CONSTRUCTION OF TROOP HOUSING FACILITIES	SEOHEE CONSTRUCTION CO., LTD.
11,289	CONSTRUCT/HOSPITALS & INFIRMARIES	ILSUNG CONSTRUCTION CO., LTD.
10,155	CONSTRUCT/OTHER ADMIN & SVCS BLDGS	FINE CONSTRUCTION CO., LTD..
8,800	CONSTRUCTION OF OTHER UTILITIES	ILKWANG E&C CO., LTD.
7,549	CONSTRUCT/OTHER ADMIN & SVCS BLDGS	KUMSUNG CONSTRUCTION CO., LTD.
5,598	MAINT-REP-ALT/MISC BLDGS	CHUNG KWANG CONSTRUCTION CO., LTD.
5,337	MAINT-REP-ALT/OTHER HOSPITAL BLDGS	YUIL ENG. & CONST. CO., LTD.
5,049	MAINT-REP-ALT/OTHER WAREHOUSE BLDGS	SEONG BO CONSTRUCTION IND., LTD.
4,422	MAINT-REP-ALT/MISC BLDGS	ETEC E&C LIMITED
3,888	MAINT-REP-ALT/OTHER HOSPITAL BLDGS	SHINSAEGYE CONSTRUCTION CO., LTD

RAND

9

Many large reportable contracts with no subawards reported to FSRS were written by the Far East Engineering District. We found 29 contracts with a total award value (often over multiple years) of more than \$225 billion written by the Far East Engineering District for construction or maintenance of overseas facilities, likely to support the increased presence of U.S. forces in the western Pacific. Altogether, there were 125 reportable contracts for the Far East Engineering District, none of which had subawards reported.

In Chart 9, we list the 15 contracts awarded by the Far East Engineering District with award value of more than \$3 billion each and the PSC for the goods and services procured and the prime contractor. We found that the contractors for all 29 Far East Engineering District contracts are foreign firms. Many, if not all, are likely to have subawards. However, such sub-contractors are also likely to be local, non-U.S. firms.

Other Top Reportable Non-Weapon Contracts Without FSRS Data

Awarded (\$ millions)	PSC	Contracting Office
20,462	MEDICAL- GENERAL HEALTH CARE	TRICARE MGMT ACTIVITY AURORA WEST
7,218	AIRCRAFT, ROTARY WING	W6QK ACC-RSA
3,677	R&D-ELECTRONICS & COMM EQ-B RES	FA8721 ESC CAA
3,003	MAINT-REP OF COMMUNICATION EQ	W6QL ECC PARC KOREA
1,884	DENTISTRY SERVICES	TRICARE MGMT ACTIVITY AURORA WEST
1,883	LIQUID PROPELLANTS AND FUELS, PETROLEUM BASE	DLA ENERGY
1,850	AIRCRAFT, FIXED WING	FA8615 ASC WWMK
1,358	LIQUID PROPELLANTS AND FUELS, PETROLEUM BASE	DLA ENERGY
1,289	SUBMARINES	NAVSEA HQ
1,096	LIQUID PROPELLANTS AND FUELS, PETROLEUM BASE	DLA ENERGY
1,090	DEFENSE STUDIES	W6QK ACC-NCR
1,044	OTHER MANAGEMENT SUPPORT SERVICES	W6QK ACC-APG (SCRT)
970	FIRE CONTROL SYSTEMS, COMPLETE	W6QK ACC-PICA
917	FOOD SERVICES	HEADQUARTERS MARINE CORPS

RAND

10

Several large contracts without FSRS data were issued outside the Far East Engineering District. In Chart 10, we show the 14 largest such contracts that did not have a weapon-system code, including the contract-award amount, the PSC, and the contracting office. Weapon-system contracts are those coded as such in the Program, System, or Equipment Code of the Federal Procurement Data System. Contracts are again ranked by award value, with many awards distributed over multiple years. These large contracts without FSRS data span a broad range of goods and services. Some may, indeed, have no subawards, but some likely have subawards that the prime contractors are not reporting. To best understand its supplier base, particularly how its procurement affects small businesses—a continuing policy concern of Congress—DoD should confirm whether there are subawards here and with which subcontractors.

Other Top Reportable Non-Weapon Contracts Without FSRS Data

Awarded (\$ millions)	Weapon System	Agency	Contractor
36,394	Air Force Tanker Rep	Air Force	THE BOEING CO
4,536	LCS	Navy	AUSTAL USA, LLC
3,294	CAA	MDA	BOEING CO
2,002	DD(X)	Navy	BATH IRON WORKS CORP
1,828	F-15	Air Force	BOEING CO, THE
1,340	DDG 51	Navy	BATH IRON WORKS CORP
1,131	EELV	Air Force	UNITED LAUNCH SERVICES, LLC
881	SSN 774	Navy	ELECTRIC BOAT CORP
798	SDB	Air Force	RAYTHEON CO
790	DDG 51	Navy	HUNTINGTON INGALLS INC
694	DDG 51	Navy	HUNTINGTON INGALLS INC
598	V22	Navy	ROLLS-ROYCE CORP
575	EELV	Air Force	UNITED LAUNCH SERVICES, LLC
559	CAA	MDA	RAYTHEON CO
535	JSF (F-35)	Navy	LOCKHEED MARTIN CORP
522	JSF (F-35)	Navy	LOCKHEED MARTIN CORP

RAND

11

Chart 11 lists the 16 largest reportable weapon-system contracts from FY 2010 to FY 2012 without FSRS subawards. In addition to contract-award amount (which, we remind the reader, can be obligated over many years), we list the weapon system, the agency procuring the weapon system, and the prime contractor. Given that original equipment manufacturers are often assemblers of major components from subcontractors, we would expect to see subawards reported in the FSRS for these contracts, but we do not. The contracting offices that awarded these contracts should check the subcontracting plan submitted by the prime contractors. They should then verify that there have been no subawards or require that prime contractors promptly report their subawards on the contract. This can help DoD understand its industrial base for weapon systems and how much it supports small businesses—a continuing concern of Congress.

Data Quality Depends on Input

- Average annual revenue → contractor input
- Prime contract actions → contracting personnel input
- Subawards → prime contractor input
- Base and all options → contracting personnel input

RAND

12

Our analyses also identified several other data-quality issues that must be addressed for further analyses (Chart 12).

We found that contractor-reported average annual revenue for the past three years as reported in the CCR and the SAM was sometimes less than average total FPDS prime contract and FSRS subcontract revenue. This may be because the contractor is a new business or the reported revenue was in the wrong units. Another possible explanation would be recent receipt of new contracts that are much greater than past contracts and this revenue has not yet been reported. Because average annual revenue may determine parent-firm size for small-business purposes, DoD should regularly check reported average annual revenue against actual revenue reported in the FPDS and FSRS and require immediate updating if large discrepancies are found.

The FPDS depends on input from contracting personnel for some data elements. Errors have been made on FPDS entries, which can take time to correct. That said, automated population of some FPDS elements from other data systems has helped improve the quality of FPDS data. Efforts have also been made to better train contracting personnel to improve input accuracy.

The input of subaward data depends on input from prime contractors. Although they are required to provide such data, there is no penalty for failing to do so. The requirement for subaward data is also fairly new. Hence, prime contractors may not be proficient at entering correct dollar amounts or NAICS codes for the subaward.

The FPDS has a data element called “base and all options” for the total value of the contract. This data element is not always populated for the first or even second action on a contract and can change over time. Consequently, identifying reportable contracts over time was

challenging given the lack of these data elements or population of these data elements with the amount of the initial and not ultimate award value of the contract.

In the next chapter we analyze subaward data by contractor.

Findings on Contractor Subaward Data

In addition to assessing overall DoD subaward data, we analyzed subaward data by contractor. In this chapter, we present data on overall subawards by contractor, as well as more detailed data for a large contractor.

Contractors Can Both Award and Receive Subawards

- FSRS tracks subaward dollars *awarded* by a prime contractor (outbound subcontract) to a subcontractor
- It can also be used to track subaward dollars *received* by a subcontractor (inbound subcontract)
- Some federal contractors both award and receive subawards

RAND

13

The FSRS collects data on subaward dollars and their recipients. The dollars are from subcontracts and subgrants awarded by recipients of federal contracts and grants. In our context, subaward dollars are awarded by prime federal contractors via subcontracts (i.e., outbound) to a subcontractor. The data can also be used to track subaward dollars received by a subcontractor (i.e., inbound) from subcontracts on federal prime contracts. Because some federal contractors both award and receive subawards, we distinguish outgoing dollars to subcontractors as subawards and incoming dollars to subcontractors as subcontract revenue to help clarify the flow of the dollars (Chart 13).

Contractors with the Most Reported FSRS Subawards

Rank	Contractor	# Subaward	Subaward (\$ millions)	Prime Award (\$ millions)
1	DIETARY EQUIPMENT INC	378	4	6
2	SAIC (1)	278	23	39
3	TEXTRON INC.	255	40	549
4	ITT SYSTEMS CORP	249	119	902
5	LOCKHEED MARTIN CORP	218	502	1,083
6	FORCE 3, INC.	213	58	89
7	SAIC (2)	195	219	444
8	MCCANN WORLD GROUP INC	187	98	16
9	HENSEL PHELPS CONSTRUCTION CO	171	223	289
10	L-3 COMMUNICATIONS CORP	162	17	302
11	ATLANTIC DIVING SUPPLY, INC.	153	74	180
12	L-3 COMMUNICATIONS CORPORATION	150	43	226

RAND

14

We ranked contractors with subawards by the number of subawards associated with their prime contracts from FY 2010 to FY 2012. Ranking firms this way, as well as by their subaward dollars, helps identify firms to investigate for better understanding the DoD industrial base.

