

# **FUTURE CAPABILITY OF DOD MAINTENANCE DEPOTS**

INTERIM REPORT

REPORT LG901M1

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## Executive Summary

The *Duncan Hunter National Defense Authorization Act for Fiscal Year 2009* requires a study to evaluate the capability and efficiency of the maintenance depots of the Department of Defense to ensure they can provide the logistics capabilities and capacity necessary for national defense. LMI, a not-for-profit government consulting firm, was contracted to perform the study. This report, which is submitted in response to one of the requirements stipulated by the legislation, provides the interim status on the study and summarizes LMI's research and data collection efforts to date.

This interim report contains information about the study's analytical framework and offers examples of the kinds of data and information that will support more detailed analysis in the second phase of our work. It also establishes a context for the assessment of multiple issues and potential recommendations to be included in our final report, due in October 2010.

Our initial data collection and review focused on the FY2001–FY2008 time-frame.<sup>1</sup> FY2001 preceded the nation's response to the terrorist attacks that necessitated ongoing combat operations. FY2008 serves as an exemplar of depot maintenance requirements and workload levels to sustain current operations, including substantive amounts of reset work.

We have relied on a combination of information sources, including a data call to the military services. Further validation of much of the collected data is ongoing, and analysis for implications based upon that data is now underway. No conclusions or recommendations are contained in this interim report, and data depicted should be considered preliminary. The Office of the Secretary of Defense and the military services have been fully supportive of our data collection efforts.

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<sup>1</sup> The second phase of our work will include data collection and review through FY2015.

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This report contains information in the following areas:

- ◆ The backdrop for the study, including a brief overview of the size and scope of depot maintenance operations
- ◆ Our study approach and analytical framework
- ◆ The main laws, regulations, and business policies that guide DoD depot maintenance performance and financial reporting
- ◆ Examples of descriptive information in key areas of DoD depot maintenance provision, including topics specifically cited in the legislation
- ◆ Additional topics that shape the DoD depot maintenance environment.

In the second phase of this study, we will continue to execute our analysis of the depot maintenance environment. Supported by the efforts to produce this interim report, our analysis will result in the publication of a depot maintenance future capability final report. To develop that final product, we will continue to synthesize appropriate data and the results of interviews, site visits, and our independent research.

The goal of Phase II will be to describe a path Congress and senior Department of Defense managers may take to logically and strategically shape the future DoD maintenance enterprise.

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# Chapter 1

## Background, Study Approach, and Analytical Framework

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### BACKGROUND

The Department of Defense's organic depot maintenance capability is a significant and vital portion of the DoD sustainment infrastructure. DoD's maintenance capabilities are a hallmark of our national defense posture. No other nation is capable of worldwide operation with the force structure that is projected by the United States.

The ability to sustain that force structure in any operating environment is a testament to the effectiveness of the maintenance capabilities that are an inherent part of the operating forces.

Organic depots provide a surge capability that is absolutely essential to warfighter success...if the Army did not have five depots and the Marine Corps did not have the Albany depot, neither service would have had the capability to enable DoD's success on the ground.<sup>1</sup>

The organic depot maintenance establishment is vast:

- ◆ 17 major installations with an estimated facility value in excess of \$48 billion
- ◆ 75,000 civilian employees
- ◆ Annual operating expenses in excess of \$16 billion.

But the organic depot maintenance element is only half of the depot maintenance equation. Contract maintenance is performed at some 900 locations across the United States, consuming more than \$14 billion per year and performing just slightly less than half of the total DoD depot maintenance workload.

Within the context of the DoD maintenance environment, depot maintenance stands out in several respects. While it is a relatively small portion of the total maintenance workforce, it is composed almost entirely of civilian personnel at installations, many of which are the largest industrial facilities in their states or regions. The organic resource expenditure is concentrated at these major the

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<sup>1</sup> General Richard A. Cody, 31st Vice Chief of Staff of the U.S. Army (June 24, 2004 to July 31, 2008).

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installations, resulting in a positive influence on local communities and businesses, and a potent consideration for political processes.

This report represents the culmination of Phase I of a congressionally mandated study of the future of depot maintenance. It provides the baseline context for the analysis that will inform conclusions and recommendations in our final report, which is due in October 2010. Even though this report provides only the interim status of our study, it serves as an essential baseline for Phase II. Perhaps more importantly, it also documents the substantial contribution organic depots have made to defense sustainment in support of overseas contingency operations since September 11, 2001.

## LEGISLATIVE REQUIREMENT

The *Duncan Hunter National Defense Authorization Act for Fiscal Year 2009* (also known as the *FY2009 National Defense Authorization Act*, or FY2009 NDAA) requires a study of the maintenance depots of the Department of Defense to ensure they can provide the logistics capabilities and capacity necessary for national defense. (Appendix A contains the full text of the mandate.)

Report language accompanying the FY2009 NDAA stated,

...when wartime operations in the Republic of Iraq and the Islamic Republic of Afghanistan cease, and supplemental appropriations for depot-related maintenance are reduced, DoD depots must not return to the post-Cold War environment where public- and private-sector facilities fought for limited available workload to the detriment of both.<sup>2</sup>

Recognizing the contribution and performance of the organic depots and arsenals, Congress has frequently encouraged DoD to develop a more comprehensive strategy to ensure the organic depots are viably positioned for the future, and that they have the workforce, equipment, and facilities they need to maintain efficient operations to meet the nation's current and future requirements.<sup>3,4</sup>

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<sup>2</sup> *Duncan Hunter National Defense Authorization Act for Fiscal Year 2009: Report of the Committee on Armed Services, House of Representatives, on H.R. 5658 together with additional views* (including cost estimate of the Congressional Budget Office), House Report 110-652, May 16, 2008, p. 333.

<sup>3</sup> *National Defense Authorization Act for Fiscal Year 2004, Report of the Committee on Armed Services for the House of Representatives, on H.R. 1588, together with additional, dissenting, and supplemental views* (including cost estimate of the Congressional Budget Office), May 16, 2003, p. 304.

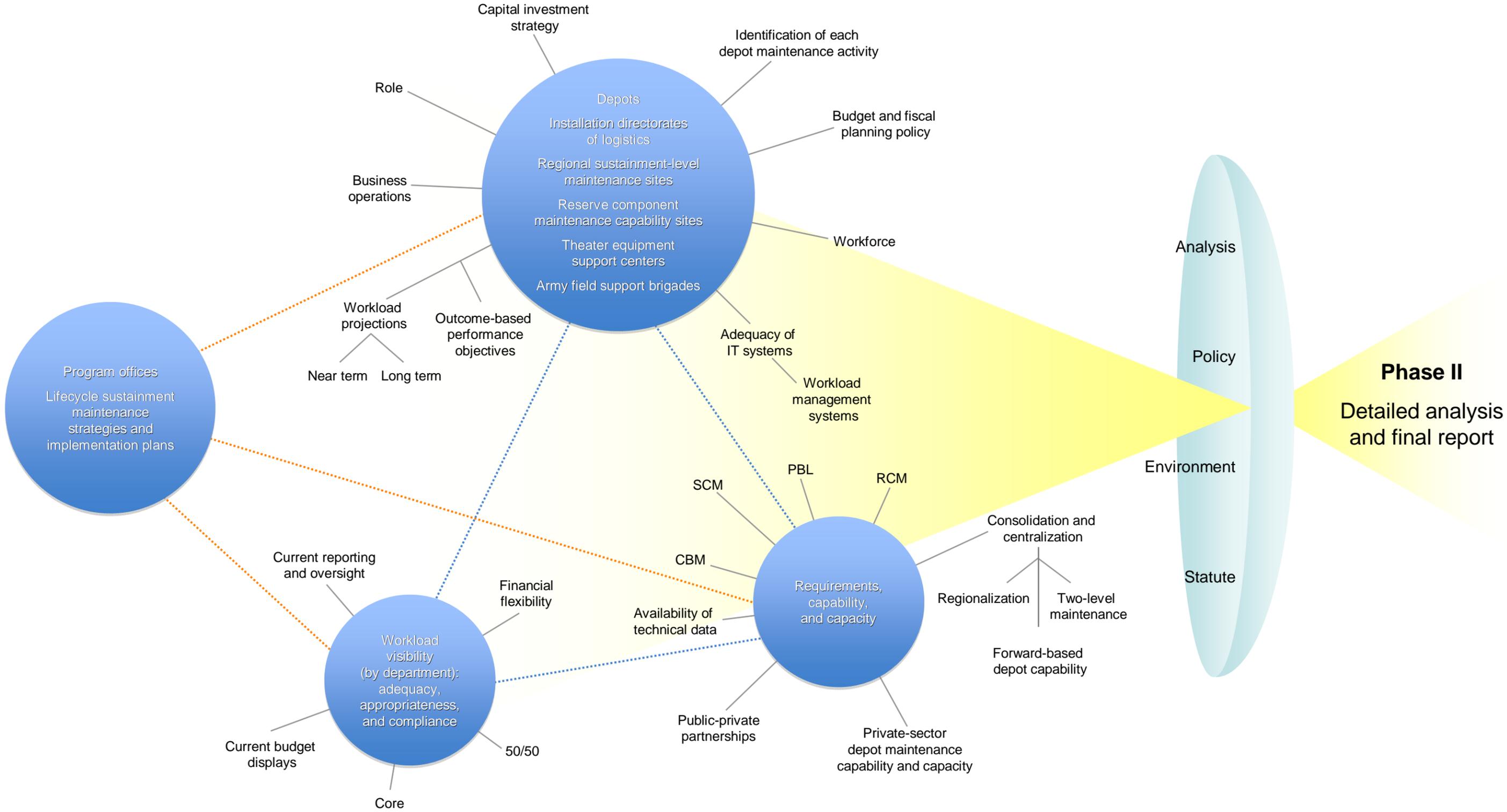
<sup>4</sup> *National Defense Authorization Act for Fiscal Year 2007: Report of the Committee on Armed Services, House of Representatives, on H.R. 5122, together with additional and dissenting views* (including cost estimate of the Congressional Budget Office), House Report 109-452, May 5, 2006, p. 296.

## STUDY APPROACH AND ANALYTICAL FRAMEWORK

To address the many facets of the legislative requirement, we broke our study into two phases. In Phase I, we endeavored to identify the specific information needed to respond properly to the NDAA mandate and generate a suitable baseline of data and information to support the forthcoming analysis. We organized our research to focus on several areas and then structured our investigations around those areas. Our initial organization and synthesis of the requirement, as well as its linkage to the Phase II detailed analysis and report phase, is depicted in Figure 1-1.

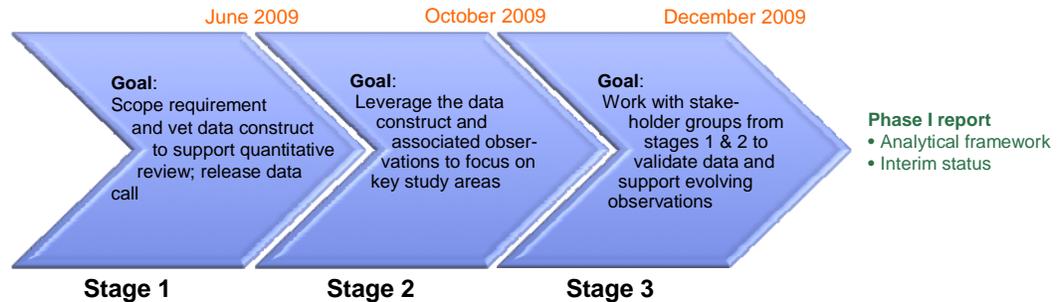
Figure 1-1 highlights the complexity of the study as well as the major topical areas, including depot maintenance workloads and the visibility of those workloads, depot maintenance providers, and the many influencers and enablers of depot maintenance. The figure also emphasizes the need for strategic consideration of issues; this includes the necessity to integrate matters of analysis, policy, statute, and the depot maintenance environment when developing and recommending improvement alternatives.

Figure 1-1. Scope of LMI's Depot Maintenance Assessment



Given this view of the study requirement, we conducted Phase I in three stages. Figure 1-2 provides a high-level depiction of each stage, along with its associated goal and timeline.

Figure 1-2. Three Stages of Phase I Research and Data Collection



Overall, our focus throughout Phase I was to develop a baseline description of the current DoD depot maintenance environment. Both quantitative and qualitative characteristics were necessary to fully inform this portrayal.

To develop a quantitative baseline we identified several key attributes that describe, influence, or measure DoD depot maintenance provision. These include such elements as depot maintenance requirements, workload, workforce, facilities, and capital investment.

We then researched a variety of sources to collect information on these attributes (e.g., the military services’ budgets and programming documents, relevant studies, applicable Government Accountability Office (GAO) reports, and existing joint service reports). To augment and update existing data, LMI developed a data call that was sent to the military services to obtain additional information about these attributes over time.<sup>5</sup>

To define the parameters of our data review and collection, we chose the time frame of FY2001–FY2008. FY2001 preceded the nation’s response to the terrorist attacks that necessitated ongoing combat operations. FY2008 served as the exemplar of depot maintenance requirements and workload levels to sustain combat operations, including substantive amounts of reset<sup>6</sup> work.

<sup>5</sup> The data call was released in June 2009. Responses are currently being validated. The resulting data repository will inform Phase II of our assessment by enabling the presentation and analysis of trends or general relationships based on individual service and DoD composite data. This data repository will also enable the analysis of the future depot maintenance environment through 2015.

<sup>6</sup> The term “reset” means actions taken to repair, enhance, or replace military equipment used in support of military operations and the associated sustainment of that equipment. Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, §322(g)(2), October 14, 2008.

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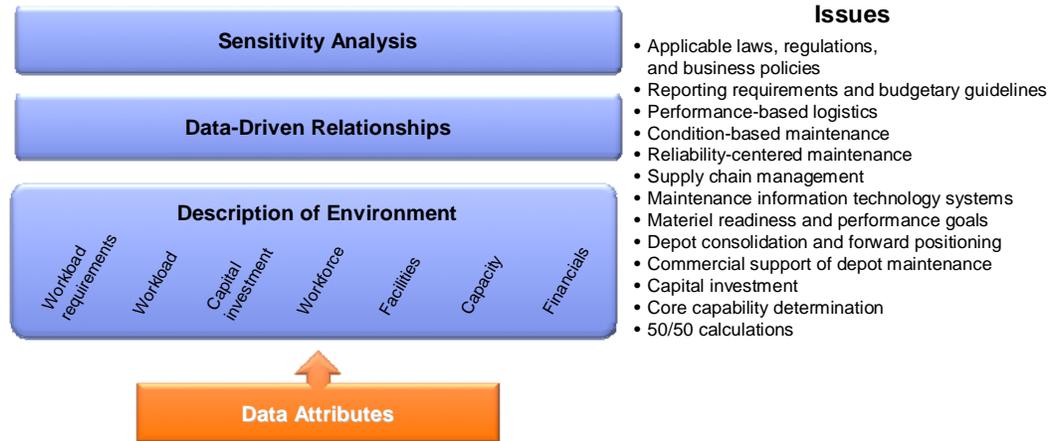
We connected this quantitative data assembly with research into several qualitative issues that were identified in the legislative tasking. We validated these issues with appropriate stakeholders as we explored their content and evolution. The following are among the issues we considered:

- ◆ Applicable laws, regulations, and business policies
- ◆ Reporting requirements and budgetary guidelines
- ◆ Performance-based logistics (PBL)
- ◆ Condition-based maintenance (CBM)
- ◆ Reliability-centered maintenance (RCM)
- ◆ Supply chain management (SCM)
- ◆ Maintenance information technology systems
- ◆ Materiel readiness and performance goals
- ◆ Depot consolidation and forward positioning
- ◆ Commercial support of depot maintenance
- ◆ Capital investment
- ◆ Core capability determination
- ◆ Public- and private-sector share of work (i.e., 50/50 calculations).

Each of these issues affects the provision of DoD depot maintenance in some manner, and each can be further understood in the context of the key quantitative attributes described above.

To help analyze the complex relationships among the data attributes and qualitative issues, we developed the data assessment hierarchy shown in Figure 1-3.

Figure 1-3. Data Assessment Hierarchy



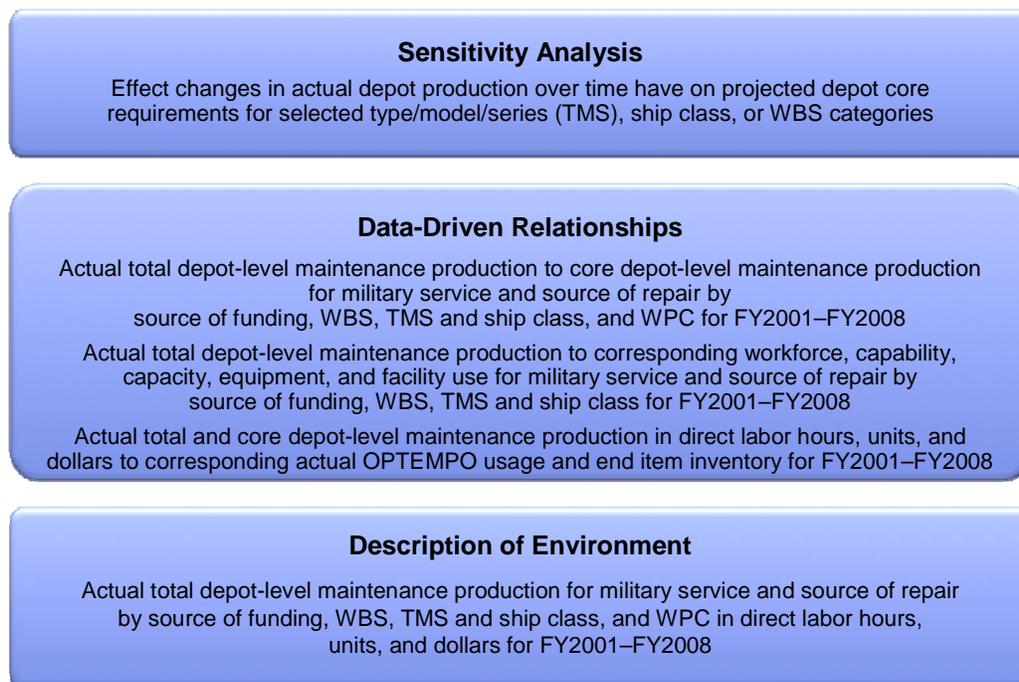
Our approach begins with the data attributes and their content. With this information, we can describe the depot maintenance environment for each data attribute at several levels over time (e.g., DoD, individual service, and each depot) and analyze the time series that might highlight major trends and insights.

This construct also supports the comparison of the basic data attributes, suggesting relationships so that we may better understand their influence over the depot maintenance environment. Interactions among the data attributes and the qualitative issues provide a foundation from which to explore the internal and external influences on depot maintenance, and explain how those influences change over time. Outputs from the analysis facilitate data-based discussions about what steps to take to enhance future DoD depot maintenance viability and effectiveness.

Ultimately, this analytical framework also supports sensitivity analyses that help define several possible scenarios of the future depot maintenance environment and anticipate future depot maintenance environment issues and solutions for the Phase II assessment.

Figure 1-4 illustrates a notional example of this kind of application with regard to depot maintenance production information.