Chart 14 lists the 12 contractors with the largest number of subawards. Note that some company names are repeated. This is because some large companies comprise multiple contractors with multiple DUNS numbers. We will later review more detailed data for Lockheed Martin, highlighted above.

We found that one contractor reported more subaward dollars in the FSRS than prime-contract dollars in the FPDS: McCann World Group reported \$98 million in subawards made from prime contracts it received but the publicly available FPDS contained prime-contract revenues of only \$16 million.

Tracking down such anomalies was beyond our resources but should be done to improve the overall quality of results.

Contractors with the Most Reported FSRS Subaward Dollars

Rank	Contractor	Subaward (\$ millions)	Prime Award (\$ millions)	# Subawards
1	PROTECTIVE PRODUCTS ENTERPRISES, INC	2,600	2	1
2	WEBCOR / RA BURCH A JV	1,543	124	98
3	BALFOUR BEATTY/DPR/BIG-D, A JOINT VENTURE	1,147	1,222	115
4	WALBRIDGE OVERAA, A JOINT VENTURE	964	23	41
5	WYLE INFORMATION SYSTEMS, LLC	897	16	7
6	SKANSKA USA BUILDING INC.	848	153	43
7	HARPER CONSTRUCTION COMPANY, INC.	796	278	73
8	MOWA DEVELOPMENT LLC	795	2	2
9	HUMANA MILITARY HEALTHCARE SERVICES, INC.	755	23,588	11
10	NORTHROP GRUMMAN SYSTEMS CORPORATION	502	413	113
11	LOCKHEED MARTIN CORPORATION	502	1,083	218
12	SAUER INCORPORATED	484	174	107

RAND

15

We also ranked contractors by their reported subaward dollars in the FSRS from FY 2010 to FY 2012 (Chart 15). Nine of the top 12 contractors reported subaward dollars that exceeded their prime-contract dollars, indicated in red. Again, possible explanations include reporting in the wrong units, given FSRS was a new database with some possible confusion on how to comply with it, or subawards being publicly reported before prime-contract awards were.

Lockheed Martin was among the top 12 contractors as ranked by number of subawards, and among the top 12 contractors as ranked by subaward dollars. Other Lockheed Martin contractors had an additional 286 subawards reported to the FSRS as of February 2013, for a total of 504 contracts to 311 different subcontractors. We selected these Lockheed Martin contractors for more detailed analysis.

Other-than-small businesses are required to submit a Subcontracting Plan if the estimated award value of a federal contract exceeds \$650,000 (\$1.5 million for construction contracts). All those required to submit subcontracting plans are also required to submit one or more Individual Subcontract Reports and Summary Contract Reports on their subcontracts awarded to small businesses.¹ Such plans are filed with the Electronic Subcontracting Reporting System (eSRS). If the FSRS is providing the same data elements reported in the eSRS as well as additional information, then it may be possible to replace eSRS reporting once FSRS applies to all contracts with an award value exceeding \$650,000.

¹ Such reports are also required for designated categories of small businesses, including small businesses owned by socially and economically disadvantaged individuals, women, veterans, and service-disabled veterans, as well as those located in historically underutilized business zones and having other characteristics of HUBZone businesses.

Not All Lockheed Martin Subcontractors Are in the SAM

Subcontractors	Subcontractors		Subaward Contracts		Subaward Dollars	
	#	%	#	%	Amount	%
In SAM	285	92	475	94	607,335,205	98
Not in SAM	26	8	29	6	12,874,781	2
Total	311	100	504	100	620,209,986	100

RAND

16

Comparing the DUNS numbers for Lockheed Martin subcontractors with those in the SAM, we found that 8 percent of the subcontractors were not registered. As a result, 6 percent of the subawards and 2 percent of the subaward dollars could not be classified by their small-business status (Chart 16).

Most Lockheed Subcontractors, But Not Dollars, Were Small Businesses

SAM Classification	Subcontractors		Subaward contracts		Subaward dollars	
	#	%	#	%	Amount	%
Small business	148	52	248	52	273,426,511	45
Other-than-small	137	48	227	48	333,908,694	55
Total	285	100	475	100	607,335,205	100

RAND

17

Among Lockheed Martin subcontractors registered in the SAM, 52 percent were small businesses. These small subcontractors held 52 percent of the subaward contracts for Lockheed Martin, and received 45 percent of Lockheed Martin subaward dollars (Chart 17). This is well above the current DoD goal that 36.7 percent of subcontracting dollars go to small businesses (Department of Defense, Office of Small Business Programs, 2013).

Many Small Lockheed Martin Subcontractors Had Special Status

Small Business Subcontractors	SB Subcontractors		SB Contracts		SB Dollars	
	#	%	#	%	Amount	%
Small disadvantaged business, self identified	11	7	15	6	7,191,830	3
Woman-owned	30	20	52	21	10,766,360	4
Service-disabled veteran-owned	5	3	7	3	344,738	<1
Total	148	100	248	100	273,426,511	100

RAND

18

We also analyzed Lockheed Martin's small-business (SB) subcontractors by special status. Thirty percent of these subcontractors had additional small-business status, whether disadvantaged, women-owned, or service-disabled veteran-owned. Women-owned small businesses were the largest such group, numbering 20 percent of such subcontractors, holding 21 percent of subawards and receiving 4 percent of small-business subaward dollars from Lockheed Martin (Chart 18).

This analysis demonstrates that FSRS data can be used to learn more about prime contractors' small-business utilization plans. In the next chapter, we review what information FSRS data can yield by industry.

Industry Subaward Data

To illustrate what information FPDS and FSRS data could offer on industries, we first ranked industries, defined by their NAICS code, by their total reported subaward dollars. We then selected a specific industry for more detailed analysis, including concentration of the supply base.

Industries with the Most Reported FSRs Dollars

NAICS	Dollars (millions)		# Sub-Contractors
	Subaward	Prime Awarded	
Commercial and Institutional Building Construction	7,692	27,599	1,690
Surgical Appliance and Supplies Manufacturing	2,607	279	14
Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	1,290	18,621	799
Highway, Street, and Bridge Construction	816	1,308	17
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	722	9,254	152
Direct Health and Medical Insurance Carriers	755	45,874	10
Guided Missile and Space Vehicle Manufacturing	739	5,981	225
Computer Facilities Management Services	692	950	22
Other Ordnance and Accessories Manufacturing	481	1,531	19
Office Machinery Manufacturing	466	223	5
Engineering Services	389	10,294	327
Military Armored Vehicle, Tank, and Tank Component Manufacturing	257	3,258	187
Security Guards and Patrol Services	247	814	4
Aircraft Manufacturing	235	63,986	113
Computer Systems Design Services	180	3,841	123

RAND

19

Chart 19 ranks industries by their total reported subaward dollars from FY 2010 to FY 2012. It also includes total reportable prime-award dollars and the number of different subcontractors that received subawards. Reportable prime-award dollars may be less than subaward dollars for some industries, as it is for two industries above, because the industry for the subaward may differ from that for the prime-contract award. For example, a large contract in aircraft manufacturing may have subcontracts in navigation systems. Understanding both would be key to understanding the industrial base for DoD aircraft.

One of the top 15 industries by subaward dollars, Guided Missile and Space Vehicle Manufacturing, ranked seventh with \$739 million in subawards and 225 subcontractors out of a total of \$5,981 million in reportable prime contract awards. Because this industry is of interest for industrial-base issues, we selected it for more detailed analysis.

Guided Missile And Space Vehicle Manufacturing Industry Details

- 85 reportable prime contracts awarded between FY 2010 and FY 2012
- 31 contractors with 23 parent firms

RAND

20

DoD awarded 85 reportable prime contracts for Guided Missile and Space Vehicle Manufacturing from FY 2010 to FY 2012. These contracts, made with 31 contractors of 23 parent firms, had an aggregate value of \$5.98 billion. In FY 2012, DoD prime contractors obligated \$6.74 billion in subcontracts for this industry. The difference largely arises from newly awarded contracts and obligations made on contracts awarded before FSRS reporting requirements were in place (Chart 20).

225 Subcontractors in Guided Missile and Space Vehicle Industry

- 221 are in SAM
- All were associated with at least one DoD prime contract
- 12 had subawards for non-DoD prime contracts
- 164 had prime federal contracts

RAND

21

Of the 225 subcontractors for Guided Missile and Space Vehicle Manufacturing, 221 were in the SAM. All of the subcontractors had subawards associated with DoD prime contracts. Twelve also had reported subawards for non-DoD prime federal contracts.

In addition, 164 of these subcontractors had their own prime federal contracts. Of these, 158 had DoD prime contracts, and 106 had non-DoD prime contracts (with some holding both DoD and non-DoD prime contracts) (Chart 21).

Assessing Supplier Dependency and Its Importance

- Literature recommends buying no more than 15 to 30 percent from any one supplier's entire capacity
- Supplier diversity guards particularly important for products with long lead times
- We calculate dependence as FPDS and FSRS revenue combined as percentage of average total revenue

RAND

22

FSRS and FPDS data can offer information on supplier dependency (Chart 22). Leading purchasing textbooks (e.g., Burt, Petcavage, and Pinkerton, 2010) recommend that buyers purchase no more than 15 to 25 percent of any one supplier's entire capacity. This can guard against a buyer potentially putting a supplier out of business in the event of order cancellations resulting from economic downturn, product discontinuation, or switching to another supplier. This is particularly important for products with long lead times, as the supplier may have significant resources invested in orders for inputs to production or work in progress. Others (e.g., Fung, Fung, and Wind, 2008; Bitran, Gurumurthi, and Sam, 2006; Belavina and Girotra, 2010; Gilliam, Taylor-Jones, and Costanza, 2005) note that consuming about 30 percent of a supplier's capacity can help buyers command attention from suppliers while avoiding complete dependence of suppliers on a particular buyer's orders. Concerns of detrimental reliance and possibly even legal issues could ultimately arise if buyers account for more than 25 to 35 percent of a supplier's business (Ghamani, 2008; Paquette, 2004). (See also Moliné and Coves, 2013; Federgruen and Yang, 2011; and Agrawal and Nahmias, 1997, on modeling supply bases and optimizing order allocation over multiple suppliers.) That said, we acknowledge (as our reviewers noted), given the structure of the defense industry, DoD may not be able to purchase such small proportions of its contractors' output. Yet DoD should still understand this rule and the effect that more dependent suppliers can have on it, and its capabilities, should they exit business.

To calculate supplier dependence on DoD, we calculate the sum of reported FPDS prime contract and FSRS subcontract revenue as a percentage of average total revenue as reported in SAM. Because, as we will see, smaller contractors have greater dependence on the federal government, we present separately results for those with average annual revenue less than or greater than \$100 million.

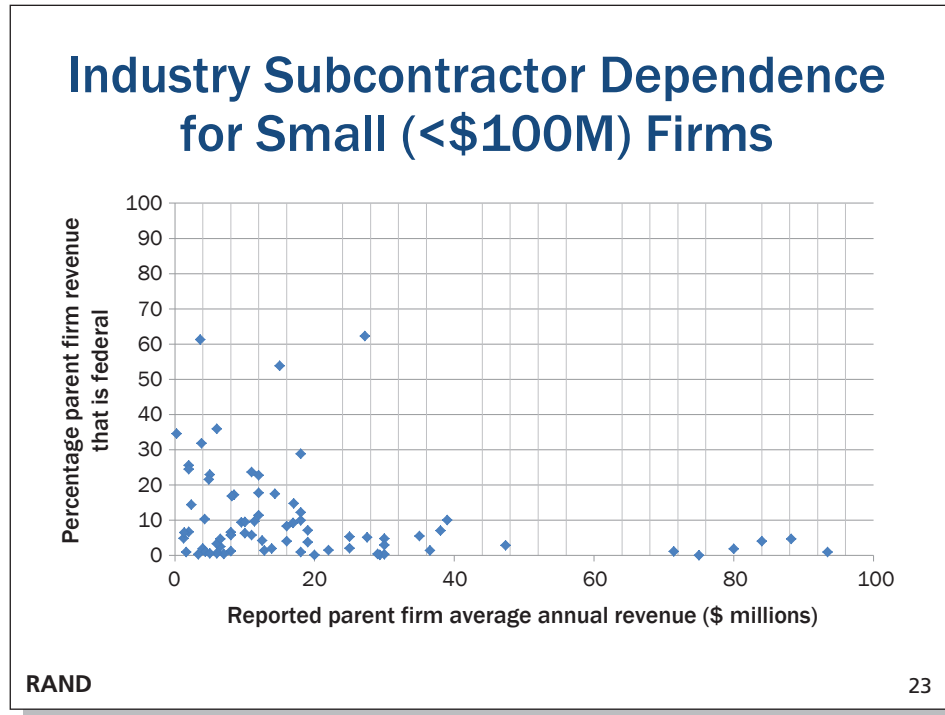
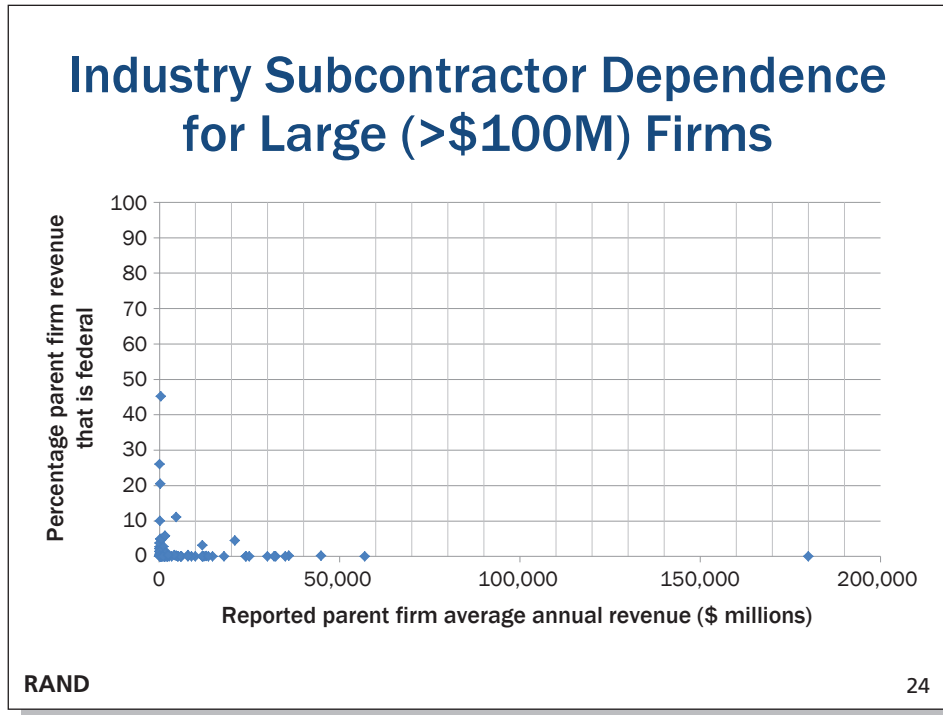


Chart 23 shows, for subcontractors in Guided Missile and Space Vehicle Manufacturing whose average annual revenue is less than \$100 million, the percentage of parent firm revenue that is federal (vertical axis) and the total reported parent firm average annual revenue (horizontal axis). We derive our federal revenue calculations, as noted, from the FPDS prime contract awards and FSRS subcontract awards and our parent firm average annual revenue from that reported to the SAM.

Two of these small firms received more than 60 percent of their reported revenues from the federal government, and a third received more than 50 percent of its revenue from the federal government. Most firms received less than 20 percent of their revenue from the federal government—indicating that the supply base in this industry is not greatly dependent on DoD or the federal government overall. Nevertheless, we caution that this analysis is only illustrative. In FY 2012, about 60 percent of obligated dollars, as noted above, were not reported to FSRS, even though 99 percent of new awards were. Including these other purchases over time, as should happen as more contracts become subject to FSRS, may show a different level of supplier dependency.



In Chart 24 we show federal government dependency for subcontractors in Guided Missile and Space Vehicle Manufacturing whose average annual revenue is more than \$100 million. Not surprisingly, few such large firms have much dependence on the federal government. For only two firms did we find dependence on federal revenue exceeding 25 percent, and for only five firms did we find it as high as 10 percent. All such firms had less than \$1 billion in average annual revenue. Of course, these numbers could change as more obligated dollars are subject to reporting in the FSRS.

Subcontractors with > 25% Revenue from Federal Prime and Subcontracts

Subcontractor	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
TOYON RESEARCH CORP.	27,181,515	16,810,387	106,499	16,916,886	62
AMC INCORPORATED	3,621,438	2,183,500	36,410	2,219,910	61
REAL-TIME LABORATORIES, LLC	15,000,000	2,054,115	6,014,928	8,069,042	54
DLT SOLUTIONS, LLC	511,000,000	229,098,387	1,843,828	230,942,216	45
YORK INDUSTRIES, INC.	6,000,000	1,887,882	266,818	2,154,700	36
R&B DESIGNS	250,000	40,027	46,345	86,372	35
INVOCON, INC.	3,800,000	1,192,562	16,667	1,209,229	32
TELEDYNE REYNOLDS, INC.	18,000,000	5,037,340	156,522	5,193,863	29
AIRBORNE SYSTEMS NORTH AMERICA OF CA INC	151,645,000	31,808,353	7,669,891	39,478,245	26
ADVANCE METALWORKING COMPANY, THE	2,000,000	491,760	18,829	510,589	26

RAND

25

We ranked individual subcontractors in Guided Missile and Space Vehicle Manufacturing by their calculated dependence on federal revenue. In Chart 25 we show the top ten subcontractors at risk with more than 25 percent of their average parent revenue derived from federal government contracts. We list their average parent, FPDS prime contract, FSRS subcontract, total federal revenue for the past three years, and the federal percentage of all revenues. Note that all of these subcontractors have both prime contract and reported subcontract revenue from the federal government. Exploring the particular goods and services these subcontractors provide could better identify what level of risk supplier failure could pose by linking them to key DoD requirements such as critical parts for its top weapon systems.