Figure 1-4. Data Assessment Hierarchy—Notional Example



Note: WBS = work breakdown structure; WPC = work performance category.

The qualitative issues that underpin the current depot maintenance environment are very important to this comparative analysis. These elements characterize congressional concern regarding depot maintenance and focus our attention on DoD’s ability to maintain critical depot capabilities, provide the governance and strategy to ensure depot capabilities are effective and timely, and securing a workload level that keeps the DoD maintenance depots relevant and viable for the long term. We carefully consider these fundamental elements, including depot maintenance law, policy, and management visibility, as part of our analytical approach.

## KEY OBJECTIVES

Three key objectives underlie our approach and framework for characterizing the future capability of DoD maintenance depots.

The first was to properly assess the legislative requirement to appropriately identify and position the expanse of information needed to address the full range of DoD depot maintenance capabilities and capacities. To support this objective, we reached out to myriad stakeholders to ask for their input.

The second objective was to address the quantitative requirements in the governing legislation. This meant we had to build and populate an appropriate data construct that could augment existing sources. We addressed this requirement but tried to keep the data collection and assembly as non-intrusive for the military services as possible.

The third and final objective was to support the requirement for independent analysis. Although collaboration was essential for open and free information exchange, we fully examined issues from different perspectives and sought multiple inputs. We also conveyed the need for independent inputs in our interactions with members of the maintenance community.

Table 1-1 reviews the three objectives discussed above as well as the study elements we employed to reach them. The third column outlines actions that were taken to reach these objectives.

Table 1-1. Study Objectives, Elements, and Phase I Actions

Objective	Study element	Phase I actions
Properly define the parameters of the overall study; focus on the need to analyze and address strategic issues in Phase II	Collaborative knowledge development and awareness of depot maintenance environment	<ul style="list-style-type: none"> <li>◆ Held several HASC/SASC discussions to clarify study scope and intent</li> <li>◆ Engaged DoD maintenance leadership                             <ul style="list-style-type: none"> <li>• Seven Maintenance Executive Steering Committee updates</li> <li>• Two Joint Group–Depot Maintenance briefings</li> <li>• DoD Maintenance Symposium update and interface</li> <li>• Seven field site visits to clarify data call requirements and introduce strategic issues to representative group of locations</li> </ul> </li> </ul>
Use quantitative data to support balanced view of the current depot maintenance environment; identify any need to supplement existing data sources	Broadly representative data call that was informed and validated by depot maintenance community	<ul style="list-style-type: none"> <li>◆ Developed initial data call with depot maintenance experts; data call vetted in four meetings before it was released by service-designated points of contact</li> <li>◆ Released data call in June 2009 (validated results will be applied to Phase II analysis); constant refinement with military service points of contact and experts</li> <li>◆ Consulted and researched additional authoritative sources for quantitative depot maintenance information                             <ul style="list-style-type: none"> <li>• Depot maintenance business profiles</li> <li>• Depot Maintenance Cost System (DMCS)</li> <li>• Maintenance budget exhibits</li> </ul> </li> </ul>
Ensure informed and independent perspective on issues central to DoD depot maintenance management	Methodical investigation and multiple-perspective awareness of key issues	<ul style="list-style-type: none"> <li>◆ Researched and reviewed key depot maintenance studies and analyses (for example, GAO reports, service documentation, CBO, budget materials, and previous BRAC-related information)</li> <li>◆ Met with depot maintenance experts (industry association representatives, conference attendees, and past depot leaders) for initial input</li> </ul>

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## REMAINDER OF THE PHASE I REPORT

The study approach and analytical framework described above positioned us for further analysis. It also enabled us to provide indications of the scope and focus of our work throughout the chapters of this interim report, the remainder of which is organized as follows:

- ◆ In Chapter 2, “Legislative Framework and Budget Visibility,” we review the main laws, regulations, and business policies that guide DoD depot maintenance performance and financial reporting.
- ◆ In Chapter 3, “Initial Baseline,” we provide sample descriptions of key DoD depot maintenance provision areas.
- ◆ In Chapter 4, “Other Influences,” we discuss several topics that shape the DoD depot maintenance environment.
- ◆ In Chapter 5, “Next Steps,” we present an overview of Phase II of this study, which will result in the final DoD depot maintenance future capability study report.
- ◆ The appendixes provide supplemental and background information.

## Chapter 2

# Legislative Framework and Budget Visibility

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Several fundamental elements of law and DoD policy and management underpin the current depot maintenance environment and visibility of that environment. In this chapter, we review two such elements. First, we synthesize the body of pertinent laws and policies and discuss several aspects that fundamentally articulate the rationale and role of DoD depot maintenance activities. Second, we describe the existing visibility structure of depot maintenance budgetary resources and how that structure influences depot maintenance management.

## APPLICABLE LAWS, POLICY, AND COMPLIANCE REPORTING

Congress and DoD have set down a body of pertinent laws and policies under which depot maintenance operates. Topics range from defining depot maintenance<sup>1</sup> to a prohibition on the management of depot employees by end strength<sup>2</sup>. In Title 10, U.S.C., Chapter 146, “Contracting for performance of civilian commercial or industrial type functions,” Congress clearly articulates its intent to ensure an efficient, ready, and controlled source of technical competence and provide the resources necessary to secure effective and timely response to a mobilization, national defense contingency situation, or other emergency requirements. Chapter 146 also instructs the services to ensure government depots remain viable by reinvesting in infrastructure, equipment, and process improvement in direct support of depot operations.

Legislative direction for depot maintenance exists not only in Title 10, but also in applicable sections of various national defense authorizations and conference reports, and that direction is implemented by DoD policy.

Legislative guidance is provided on the following elements:<sup>3</sup>

- ◆ Definition of depot maintenance
- ◆ Core logistics capabilities
- ◆ The 50 percent limitation on contracting for depot maintenance

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<sup>1</sup> Title 10 U.S.C. §2460, *Definition of Depot-level Maintenance and Repair*.

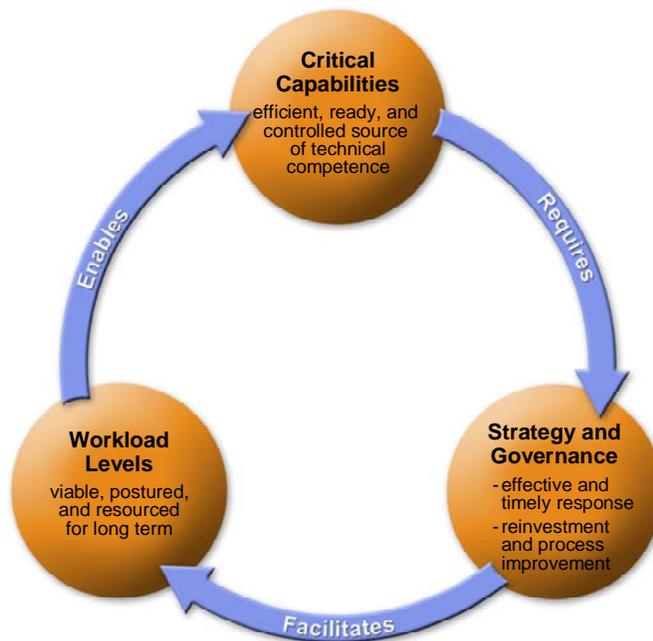
<sup>2</sup> Title 10 U.S.C. §2472, *Management of Depot Employees*.

<sup>3</sup> DoD, House Armed Services Committee (HASC) briefing, “It’s the Law,” October 26, 2009.

- ◆ Public-private partnering and sale of services
- ◆ Minimal capital investment
- ◆ Technical data rights.

All of these elements influence highly interdependent actions and decisions. Those actions and decisions drive DoD's ability to maintain critical depot capabilities, provide the governance and strategy required to make depots effective and timely, and secure an appropriate level of work to keep the organic depot enterprise relevant and viable for the long term. Figure 2-1 illustrates the interdependence of depot maintenance capabilities, strategy, and workload.

*Figure 2-1. Critical Relationships Affecting Depot Maintenance*



In the following subsections, we present specific details on how Congress has mandated DoD action on these three critical elements. We present this summary against a backdrop of generally accepted business terms and focus areas because each DoD depot functions as an entity that reports a net operating result (gain or loss). The linkage among these three key elements is also fundamental to well integrated maintenance accomplishment, regardless of the performing sector.

After a brief discussion on the statutory definition of depot maintenance, we present DoD's response to these mandates, both in its policy directives and its compliance reporting. Within our discussion, we include key sections on technical data rights, results-oriented budgeting and management, and capital investment and process improvement.

## Definition of Depot Maintenance

According to 10 U.S.C. §2460, the term “depot-level maintenance and repair” means the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies. This includes all elements of

- ◆ testing and reclamation,
- ◆ software maintenance, and
- ◆ interim contractor support, contractor logistics support, and similar contractor support (if considered a depot service).

The definition of depot-level maintenance does not depend on the source of funds or the location of performance.

Exceptions to this definition include the

- ◆ procurement of major modifications or upgrades designed to improve performance,
- ◆ nuclear refueling of an aircraft carrier, and
- ◆ procurement of parts for safety modifications (although installation of these modifications is considered part of depot maintenance).

## Directives and Regulations

The Department of Defense implements policies through either DoD directives (DoDDs) or DoD instructions (DoDIs). Directives and instructions are reviewed and reissued at regular intervals to ensure currency, and they are subjected to a formal coordination within the Department.

DoD Directive 4151.18, *Maintenance of Military Materiel*, March 31, 2004, articulates overarching maintenance policy. It outlines how maintenance programs for the Department of Defense should be structured and managed to achieve inherent performance, safety, and reliability levels for materiel and in an effective and efficient fashion. The directive also provides broad, maintenance-related statutory implementation guidance.

The 4151 series of DoD instructions are specific to maintenance and provide implementation guidance on such programs as CBM, public-private partnering, and serialized item management (SIM). The 5000 series of directives and instructions, which are intended for the acquisition community, provide guidance to program managers and relate to maintenance planning.

Table 2-1 lists the principal DoD-level directives and instructions related to depot maintenance.

*Table 2-1. DoD Maintenance-Related Directives and Instructions*

Number	Title	Date
DoDD 4151.18	<i>Maintenance of Military Materiel</i>	March 31, 2004
DoD 4151.18-H	<i>Depot Maintenance Capacity and Utilization Measurement Handbook</i>	March 10, 2007
DoDI 4151.19	<i>Serialized Item Management</i>	December 26, 2006
DoDI 4151.20	<i>Depot Maintenance Core Capabilities Determination Process</i>	January 5, 2007
DoDI 4151.21	<i>Public-Private Partnerships for Depot-Level Maintenance</i>	April 25, 2007
DoDI 4151.22	<i>Condition Based Maintenance Plus (CBM+) for Materiel Maintenance</i>	December 2, 2007
DoDD 5000.01	<i>Defense Acquisition System</i>	May 12, 2003
DoDI 5000.02	<i>Operation of Defense Acquisition System</i>	December 8, 2008
DoD 7000.14-R, Vol. 6, Chapter 14	<i>Depot Maintenance Reporting</i>	May 2009

Source: OSD Cost Assessment and Program Evaluation developed original table; subsequently modified by LMI.

## Critical Capabilities

The practice of developing and nurturing essential competencies is common to both the private and public maintenance sector. Although they differ in their approaches, most successful businesses have formal efforts to identify and manage capabilities they consider critical to meeting strategic corporate objectives. They seek out technical, process, and decision-making superiority through capability maturation and process modularity. They also seek agility in sourcing and resourcing to the right organization, whether internal or external, so they can maintain a level of internal maturity appropriate for effective decision making.

The notion of critical capabilities is based on the fundamental idea that organizations succeed not just by keeping gross income above long-run costs, but by maintaining lower costs, higher quality, or improved operations in key areas. In terms of DoD organic depot maintenance, this concept is expressed as core logistics capabilities. Access to accurate and timely technical data is often essential to both establish and sustain these capabilities for depot maintenance provision.

## CORE LOGISTICS CAPABILITIES

The DoD approach to core depot maintenance capabilities is consistent with the idea that core competencies relate to essential capabilities. To ensure a ready and controlled source of technical competence and resources, Congress mandates in 10 U.S.C. §2464 several attributes of core capability:

- ◆ The Secretary of Defense is responsible for the identification of core capability requirements and the workload necessary to sustain those capabilities.
- ◆ Capability must be identified within 4 years of initial operating capability.
- ◆ Core sustaining workloads must be accomplished by government personnel at government-owned and operated facilities using government-owned and operated equipment.
- ◆ Facilities must be assigned sufficient workload to ensure cost efficiency and technical competence.

Exceptions to this policy—if justified and reported to Congress—include special access programs, nuclear aircraft carriers, and inherently commercial items.

In terms of DoD policy, DoD Instruction 4151.20 outlines a two-part core determination process for elements of weapon system maintenance that meet the definition for depot maintenance (as presented in 10 U.S.C. §2460). Part 1 of the instruction identifies the capabilities determined to be core, while part 2 outlines the workload required to maintain cost efficiency and technical competence. To identify and develop core depot maintenance capabilities, DoDI 4151.20 must be followed during system acquisition and follow-on sustainment.

Over the last 10 years, the GAO has audited DoD's core depot capabilities several times. In its most recent related report, GAO concluded that DoD may not be complying fully with legislative mandate or its own policy:

DoD, through its biennial core process, has not comprehensively and accurately assessed whether it has the required core capability to support fielded systems in military depots.<sup>4</sup>

## TECHNICAL DATA FOR MAINTENANCE

To be the ready, controlled source of technical competence for weapon system maintenance requires timely access to accurate technical data. Under the current lifecycle management concept, program managers (PMs) must ensure all data and software required to successfully procure and sustain the system are available

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<sup>4</sup> GAO, *Actions Needed to Identify and Establish Core Capability at Military Depots*, Report GAO-09-083, May 2009.

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throughout the system's life, as well as ensure competitive sourcing of new item procurement and the repair of existing and emerging items can be accomplished.

Technical data includes recorded information (regardless of the form or method of the recording) that is of a scientific or technical nature. Technical data includes

- ◆ product data, including the data created as a consequence of defining (requirements), designing (including the engineering drawings), testing, producing, packaging, storing, distributing, operating, maintaining, modifying, and disposing of a product;
- ◆ computer software documentation, including owner's manuals, user's manuals, installation instructions, operating instructions, and other similar items that explain the capabilities of the computer software or provide instructions for using the software; and
- ◆ computer databases (e.g., a collection of data recorded in a form so that it can be processed by a computer), which are treated as technical data because of the nature of the data they contained.

Computer software, including computer programs, source code, source code listings, object code listings, design details, algorithms, processes, flow charts, formulae, and related material that would allow the software to be reproduced, recreated, or recompiled is not considered technical data; but some of the maintenance issues relevant to technical data are applicable to computer software.

In 2006, GAO found that DoD's current acquisition policies did not require program managers to assess the long-term needs for technical data rights to support their weapon systems.<sup>5</sup>

In FY2007, Congress included a provision in the *John Warner National Defense Authorization Act* to require DoD to publish policy directing the PMs to assess the long-term technical data needs for DoD acquisition programs. In response, DoD promulgated acquisition policy that requires "program managers for ACAT [acquisition category] I and II programs, regardless of the planned sustainment approach, to assess the long-term technical data needs of their systems and reflect that assessment in a data management strategy."<sup>6</sup> The policy further requires the PM to "assess the data required to design, manufacture, and sustain the system, as well as to support re-competition for production, sustainment, or upgrades."<sup>7</sup>

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<sup>5</sup> GAO, *DoD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems*, Report GAO-06-839, July 2006, p. 6.

<sup>6</sup> DoD Instruction 5000.02, *Operation of the Defense Acquisition System*, December 8, 2008, p.79.

<sup>7</sup> *Ibid.*, DoDI 5000.02.

Current DoD maintenance policy also prescribes that maintenance managers must

ensure access to support and support-related technical information consistent with the planned support concept to cost effectively maintain fielded systems and foster competition for sources of support (including maintenance) throughout the life of the fielded systems.<sup>8</sup>

Documentation of technical information and data management policies and procedures, as well as training for data managers, is included in this body of policy.<sup>9</sup> From a practical perspective, the principal question is, has appropriate technical data been acquired (through actual purchase or access rights) to permit maintenance activities to compete for and subsequently accomplish required maintenance of end items or reparable components?

Assurance that required technical data exists for depot maintenance provision is an important and ongoing issue. According to the GAO,

the Army and the Air Force have encountered limitations in their sustainment plans for some fielded weapon systems because they lacked needed technical data rights. The lack of technical data rights has limited the services' flexibility to make changes to sustainment plans that are aimed at achieving cost savings and meeting legislative requirements regarding depot maintenance capabilities.<sup>10</sup>

## Sufficient Workload Levels

In the private sector, investors carefully assess indicators (such as market share increases and decreases) because they can be a sign of the relative competitiveness of a company's products or services. Market share increases can allow a company to increase its operations and improve its profitability. The private sector also has a strong focus on maintaining essential capabilities and the workload needed to efficiently sustain those capabilities. The organic depot maintenance sector is similarly focused on capability and the sustainment of those capabilities.

10 U.S.C. §2464 is designed to minimize operational risk (namely the risk that support will not be available when it is needed by operating forces), and this consideration undergirds the primary rationale for maintaining organic maintenance depots and workload. The statute is based on the premise that organic depot maintenance activities are more ready and controlled than their private-sector counterparts because they have historically demonstrated important characteristics in responding to operational requirements. These include the ability to rapidly increase output within a spectrum of unpredictable needs and provide a wide range of industrial repair capabilities at a single site.

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<sup>8</sup> DoD Directive 4151.18, *Maintenance of Military Materiel*, March 31, 2004, p. 3.

<sup>9</sup> DoD Handbook, MIL-HDBK-X132, *Acquisition Data Management*, December 12, 2008.

<sup>10</sup> Op. cit., GAO-06-839, "Highlights" page.