Subcontractors with Federal Revenue Exceeding Total Revenue

Subcontractor	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
HARRIS CORPORATION	1	-62,086	6,544,269	6,482,183	648218342
TELEDYNE STORM PRODUCTS, INC.	1	112,972	303,752	416,724	41672393
STEVE LIEBER & ASSOCIATES INC	1	14,203	119,980	134,183	13418340
PRESIDIO COMPONENTS INC.	1	29,102	23,335	52,437	5243730
HAIGH-FARR INC.	10	92,191	353,296	445,486	4454863
B.J.G. ELECTRONICS, INC.	100	1,458,198	678,873	2,137,071	2137071
MICROPHASE CORPORATION	100	331,367	38,322	369,689	369689
AEROJET-GENERAL CORPORATION	662,967	4,785,668	10,068,716	14,854,384	2241
RAYTHEON COMPANY	200,000,000	318,555,945	27,561,182	346,117,127	173
EMF, INC.	6,500,000	555,384	7,950,941	8,506,325	131

May be new firms

May be wrong units

May be local revenue only

May be new revenue

RAND

26

We observe that for ten subcontractors in Guided Missile and Space Vehicle Manufacturing, federal revenues exceed 100 percent of reported total average revenues. (These subcontractors are excluded from the preceding scatterplots.) We list these in Chart 26, with their average parent-firm revenue, their average FPDS¹ prime contract and FSRS subcontract revenues in the past three years, their average total federal revenues (sum of FPDS and FSRS revenues), and the percentage that total federal revenues comprise of their average revenue for the past three years. For example, Harris Corporation reported to the SAM that it received only \$1 in total revenue (an anomaly we discuss below). At the same time, it had an average annual FPDS prime contract revenues of -\$62,086 (likely from deobligations on prime contracts) and average annual subcontract revenues from the FSRS of \$6,544,269. Together, these account for average total federal revenues of \$6,482,183 or, more precisely, \$6,482,183.42. This yields an obviously anomalous result of 648,218,342 percent of revenue that is federal for Harris, the result of dividing \$6,482,183.42 in federal revenues by \$1 in total revenues.

We surmise several possible causes for federal revenues exceeding reported total revenues. The first seven subcontractors listed above all reported average annual revenues of less than \$100, with most reporting average annual revenues of only \$1. These may be new firms receiving their first federal contracts and hence unsure what to report for total firm revenues in the SAM, although it might be unusual for new firms to receive million-dollar contracts.

The eighth subcontractor on the list, Aerojet-General Corporation, is a large contractor with more than one DUNS number. Another DUNS number for it on the subcontractor list has parent revenue of \$662,967,000, or 1,000 times larger than the total revenue listed for

¹ Deobligations may result in a firm having negative FPDS revenue, as is evident for one subcontractor listed in Chart 26.

Aerojet above. We surmise that this is a case of income being entered in the wrong units for this DUNS number.

The ninth contractor on the list, Raytheon Company, may have reported local revenue and not parent revenue.

The last subcontractor on the list, EMF, Inc., may have recently received one or more new contracts that bumped its average federal revenue above its reported average annual revenue.

The SAM data for all these firms need to be checked and revised to ensure that all federal prime contract and subcontract revenue and all other revenue are included in the total.

Most Industry Subcontractors, but not Dollars, Were Small Businesses

SAM Classification	Subcontractors		Subaward contracts		Subaward dollars	
	#	%	#	%	Amount	%
Small business	115	57	214	63	333,115,464	49
Other-than-small	86	43	128	37	346,564,434	55
Total	201	100	342	100	679,564,434	100

RAND

27

We were able to determine small-business status for Guided Missile and Space Vehicle Manufacturing subcontractors registered in the SAM. More than half the subcontractors, or 57 percent, were small businesses. They received 63 percent of subcontracts and 49 percent of subcontracted dollars (Chart 27).

Comparing these data with Economic Census data can also yield information on how well DoD is implementing small-business preference policies. In FY 2007, DoD spent \$5.11 billion in Guided Missile and Space Vehicle Manufacturing, a total equivalent to one-third of the \$15.3 billion in receipts the industry reported that year to the Economic Census. Of DoD's prime-contract expenditures in that industry, 14.7 percent were with small businesses—exceeding the 6.0 percent of all revenues that we estimate went to small businesses in that industry that year. The 49 percent share of DoD subcontracted dollars going to small businesses in this industry was greater still—and perhaps indicative of how the greatest opportunities for small business in this industry are in lower tiers of the supply chain.

Many Industry Subcontractors Had Special Status

Small Business Subcontractors	SB Subcontractors		SB Contracts		SB Dollars	
	#	%	#	%	Amount	%
SDB, self identified	6	5	10	5	6,658,000	2
Woman-owned	17	15	37	17	10,739,303	3
Service-disabled veteran-owned	2	2	4	2	5,800,723	2
Total	115	100	214	100	333,115,464	100

RAND

28

Similarly, we were able to determine special status for small-business subcontractors providing goods and services in the Guided Missile and Space Vehicle Manufacturing industry (Chart 28). Twenty-two percent of such subcontractors had special status; most of these were women-owned small businesses. Altogether, women-owned small businesses comprised 15 percent of small-business subcontractors in this industry, accounted for 17 percent of small-subcontractor contracts, and received 3 percent of revenues to small-business subcontractors in this industry.

As we saw for our analysis of Lockheed Martin subcontractors, so here, too, we see that FSRS data can be used to learn more about small-business subcontracting plans within a specific industry. In the next chapter, we present some illustrative analyses of subcontracting by weapon system.

Weapon System Subaward Data

As we did for industries, we identified prime contracts associated with weapon systems and aggregated them by weapon systems. We then tabulated the number of subcontractors, subcontracts, and subcontract dollars for each weapon system. Finally, we selected a weapon system for detailed analyses of subcontractors. As noted above, a number of multibillion-dollar weapon systems have no reported subawards (and hence are excluded from the following analyses).

Weapon Systems with the Most Subcontractors

Weapon System	# Subcontractors	Subaward Dollars	# Subcontracts
PATRIOT	96	303,387,241	152
Trident II Missile	85	77,003,232	123
BMDS	60	157,017,630	70
E-2C Advanced Hawkeye	51	157,995,432	80
MLRS	32	196,196,978	66
LCS	28	27,326,443	34
CH-47F	26	27,864,684	104
Environmental Programs	19	6,667,205	25
CAA	17	9,114,647	27
APACHE (AH-64A)	17	14,702,716	125
V22	12	5,939,820	15
KIOWA WARRIOR	11	2,626,041	20

RAND

29

Chart 29 shows the 12 weapon systems with the largest number of reported subcontractors. It also shows the subaward dollars and the number of subcontracts for each.

Among these, we selected the Trident II Missile for more detailed illustrative analyses. In addition to having the second-highest number of subcontractors, it has the fifth-most-reported subaward dollars and the third-most subcontracts. Whereas Trident prime contractors provided goods and services in 50 different industries, reported subcontractors did so only in seven. This suggests that Trident subcontractors are more narrowly focused in their work. Many prime contractors provide goods and services in a very broad range of industries, but the subcontractors are more likely to specialize.

Summary of Trident Prime Contractors and Subcontractors

- 111 contractors (105 parent firms) had 168 Trident prime contracts
- 85 subcontractors had 123 Trident subcontracts
- 3 contractors held both prime contracts and subcontracts for Trident

RAND

30

We found 111 contractors (of 105 parent firms) with 168 prime contracts for Trident in the FY 2012 FPDS. From FY 2010 to FY 2012, they received \$1.19 billion in Trident contract awards reportable to the FSRS. In FY 2012, DoD obligated \$1.80 billion to these Trident contractors. The difference largely stems, as noted above in our industry analyses, from obligations made under contracts awarded before FSRS reporting requirements were in place. The difference provides a rough indicator of how much current activity is covered by FSRS. Among the 111 Trident prime contractors, 37 also had reported subawards in the FSRS. Among the 37 Trident prime contractors with FSRS subcontracts, three had Trident prime contracts (Chart 30).

Trident prime contractors reported 123 subawards, totaling \$77 million, to 85 subcontractors in the FSRS. Of these 85 subcontractors, 58 had other prime contracts in the FPDS, including the three Trident prime contractors noted above with Trident subcontracts as well. Of the 85 subcontractors, 77 were in the SAM.

Lockheed Martin Dependence on Federal Reserve for Trident OEM

Year	Reported Average Annual Revenue (\$ millions), SAM	Federal Prime Contract Dollars (\$ millions), FPDS	Federal Subcontract Dollars (\$ millions), FSRS	Total Federal Dollars (\$ millions)	Percent Revenue from Federal Dollars
2010	NA	35,811	4	35,815	NA
2011	NA	41,477	150	41,627	NA
2012	NA	36,169	64	36,233	NA
Total	NA	113,457	218	113,675	NA
Average annual	41,404	37,819	73	37,892	92

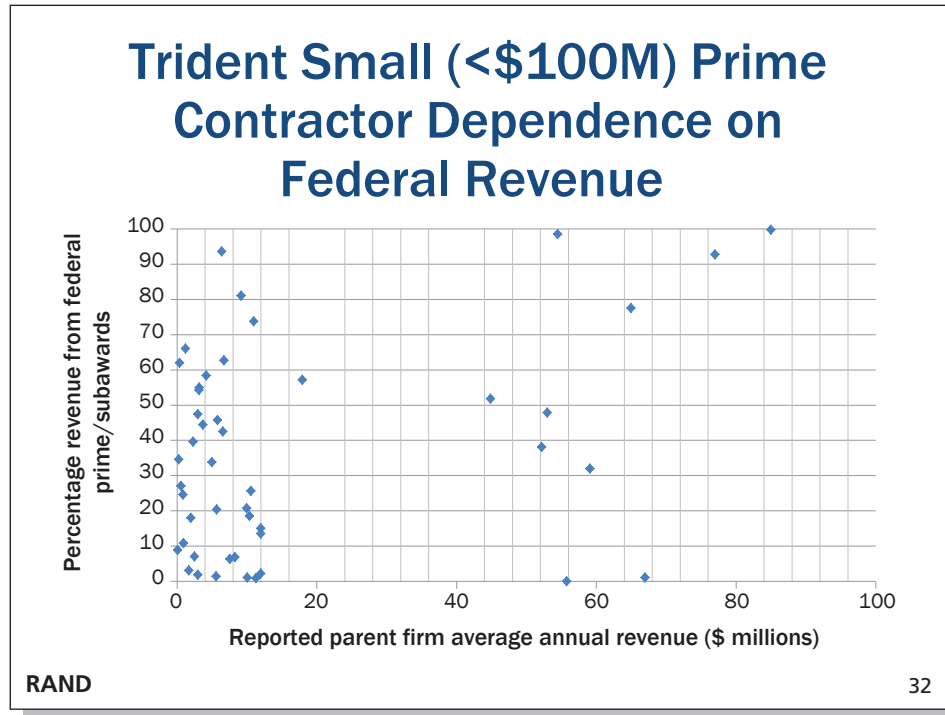
Lockheed Martin Space Systems was prime Trident contractor