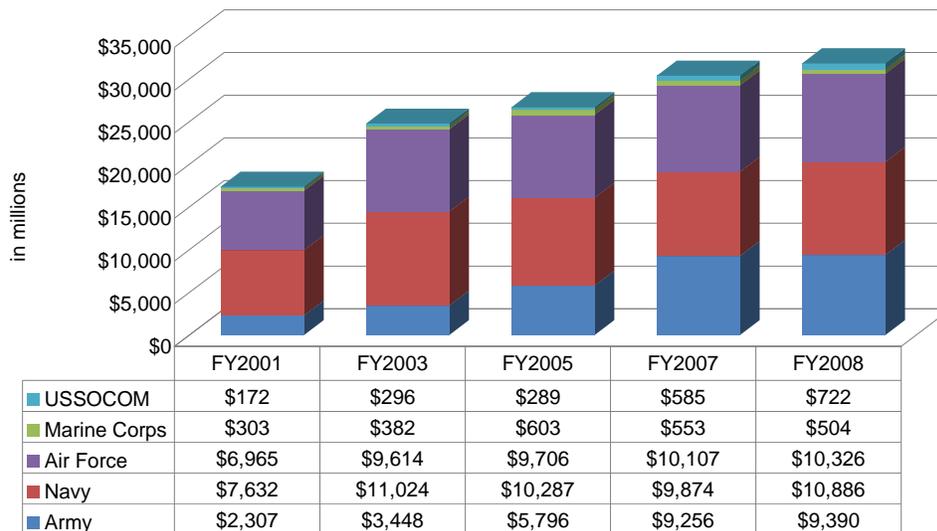
Similarly 10 U.S.C. §2466 addresses specific workload allocation requirements associated with the need to protect critical or value-adding organic depot maintenance capabilities by placing a 50 percent limitation on contracting for depot maintenance:

Not more than 50 percent of the funds made available in a fiscal year to a military department or a defense agency for depot-level maintenance and repair workload may be used to contract for the performance by non-federal government personnel of such workload for the military department or the defense agency.<sup>11</sup>

This section also requires DoD to provide a comprehensive identification of depot maintenance spending in an annual report to Congress. The report, commonly referred to as the 50/50 report, ensures at least 50 percent of depot maintenance for each military department is performed at DoD organic facilities. The 50/50 report is based on the depot maintenance definition of 10 U.S.C. §2460, but in accordance with 10 U.S.C. §2474, *Centers of Industrial and Technical Excellence (CITE)*, work performed at a DoD CITE by private industry or other non-DoD entity pursuant to a public-private partnership is not counted toward the 50/50 limitation.<sup>12</sup>

Depot maintenance obligations (including U.S. Special Operations Command, or USSOCOM) reported via 50/50 reports to Congress in recent years have nearly doubled (from \$17.4 billion in FY2001 to \$31.8 billion in FY2008). This increase was largely driven by maintenance requirements to support overseas contingency operations and, to a lesser extent, higher material costs (see Figure 2-2).

*Figure 2-2. Actual Depot Maintenance Obligations Reported to Congress*



<sup>11</sup> Title 10 U.S.C. §2466, *Limitations on the performance of depot-level maintenance of materiel.*

<sup>12</sup> Title 10 U.S.C. §2474(f), *Centers of Industrial and Technical Excellence: designation; public-private partnerships—Exclusion of certain expenditures from percentage limitation.*

At least half of the depot maintenance workload is accomplished at DoD activities, primarily at 17 major depots, which, except for shipyards,<sup>13</sup> operate under the Defense Working Capital Fund (DWCF). Depot activity costs visible to Congress in budget documents total about \$20 billion per year; however, costs are by activity group only, not by individual facility (again, except for shipyards). Depot maintenance is also performed at other facilities, such as the Naval Undersea Warfare Center Keyport, Naval Surface Warfare Center Crane, Space and Naval Warfare Systems Center San Diego, and Space and Naval Warfare Systems Center Pacific under the Navy Working Capital Fund Research and Development activity group.

## Strategy and Governance

Congress has tried to influence how depots fit within a larger defense business strategy and how that strategy should induce the depots to be more results-oriented.

An organization's business strategy creates a logical link between the execution of activities and the achievement of desired outcomes. Organizations typically define a structured approach for developing and producing a strategic plan. They then use that structure to develop an organization-wide understanding of the plan and the planning process and use that understanding to continuously challenge assumptions about specific capabilities and particular outcomes.

In its report to accompany the FY2007 NDAA, Congress tasked DoD to address its strategic focus, and other issues, in a depot maintenance strategic plan. Specifically, the House Armed Services Committee noted that,

despite the direction in the committee report (H. Rept. 108-106) accompanying the *National Defense Authorization Act for Fiscal Year 2004*, the Secretary of Defense has not developed a comprehensive, results-oriented management plan to guide future service depot maintenance and has not provided a framework that assures the long-term viability of the depot system.<sup>14</sup>

The committee requested the following specific information about DoD's organic depot maintenance activities:

- ◆ An assessment of the extent to which current facilities will continue to be used
- ◆ An assessment of the extent to which the appropriate work is being performed in the depots to maintain core capability

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<sup>13</sup> Beginning in FY1999 and concluding in FY2007, Naval shipyards transitioned from Defense Working Capital Funded operations to direct mission financing.

<sup>14</sup> *National Defense Authorization Act for Fiscal Year 2007: Report of the Committee on Armed Services, House of Representatives, on H.R. 5122, together with additional and dissenting views* (including cost estimate of the Congressional Budget Office), House Report 109-452, May 5, 2006.

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- ◆ Future planning for core capability and the identification of workloads by depot and commodity group that are currently performed in the depots
  - ◆ Current workforce breakdown and a personnel requirements strategy for maintaining the required workforce
  - ◆ Planned equipment and facility improvements and the associated funding stream, by depot, with distinction made for what is planned as a replacement and what will provide capability for a new system
  - ◆ A specification of statutory, regulatory, or operational impediments to achieving a strategy that enables a capital investment in facilities, equipment, processes, and personnel of an amount not less than 6 percent of the actual total revenue
  - ◆ A description of the benchmarks established by each depot for capital investment and the relationship of the benchmarks to applicable performance methods used in the private sector.

In response, DoD published *Depot Maintenance Strategy and Implementation Plans*.<sup>15</sup> That report consisted of two parts:

- ◆ Part I was the *DoD Depot Maintenance Strategic Plan*.
- ◆ Part II was the DoD's response to the HASC request for information about DoD's organic depot maintenance activities.

In the DoD *Depot Maintenance Strategic Plan*, the military services were tasked with providing their own depot maintenance strategic plans. The minimum requirements set forth for service plans were as follows:

- ◆ Logistics transformation initiatives, including how capabilities will be quantified and measured within the organic depots
- ◆ Core logistics capability assurance
- ◆ Workforce revitalization, including reengineering and replenishment strategies
- ◆ Capital investments within the depot.<sup>16</sup>

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<sup>15</sup> Office of the Undersecretary of Defense for Acquisitions, Technology and Logistics (USD[AT&L]), *Report to Congress: Depot Maintenance Strategy and Implementation Plans*, March 2007.

<sup>16</sup> LMI is aware of current GAO assessments in this area. As part of our research for this interim report, we developed a framework to gauge the compliance and progress of the services. Outcomes of our work in the strategic planning area will be incorporated into ongoing analysis.

Alignment among the overall strategy and specific plans to address key elements of that strategy, including capital investment, is crucial. Strategic alignment ensures DoD's organic depot maintenance infrastructure is postured and resourced for responsive performance that addresses materiel sustainment requirements.

## TIMELY AND RESPONSIVE PERFORMANCE—RESULTS-ORIENTED BUDGETING AND MANAGEMENT

The performance of the various organizations that contribute to weapon system sustainment is traditionally measured in terms of output. While this measurement is necessary for internal management, it is seldom sufficient to determine a clear link to the end result or consequence desired (i.e., the required outcome). Conversely, a results-oriented management environment can be characterized by the following:<sup>17</sup>

- ◆ Result and outcome hierarchies are laid out and understood.
- ◆ Indicators that measure result and outcome achievement are defined.
- ◆ Indicators are measurable with reasonable effort.
- ◆ Logical links are made between the ultimate outcome and the activities, outputs, and intermediate outcomes being pursued.
- ◆ A strategy exists to achieve the outcome, and that strategy is shared across organizations in the domain.
- ◆ Organizations in the domain are capable of executing strategies for more than one outcome if multiple outcomes are applicable.
- ◆ Accountability for outcome achievement is defined and understood.

Attaining such an environment requires an overarching management strategy that focuses on carefully defining requirements in terms of intended effects (i.e., planned outcomes) and then optimizing the achievement of the outcomes rather than optimizing the production of intermediate outputs.

In 1993, *The Government Performance Results Act* (GPRA) amended Title 5 U.S. Code by adding a new section on strategic plans (§306). In carrying out the provisions of GPRA, the Director of the Office of Management and Budget (OMB) tasks each agency to prepare an annual performance plan that covers each program activity set forth in their budget. This performance plan must include

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<sup>17</sup> Paul Duignan, *Principles of Outcome Hierarchies: Contribution Towards a General Conceptual Framework for Outcomes Systems (Outcome Theory)*, Strategic Evaluation website, June 3, 2004, available at <http://www.strategicevaluation.info/documents/122.htm>.

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general goals and objectives, including outcome-related goals and objectives, for the major functions and operations of the agency. Each agency's plan must also

- ◆ establish performance goals to define the level of performance to be achieved by a program activity;
- ◆ express such goals in an objective, quantifiable, and measurable form;
- ◆ describe the operational processes, skills, and technology and the human, capital, information, or other resources required to meet the performance goals;
- ◆ establish performance indicators to be used in measuring or assessing the relevant outputs, service levels, and outcomes of each program activity;
- ◆ provide a basis for comparing actual program results with the established performance goals; and
- ◆ describe the means to be used to verify and validate measured values.

DoD recently solidified the performance linkage between the various organizations that contribute to weapon system sustainment. This effort integrated product support strategy with specific materiel readiness outcomes for a weapon system. In August 2006, the Joint Requirements Oversight Council approved the adoption of a mandatory "materiel availability" key performance parameter (KPP) for all major defense acquisition programs and select ACAT II and III programs.<sup>18</sup> That KPP has two supporting key system attributes: materiel reliability and ownership cost.

OSD subsequently published explanatory guidance for the KPP and the consequent system attributes:<sup>19</sup>

*Materiel availability* is a measure of the percentage of the total inventory of a system operationally capable (or ready for tasking) of performing an assigned mission at a given time.

*Materiel reliability* is a measure of the probability that the system will perform without failure over a specific interval.

*Ownership cost* provides balance to the sustainment solution by ensuring that the operations and support costs associated with materiel readiness are considered in...decisions.

These parameters and attributes introduce the broader concept of materiel readiness into the weapon system acquisition process. Their proper application should increase value in the future through the fielding of more supportable systems.

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<sup>18</sup> The Joint Staff, *Key Performance Parameter Study Recommendations and Implementation*, August 17, 2006.

<sup>19</sup> Deputy Under Secretary of Defense (Logistics and Materiel Readiness), *Life Cycle Sustainment Outcome Metrics*, March 10, 2007.

Ultimately the budget performance plan, if it is to include outcome-related goals and objectives, must include these general goals and objectives at the agency level.

## CAPITAL INVESTMENT AND PROCESS IMPROVEMENT

Congressional concern that DoD depot maintenance activities might not be investing enough in capital improvements resulted in 10 U.S.C. §2476,<sup>20</sup> which requires a minimum depot maintenance capital investment by DoD. Beginning in FY2007, the military departments were required to invest in their capital budgets an amount equal to not less than 6 percent of the average total combined workload funded at all the depots of that military service for the preceding 3 fiscal years. The Army and Navy minimum depot investment criteria were phased in at 4 percent for FY2007 and 5 percent for FY2008. The law initially applied to five Army depots, three Navy fleet readiness centers, four Navy shipyards, two Marine Corps depots, and three Air Force depots. Three Army arsenals were added by the FY2009 NDAA, which also requires separate consideration and reporting of Marine Corps depots.

## BUDGET VISIBILITY

In the previous section, we presented fundamental elements that are necessary for the effective management of DoD depot maintenance. We focused on DoD's ability to maintain critical depot capabilities and provide the governance and strategy required to make them effective and timely, while securing a workload level that keeps the organic depot enterprise relevant and viable for the long term.

In this section, we provide an overview of the high-level products (parts or end items) that generate weapon system materiel readiness. We detail how depot maintenance contributes to the availability of both the individual part and the weapon system as a whole. We also illustrate how the depot acts as part of a larger product team, which may include field-level and contractor maintainers. We further describe the existing visibility structure of maintenance resources for those products and how that visibility relates to Congress' fundamental concerns and the planning, programming, budgeting, and execution (PPBE) process.

### Description and Context

The study of future depot capability mandated by §322 of the FY2009 NDAA requires analysis of the depot maintenance program and budget structure of appropriated accounts and an analysis of DoD organic facilities that execute a major portion of the depot maintenance program. Because the scope of depot maintenance is not uniformly defined or visible in DoD budgets and related documents, an understanding of depot maintenance within the context of the larger DoD maintenance budget structure is necessary.

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<sup>20</sup> 10 U.S.C. §2476, *Minimum capital investment for certain depots*, amended by P.L.110-417, §327, 122 Stat. 4418.

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It is useful to view depot maintenance resourcing in terms of the products being produced. The overall DoD maintenance enterprise, which includes depot maintenance, maintains equipment by completing maintenance, repair, and overhaul (MRO) of the weapon system end items and the resupplying of that MRO effort:

- ◆ MRO includes the inspection, repair, modification, and overhaul of weapon system end items (including remove-and-replace operations for failed depot-level reparables [DLRs] and engines).
- ◆ Resupply of the MRO includes the procurement, transportation, maintenance, modification, repair, and overhaul of critical sub-systems (including consumable parts, DLRs, and engines).

MRO and resupply of MRO operate under distinct business units, business rules, and performance objectives. Equation 2-1 shows how maintainers in both product lines, including depot maintainers, influence the materiel availability of DoD weapon systems (shown as operational availability,  $A_o$ ).

$$A_o = \frac{MTBF}{MTBF + MTTR + ACWT}, \quad \text{Eq. 2-1}$$

where

- ◆ maintainers engaged in the MRO effort influence the mean time to repair (MTTR) the weapon system;
- ◆ maintainers engaged in the resupply effort influence the average customer wait time (ACWT) experienced by the MRO maintainer; and
- ◆ maintainers engaged in both product lines influence the mean time between failure (MTBF) of the system through the quality of their repair, inspection, and overall practices.

Both MRO and resupply have discrete measures of success that might include an element of readiness, safety, or cost. Ultimately, end-item MRO and resupply can be summarized as how well it satisfies the following measures:

- ◆ End-item MRO
  - Equipment availability—units ready for tasking
  - Mission completion rates
  - Regeneration rates
  - Mishap rates
  - Cost per unit of use

- ◆ Materiel resupply
  - Customer wait times—logistics response rates
  - Cost per item (includes repair and supply cost recovery)
  - Inventory preparedness and level
  - Component reliability.

Each MRO measure can be classified further as to whether end-item-related efforts address near-term availability or longer-term availability.

- ◆ Near-term availability tasks focus on the expeditious repair of units in the possession of warfighting units. These tasks are often unscheduled and more corrective in nature.
- ◆ Longer-term availability tasks are associated with an extensive maintenance effort at scheduled intervals. These tasks are often more preventive in nature.

The categorization of maintenance work as either MRO or resupply efforts is important if we are to understand how

- ◆ different types of depot work are programmed for and presented to Congress in the PPBE process,
- ◆ individual weapon system product support decisions influence the way depot work is programmed for and presented to Congress in the PPBE process, and
- ◆ depot performance in each product line influences the annual performance plan set forth in the DoD budget and how it is presented to Congress in the PPBE process.

## Traditional Levels of Maintenance

The delivery of parts (resupply) and end-items (MRO) involves a diverse maintenance workforce of uniformed military personnel, government civilians, and contractors. Historically, this workforce has related to three levels of maintenance:

- ◆ Organizational maintenance consists of the on-equipment MRO tasks necessary for day-to-day operation, including inspection and servicing and remove-and-replace operations for failed components (includes line-replaceable units or weapon-replaceable assemblies).
- ◆ Intermediate maintenance consists of both on-equipment MRO and off-equipment repair capabilities employed in the resupply effort. Operating units and in-theater sustainment organizations possess these capabilities,

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which can be quite extensive and include remove-and-replace operations for subcomponents of line replaceable units (so-called shop-replaceable units or assemblies), local manufacture, and other repair capabilities.

- ◆ Depot maintenance consists of all MRO and resupply repairs that are either beyond the capabilities of the field-level units or for which rebuild, overhaul, and extensive modification of equipment platforms, systems, and subsystems are centralized (for economic or other reasons).

The mix of maintainers (military, government civilian, and contractor) varies, but it is not unusual to see all levels providing simultaneous support in both product lines. Such support can be provided at a home station or in a deployed environment. The specific mix for any weapon system is the result of acquisition logistics planning that occurs during system development. In almost all cases, the depot acts as part of a larger product team.

## Acquisition Policies and Practices

Acquisition logistics planning decisions made during system development will impact how resources for depot work are programmed and presented to Congress in the PPBE process. The answers to three distinct questions, when considered together, influence the resulting resourcing strategy:

- ◆ Where will repair occur? (Addresses level of repair decisions.)
- ◆ Who will do the repair? (Addresses source of repair decisions.)
- ◆ What type of product support arrangements will be employed? (Addresses product support integration decisions.)

In addition to core determination, these programmatic decisions also affect the level of workload and product support governance. Moreover, they influence how resources that are required to execute product support strategies fit within the traditional budget exhibits sent to Congress. In what follows, we review traditional level-of-repair and source-of-repair processes and evolving DoD actions to mature product support management.

### LEVEL OF REPAIR

According to Defense Acquisition University (DAU) publications, level-of-repair analysis (LORA) is performed to determine the best, most efficient location where an item can be repaired. This analytical methodology also determines when an item will be replaced, repaired, or discarded based on cost considerations and operational readiness requirements. The LORA process affects both the MRO and resupply product lines.

The LORA process starts with the identification of the options for where maintenance can be performed. Because systems commonly use two or three levels of

maintenance, LORA produces a decision for every item (part or end item), indicating where each maintenance action should be performed.

Level-of-repair analysis is performed in two steps. The initial support decisions are based on non-economic decision criteria, such as core capability requirements, 50/50 status, or existing capabilities. Economic modeling then determines the most cost effective alternative to provide support for the system. Non-economic LORA decision criteria include service-specific rules or guidelines that determine if there is an overriding reason why maintenance should be performed at one level or another.

## SOURCE OF REPAIR

Source of repair decisions influences both the MRO and resupply product lines as well as the makeup of both field- and depot-levels of maintenance. The more formal decision process involves depot source of repair (DSOR) decisions.

The DSOR process

- ◆ addresses critical capabilities that must be maintained within DoD (core) and
- ◆ balances commercial and organic workload options (50/50).

DoD Directive 4151.18 presents the policy related to the DSOR process. In addition, each service has related DSOR guidance. Any differences in how each service implements this decision process can influence how work is programmed and presented to Congress during the PPBE process.

## PRODUCT SUPPORT ARRANGEMENTS

Two consecutive Quadrennial Defense Reviews (QDRs) concluded that DoD must transform its business process and infrastructure to enhance the capabilities inherent in the Department's support functions and free up resources to support warfighting and the transformation of military capabilities.

USD(AT&L) first took action in 2001 to change the traditional weapon system sustainment management pattern by publishing guidance that clarified and emphasized the intent of DoD acquisition policy; namely, that product support is a program manager's responsibility.<sup>21</sup>

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<sup>21</sup> OUSD(AT&L), *Product Support: A Program Manager's Guide to Buying Performance*, November 2001.

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The following is an excerpt from that guidance,<sup>22</sup> which is now contained in the *Defense Acquisition Guidebook*:

Product support is the package of logistics support functions necessary to maintain the readiness and operational capability of a system. Program managers are responsible for laying out and executing a strategic blueprint for the logistics process so that every part of the package is integrated and contributes to the warfighter's mission capability.

Two of the initiatives developed in response to the QDR mandate to transform DoD's support infrastructure and processes—performance-based logistics and the use of product support managers or integrators—are particularly relevant to any discussion of how resources for depot maintenance are programmed and reported to Congress.

### Performance-Based Logistics

The 2001 QDR<sup>23</sup> mandated the implementation of performance-based logistics and modern business systems with appropriate metrics to increase value by compressing the supply chain, eliminating non-value-added steps, and improving readiness for major weapon systems and commodities. The Department of Defense formally adopted PBL as the preferred approach to providing product support for military materiel.<sup>24</sup>

In concept, performance-based logistics entails the delivery of acquisition, supply, maintenance, distribution, and engineering support as an integrated, affordable, performance-oriented package designed to meet total system availability requirements while optimizing equipment reliability and mean down time and minimizing costs and the logistics footprint.

For the most part, the military services' PBL efforts have been successful; however, PBL has been applied primarily in contracted logistics support situations. Within the defense acquisition community, PBL has come to be associated almost exclusively with commercial contracts for weapon system support. For instance, the *Defense Acquisition Guidebook*, states

PBL is the *purchase* of support as an integrated, affordable, performance package designed to optimize system readiness and meet performance goals for a weapon system through long-term support arrangements with clear lines of authority and responsibility.<sup>25</sup>

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<sup>22</sup> *Defense Acquisition Guidebook*, Defense Acquisition University, July 2006.

<sup>23</sup> *Quadrennial Defense Review Report*, Department of Defense, September 2001.

<sup>24</sup> DoD Directive 5000.1, *The Defense Acquisition System*, May 12, 2003.

<sup>25</sup> Section 5.3, *Defense Acquisition Guidebook*, Defense Acquisition University, July 2006.

## Product Support Managers and Integrators

FY2010 NDAA §805, *Life-cycle management and product support*, states “the Secretary of Defense shall require that each major weapon system be supported by a product support manager (PSM).” This represents a major adjustment in how DoD plans, develops, fields, and manages product support and sustainment (including depot maintenance) of its major weapon systems, and how performance-based lifecycle product support (i.e., PBL) arrangements will be managed and executed in the future.

The PSM will have six specifically identified responsibilities:

- ◆ Develop and implement a comprehensive product support strategy for the weapon system.
- ◆ Conduct appropriate cost analyses to validate the product support strategy, including cost-benefit analyses as outlined in OMB Circular A-94.<sup>26</sup>
- ◆ Ensure achievement of desired product support outcomes through development and implementation of appropriate product support arrangements.
- ◆ Adjust performance requirements and resource allocations across product support integrators and product support providers as necessary to optimize implementation of the product support strategy.
- ◆ Periodically review product support arrangements between the product support integrators and product support providers to ensure the arrangements are consistent with the overall product support strategy.
- ◆ Prior to each change in the product support strategy, or every 5 years, whichever occurs first, revalidate any business case analysis performed in support of the product support strategy.

FY2010 NDAA §805 also clarifies the role, responsibilities, and definition of the product support integrator (PSI) under PBL arrangements, stating “product support integrator means an entity within the federal government or outside the federal government charged with integrating all sources of product support, both private and public, defined within the scope of a product support arrangement.”

Such product support arrangements have had—and will continue to have—a significant effect on the elements influencing DoD’s resourcing strategy.

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<sup>26</sup> OMB Circular No. A-94 (Revised), *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, October 29, 1992.

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## Planning, Programming, and Budgeting Policies, Practices, and Mechanisms

DoD mandates the military departments (MILDEPs) use a very elaborate system for making resource allocation decisions. The Programming, Planning, Budgeting, and Execution System (PPBES), the Joint Capability Improvement and Development System (JCIDS), and the Defense Acquisition System (DAS) all consider a variety of factors so that, ultimately, the Department can generate and sustain military forces and satisfy the President's national security objectives using the funds allocated for national defense.

The fiscally constrained programming phase produces a detailed resource summary of current and future funding requirements. Programming offices interpret the defense planning guidance and allocate all the assigned resources to the different programs that roll up to the defense budget.

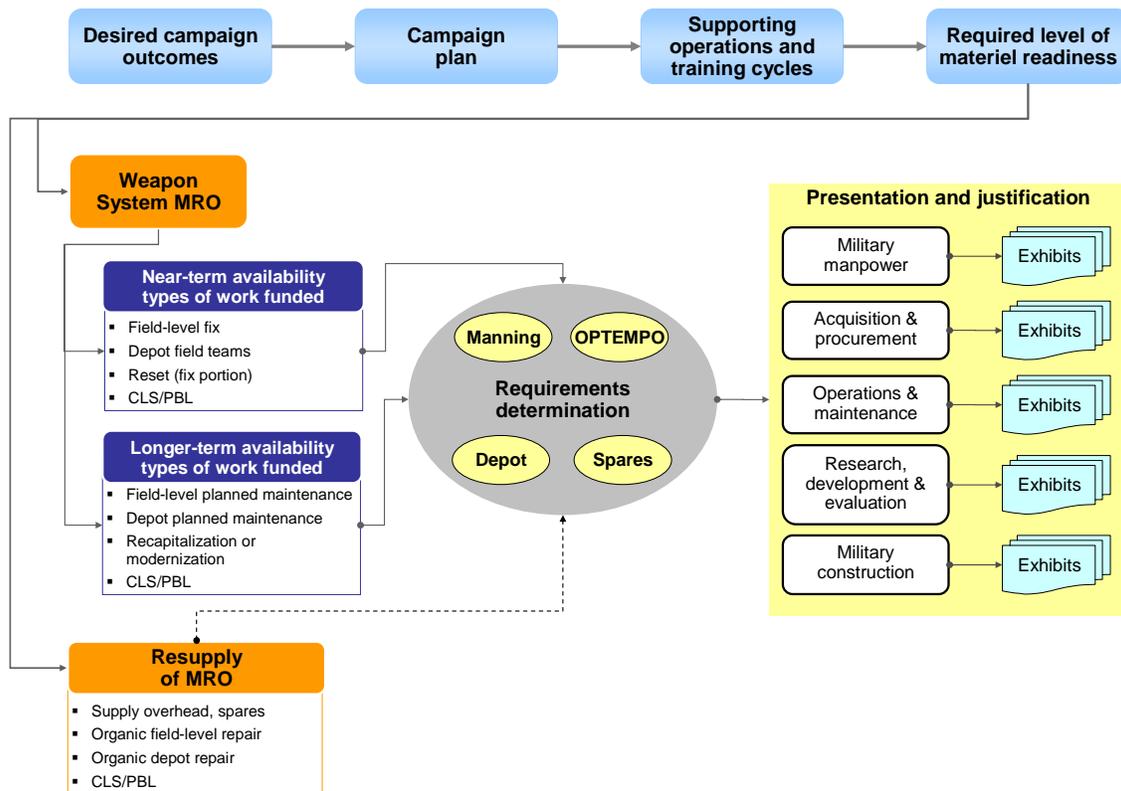
The Future Years Defense Plan (FYDP) identifies the required funding by program element (PE). OSD reviews the program objectives memorandum (POM) submitted by each MILDEP and makes adjustments that are documented in a program decision memorandum (PDM). The PDM is the authoritative direction for what the MILDEPs should include in their budget estimate submission (BES), which is due to Office of the Secretary of Defense (OSD) in the fall of each year.

Each military service has its own method for integrating and presenting life-cycle weapon system and equipment funding requirements. These processes go through continual refinement based on lessons learned, OSD guidance, and any congressional inquiry. Such refinements strengthen the link between resource allocation and materiel readiness outcomes.

### REQUIREMENTS VALIDATION, PRESENTATION, AND JUSTIFICATION

The fundamental task when resourcing DoD weapon system sustainment is to make the valid connection between a required level of performance in specific warfighting capability areas and the level of materiel readiness that will support that performance level. Figure 2-3 presents a general flow of how requirements for the maintenance products flow from users, are validated, and are presented in support of the capabilities required by defense programming guidance.

Figure 2-3. Resource Requirements Determination and Budget Presentation



Note: CLS = contractor logistics support; OPTEMPO = operations tempo.

Although each service has its own methods to determine, validate, and present overall maintenance requirements, the following universal elements are critical to understanding how different types of depot work have been programmed for and presented to Congress in the PPBE process:

- ◆ Planning for near-term availability is required to meet operations tempo (OPTEMPO). Typically based on hours flown, steaming days, miles driven, or rounds fired, near-term planning generates a significant requirement for depot maintenance in terms of
  - expeditious repair and reset of weapon systems and
  - maintenance, modification, repair, and overhaul of critical subsystems (including consumable parts, DLR components, and engines).

- 
- ◆ Planning for longer-term availability has been based on failure management policies, rigorous supporting engineering analysis, and strategies for implementing reliability, maintainability, and supportability improvements. Longer-term planning generates significant requirement for depot maintenance in
    - scheduled weapon system overhaul,
    - planned weapon system modification, and
    - planned weapon system recapitalization.

Planning, both near and longer term, has also included the use of various manpower, OPTEMPO, sparing, and scheduled maintenance requirements processes or models. In essence, planning presents a summary of the requirements of numerous weapon system product support strategies. As noted above, the requirements determination process has been managed separately, by function, maintenance level, or appropriation, making the cross-activity connections from budget line, to product, to materiel readiness levels difficult. The results are most often presented by appropriations in military manpower, operations and maintenance (O&M), procurement, military construction (MILCON), and research, development, testing, and evaluation (RDT&E), with funds flowing to organic and private depot providers.

## Presentation and Justification

Budget submitting offices (BSOs) throughout DoD interpret the POM, refine the estimates, and reallocate money within their top line controls so the resulting budget is executable. Analysts review the budget to confirm it is executable and it can achieve the program objectives in the approved POM.

When service comptrollers complete budget deliberations, they pass final budget controls back to the BSOs so they can produce another budget submission for review by analysts in the Office of the Under Secretary of Defense (Comptroller). During the joint OSD and OMB budget review, further adjustments can be made to the component budgets. Changes to the budget submissions are documented in program budget decisions (PBDs), which the Deputy Secretary of Defense signs. At the end of the OSD-OMB budget review, the budget is passed back to the MILDEPs, and they, in turn, pass them back to their subordinate commands to produce the budget justification materials that are transmitted to Congress in February as part of the President's annual budget submission.

By the end of the program-budget cycle, literally hundreds of thousands of hours have been devoted to documenting the program and the decisions that have been made to shape it. When the final budget justification materials are delivered to Congress, usually by the beginning of March, the program-budget cycle for the next year's budget submission has already begun. Congress deliberates over the budget and directs a series of changes, which are reflected in their markup of the President's budget submission. By the beginning of the October following the

budget submission to Congress, the Authorization and Appropriation committees pass laws that enact the approved budget for the next fiscal year.

## Budget Exhibits

The DoD *Financial Management Regulation* (FMR) includes applicable instructions and exhibits for preparing the justification material required for appropriations. The current exhibits do little to address the fundamental elements that are necessary for effective depot maintenance management. They also do not relate resource requirements to achieving core logistics capabilities or required materiel readiness outcomes.

No single exhibit or series of exhibits presents the integrated maintenance requirements presented in Figure 2-3, but several exhibits identify individual requirements for depot maintenance. The following exhibits focus on major areas of depot activity:

- ◆ OP-30, *Depot Maintenance Program*, summarizes O&M appropriations-funded depot maintenance. OP-30 includes budget material submitted to Congress by centrally managed depot maintenance subactivity groups (SAGs).<sup>27</sup> The Navy is the only service that also submits portions of other SAGs, such as combat communications, that are not predominately depot maintenance in nature but include some depot maintenance.

The OP-30 exhibit also identifies funded and unfunded requirements by major category (ships, aircraft, combat vehicles, and other). In recent years, Navy shipyards have transferred out of the working capital fund to direct mission funding in the O&M account. This has resulted in a loss of single-point visibility of shipyard depot maintenance funding as a separate budget category.

- ◆ SM-3, *Supply Management*, addresses repairs required for the resupply of the MRO effort. Such repair includes reparable equipment components that are managed and stocked by the supply system and commonly referred to as depot-level reparable. Consumer purchases of DLRs from supply, which may be new or rebuilt items, are identified in appropriated customer budgets as operating expenses. DLR repairs funded by DWCF Supply Management are identified in exhibit SM-3b, *Operating Requirement by Weapon System/Category*, with the exception of the Army, which has not included exhibit SM-3b in O&M budget submissions to Congress. There are significant inconsistencies among the military services regarding the definition and scope of DWCF submissions.
- ◆ OP-32, *Summary of Price and Program Changes*, is another O&M exhibit that provides some insight into depot maintenance spending. Although an

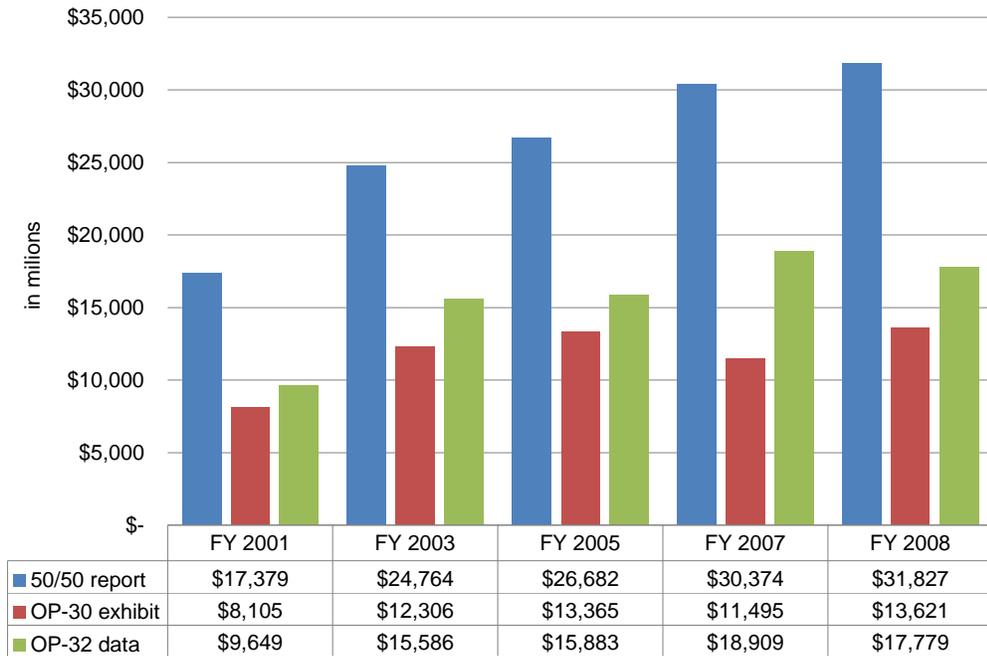
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<sup>27</sup> Exhibit OP-5, *Detail by Subactivity Group*, describes and provides justification for O&M subactivity group.

imprecise method, OP-32 lists O&M purchases by their use, such as personnel compensation, fuel, purchases from DoD DWCF facilities, and contract purchases.

Existing budget exhibits fail to identify the same picture presented in the 50/50 report. Figure 2-4 illustrates the disparities in depot maintenance budget justification totals in 5 different fiscal years. As mentioned above, OP-32 lists O&M purchases by their use; OP-30 summarizes O&M appropriations-funded depot maintenance.

*Figure 2-4. Disparity in Depot Maintenance Budget Justification Totals Submitted to Congress*



In addition, no budget exhibit summarizes depot maintenance funded by either the procurement or research and development accounts. Depot maintenance can also be financed by U.S. Transportation Command (USTRANSCOM) and the Navy’s Military Sealift Command (MSC) using DWCF funding authority, but these depot maintenance costs are not identified separately in budget exhibits submitted to the Congress. Depot maintenance is occasionally mentioned in narrative justification material submitted to Congress, although it is generally incidental to the program.

## PRESENTATION AND JUSTIFICATION OF CLS/PBL ACTIVITY

Consistent with the QDR guidance, the MILDEPs have attempted to implement contractor logistics support and PBL based on business case analyses. Early applications of PBL uncovered a number of financial and contractual challenges to full implementation within DoD. Many CLS contracts involve multiple line items associated with repairable parts, maintenance, technical services, and consumable

parts. Each line item may be funded by specific appropriations, with limited or no flexibility across the contract. In essence, the Department is buying a collection of traditional budget elements on a single contract; but, instead of paying for independent outputs, it is purchasing levels of performance at the weapon system level.

PBL strategies are programmed and resourced differently and vary depending on each service's unique approach. Within O&M appropriations, PBL agreements can include funds from various O&M activities, such as depot maintenance, supplies, and depot-level reparable. And, because National Guard and reserve components have individual O&M appropriations, the number of funding areas multiplies when the PBL agreement supports both Guard or reserve components and the active component. In the execution year, the program manager may need to collect separate funding documents from many resource sponsors to finance the PBL agreements.

Current DoD CLS and PBL requirements determination often resides outside traditional budget shops. In effect, the program manager must finance PBL agreements through several functional activities within various appropriations rather than financing to the weapon system performance level.

## FINANCIAL FLEXIBILITY IN DEPOT MAINTENANCE PROGRAMS

During the program/budget formulation process, the military services have the ability and responsibility to recalculate proposed program funding to ensure they can properly support force levels approved by the Joint Chiefs of Staff and the Secretary of Defense. DoD program and budget guidance rarely includes specific guidance regarding depot maintenance funding.

The flexibility to realign funds is limited once an appropriations bill is passed by the Congress and signed by the President. In general, reprogramming in excess of \$15 million (cumulative for the year) in or out of an O&M budget activity or special interest item (like depot maintenance) requires the prior approval of Congress. The services may, however, realign funds within a budget activity and line item SAG, such as O&M depot maintenance.

Congress has expressed concern over this realignment of funds and DoD's use of a "rebaselining" process without the approval of Congress. The House Committee on Appropriations stated:

While the waging of war certainly has increased the need for flexibility in executing the Departments' resources, the Committee fears that the Department has come to rely on reprogramming and transfer authority in lieu of a thoughtful and deliberate budget formulation and fiscal management process.<sup>28</sup>

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<sup>28</sup> *Department of Defense Appropriations Bill, 2008, Report of the Committee on Appropriations [to accompany H.R. 3222], House Report 110-279. July 30, 2007, p. 10.*

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The committee report further recommended a provision that

prohibits the Department from executing any reprogramming or transfer of funds for any purpose other than originally appropriated until the aforementioned<sup>[29]</sup> report is submitted to the Committees of Appropriations of the Senate and House of Representatives.

## SUMMARY

In this chapter, we presented fundamental elements of law and DoD policy that are significant to the framework for the effective management of DoD depot maintenance. These elements focus on DoD's ability to maintain critical depot capabilities and provide the governance and strategy required to make them effective and timely, all while securing sufficient workload levels that keep the organic depot enterprise relevant and viable for the long term.

We also presented an overview of how depot maintenance contributes to the two main product lines of MRO and resupply, which ensure weapon system readiness. We then presented the current budgetary structure for depot maintenance requirements determination, depot maintenance resources, and the justification and presentation of various budget materials, investment strategies, and oversight documents.

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<sup>29</sup> Refers to a DD 1414 report that displays the President's budget, adjustments made by Congress, adjustments made due to enacted rescissions, and the fiscal year-enacted level by appropriation and program line item. The DD 1414 constitutes the baseline for reprogramming requests.