RAND

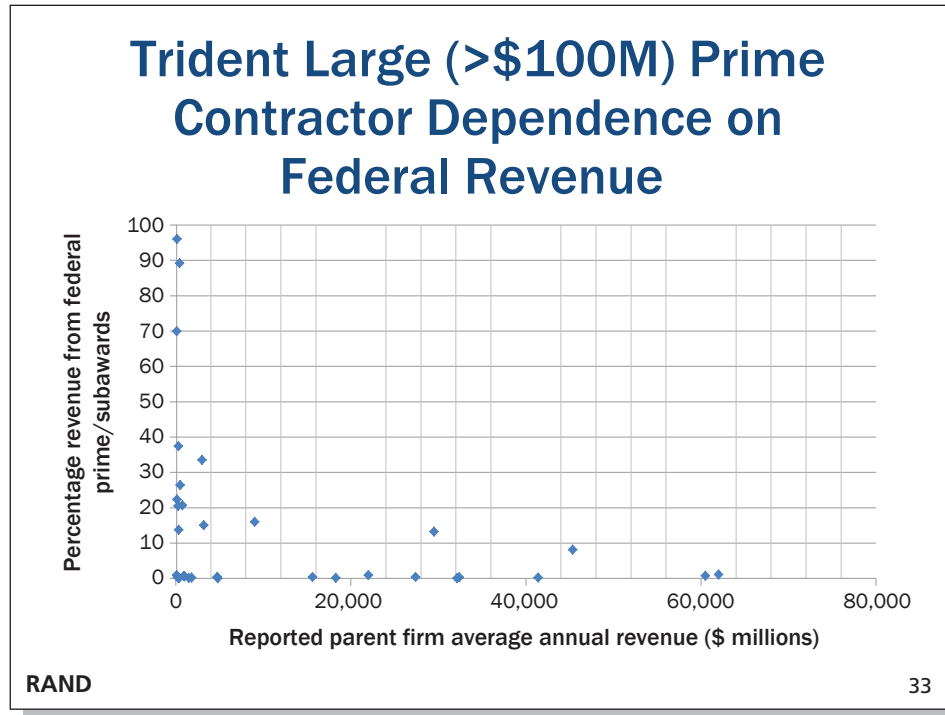
31

We use the FPDS prime contract and FSRS subcontract revenue to assess dependence on federal revenue for both prime contractors and subcontractors on the Trident system. The original equipment manufacturer (OEM) for Trident was Lockheed Martin Space Systems, whose parent we analyzed above for contractor subaward data.

Chart 31 shows the parent firm's reported average annual revenue for the past three years as reported to SAM as well as its federal prime-contract awards (from the FPDS) and subcontract awards (from the FSRS) for those years. Adding FPDS and FSRS revenues for the past three years and averaging them over time shows that 92 percent of recent Lockheed Martin revenue was directly or indirectly from the federal government. In fact, given the ongoing use of large multiyear contracts written before the requirement to report subawards to the FSRS, this calculation may actually underestimate Lockheed Martin's dependence on federal revenue. As the percentage of obligation dollars on reportable contracts grows, Lockheed Martin may be shown to have even more dependence on the federal government.



As we did for subcontractors in the Guided Missile and Space Vehicle Manufacturing industry, here, too, we show dependence on federal revenue of Trident prime contractors whose reported average annual revenue is below \$100 million (Chart 32). Note that a large number are above the recommended 25 percent dependence on revenue from one buyer—and a half-dozen are above 75 percent—which puts them at considerable risk should their total federal revenue substantially decrease.



In Chart 33, we show the distribution of large prime contractors (i.e., those with more than \$100 million in annual revenue) on the Trident project by revenue and dependence on federal prime contracts and subcontracts. Although most large prime contractors on Trident receive less than 25 percent of revenue from the federal government, seven receive more than one-fourth of their revenue directly or indirectly from the federal government.

Trident Prime Contractors with Highest Percent of Federal Revenue

Contractor	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
GOVPLACE	85,000,000	84,794,897	0	84,794,897	100
TKC GLOBAL SOLUTIONS, LLC	54,475,799	53,586,174	63,670	53,649,844	98
FOUR POINTS TECHNOLOGY, L.L.C.	134,706,496	129,179,351	189,983	129,369,334	96
EMCUBE INC	6,400,000	5,990,359	0	5,990,359	94
SYSTEMS ENGINEERING ASSOCIATES CORP	76,991,805	71,397,880	0	71,397,880	93
CHARLES STARK DRAPER LABORATORY, INC.,	448,525,866	398,802,901	1,263,804	400,066,704	89
SPRY METHODS, INC.	9,200,000	6,257,664	1,199,925	7,457,589	81
AARDVARK TACTICAL, INC.	65,000,000	50,387,730	0	50,387,730	78
ASR INTERNATIONAL CORPORATION	11,000,000	8,109,329	0	8,109,329	74
SYSTEMS PLANNING AND ANALYSIS, INC.	100,000,000	69,655,910	294,922	69,950,832	70
NORD ATLANTIC TRADING INC	1,225,000	808,756	0	808,756	66
CRANE TECHNOLOGIES GROUP, INC.	6,728,065	4,217,707	0	4,217,707	63
OGIS COMMUNICATION GROUP, INC.	400,000	247,780	0	247,780	62

RAND

34

Altogether, 33 prime contractors for Trident received more than 25 percent of their revenue from federal sources (both Trident prime contracts and other prime contracts and subcontracts). In Chart 34, we list the 13 prime contractors receiving more than 60 percent of their revenue from the federal government, including their total parent-firm revenue, FPDS prime contract revenue, FSRS subcontract revenue, and total federal revenue. (Lockheed Martin, although the OEM for this system, has not been among the top recipients of recent prime-contract dollars for it.) These firms would be at high risk should their federal revenue drop substantially.

Trident Prime Contractors with Federal Revenue Exceeding Total Revenue

Contractor	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
GTP INCORPORATION	4	2,516,049	0	2,516,049	62,901,230
S.E. GA FORD, INC.	1	21,146	0	21,146	2,114,645
EN POINTE GOV INC	980,000	15,276,202	14,130	15,290,332	1,560
INTERNATIONAL BUSINESS MACHINES CORPORATION	100,848,000	1,197,222,249	1,373,559	1,198,595,808	1,189
TIBURON ASSOCIATES, INC.	2,000,000	15,854,036	0	15,854,036	793
IMMIXTECHNOLOGY, INC.	41,694,071	282,137,490	824,945	282,962,435	679
ALVAREZ&ASSOCIATES, LLC	19,000,000	94,627,066	0	94,627,066	498
BARA INFOWARE, INC.	4,407,761	15,204,085	0	15,204,085	345
MICROTECHNOLOGIES LLC	93,413,994	277,325,813	2,216,308	279,542,121	299
JRC INTEGRATED SYSTEMS, INC.	1,500,000	3,696,493	0	3,696,493	246
DBV TECHNOLOGY	72,000	166,667	0	166,667	231
EC AMRC/BSNESS OBJECTS AMERICAS	36,001,856	77,916,335	97,437	78,013,772	217

RAND

May be new firms

Local revenue only

35

Just as with our analyses of subcontractors in the Guided Missile and Space Vehicle Manufacturing industry, here, too, we see a number of data anomalies among Trident prime contractors. (These contractors are excluded from the earlier scatterplots.) Correcting these may indicate how many additional firms are at risk.

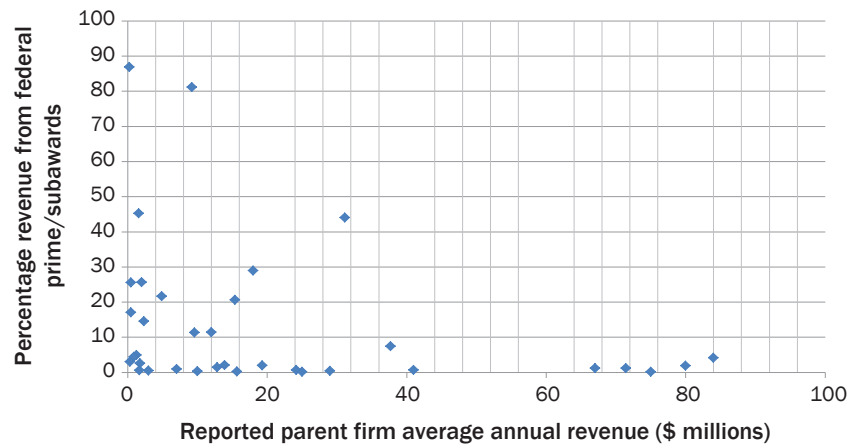
Altogether, we found 26 prime contractors for Trident whose reported total federal direct and indirect revenues exceeded their reported average annual revenue. We list 12 of these in Chart 35, showing three-year averages of their reported parent-firm, FPDS prime contract, FSRS subcontract, and total federal revenue, and the reported federal revenue as a percentage of their reported total parent-firm revenue.