## Chapter 3

# Initial Baseline

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The maintenance of materiel (weapon systems and related components and equipment, excluding real property, installations, and utilities), cost DoD \$83 billion in FY2008. Of that amount, \$31.1 billion was spent in the performance of depot-level maintenance and repair of military equipment by a combination of organic (government-owned and operated) and commercial (private industry) activities. Table 3-1 shows the division between organic and commercial obligations from FY2001 through FY2008.

*Table 3-1. Total DoD Depot Maintenance Obligations (\$ in billions)*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Organic	8.9	11.1	13.2	13.3	13.9	15.9	16.3	16.9
Commercial	8.3	9.6	11.3	11.8	12.4	12.8	13.5	14.2
Total funds	17.2	20.7	24.5	25.1	26.3	28.7	29.8	31.1

Note: As reported by the DoD in the annual Report to Congress, *Distribution of Depot Maintenance Workloads*.

This actual trend in total DoD depot maintenance obligations was not anticipated at the beginning of the decade. By FY2000, organic depot maintenance consisted of 17 major installations,<sup>1</sup> and the President's budget for FY2001 reflected a relatively stable plan for depot maintenance and repair, as depicted in Table 3-2. Although planned workload projected an initial decline (from FY2001 to FY2005 workload levels), personnel and capacity remained relatively stable. This continued the general depot maintenance trends of the 1990s. These projections of relative stability were a product of consolidation activities that characterized depot maintenance management initiatives during the 1990s.

*Table 3-2. Projections of DoD Depot Maintenance Workload, Personnel, and Capacity*

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005
Planned workload (millions of DLHs)	74.4	71.6	70.5	71.4	71.1	71.2
Personnel	63,440	63,250	62,299	63,506	62,283	63,645
Capacity (millions of DLHs)	80.1	79.6	79.6	79.6	79.5	79.5

Note: Depot maintenance business profiles published by the Joint Depot Maintenance Activities Group. FY2000 projections are from the congressionally approved budget; FY2001 data is from the President's budget; FY2002–FY2005 data reflects out-year projections.

<sup>1</sup> These numbers include the current 17 DoD major organic depots and the Aerospace Maintenance and Regeneration Group (AMARG), which is now part of Ogden Air Logistics Center.

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# EFFECT OF OVERSEAS CONTINGENCY OPERATIONS ON DEPOT MAINTENANCE

For the past 8 years, the U.S. military has been on a war footing, with personnel and equipment in a constant expeditionary cycle of deploy, prosecute the war, re-deploy, recover, and repeat. During deployments, operations are conducted at a rapid pace in harsh environments. The combination of constant deployments and programs keeping equipment in theater (instead of returning it stateside) has increased utilization rates and raised the OPTEMPO for numerous weapon systems many times higher than what was originally planned for in FY2001.<sup>2</sup> As a consequence, the requirements for ongoing maintenance and repair—including reset—increased, which led to a high-level focus on ensuring the depots can continue to provide ready equipment to the warfighters.

To learn what was happening to the weapon systems as a result of Operations Enduring Freedom and Iraqi Freedom (OEF and OIF), we first looked at weapon system inventories and found that, with the exception of ground vehicles (most notably tactical wheeled vehicles), there was no major increase in inventories from FY2001 to FY2008. To investigate how the constant expeditionary cycle of war has affected weapon systems, we reviewed usage rates for selected aviation and ground systems, examples of which are provided in Table 3-3. The data we reviewed implies increased usage (which is related to OPTEMPO) for deployed weapon systems and equipment well above peacetime rates; but it does not necessarily reflect a fleet-wide increase. While not all-encompassing, Table 3-3 reflects significant growth in usage rates over historical, peacetime averages.

As we demonstrate later in this chapter, there is a plausible relationship between OPTEMPO and depot maintenance workload. The increased usage of the various systems to support overseas contingency operations has resulted in a significantly higher depot maintenance requirement.

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<sup>2</sup> Forward-deployed depot maintenance is further addressed in Chapter 4. In many cases, depot work at forward locations is not done completely independent of CONUS organic depots. Depots variously use field service teams, voyage repair teams, battle damage repair teams, and forward repair activities to get their technicians and artisans into the combat zone and to the equipment that needs repair or support.

Table 3-3. Examples of Aviation and Ground System Usage Rates

Service	Category	Model	Average OEF/OIF usage (hrs/mo)	Historical, peacetime average (hrs/mo)
<b>Aviation systems</b>				
Army	Apache	AH-64A	34.5	13.0
		AH-64D	40.2	13.0
	Blackhawk	UH-60L	55.6	13.0
	Kiowa Warrior	CH-58D	50.3	13.0
	Chinook	CH-47D	26.1	13.0
Marine Corps	KC-130	—	70.9	34.4
	Cobra	AH-1W	26.7	17.3
	UH-1	UH-1N	32.2	16.6
Navy	Prowler	EA-6B	84.2	22.5
	ECM	ALQ-99	84.2	44.5
	Hornet	F/A-18	95.0	24.6
Air Force	B-1	B-1B	139.0	37.0
	C-130	C-130E/H	187.0	83.0
		C-130J	84.0	49.0
	EC-130	EC-130H	170.0	46.0
<b>Ground systems</b>				
Army	Abrams	M1A1	138	67
		M1A2	307	67
	Bradley	M2A2	270	70
		M2A3	313	70
		M3A3	827	70
	M88	M88A1	32	32
M88A2		42	23	
Marine Corps	HMMWV	HMMWV	550	183
	MTWV	MTWV	2,000	500
	LVS	LVS	1,500	375
Navy	HMMWV	1151A1B1	400	150
	MTWV	Cargo	266	150
		Dump	296	100
	Truck Tractor	60000 GVW	428	175

Note: Data in this table reflects a snapshot in time and was obtained from the *OSD Report To Congress on Long-Term Equipment Repair Costs* (September 2006) and data provided by the military services as of January 2009.

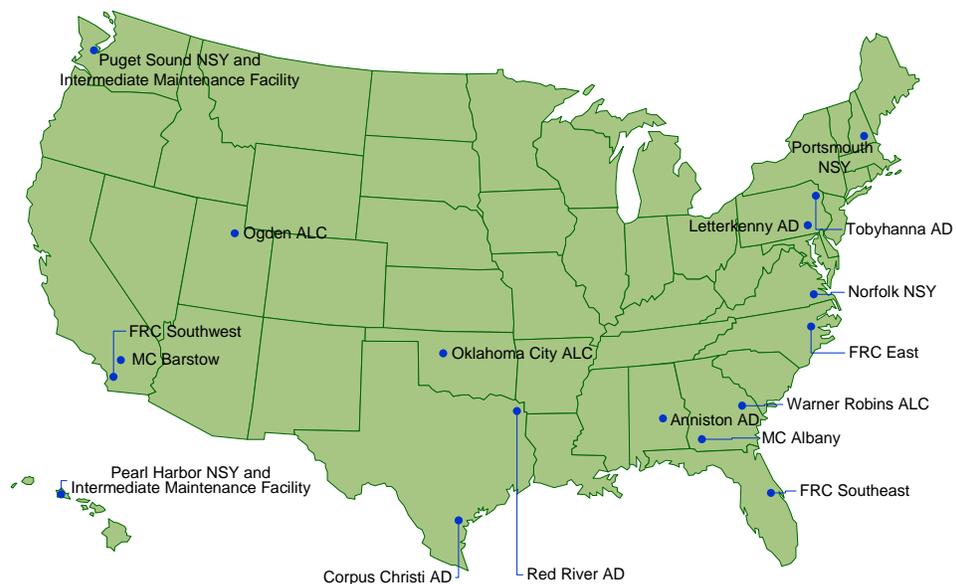
Note: ECM = electronic countermeasure; HMMWV = high mobility multipurpose wheeled vehicle; MTWV = medium tactical wheeled vehicle; LVS = logistics vehicle system.

# ORGANIC DEPOT MAINTENANCE FY2001 TO FY2008

In keeping with their responsibility to equip their forces, each military service operates two or more maintenance depots to perform depot-level maintenance and associated activities for its major weapon systems and equipment. Overall these activities had an operating cost of more than \$16 billion in FY2008.

As of September 10, 2001, and after the depot closings recommended by the 1995 Base Closure and Realignment Commission, five Army depots (ADs), two Marine Corps maintenances centers (MCs), four Navy shipyards (NSYs), three Navy aviation depots (NADEPs), and three Air Force air logistics centers (ALCs) constituted the sum of DoD's major organic depot maintenance universe (see Figure 3-1).

*Figure 3-1. DoD Organic Major Depot Maintenance Activities*



Note: Each of these activities is designated a center of industrial and technical excellence (CITE) within its core competencies.

In addition to defining the missions of each depot, the remainder of this chapter characterizes organic depot maintenance as a whole between FY2001 and FY2008, using baseline data in the following key areas:

- ◆ Budget displays, obligations, and costs
- ◆ Capacity and workload
- ◆ Depot maintenance workforce
- ◆ Capital investment
- ◆ Statutory workload requirements, including compliance with the core and 50/50 requirements.

## Missions of the Organic Maintenance Depots

### ARMY DEPOTS

The Army's five major organic maintenance depots operate under the authority of the U.S. Army Materiel Command (AMC). These maintenance installations also fall under the direct command and control of the lifecycle management commands, and each depot is aligned in accordance with its mission.

- ◆ Anniston AD, Anniston, Alabama—Combat vehicles, artillery systems, bridge systems, small arms, and secondary components
- ◆ Corpus Christi AD, Corpus Christi, Texas—Helicopters and associated components
- ◆ Letterkenny AD, Chambersburg, Pennsylvania—Tactical missiles and ammunition, related ground support and radar equipment, and HMMWVs
- ◆ Red River AD, Texarkana, Texas—Light tracked combat vehicles, tactical wheeled vehicles, electronic systems, missile systems, towed and self-propelled artillery, and support equipment
- ◆ Tobyhanna AD, Tobyhanna, Pennsylvania—Communications-electronics systems, avionics, related equipment, and missile guidance systems.

### MARINE CORPS MAINTENANCE CENTERS

The two Marine Corps maintenance centers operate under the authority of Marine Corps Logistics Command. Depot maintenance requirements for Marine Corps aircraft are supported by the Navy.

- ◆ Marine Corps MC Albany, Albany, Georgia—Combat and combat support systems (to include amphibious), combat and tactical vehicles, automotive and construction equipment, ordnance and weapons, general purpose equipment, and communications and electronics equipment.
- ◆ Marine Corps MC Barstow, Barstow, California—Combat and combat support systems (to include amphibious), combat and tactical vehicles, automotive and construction equipment, ordnance and weapons, general purpose equipment, and communications and electronics equipment.

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## NAVY FRCs AND SHIPYARDS

The Commander, Fleet Forces Command, and the Commander, Pacific Fleet, as budget submitting officers, “own” the shipyards. The Naval Sea Systems Command (NAVSEA) operates the shipyards and has technical authority for ship maintenance operations. For aviation, the Commander, Fleet Readiness Command (COMFRC),<sup>3</sup> is aligned to the fleet through his or her subordinate relationships with the Commander, Naval Air Forces (CNAF), and Commander, Naval Air Systems Command (NAVAIR). Operationally, COMFRC responds to warfighter requirements through CNAF; technical authority for maintenance resides with NAVAIR.

- ◆ NAVAIR FRCs

- FRC East, Cherry Point, North Carolina—Marine Corps and Navy aircraft, jet and turbofan vectored engines, auxiliary power units, propeller systems, and related components
- FRC Southeast, Jacksonville, Florida—Airframes, propulsion, avionics, surveillance, countermeasure systems and associated components, and engineering and manufacturing services associated with aircraft maintenance, repair, and overhaul
- FRC Southwest, San Diego, California—Navy and Marine Corps fixed and rotary wing airframes, propulsion systems, avionics, command and control equipment, early warning and airborne battle management systems, and associated components

- ◆ NAVSEA shipyards

- Norfolk NSY, Portsmouth, Virginia—Nuclear refueling and defueling, surface combatants, large deck ships, nuclear submarines, and craft
- Portsmouth NSY, Kittery, Maine—Nuclear refueling and defueling, nuclear submarines, and deep submergence vehicle maintenance
- Puget Sound NSY, Bremerton, Washington—Nuclear refueling and defueling, nuclear submarines (including inactivations), large deck ships, surface combatants, and ship recycling
- Pearl Harbor NSY, Pearl Harbor, Hawaii—Nuclear refueling and defueling, nuclear submarines, surface combatants, and watercraft.

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<sup>3</sup> The 2005 BRAC decisions required the establishment of fleet readiness centers (FRCs), which integrated the former naval air depots (NADEPs) and the continental United States (CONUS) aircraft intermediate maintenance detachments (AIMDs) into a single organization.

## AIR FORCE AIR LOGISTICS CENTERS

Air Force Materiel Command (AFMC) has authority over the three air logistics centers. Depot maintenance is performed by the maintenance wing located at each ALC.

- ◆ Ogden ALC, Hill AFB, Utah—Combat aircraft, aircraft landing gear, wheels and brakes, composite repair, rocket motors, air munitions, guided bombs, avionics systems, various instruments and electrical accessories, hydraulic and pneumatic systems, special purpose vehicles, shelters, radome communications systems, gas turbine engines, secondary power support equipment, and other related components (The Aerospace Maintenance and Regeneration Group, which aligned under Ogden Air Logistics Center in 2007, performs maintenance and regeneration.)
- ◆ Oklahoma City ALC, Tinker AFB, Oklahoma—Bombers, surveillance and tanker aircraft, aircraft engines, cruise missile engines, hydraulic and pneumatic systems, pneumatics, oxygen- and other gas-generating equipment, instruments, offensive avionics systems, flight controllers, and aircraft- and engine-related repairable items
- ◆ Warner Robins ALC, Robins AFB, Georgia—Major aircraft, airlift systems and helicopters, hydraulic and pneumatic systems, pneumatics, oxygen- and other gas-generating equipment, instruments and displays, avionics systems, and aircraft-related repairable items.

## Budget Displays, Obligations, and Costs

The financial resource implications of DoD depot maintenance operations can be viewed from many perspectives. In this section, we attempt to provide high-level views of the financial resources consumed by organic depot maintenance operations from three perspectives: budgetary funding, congressional reporting, and actual operating costs of organic maintenance depots.

### BUDGETARY FUNDING

One way to view the resource implications of depot maintenance operations is from a budgetary perspective. As noted in Chapter 2, DoD identifies only a portion of its total depot maintenance funding in its budget material; and even the portion of funding identified is not presented in a single display. In recent years, as overseas contingency operations have required supplemental funding (including substantial resources for depot maintenance), visibility of the total depot maintenance budget estimate in the larger DoD budget has been reduced even more.

The OP-30 exhibit for O&M depot maintenance funding provides the greatest visibility of depot maintenance budgetary resources. The exhibit contains a prospective budget estimate and actual past obligations. But the OP-30 exhibit relates to both organic and commercial depot maintenance and does not separate the

respective funding application. The OP-30 exhibit relates principally to end-item MRO and engine resupply. In FY2008, DoD funding from O&M appropriations for depot maintenance (including supplemental funding) totaled \$17.3 billion. This amounts to about 54 percent of the estimated total depot maintenance workload identified by DoD in its 50/50 report. As Table 3-4 shows, when factoring in supplemental amounts, overall depot maintenance funding (as identified in the OP-30 display) increased by 118 percent for the period FY2001–FY2008.

*Table 3-4. O&M Budget Exhibit OP-30 Actual Depot Maintenance Spending by Service and Component (\$ in millions)*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Army total	936.0	988.4	1,395.1	2,254.0	2,939.2	3,671.3	4,653.1	5,479.2
Navy total	4,286.8	5,523.8	6,900.4	5,875.3	6,457.9	6,244.7	6,316.1	7,387.4
Marine Corps total	130.5	110.4	261.3	180.3	343.1	385.8	533.8	464.7
Air Force total	2,589.1	3,424.2	3,470.1	3,391.8	3,383.0	3,523.4	3,377.9	3,948.1
DoD total	7,942.4	10,046.8	12,026.9	11,701.4	13,123.2	13,825.2	14,880.9	17,279.4

Note: O&M overview exhibit of annual DoD budget estimates plus appropriated supplemental funding for Army in FY2007 and FY2008.

Note: Army excluded overseas contingency operations supplemental funding from OP-30 actuals for FY2007 and FY2008. Army data includes \$3,824.2 million in FY2007, \$4,261.1 million in FY2008 that was appropriated for reset (SAG 137) depot maintenance. Actual Army supplemental obligations for depot maintenance are not known. Other services included actual supplemental funding in the OP-30 exhibit, indistinguishable from baseline funding.

Army funding for depot maintenance increased more than five-fold between FY2001 and FY2008. In FY2008, \$4.3 billion of that increase was due to supplemental funding. The Marine Corps’ depot maintenance budgets also grew by more than 256 percent (from \$130.5 million in FY2001 to \$464.7 million in FY2008).

## CONGRESSIONAL REPORTING

Due to its relatively decentralized approach to accomplishing depot maintenance requirements, DoD obligates appropriated funds for depot maintenance in many areas of its budget. In some cases, depot maintenance is performed as part of a broader support contract or acquisition-funded modification; thus complicating the identification and aggregation of total obligations. The most authoritative source for viewing total depot maintenance obligations is the 50/50 report to Congress.

The 50/50 report requires DoD to identify all of its depot maintenance activity, regardless of source of funding, to determine the relative percentage of depot maintenance performed by the public and private sectors. To satisfy this reporting requirement, DoD analyzes its annual financial obligations for depot maintenance. But obligations of funding in a given year are not necessarily evidence of costs incurred. For example, awarded contracts may not be fully executed during the year of award, and working capital funds can carry over limited amounts of work that has been funded but not executed.

In Table 3-5, we identify the organic portion of DoD 50/50 reporting by the military services for FY2001–FY2008. These obligations are for all DoD organic depot maintenance. Of note is the nearly 90 percent growth in total obligations identified over the period and the significant increases in both Army and Marine Corps obligations.