The first two prime contractors on the list reported average annual revenue of less than \$5. As indicated, these may be new firms. The government may wish to clarify the status of these firms and their reported revenues in the SAM, asking the firms to revise their reported revenues as necessary.

The remaining firms on the list may have reported local revenue only, rather than parent firm revenue. All contractors listed should revise their annual average annual parent-firm revenue reported to SAM.

An additional 14 prime contractors not shown above have federal revenues that are 100 to 200 percent of their parent-firm revenues. This may result because new federal prime contract and subcontract awards are greater than those they have received in the past. Nevertheless, all need to update their average annual revenue in SAM.

Trident Small (<\$100M) Subcontractor Dependence on Federal Revenue

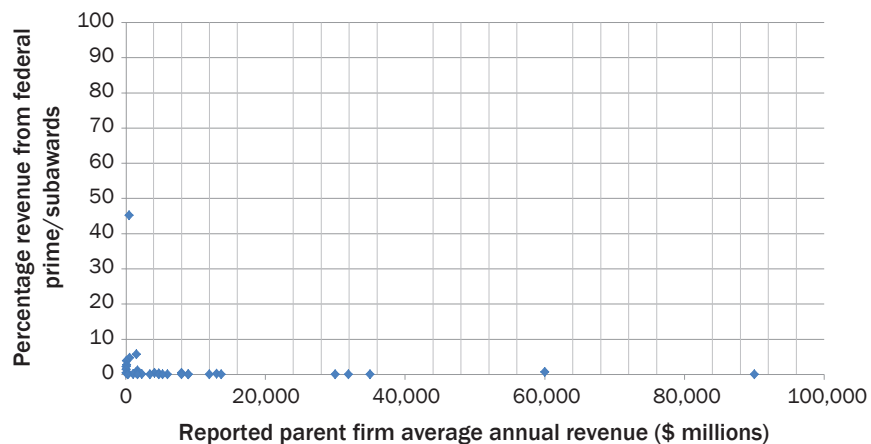


RAND

36

As we did with prime contractors, we also plot each reported Trident subcontractor by reported average parent-firm revenue and total direct prime and indirect subcontract federal revenue as a percentage of total revenue. Chart 36 shows subcontractors whose total parent-firm revenues are less than \$100 million annually. Trident subcontractors appear to be less dependent on the federal government than Trident prime contractors are, although several are highly dependent. The slide shows seven small firms with at least 25 percent of their revenue from federal sources. Such firms could be at risk if their federal revenue falls substantially, with risks possibly carrying over to Trident and other supply chains.

Trident Large (>\$100M) Subcontractor Dependence on Federal Revenue



RAND

37

In Chart 37, we show federal contract dependence for large Trident subcontractors, that is, those with parent-firm revenues exceeding \$100 million annually. Again, dependence of subcontractors on the federal government appears to be less than that of prime contractors. Only one parent firm that subcontracts on Trident has more than 25 percent dependence on the federal government. No other firm shown has more than 10 percent dependence on the federal government. Once again, we caution that dependence on federal revenue for these contractors may increase when more obligations are revealed in reportable contracts.

Trident Subcontractors with Highest Percentage of Dependence on Federal Revenue

Subcontractors	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
SAP ENTERPRISE SOLUTIONS	250,000	0	216,906	216,906	87
SPRY METHODS, INC.	9,200,000	6,257,664	1,199,925	7,457,589	81
DLT SOLUTIONS, LLC	511,000,000	229,098,387	1,843,828	230,942,216	45
MCKINNEY & MCKINNEY TECHNICAL SERVICES INC	1,575,525	661,839	49,420	711,259	45
IMAGINE ONE TECHNOLOGY & MANAGEMENT LTD	31,149,907	12,531,572	1,144,882	13,676,455	44
TELEDYNE REYNOLDS, INC.	18,000,000	5,037,340	156,522	5,193,863	29
ADVANCE METALWORKING COMPANY, THE	2,000,000	491,760	18,829	510,589	26
S&D DEVELOPMENT GROUP	480,000	0	122,341	122,341	25

RAND

38

Altogether, eight Trident subcontractors received 25 percent or more of their parent-firm revenue from federal sources, with two receiving more than 80 percent of their revenues from federal sources. In Chart 38, we list these subcontractors and their recent average annual parent-firm, FPDS prime contract, FSRS subcontract, and total federal revenues, as well as the percentage that total federal revenues constitute of reported average parent-firm revenues. These contractors would be at risk if their federal revenue diminished significantly—as might the supply chains for the goods and services they provide as well.

Trident Subcontractors with Federal Revenue Exceeding Total Revenue

Subcontractors	Average Revenue for Past Three Years (\$)				% Federal
	Parent	FPDS	FSRS	Total Federal	
P-S TECHNOLOGIES, LLC	10	544,966	9,741	554,707	5,547,069
DJD & ASSOCIATES CONSULTING, INC	3	0	113,686	113,686	3,789,524
DKG CONSULTING INC	5	0	102,940	102,940	2,058,800
AEROJET-GENERAL CORP	662,967	4,785,668	10,068,716	14,854,384	2,241
RAYTHEON COMPANY	200,000,000	318,555,945	27,561,182	346,117,127	173
SB BUSINESS SERVICES, INC.	350,000	0	586,802	586,802	168
HERDT CONSULTING, INC.	2,270,000	1,389,535	1,310,766	2,700,300	119

May be new firms

May be wrong units

Local revenue only

May be new revenue

RAND

39

As in earlier, similar analyses, here, too, we find several Trident subcontractors whose federal prime contract and subcontract revenue exceeds total reported average parent-firm revenue in SAM. (These suppliers are not shown on the earlier scatterplots.) The first three firms in Chart 39 may be new firms needing to update their parent-firm revenue data with recent federal contract and subcontract awards and other revenues. The next two firms, Aerojet-General and Raytheon, are well-established, large defense contractors that we saw on an earlier analysis of subcontractors. We surmise that Aerojet may have reported its parent-firm revenue in the wrong units and Raytheon may have reported local contractor revenue rather than parent-firm revenue. The last two firms shown may have received new prime contracts and subcontracts boosting their federal revenue above their reported average annual revenue. All these firms need to revise their data input to SAM. Such revision would allow better identification of dependence on the federal government and risks to these firms should federal revenue decrease.

Procurement data can be used in other ways besides to identify dependence on total direct and indirect federal revenue. In the next chapter, we discuss how procurement and other data can be used to identify other supply-chain risks.

Natural Disaster Risk Data

Sources of Data on Natural Disaster Risks

- FPDS data—supplier's place of performance
- USGS hazard data
- Services' and DLA weapon-system sustainment data

RAND

40

Recent RAND research (Moore et al., forthcoming) has explored suppliers at risk for natural disasters. Identifying such suppliers and the risks they face involves integrating several data sources. By integrating multiple sources of risk, as we discuss below, DoD can better understand risks in its supply chain.

One way DoD may wish to proactively manage supply-chain risks is through mapping its suppliers and the risks they face. In this chapter, we explore how DoD may wish to more proactively manage its supply-chain risks, including that posed by its suppliers and their suppliers. We do so by demonstrating how DoD might build a tool, using existing data, to map these risks. Mapping supplier locations and risks reflects a best practice of private industry. To map suppliers, we use Google Maps, which are readily available at no cost. The FPDS contains place of performance for each contractor. Once these are identified, USGS hazard maps of earthquakes, hurricanes, tornados, and floods can be used to identify the risk that each faces for natural disasters. Information on the products produced by each supplier are also available

from data collected by each service and the DLA, linking contract numbers to part numbers and weapons, as well as order, delivery, inventory, cost, and other characteristics of these parts. Integrating FPDS, USGS, and DoD sustainment data thus allows supplier risks to be linked to specific parts and weapons (Chart 40).

We stress that these analyses are meant to be illustrative, and further research can better compare the probabilities of risks and the costs associated with each. Simply linking natural-disaster risks with supplier locations would place DoD close to leading private practice, and help identify the safety stocks, or alternatives, it may need for its supply strategies.