*Table 3-5. DoD Organic Depot Maintenance Obligations by Service (\$ in millions)*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Army	1,205.3	1,357.3	1,932.1	2,902.1	2,907.8	4,388.0	5,139.8	5,166.9
Air Force	3,322.3	4,482.4	5,003.8	5,329.2	5,106.2	5,444.2	5,311.0	5,341.9
Navy	4,130.5	5,083.2	5,909.7	4,818.9	5,449.4	5,671.3	5,311.1	5,865.4
Marine Corps	211.8	175.2	325.0	266.3	486.6	396.6	541.6	477.4
DoD total	8,869.9	11,098.1	13,170.6	13,316.5	13,950	15,900.1	16,303.5	16,851.6

## ACTUAL OPERATING COSTS

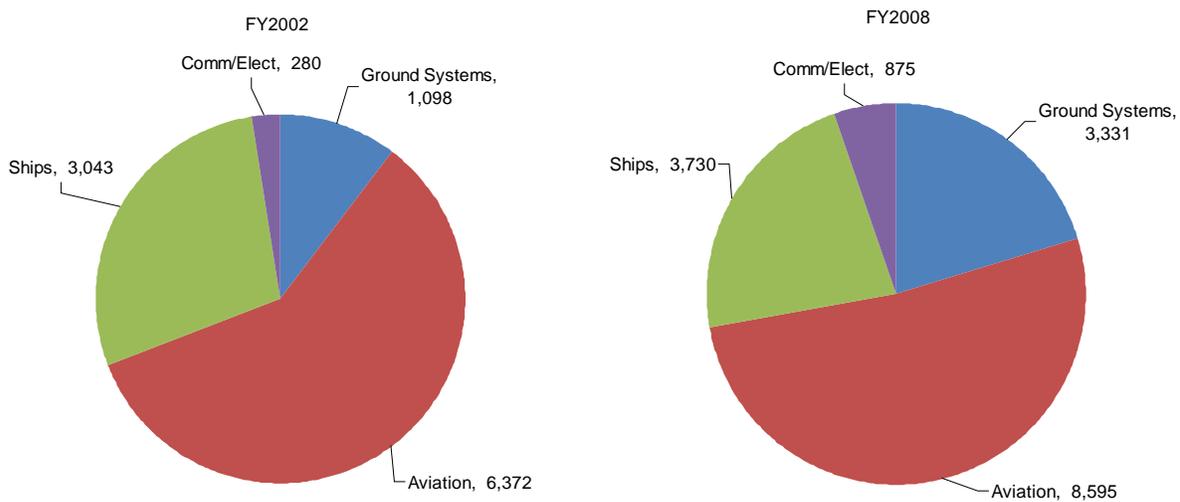
A final view of organic depot maintenance financial resource consumption is provided by a review of actual costs incurred during depot operations. This view is akin to the “cost of goods sold” from a commercial accounting perspective. DWCF depot maintenance operations must have detailed cost accounting systems that assign costs to products produced. The military services provide DoD visibility of these costs in their monthly AR(M)1307 reports.<sup>4</sup>

According to the AR(M)1307 reports, the 17 major organic depots incurred \$10.8 billion in actual operating costs in FY2002 and \$16.5 billion in FY2008. By characterizing the 17 depots along their principal functional lines, we can see the relative changes in production levels of major weapon system areas that occurred between FY2002 and FY2008.

Figure 3-2 depicts organic operating costs aggregated in the four functional categories: aviation systems, ground systems, ships, and communications and electronics. Between FY2002 and FY2008, as overall obligations increased, specific functional categories increased at varying rates, with ground systems and communications and electronics experiencing the most substantial increases.

<sup>4</sup> Shipyards no longer in the DWCF provide data analogous to the AR(M)1307 report on an annual basis. Costs comparable to DWCF operating costs are used for the ships category for shipyards converted from DWCF to direct funding. FY2002 data used as comparable FY2001 data is not available for Pearl Harbor Naval Shipyard.

Figure 3-2. Changes in Organic Depot Maintenance Functional Category Costs (\$ in millions)



## Capacity and Workload

Depot workloads are generally measured in terms of direct labor hours related to established capacity and workloads and in the context of the number of maintenance personnel involved and the corresponding costs. DoD 4151.18-H<sup>5</sup> provides the DoD standard for depot maintenance capacity and utilization measurement. The handbook provides a common methodology to be used by the services to measure capacity and utilization.

The capacity of a maintenance facility is viewed differently from that of a manufacturing entity, reflecting its unique mission. The total direct labor hours, rather than throughput of units, is used as the basic unit of measure for capacity of a maintenance activity. This metric enables the evaluation of capacity and utilization data for organizations, activities, and production shops supplying varying product mixes. Expressing capacity in DLH provides an indication of the relative size and level of utilization, and shop-level data can be more easily aggregated to develop higher-level indicators.<sup>6</sup>

Operations in Iraq and Afghanistan are placing demands on weapon systems and equipment far beyond what is typically experienced during training or home station operations. Some of these demands arise from higher usage rates, others from the rigors of extended operations in a harsh environment or combat operations.

The rigors of those operations are manifested in depot-level maintenance in two ways. First, there is an increased overall requirement for reset. In essence, reset restores equipment destroyed, damaged, stressed, or worn out beyond economic

<sup>5</sup> DoD 4151.18-H, *Depot Maintenance Capacity and Utilization Measurement Handbook*, March 10, 2007.

<sup>6</sup> *Ibid.*, DoD 4151.18-H.

repair (usually due to combat operations) by the repairing, rebuilding, upgrading, or procuring of replacement equipment. Second, the very nature of repairs is different. Heavy use of equipment in harsh conditions also limits the ability of maintainers to conduct detailed maintenance inspections at field activities. This hidden damage—known as latent damage—may not be noticed until much later or until the vehicle is taken apart for repairs at the depot. Latent damage can also have a cumulative effect that can only be detected by more in-depth and thorough inspections or during major maintenance activities.

The net result is a combat-related equipment reset requirement that exceeds military service equipment maintenance baseline programs.

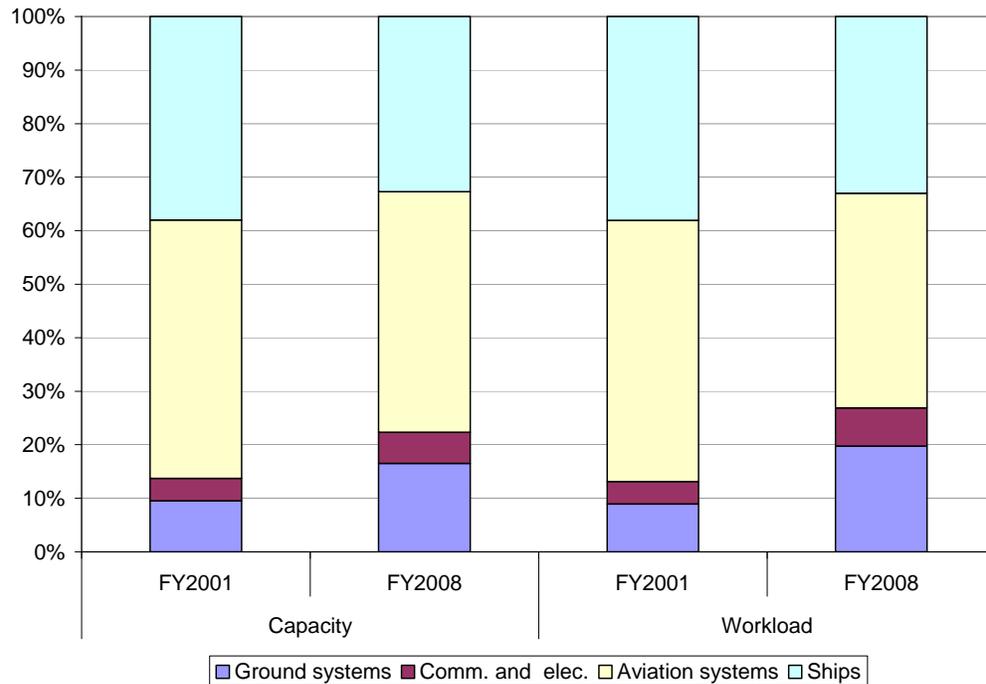
Table 3-6 represents the DoD-wide organic depot maintenance capacity and workloads. For the period FY2001–FY2008, DoD baseline organic depot capacity grew by approximately 8.8 percent, or 7.4 million DLHs. During the same period, overall workload increased by 28.5 percent, or 20.9 million DLHs.

*Table 3-6. DoD-Wide Major Depot Capacity and Workload (in millions of DLHs)*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	83.7	84.3	84.8	89.3	90.5	91.2	92.7	91.1
Workload	73.4	79.2	78.4	87.8	92.1	92.6	93.8	94.3

Figure 3-3 illustrates how the capacity of the organic depots has been directly impacted by the nature of the ongoing conflicts in Afghanistan and Iraq. Not only has overall DoD capacity grown, but the composition of the work has changed. Aviation and ship maintenance may have declined as a percentage of both the total capacity and total workload, but the percentage of ground systems and communications and electronics capacity and workload has increased.

Figure 3-3. Capacity and Workload Composition



The tables in the following sections represent the organic depot maintenance capacity, workloads, and utilization rates for each military service.<sup>7</sup>

## ARMY DEPOTS

As Table 3-7 indicates, the Army increased its capacity from 13.3 million DLHs to 22.1 million DLHs during FY2001–FY2008. At the same time, Army workload increased by a factor of almost 2.5 (from 10.3 million DLHs to 25.6 million DLHs). The largest workload increases were in combat and tactical vehicles and communications and electronics. The largest capacity increase was to accommodate tactical vehicle workloads. Utilized capacity during the same period rose from 77 percent to 116 percent.

Table 3-7. Army Depot Capacity and Workload (in millions of DLHs) and Utilization

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	13.3	14.2	14.3	18.2	18.9	19.8	20.4	22.1
Workload	10.3	11.5	11.6	15.8	20.1	21.4	25.4	25.6
Utilized capacity	77%	81%	81%	87%	106%	108%	125%	116%

<sup>7</sup> Because the military services' responses to the data call supporting this study were still being validated as of this writing, the capacity and workload data displayed in the services' tables were derived from a combination of the Joint Depot Maintenance Activities Group's depot maintenance business profiles, LMI data, and validated data from the services.

## MARINE CORPS DEPOTS

Reflecting the ground-intensive nature of the operations in Iraq and Afghanistan, the Marine Corps has also substantially increased its capacity and workload. Table 3-8 shows that, after declining from 2.0 million DLHs in FY2001 to 1.8 million DLHs in FY2003, the Marine Corps' depots rebounded and increased capacity to approximately 2.5 million DLHs in FY2008. Marine Corps workloads have followed a similar pattern, increasing from roughly 2.2 million DLHs in FY2001 to 4.5 million DLHs in FY2008. Utilized capacity ranges from a low of 94 percent in FY2003 to 180 percent in FY2008.

*Table 3-8. Marine Corps Depot Capacity and Workload (in millions of DLHs) and Utilization*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	2.0	1.8	1.8	2.0	2.5	2.7	3.0	2.5
Workload	2.2	1.8	1.7	2.3	3.2	3.6	4.0	4.5
Utilized capacity	110%	100%	94%	115%	128%	133%	133%	180%

## NAVY SHIPYARDS AND FRCs

As shown in Table 3-9, after steadily increasing capacity from 12.9 million DLHs in FY2001 to 13.6 million DLHs in FY2005, the FRCs have reduced baseline capacity to roughly 900,000 DLHs below FY2001 levels. Workload over the same period has increased by approximately 1 million DLHs. This increase in workload but decrease in baseline capacity over the last 8 years resulted in a net 103 percent utilized capacity for FY2008.

*Table 3-9. Fleet Readiness Center Capacity and Workload (in millions of DLHs) and Utilization*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	12.9	13.2	13.1	13.2	13.6	13.0	13.3	12.0
Workload	11.4	12.4	11.5	12.8	12.9	11.5	11.2	12.4
Utilized capacity	88%	94%	88%	97%	95%	88%	84%	103%

Naval shipyards remained stable in terms of capacity and workload. As Table 3-10 shows, the shipyards decreased capacity by 2.1 million DLHs, but increased workload by 3.1 million DLHs. The result is an increase in utilized capacity from 88 percent in FY2001 to 105 percent in FY2008.

*Table 3-10. Naval Shipyard Capacity and Workload (in millions of DLHs) and Utilization*

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	31.8	31.8	31.8	31.8	31.8	31.9	31.9	29.7
Workload	28.0	31.8	31.0	35.6	34.5	35.2	31.9	31.1
Utilized capacity	88%	100%	97%	112%	108%	110%	100%	105%

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## AIR FORCE DEPOTS

As Table 3-11 shows, Air Force depot capacity increased by 1.1 million DLHs, but depot workload decreased by approximately 900,000 DLHs. As a result, the Air Force's utilized capacity decreased from 91 percent in FY2001 to 83 percent in FY2008.

Table 3-11. Air Force Depot Capacity and Workload (in millions of DLHs) and Utilization

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Total baseline capacity	23.7	23.4	23.9	23.9	23.7	23.8	24.1	24.8
Workload	21.6	21.7	22.9	22.3	20.9	20.8	21.3	20.7
Utilized capacity	91%	93%	96%	89%	88%	87%	88%	83%

## Depot Maintenance Workforce

### BACKGROUND

The provision and management of the DoD depot maintenance workforce has been a subject of concern for many years.<sup>8</sup> It is DoD policy that the Department maintain a highly skilled workforce at its depot maintenance facilities to provide the requisite capabilities to support production workloads and core capability requirements. In this section, we depict the workforce as it was at the end of FY2008 and as it changed over the FY2001–FY2008 period. Data in this section was extracted from the personnel database of the Defense Manpower Data Center (DMDC).<sup>9</sup> The numbers cited are as of the end of the respective fiscal years for the 17 major depots; the data also does not include management and support personnel at headquarters activities, such as Air Force Materiel Command, Army Materiel Command, and the naval systems commands, or intermediate commands, such as the Army's lifecycle management commands.

The size and composition of the organic depot workforce is largely driven by workload requirements. Depot maintenance employees are managed on the basis of the available workload and the funding for depot maintenance and repair.<sup>10</sup>

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<sup>8</sup> GAO, *Defense Logistics: Actions Needed to Overcome Capability Gaps in the Public Depot System*, GAO-02-105, October 2001, and *DOD Civilian Personnel: Improved Strategic Planning Needed to Help Ensure Viability of DOD's Civilian Industrial Workforce*, GAO-03-472, April 2003.

<sup>9</sup> We may update or augment this data with data directly from the military services when it becomes available.

<sup>10</sup> Title 10 U.S.C. §2472, *Prohibition on management of depot employees by end strength*, specifies that the civilian depot maintenance workforce may not be managed on the basis of any constraint or limitation in terms of man-years, end strength, full time equivalent positions, or maximum number of employees.

DoD policy requires a periodic review and adjustment of maintenance programs, with direct linkage to depot maintenance workloads and manpower levels.<sup>11</sup>

That guidance, when coupled with the requirements for depot maintenance core capabilities, establishes a framework for the management and sizing of the workforce. The framework, as well as the need for efficiency, requires the workforce to be flexible enough to adjust to funding levels, operational requirements (i.e., funded workload requirements), and changes in other factors, such as skill needs and employee retirement or attrition rates.

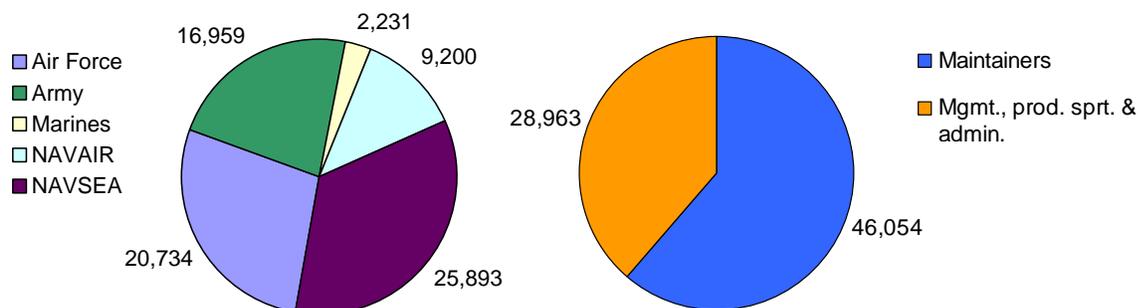
## WORKFORCE COMPOSITION AND CHANGES

At the end of FY2008, the organic DoD depot maintenance workforce comprised some 75,017 maintainers and management, production support, and administrative personnel; that was up from 64,282 in FY2001, but the number has remained stable (in size) since FY2005.

The workforce includes individuals from more than 360 job series (or skill categories). Figure 3-4 depicts the relative workforce populations of each respective depot maintenance activity group. It also shows populations of the two major workforce segments:<sup>12</sup>

- ◆ Maintainers
- ◆ Management, production support, and administrative.

Figure 3-4. FY2008 Depot Maintenance Workforce



From FY2001 to FY2008, the depot maintenance workforce grew by 16 percent. Significant growth within the Army and Navy workforces underlies the overall DoD depot workforce growth, as can be seen in Table 3-12. The Army workforce in particular was a driving factor, growing by more than 75 percent.

<sup>11</sup> DoD 4151.18-H *The Depot Maintenance Capacity and Utilization Measurement Handbook*, March 10, 2007; and Deputy Secretary of Defense, Memorandum for Secretaries of the Military Departments, Subject: Depot Maintenance Production Work Force, October 12, 2001.

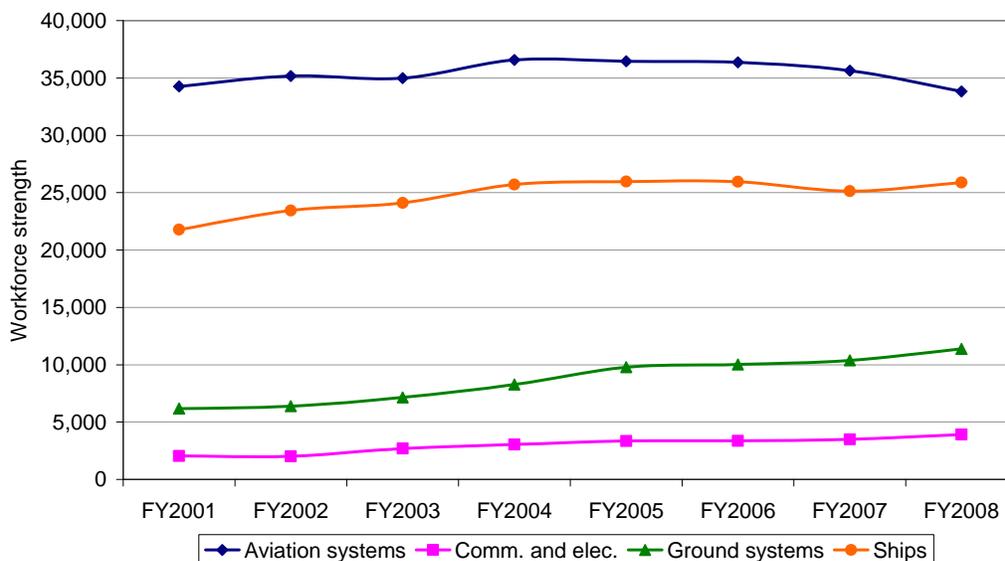
<sup>12</sup> These segments are based on job series definitions.

Table 3-12. FY2001–FY2008 Depot Maintenance Workforce by Activity Group

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Air Force	20,926	21,596	21,882	22,412	22,706	23,069	22,705	20,734
Army	9,692	9,711	11,275	12,815	14,603	14,969	15,487	16,959
Marine Corps	1,447	1,483	1,628	1,808	1,904	1,980	2,041	2,231
NAVAIR	10,432	10,794	10,037	10,858	10,371	9,741	9,284	9,200
NAVSEA	21,785	23,451	24,108	25,714	25,970	25,956	25,131	25,893
Workforce total	64,282	67,035	68,930	73,607	75,554	75,715	74,648	75,017

Another way to view the workforce population is by major depot maintenance functional category. For this analysis, we identified each of the 17 depots with one of four major functional categories: aviation systems (7 facilities), communications and electronics (1 facility), ground systems (5 facilities), and ships (4 facilities). Using this framework, Figure 3-5 shows that the workforces in communications and electronics, ground systems, and ships all increased over the FY2001–FY2008 period, while the aviation systems workforce increased in the mid-years but ended slightly lower in FY2008 than it was in FY2001. The ground systems workforce increased by more than 5,000 people, or about 84 percent.