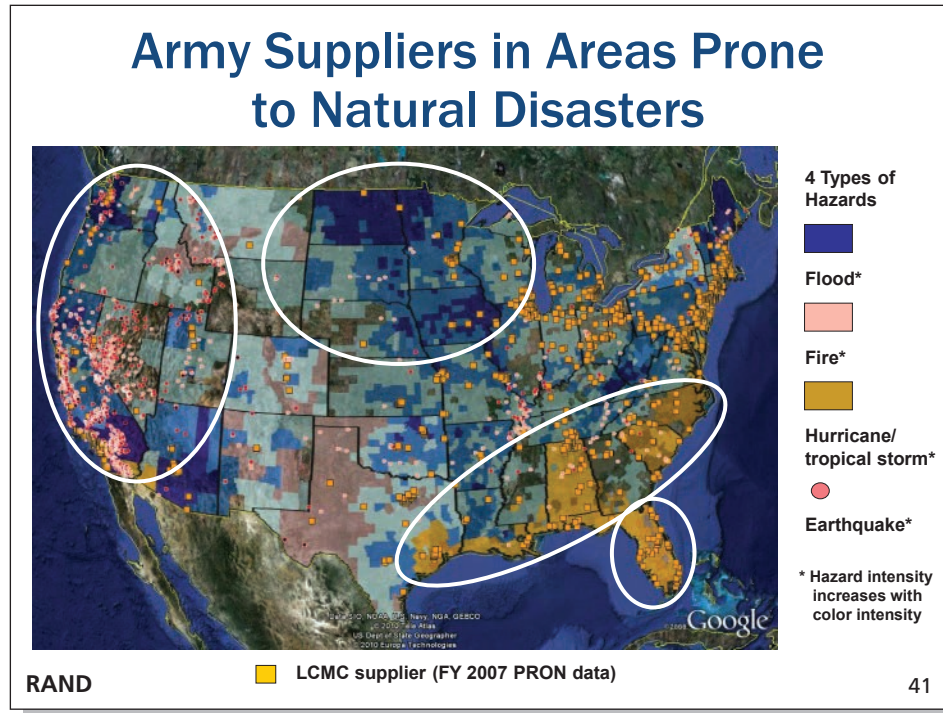
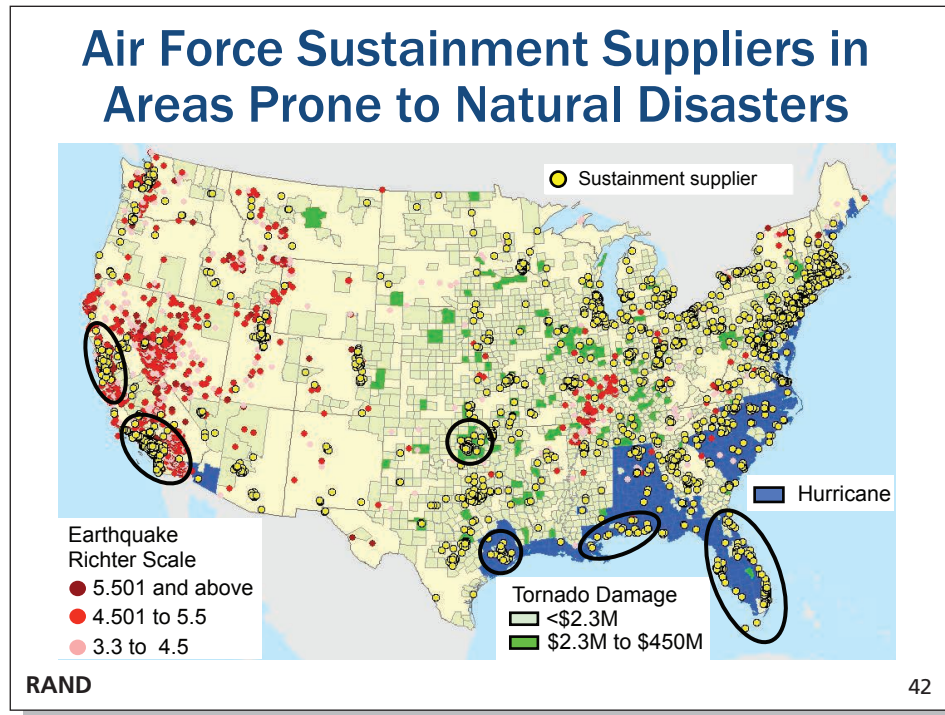
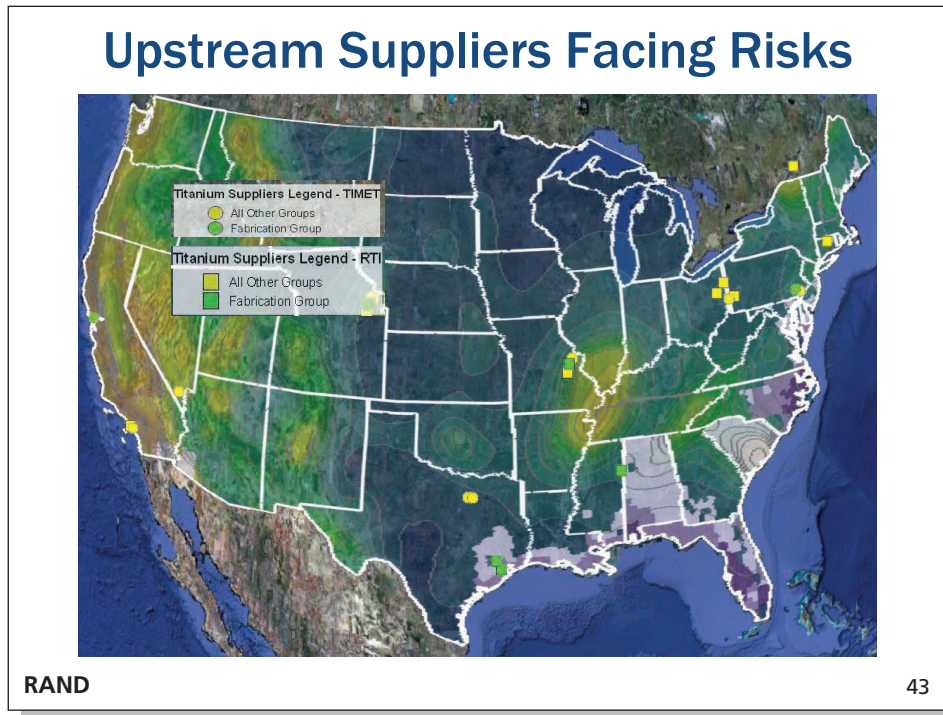


Chart 41, drawn from RAND Arroyo Center research by the authors, Mary E. Chenoweth, and Amy G. Cox, shows the location of Army Life Cycle Management Command (LCMC) suppliers throughout the contiguous United States, based on Procurement Request Order Number (PRON) data. As evident, there is a large concentration of suppliers in the Southeast, particularly in counties that have experienced hurricanes or tropical storms. Several are also in the North Central states, including in counties that have experienced floods. Finally, many are in the West, including near areas that have experienced earthquakes and fires.



Similarly, in Chart 42, we show place of performance for Air Logistics Centers suppliers (Moore and Lored, 2013). Many are concentrated in coastal areas at risk for hurricanes. Some are concentrated in areas of Oklahoma that have seen considerable tornado damage. Finally, many others are concentrated along the California coast in areas that have seen several earthquakes over time. (For similar analyses and further discussion, see Moore and Lored, 2013.)

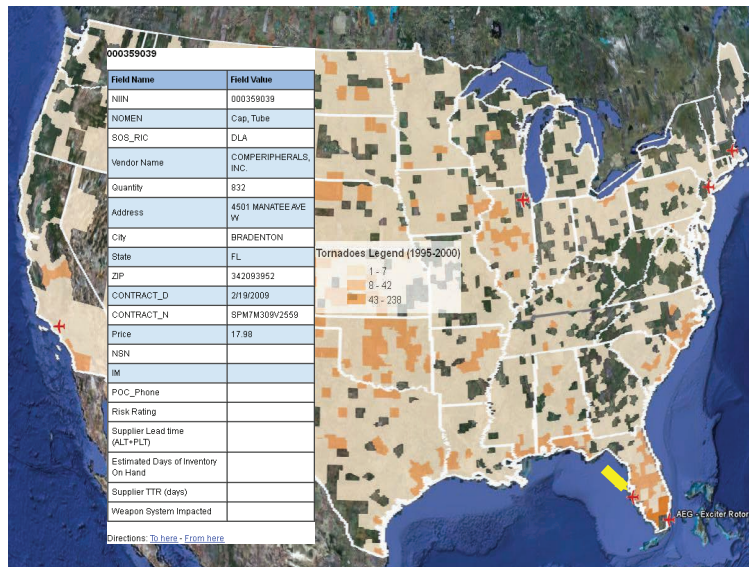


Risks may not be limited to Tier 1 or Tier 2 suppliers, of course (Moore et al., forthcoming). Suppliers at other tiers may face risks, and hence pose risks throughout the supply chain. In Chart 43, we show fabrication and other sites involved in titanium products.

As the map indicates, Timet has a fabrication facility in the San Francisco area, one of the most earthquake-prone areas in the nation. Both Timet and RTI also have facilities in other earthquake-prone regions including the Los Angeles area, southern Nevada, and even the New Madrid fault in the central United States. RTI has fabrication facilities in high-risk hurricane zones, particularly the Houston area.

Both the criticality of parts by location and the risks that earthquakes or hurricanes pose to each location may vary greatly, of course. DoD supply-chain managers may make understandable tradeoffs between low- and high-criticality of parts and low and high risk of natural disasters, as well as their predictability (given, for example, that hurricanes can be tracked over time, whereas earthquakes are sudden). Because the Federal Acquisition Regulation exempts suppliers from “acts of God,” that is, because federal contracts have a *force majeure* clause, DoD supply-chain managers must consider these types of issues. Using FPDS and FSRS data can help identify upstream supply-chain risks and the tradeoffs that may be made. FPDS already has data on location of performance, and this may be identifiable in the FSRS to the extent that a subsupplier has a DUNS number tied to a facility or is a business with a single location. Additional survey data can also help identify differences between headquarters and the work locations of subcontractors.

Specific Parts Risks: F-15 Example



RAND

44

Multiple data sources can also provide specific examples of parts at risk from natural-disaster disruption of supply chains (Moore et al., forthcoming). In Chart 44, we show how the Air Force may combine data on particular suppliers and natural disasters to identify one supplier of F-15 parts and the risks it faces from supply disruption by hurricanes. The Air Force may wish to increase its supply of this supplier's parts before hurricane season each year to guard against possible interruption of supplier operations by a hurricane. Alternatively, it may wish to require that this supplier have a business continuity plan and commit to a specific time to recovery in the event of disruption caused by a hurricane or tropical storm.