Figure 3-5. FY2001–FY2008 Depot Maintenance Workforce by Functional Category



The depot maintenance workforce can also be considered with respect to the relative populations of blue collar (wage-grade schedule) and white collar (general schedule or National Security Personnel System) workers. Table 3-13 depicts the FY2001–FY2008 depot maintenance workforce from this perspective.

Table 3-13. FY2001–FY2008 Depot Maintenance Workforce—  
Blue Collar/White Collar Composition

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
<b>Blue collar</b>								
Maintainers	33,609	34,458	34,743	37,234	37,990	38,027	37,483	38,162
Management, production support, and administrative	8,212	8,515	8,945	9,561	9,994	10,072	9,560	9,704
Blue collar total	41,821	42,973	43,688	46,795	47,984	48,099	47,043	47,866
<b>White collar</b>								
Maintainers	6,961	7,347	7,479	7,872	8,064	7,968	7,911	7,892
Management, production support, and administrative	15,500	16,715	17,763	18,940	19,506	19,648	19,694	19,259
White collar total	22,461	24,062	25,242	26,812	27,570	27,616	27,605	27,151

In FY2008, the depot maintenance workforce consisted of 64 percent blue collar workers and 36 percent white collar workers, virtually identical to the FY2001 workforce composition. As is seen in Table 3-13, the portion of the population identified as maintainers (by skill) can be either white collar or blue collar workers. In FY2008, maintainers were 83 percent blue collar and 17 percent white collar, which is consistent with FY2001 composition.

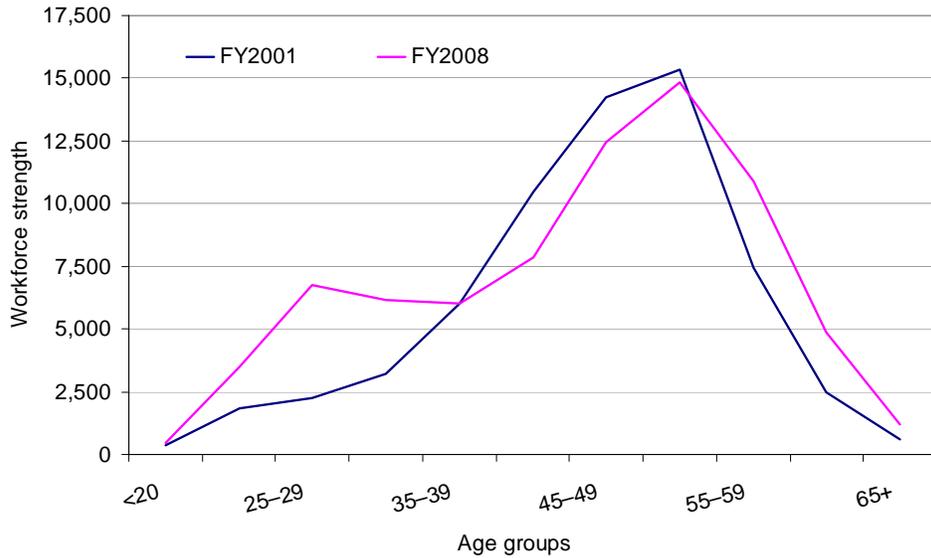
During the FY2001–FY2008 period, the number of maintainers in the workforce grew by 13.5 percent, while the number of workers characterized as management, production support, and administrative grew 22.1 percent.

There has long been concern regarding the aging of the workforce. In 2001, the GAO expressed its concern that the aging depot maintenance workforce presented significant human capital challenges for succession planning, given the average age of depot workers at that time was 46 years old.<sup>13</sup> Our data shows that, indeed, the average age in FY2001 was 46.6 years old; but the average age in FY2008 decreased to 45.6 years.

In Figure 3-6 we show the composition by age group of the FY2001 and FY2008 workforces. The number of workers under the age of 30 increased by more than 6,000 during the period, and that younger cohort comprises more than 14 percent of the FY2008 workforce (versus 7 percent in FY2001). Workers over the age of 55 now represent more than 23 percent of the FY2008 workforce (versus roughly 16 percent in FY2001).

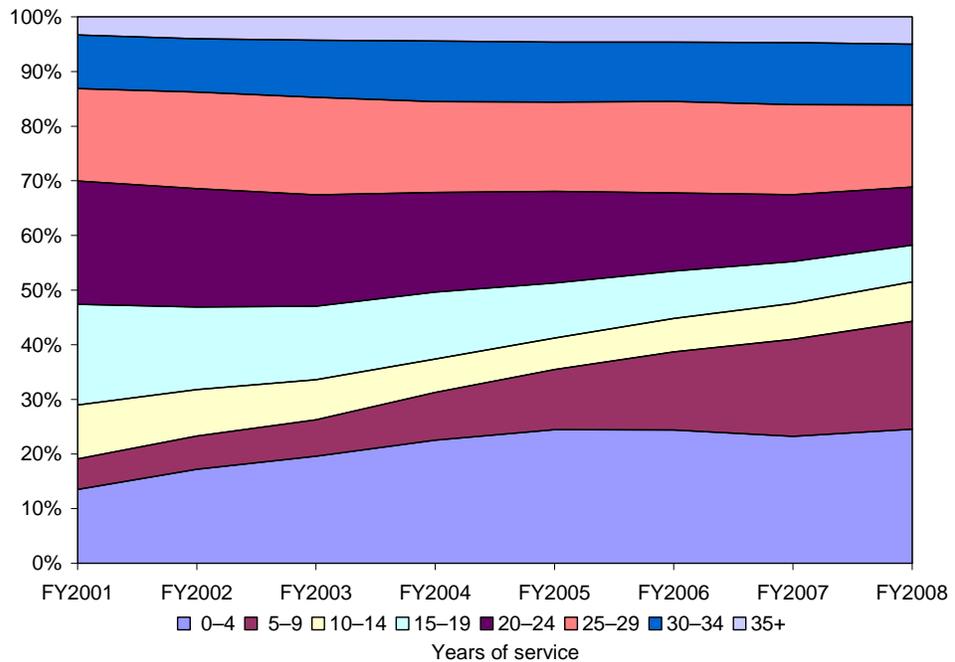
<sup>13</sup> GAO, *Defense Logistics: Actions Needed to Overcome Capability Gaps in the Public Depot System*, Report GAO-02-105, October 2001, pp. 28–29.

Figure 3-6. Depot Maintenance Workforce by Age Group



The concern with age largely centers on retirement eligibility, for which a pivotal factor has been tenure or years of service. The number of retirement-eligible workers in the depot maintenance workforce is often cited as a factor that could affect workforce composition and workload production capability. Figure 3-7 depicts the changes in years of service for the respective fiscal year depot maintenance workforces. The substantial growth in the portion of the workforce with fewer than 10 years of service is evident, as is the shrinkage of the portion with between 10 and 25 years of service.

Figure 3-7. Depot Maintenance Workforce by Years of Service



Retirement eligibility in the overall DoD civilian workforce increased from 13 percent to 18 percent between FY2001 and FY2008. In similar fashion, the retirement eligibility in the depot maintenance workforce increased from 11 percent to 17 percent over the same period. This is consistent with the “55 and over” population increasing its workforce share from 16 percent to 23 percent during the same timeframe. Retirement losses, however, play out based on the eligible population’s propensity to retire. During the past decade, approximately 23 percent of those eligible within DoD have actually retired during their first year of eligibility. More than 50 percent of the retirement-eligible cohort have retired during the first 4 years of eligibility. By the tenth year, less than 5 percent of the cohort remains in government service.

We also compared the FY2007 and FY2008 maintenance workforce populations. Although seemingly steady (the FY2007 population was 74,600; the FY2008 population 75,000), the maintenance population was not as static as the numbers might suggest. The FY2008 population total was the result of substantial gains that were offset by substantial losses in personnel. During FY2008, the maintenance workforce lost some 7,000 workers—about half from retirements, and the other half through other forms of attrition. That same year, the workforce gained some 7,400 workers, of which about 5,900 were new to federal service or DoD and 1,400 came from within DoD (including from active duty military service).

It is evident from this manpower data that the organic depots are working to refresh their workforces as requirements arise.

As mentioned earlier, the depot maintenance workforce comprises more than 360 job series. We aggregated these job series into the DoD Occupation Group structure to assess some of the major changes that occurred in the composition of the workforce from a skill perspective between FY2001 and FY2008.

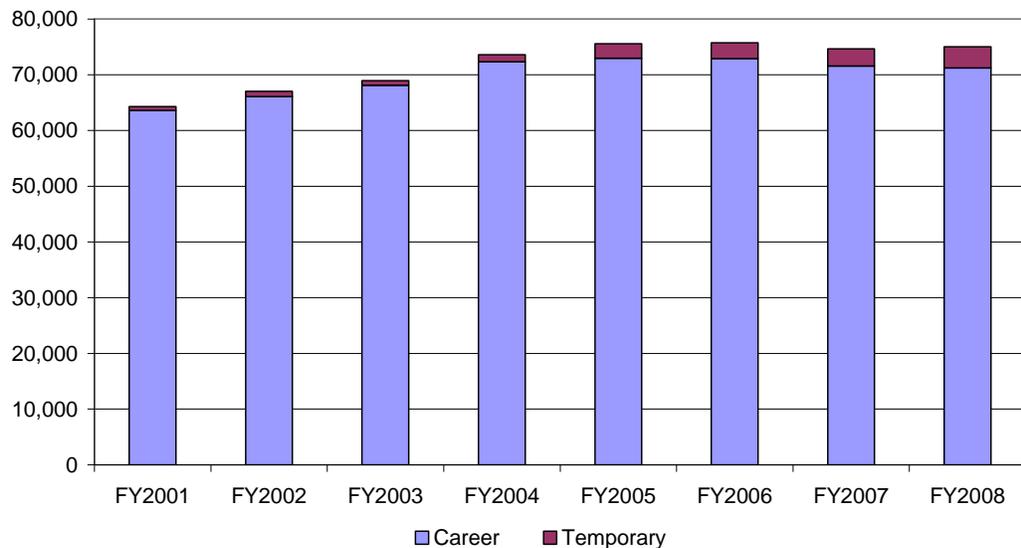
Table 3-14 shows the top 14 occupation groups within the workforce. These 14 groups account for 94 percent of the FY2008 maintenance workforce. Of special note is the significant growth in the automotive group (primarily series 58xx transportation/mobile equipment maintenance), which can be linked to the growth in ground systems workload in recent years. Also of note is the slight population shrinkage in the aircraft and aircraft-related occupation group, which is consistent with the flatness of the aviation systems workload.

Table 3-14. Top 14 Depot Maintenance Occupation Groups

	FY2001	FY2008	Percentage change FY2001–FY2008
Metalworking	11,748	12,796	9%
Engineering and maintenance officers	7,224	8,927	24%
Aircraft and aircraft-related	7,012	6,439	–8%
Administration	4,633	5,748	24%
Mechanical and electrical equipment	4,439	5,704	28%
Electronic equipment	4,698	5,490	17%
Other functional support	4,340	4,992	15%
Utilities	4,004	4,333	8%
Technical specialists	3,721	4,137	11%
Construction	3,294	3,831	16%
Automotive	1,471	3,283	123%
Material receipt, storage and issue	2,087	2,413	16%
Auxiliary labor	968	1,175	21%
Fabric, leather, and rubber	823	1,151	40%

The final piece of data to be presented relates to the employment status of the depot maintenance workforce as either “career” or “temporary.” The number of temporary workers in the workforce grew substantially between FY2001 (687) and FY2008 (3,788).<sup>14</sup> In Figure 3-8, we show this growth in the context of career and temporary workforce strengths.

Figure 3-8. Career vs. Temporary Workers within the Workforce



<sup>14</sup> Military service data also indicates that at least 4,500 contractor augmentees were used to supplement the workforce in FY2008.

The greatest use of temporary workers is in the Army, which, in FY2008 employed 76 percent of the temporary depot maintenance workforce. Also of note is that the vast majority of the temporary workforce is blue collar workers (86 percent).

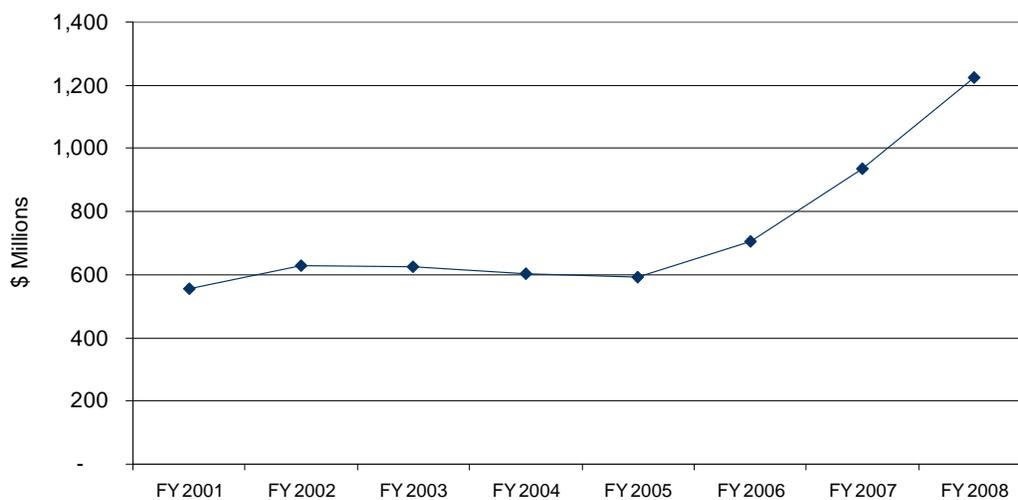
## Capital Investments in DoD Maintenance Depots

The property, plant, and equipment of DoD's depots and arsenals are valued at more than \$48 billion. Comprising more than 5,600 buildings and structures with 166 million square feet used for depot maintenance,<sup>15</sup> along with several billion dollars worth of equipment, this industrial complex produced roughly \$16.5 billion in operating costs in FY2008.

DoD's depot facilities range in age from modern to registered landmarks. This implies a substantive and methodical capital investment program needs to be in operation to sustain these industrial capabilities. In fact, DoD capital investment in these facilities amounted to more than \$1.2 billion in FY2008. This investment amount was up substantially from estimated levels of investment in the late 1990s, when it averaged \$350 million annually,<sup>16</sup> or even from the early 2000s, when investment averaged \$600 million annually.<sup>17</sup>

As depicted in Figure 3-9, depot maintenance capital investment in FY2007 and FY2008 increased significantly from earlier levels. Investments in FY2008 were 120 percent greater than in FY2001.

Figure 3-9. Total DoD Depot Maintenance Capital Investment FY2001–FY2008



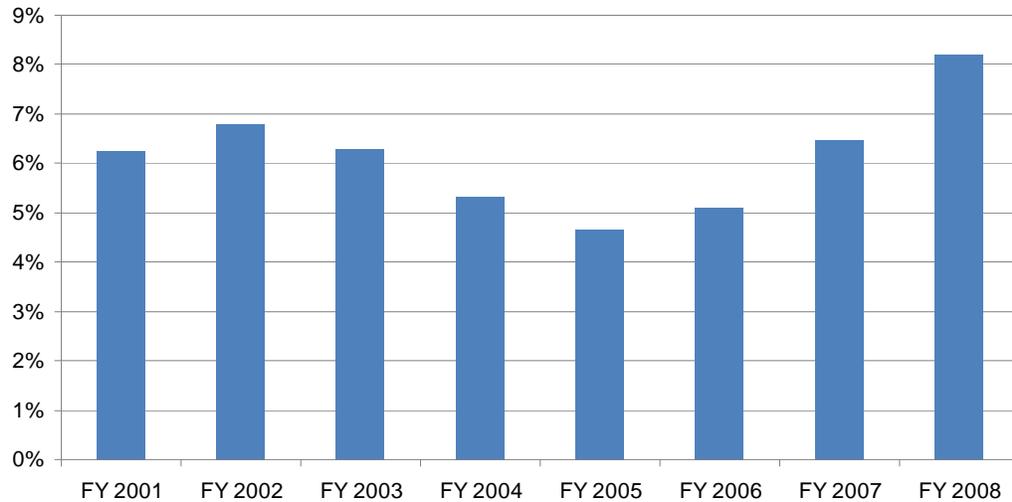
<sup>15</sup> Military service data indicates that 5,610 buildings or structures are used to support depot maintenance; in some cases, depot maintenance usage represents less than 100 percent of building capacity.

<sup>16</sup> *DoD Review of Capability and Infrastructure Requirements for Depot-Level Maintenance*, Report to Congress prepared by Deputy Under Secretary of Defense (Logistics), March 1997, p. 3.

<sup>17</sup> FY2001–FY2006 data includes some estimates for comparability purposes when service data was not available.

10 U.S.C. §2476 requires levels of investment in relation to revenue. Figure 3-10 depicts the composite DoD levels of investment from FY2001 through FY2008 using the required 10 U.S.C. §2476 investment-to-revenue relationship.<sup>18</sup> In FY2007 and FY2008, the military departments were in compliance with 10 U.S.C. §2476.<sup>19</sup> While investment levels for FY2001–FY2003 are estimated to have been in the 6 percent range, it is important to note that revenue for those years averaged \$9.4 billion; the average revenue for FY2006–FY2008 increased to \$14.4 billion.

*Figure 3-10. DoD Capital Investment in Relation to Average Revenue*



For the purposes of 10 U.S.C. §2476 compliance, the capital budget of a depot includes investment funds spent on depot infrastructure, equipment, and process improvement in direct support of depot operations. DoD guidance for budget display of capital investments at the specified depots identifies five categories of investment:

- ◆ DWCF Capital Investment Program (DWCF CIP), which includes
  - equipment,
  - automated data processing equipment (ADPE) and telecom equipment,
  - software development,
  - depot maintenance transformation, and
  - minor construction.
- ◆ Facilities sustainment, restoration, and modernization (FSRM)
- ◆ DWCF equipment below threshold (DWCF below threshold)

<sup>18</sup> 10 U.S.C. §2476 requires that investments be measured in relation to the average of the prior 3 years' revenue.

<sup>19</sup> See appropriate Fund-6 exhibits submitted with department budgets.

- ◆ Appropriated fund purchases (AFP)
- ◆ Military construction (MILCON).

We classified depot maintenance capital investments in these five categories. As indicated earlier, we worked to develop consistent data for earlier fiscal years, when the reporting structure of 10 U.S.C. §2476 was not in place. This required some estimating when consistent service data was not available.

Our data shows that DoD made capital investments totaling \$5.8 billion from FY2001 through FY2008. The major components of the capital investment programs for those years were the DWCF CIP, FSRM, and MILCON, as depicted in Figure 3-11.