Conclusions and Recommendations

Summary Findings

- Data can help gain visibility of Tier 1 and Tier 2 suppliers
- Many suppliers provide multiple goods and services
- FSRS subaward data is still being populated
- Quality of SAM annual revenue data can be improved

RAND

45

Our analyses demonstrate that SAM, FPDS, and FSRS data can help in gaining visibility of DoD's Tier 1 and Tier 2 suppliers. Knowing that this information can be obtained from existing data, even though these data sources can be improved in some ways, may minimize the need to conduct workload-intensive and time-consuming surveys of these firms or help DoD limit the fielding of surveys to cases where it cannot obtain the data in any other way.

Our analyses also found that many DoD suppliers have both prime contracts and subcontracts that cross weapon systems, goods, and services. The extent to which they depend on federal and DoD spending is critical to understanding their ability to withstand significant budget decreases.

We also found that FSRS subaward data are still being populated, particularly as new awards subject to subcontract reporting are made. As contracts expire and requirements to report subawards expand to more obligated dollars, the FSRS data will eventually cover the vast majority of Tier 2 subcontractors. Indeed, our analysis showed increasing proportions of

contracts and dollars being reported to the FSRS. Furthermore, if DoD needs to obtain information on Tier 3 subcontractors, it can use the FSRS data to do a smaller, more focused survey of Tier 2 subcontractors as needed.

Beyond increasing and improving coverage of the FSRS over time, our analyses found some issues with the SAM that should be addressed for the benefit of any future analyses. In particular, we identified what appear to be erroneous entries for average annual firm income. These problems can be corrected easily by requiring that firms frequently update information on their average annual revenue whenever they receive a federal prime contract or associated subcontract and periodically checking to see if the SAM data are consistent with FPDS and FSRS data (Chart 45).

Recommendations

- Encourage prime contractors to provide FSRS data
- Improve quality of supplier data
- Survey Tier 2 subcontractors on their Tier 3 subcontractors
- Expand analyses with other data

RAND

46

Our analyses point to four recommendations for improving the use of existing data to analyze the DoD industrial base (Chart 46).

First, we recommend that DoD encourage and verify that prime contractors with reportable contracts report their subawards. Reporting is required by law and typically by contract as well. Our analyses found several examples where this may not be happening. Contracting officers may need to ensure that subawards are, indeed, reported. We also recommend that DoD encourage contractors with multiyear contracts that are not reportable to report their subawards to the FSRS, possibly in lieu of the requirement to report the special small-business status of their subcontractors and their subawards to the eSRS.

Second, we recommend that DoD work to improve the quality of prime contractor and subcontractor data. It can do so in several ways: It can require that contractors and subcontractors frequently update information on their average annual revenue in the SAM and then verify that they have done so. It can also require that all subcontractors with subawards greater than \$25,000 register in SAM and that prime contractors report the industry (NAICS code) for the subaward, not that for the prime contract. The government may also wish to provide analysts with easier links between CAGE codes, used in SAM but not FPDS-NG and FSRS, and DUNS numbers, used in FPDS-NG and FSRS but not SAM.

Third, we recommend that DoD consider surveying Tier 2 subcontractors on their Tier 3 subcontractors—although only after the FSRS is better populated or has better coverage of all subawards, not just those on recently awarded contracts subject to FSRS reporting. More generally, although analyzing FSRS and other existing data systems can provide many insights the DoD needs to optimize its operations and supply chains, supplemental surveys focusing on data elements not currently collected can help provide a still broader picture of DoD suppliers. In addition, surveying suppliers about their own, immediate suppliers, particularly at lower

tiers, may be needed, given the reluctance, or possibly even inability, of suppliers' suppliers to divulge information about lower-tier suppliers.

Fourth and finally, we recommend that analyses be expanded with other data, such as data on supplier financial risks and vulnerability to natural disasters at their place of performance, as well as data for key weapon-system parts. Such existing data, if properly improved and combined, already gathered for other purposes, can perhaps provide DoD greater information on its industrial base, including data over time, than any new and possibly expensive surveys would, and without further burdening suppliers.

References

- Agrawal, Narendra, and Steven Nahmias, "Rationalization of the Supplier Base in the Presence of Yield Uncertainty," *Production and Operations Management*, Vol. 6, No. 3, Fall 1997, pp. 291–308.
- Belavina, Elena, and Karan Girotra, "Sourcing Through Intermediaries," INSEAD Working Paper, October 2010.
- Bitran, Gabriel R., Suri Gurumurthi, and Shiou Lin Sam, "Emerging Trends in Supply Chain Governance," MIT Sloan School of Management Working Paper, 2006.
- Burt, David, Sheila Petcavage, and Richard Pinkerton, *Supply Management*, 8th ed., New York: McGraw Hill/Irwin, 2010.
- Defense Logistics Agency, Document Services, "Active Contract Files," web page, undated-a. As of July 16, 2013:
http://efoia.documentservices.dla.mil/b_acf.htm
- Defense Logistics Agency, Logistics Information Service, "Federal Logistics Data on Portable Media (FED LOG) Information Center," web page, undated-b. As of July 16, 2013:
<http://www.dlis.dla.mil/fedlog/default.asp>
- Department of Defense Office of Small Business Programs, "Small Business Program Goals," web page, 2013. As of July 19, 2013:
<http://www.acq.osd.mil/osbp/statistics/sbProgramGoals.shtml>
- Federal Funding Accountability and Transparency Act Subaward Reporting System, "About FSRS," web page, undated. As of July 16, 2013:
<https://fsrs.gov/>
- Federgruen, Awi, and Nan Yang, "Procurement Strategies with Unreliable Suppliers," *Operations Research*, Vol. 59, No. 4, July–August 2011, pp. 1033–1039.
- Fung, Victor K., William K. Fung, and Yoram (Jerry) Wind, *Competing in a Flat World: Building Enterprises for a Borderless World*, Upper Saddle River, N.J.: Pearson Education, Inc., 2008.
- Gansler, Jacques S., *Democracy's Arsenal: Creating a Twenty-First Century Defense Industry*, Cambridge, Mass.: The MIT Press, 2011.
- Ghamami, Omid, "Calling a Supplier's Bluff," *eSide Supply Management*, Vol. 1, No. 5, September/October 2008.
- Gilliam, Dean, Steve Taylor-Jones, and John R. Costanza, *Quantum Leap: The Next Generation*, Boca Raton, Fla.: J. Ross Publishing, 2005.
- House Armed Services Committee (HASC) Panel on Business Challenges in the Defense Industry, "Challenges to Doing Business with the Department of Defense: Findings of the Panel of Business Challenges in the Defense Industry," March 19, 2012.
- Moliné, Joan Ignasi, and Anna Maria Coves, "Order Allocation in a Multi-Supplier Environment: Review of the Literature Since 2007," *Journal of Industrial Engineering and Management*, Vol. 6, No. 3, 2013, pp. 751–760.

Moore, Nancy Y., and Elvira N. Loredó, *Identifying and Managing Air Force Sustainment Supply Chain Risks*, Santa Monica, Calif.: RAND Corporation, DB-649-AF, 2013. As of July 20, 2013:
http://www.rand.org/pubs/documented_briefings/DB649.html

Moore, Nancy Y., Elvira N. Loredó, Amy G. Cox, and Clifford A. Grammich, *Identifying and Managing Acquisition and Sustainment Supply Chain Risks*, Santa Monica, Calif.: RAND Corporation, RR-549-AF, forthcoming.

Nash, Ralph C., Jr., Steve L. Schooner, Karen R. O'Brien-DeBakey, and Vernon J. Edwards, *The Government Contracts Reference Book: A Comprehensive Guide to the Language of Procurement*, 3rd ed., Frederick, Md.: Wolters-Kluwer CCH, 2007.

Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, "Annual Industrial Capabilities Report to Congress," August 2012. As of July 15, 2013:
http://www.acq.osd.mil/mibp/docs/annual_ind_cap_rpt_to_congress-2012.pdf

Paquette, Larry, *The Sourcing Solution: A Step-by-Step Guide to Creating a Successful Purchasing Program*, New York: AMACOM, 2004.

U.S. Census Bureau, "Economic Census," web page, undated-a. As of July 16, 2013:
<http://www.census.gov/econ/census/>

U.S. Census Bureau, "Statistics of U.S. Businesses," web page, undated-b. As of July 16, 2013:
<http://www.census.gov/econ/susb/>

U.S. Department of Commerce, Bureau of Industry and Security, S2T2 Survey.

U.S. Geological Survey, "Natural Hazards," web page, 2013. As of July 16, 2013:
http://www.usgs.gov/natural_hazards/

To demonstrate the potential of existing data to provide information on the defense supplier base, the researchers conducted some illustrative analyses using, among other sources, the System for Award Management, the Federal Procurement Data System—Next Generation, the Federal Funding Accountability and Transparency Act Subaward Reporting System (FSRS), and the U.S. Geological Survey. Of these, the FSRS is the most recent and its coverage of subaward dollars is expanding as older contracts expire and are replaced with ones with FSRS reporting requirements. Using these data can identify small-business participation in the supply base as well as the vulnerability of contractors and subcontractors to changes in their federal government prime contract and subcontract revenue or environmental risks. Such information can help policymakers better understand potential risks in the supply chain and better shape industrial-base policies. Adding data on natural-disaster risks can also help identify external sources of supply disruption and point to potential buffering strategies.



NATIONAL SECURITY RESEARCH DIVISION

www.rand.org

\$24.50

ISBN-10 0-8330-8704-5
ISBN-13 978-0-8330-8704-1