*Figure 3-11. DoD Total Capital Investment by Category, FY2001–FY2008*

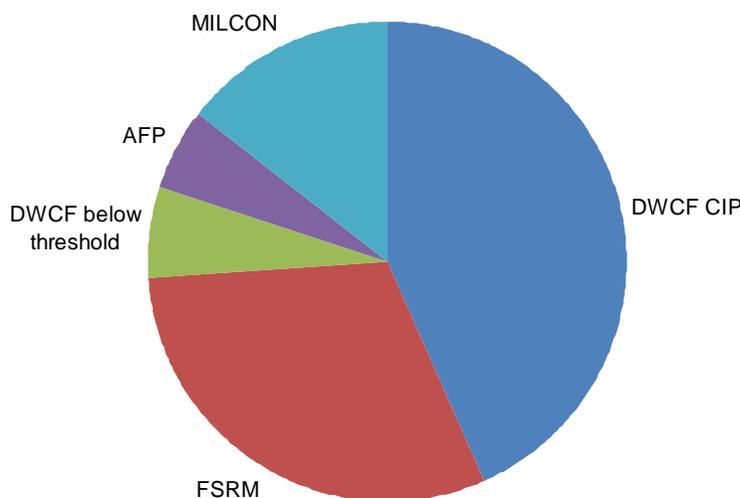


Table 3-15 depicts capital investment by depot maintenance activity group. With the exception of FY2001, the revenue<sup>20</sup> data is the average of the three prior years' revenue, as stipulated by the law. FY2001 data is the average of only the two prior years because FY1998 revenue data was not available. When compared to earlier years, capital investment as a percentage of revenue has increased, with the exception of the Marine Corps.

<sup>20</sup> Revenue used to calculate averages is reported via AR(M)1307 reports for DWCF activities and supplemented by comparable data for naval shipyards after conversion to direct funding.

Table 3-15. Capital Investment in Relation to Average Revenue

		FY2001	FY2007	FY2008
<b>Army depots</b>				
	Average revenue	\$1,315 million	\$3,276 million	\$3,770 million
	Investment percentage	6.1%	8.5%	12.7%
<b>Navy FRCs</b>				
	Average revenue	\$1,629 million	\$2,025 million	\$1,966 million
	Investment percentage	5.0%	3.9%	5.3%
<b>Naval shipyards</b>				
	Average revenue	\$2,607 million	\$3,618 million	\$3,659 million
	Investment percentage	6.6%	5.8%	8.6%
<b>Marine Corps depots</b>				
	Average revenue	\$194 million	\$439 million	\$486 million
	Investment percentage	5.9%	2.3%	2.7%
<b>Air Force ALCs</b>				
	Average revenue	\$3,161 million	\$5,112 million	\$5,044 million
	Investment percentage	6.0%	7.0%	6.2%

The following sub-sections are an analysis of capital investment by category.

#### DWCF CAPITAL INVESTMENT PROGRAM

This category of capital investment includes items purchased by the DWCF with a useful life of more than 2 years and items that exceed the investment threshold of \$100,000 for MILCON and \$250,000<sup>21</sup> for all other purchases. Investment categories include non-ADPE equipment, ADPE and telecommunications equipment, automated data software, and minor construction projects costing up to \$750,000. Construction projects costing more than \$750,000 are funded by the MILCON appropriations, although in rare instances the DWCF may finance projects up to \$1.5 million to correct deficiencies that threaten life, health, or safety.

The DWCF Capital Investment Program does not finance weapon systems; equipment to meet mobilization requirements; equipment procured and furnished to support a new weapon system; equipment normally provided to contractors as government-furnished equipment; equipment supporting morale, welfare, and recreation activities; or equipment provided for purposes other than the support of the DWCF activity mission.

DoD investments in the DWCF CIP were significant in FY2007 and FY2008. From levels of investment in FY2001 for comparable requirements, they are up substantially. As can be seen in Table 3-16, such investments remain a substantive

<sup>21</sup> The investment threshold for equipment was \$100,000 before April 2007.

part of overall capital investments; for FY2008, they amounted to more than 33 percent of total depot maintenance capital investment.<sup>22</sup>

*Table 3-16. DWCF CIP Investments (\$ in millions)*

	FY2001	FY2007	FY2008
Department of the Army	48.6	133.1	213.5
Department of the Navy	110.1	42.9	43.9
Department of the Air Force	125.9	128.2	157.4
Total	284.6	304.2	414.9

## FACILITIES SUSTAINMENT, RESTORATION, AND MODERNIZATION

This category of capital investment includes repair and maintenance, but excludes minor recurring maintenance. It includes major repairs or replacement of facility components, such as roofs and heating/cooling systems that are expected to occur periodically throughout the life of the facilities. It also includes regularly scheduled inspections, preventive maintenance, and emergency response repairs. These services are usually provided by non-depot organizations that are reimbursed by the DWCF depots for costs incurred. Direct-funded naval shipyards do not reimburse the service provider, but account for the cost when calculating their total investment support.

In FY2008, investments in FSRM were 32 percent of the Department's overall depot maintenance capital investments. This is consistent with the large number of depot maintenance buildings and structures, the aging of these facilities, and the increased usage implied by workload levels. Table 3-17 shows the relative levels of FSRM in FY2007 and FY2008 compared to FY2001.<sup>23</sup>

*Table 3-17. FSRM Investments (\$ in millions)*

	FY2001	FY2007	FY2008
Department of the Army	31.3	74.9	126.9
Department of the Navy	105.1	138.0	183.5
Department of the Air Force	34.1	92.1	77.8
Total	170.5	304.9	388.3

<sup>22</sup> Army DWCF CIP investment data includes ordnance activities for year-to-year comparative purposes. CIP investment data by subcategory (such as software development and minor construction), and by depot and ordnance activities is unavailable after FY2003, which was when depots and ordnance activities were merged to form the Industrial Operations activity group.

<sup>23</sup> FY2001 FSRM is estimated based on average costs for FY1997–FY1999, adjusted for inflation. Costs for FY1997–FY1999 are identified in the *DoD Review of Capability and Infrastructure Requirements for Depot-Level Maintenance*, Report to Congress prepared by Deputy Under Secretary of Defense (Logistics), March 1997.

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## DWCF EQUIPMENT BELOW THRESHOLD

This category represents equipment purchased by DWCF activities, the cost of which is below the expense or investment threshold of \$250,000. Purchases are financed as expense items by DWCF activities.

Equipment investments in this category grew substantially since FY2001. As can be seen in Table 3-18, investments were up nearly five-fold from FY2001 levels. The Air Force could not derive investment in this category for the fiscal years in question.

*Table 3-18. DWCF Equipment Below Threshold Investments (\$ in millions)*

	FY2001	FY2007	FY2008
Department of the Army	20.9	54.4	95.8
Department of the Navy	1.1	9.0	8.2
Department of the Air Force	—	—	—
Total	22.0	63.4	104.0

## APPROPRIATED FUND PURCHASES

The AFP category of capital investment includes items that are purchased by funds other than DWCF and MILCON appropriations. Purchases for naval shipyards by the Other Procurement, Navy, appropriation account for a major portion of this category. Appropriated funds, primarily procurement accounts, are used to finance equipment and facilities to support depot maintenance of new weapon systems at DoD depots.

Investments in depot maintenance facilities by appropriated funds also include productivity-enhancing initiatives (such as Lean Six Sigma), purchase or improvements of equipment and facilities, and Air Force depot maintenance transformation. Productivity-enhancing investments, including Air Force depot maintenance transformation, are also financed in part or whole using DWCF capital investment or operating funds. Investments are financed by operating or investment accounts, depending on whether the specific investments are over or under the expense or investment threshold.

As can be seen in Table 3-19, the Navy and Air Force have documented substantive investment levels for this category. Comparable data is not available for FY2001, and we have no basis upon which to calculate an estimate.

Table 3-19. AFP Investments (\$ in millions)

	FY2001	FY2007	FY2008
Department of the Army	—	15.3	2.2
Department of the Navy	—	44.5	63.2
Department of the Air Force	—	110.7	76.2
Total	—	170.5	141.6

## MILITARY CONSTRUCTION

MILCON appropriations finance construction of military facilities that cost more than \$750,000, although DWCF activities may finance projects up to \$1.5 million in rare instances, as described above. Construction costs include installed equipment built into a facility as an integral part of the facility; however, the initial facility outfitting of moveable, collateral equipment is not financed by MILCON appropriations, and the cost is categorized as an expense or investment according to the general policy criteria.

Table 3-20 shows MILCON investments by military department. In FY2007 and FY2008, MILCON investment by the naval shipyards was the dominant driver of the investment levels.<sup>24</sup> Comparable Army data was not available.

Table 3-20. MILCON Investments (\$ in millions)

	FY2001	FY2007	FY2008
Department of the Army	—	—	38.6
Department of the Navy	49.5	66.2	137.0
Department of the Air Force	28.9	26.0	—
Totals	78.4	92.2	175.7

<sup>24</sup> There may have been other Air Force MILCON projects funded with Depot Maintenance Transformation dollars, but those projects were not visible in budget materials.

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## Statutory Workload Requirements

### CORE

10 U.S.C. §2464 states

It is essential for the national defense that the Department of Defense maintain a core logistics capability that is government-owned and government-operated (including government personnel and government-owned and government-operated equipment and facilities) to ensure a ready and controlled source of technical competence and resource necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements.

The statute establishes two overarching requirements:

- ◆ It directs DoD to maintain a core depot maintenance capability that is government-owned and government-operated.
- ◆ The Secretary of Defense is required to assign government depots sufficient workload to ensure the cost-effective maintenance of core depot maintenance capabilities.

The intent of this statute is to ensure the organic depot system is sufficiently structured, “workloaded,” and infused with new technology to provide a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to contingencies.

Table 3-21 displays the total approved DoD core requirements from FY1999 to FY2007.<sup>25</sup>

*Table 3-21. DoD-Approved Core Requirements (in millions of DLHs)*

	FY1999	FY2001	FY2005	FY2007
Army	10.3	10.9	14.5	15.5
Navy	34.7	35.1	36.2	33.6
Marine Corps	1.9	1.9	1.5	1.5
Air Force	21.5	22.4	21.4	19.9
DoD total	68.4	70.3	73.6	70.5

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<sup>25</sup> Core requirements are determined biennially. They are submitted in the even years for requirements in the odd years. Between FY2000 and FY2004, the methodology to determine requirements was changed and the new methodology was tested, but no official requirements were approved. After the FY2004 submission, the scheduled FY2006 submission was delayed to avoid conflict with the 2005 BRAC process. Approved FY2009 core requirements were not available as of the writing of this report.

The overall DoD core requirement increased by just over 3 percent from FY1999 to FY2007. The Air Force and Navy remained relatively stable through FY2007. The Army's total core requirement increased substantially—by 50.5 percent, or 5.2 million DLHs. The Marine Corps, on the other hand, reduced its requirement over the same period by 21 percent, from 1.9 million DLHs to 1.5 million DLHs.

Table 3-22 demonstrates, that on an aggregate basis, organic workloads exceeded core requirement; however, aggregation does not ensure sufficient workloads are available in all areas to sustain core capability requirements.

Table 3-22. Core Requirements Compared to Organic Workloads (in millions of DLHs)

Service	FY1999		FY2001		FY2005		FY2007	
	Core requirement	Organic workload						
Army	10.3	8.8	10.9	10.3	14.5	20.1	15.5	25.4
Navy	34.7	41.9	35.1	39.3	36.2	47.4	33.6	43.1
Marine Corps	1.9	2.0	1.9	2.2	1.5	2.5	1.5	4.0
Air Force	21.5	24.1	22.4	22.5	21.4	20.9	19.9	21.3
DoD total	68.4	76.8	70.3	73.4	73.6	90.9	70.5	93.8

The last step for 10 U.S.C. §2464 compliance is to output to PPBES from the core methodology. With the exception of Navy aircraft engines, there is no apparent evidence that the military services have begun to use core computations in the programming and budgeting process. The Department is reviewing the current methodology and its application to ensure it provides the requisite workloads and capabilities for both legacy and new systems within required time frames.

#### DISTRIBUTION OF WORKLOAD (50/50 REPORT)

In 1992, 10 U.S.C. §2466, *Limitations on the performance of depot-level maintenance of materiel*, was codified, prohibiting the military departments and defense agencies from contracting out more than 40 percent of their depot maintenance work (based on the funds appropriated) to the private sector. In 1997, the limitation was changed to 50 percent and mandated the inclusion of maintenance costs related to contractor logistics support and interim contractor support arrangements.<sup>26</sup> In addition, GAO was required to validate reporting compliance until that provision was removed in 2006.<sup>27</sup>

Within 90 days after the President's budget is submitted, the Secretary of Defense must submit to Congress an annual report identifying for each of the military component the percentage of the funds expended during the preceding fiscal year and the percentage projected to be expended during the current fiscal year and the

<sup>26</sup> P.L. 105-85, §357.

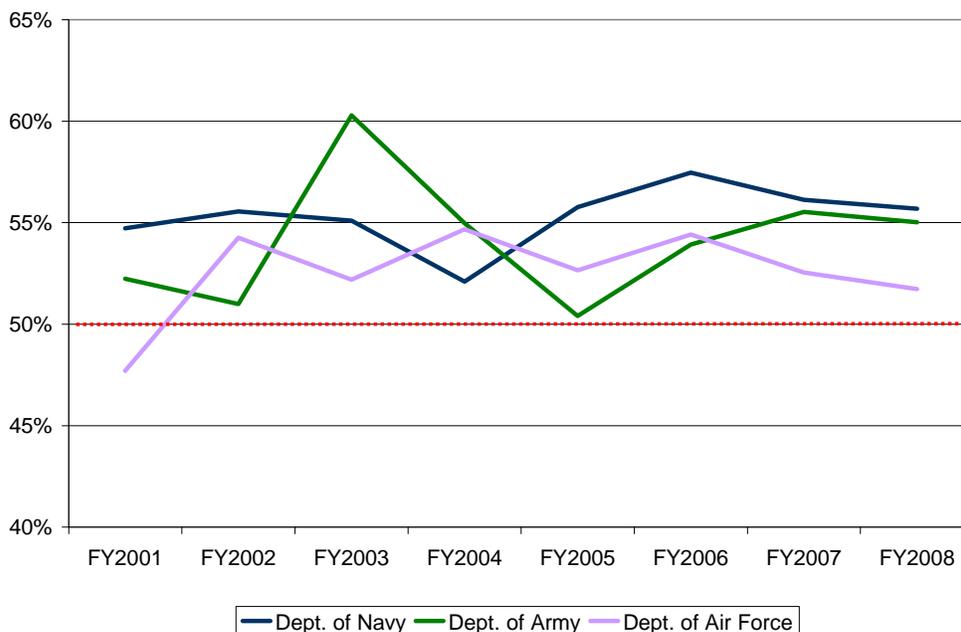
<sup>27</sup> P.L. 109-364, §331(b)(1).

ensuing fiscal year for performance of depot-level maintenance and repair workloads by the public and private sectors.

It is useful to note that this is the only time DoD quantifies the extent of depot maintenance, and it is the only method that gauges the Department's depot maintenance level of effort.

Figure 3-12 displays the organic share of depot maintenance as reported by OSD to Congress in the military departments' annual reports. It is based on actual obligations achieved by the military departments.

*Figure 3-12. Organic Share of DoD Maintenance Funding*



Note: FY2002–FY2008 adjusted for exempted partnership work, per 10 U.S.C. §2474.

In recent years, the military departments have reported their compliance with the requirements of 10 USC §2466. Despite substantial increases in funding, the organic portion of depot maintenance funding has continued to exceed 50 percent and, for the most part, fluctuated within a narrow range. There is a spike in the Army percentage of organic spending in FY2003, which coincides with the FY2002–FY2004 growth in Army total depot maintenance funding from \$2.7 billion to \$5.3 billion.<sup>28</sup>

<sup>28</sup> Distribution of DoD Depot Maintenance Workloads Reports to Congress.

## SUMMARY

In this chapter we presented the baseline data for key areas of depot maintenance to illustrate how depot operations evolved from FY2001 through FY2008. This baseline will ground our ongoing analysis of depot maintenance operations projected from now through 2015, so that we may project the anticipated future environment.



# Chapter 4

## Other Influences

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In this chapter we review several influences that are important to depot maintenance provision. While some have been discussed in previous chapters, they are described further here because they are important to our ongoing analysis and will be investigated in our Phase II analysis.

### CONDITION-BASED MAINTENANCE PLUS

CBM+ is a DoD initiative for the application and integration of appropriate processes, technologies, and knowledge-based capabilities to improve the reliability and maintenance effectiveness of DoD weapon systems and components. Today, CBM policies and high-level planning are in place at the DoD and service levels. The goals of CBM+ are to

- ◆ develop more effective and efficient maintenance plans and programs;
- ◆ implement an optimum mix of maintenance technologies, processes, and enablers; and
- ◆ proactively maintain weapon systems to minimize unscheduled repairs and reduce scheduled maintenance activity.

Institutionalization of the CBM+ strategy in relevant regulatory publications is the first step toward attaining CBM+ utilization throughout DoD. The Department has published formal policy direction and a “best practices” guidebook to assist CBM+ implementation. The military services have also initiated actions to put the primary elements of CBM+ capabilities in place throughout their maintenance processes. Initially, defense acquisition programs will exploit CBM+ opportunities as elements of system performance requirements during the technology and engineering development and manufacturing phases of an acquisition and then continue CBM+ practices throughout the acquired system’s life cycle.

Under CBM+, maintenance is performed according to evidence of need provided by reliability analysis and other enabling processes and technologies. CBM+ outcomes are measured through the key performance indicators of materiel readiness: materiel availability (MA), materiel reliability (MR), mean downtime (MDT), and ownership costs (OC). The Department will endeavor to assess the results of applying CBM+ maintenance strategies (versus alternative strategies, such as periodic maintenance or “run-to-failure”) against these performance indicators.

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Once fully implemented, CBM+ will be the primary reliability driver in DoD's systems maintenance management strategy. In concert with other enablers (such as continuous process improvement, supply chain management, cause-and-effect predictive modeling, and PBL), the implemented CBM+ strategy will help optimize materiel readiness. The desired CBM+ end state is a trained force of maintainers (from the tactical field technician to the strategic system analyst) working in an interoperable environment to maintain complex systems through the use of CBM+ processes and technologies. Fully implemented CBM+ will improve maintenance decisions and help integrate all functional aspects of lifecycle management.

It is possible the extent and depth of implementation of specific CBM+ elements could be better defined across military service maintenance activities. Preliminary review indicates CBM+ implementation is somewhat sporadic. The current need for greater management emphasis, additional trained personnel, and focused funding is not generally known.

## RELIABILITY-CENTERED MAINTENANCE

Reliability-centered maintenance (RCM) principles were first developed in the commercial airline industry as a response to rapid changes in technology and the demands of maintaining these more complex and costly technologies. Before the advent of RCM, it was generally believed that there was a direct relationship between properly scheduled maintenance overhauls or replacements and end item availability. That is, as operating time increased, failure was more likely to occur.

That belief led to the mindset that major maintenance could be scheduled in advance of failures, resulting in more available equipment. DoD adopted this belief and, for many years, relied on periodic maintenance schedules as the principal approach to timing major maintenance actions for aircraft, ships, vehicles, and other equipment. Later, analytical work in both the private sector and DoD found that the length of time in service, by itself, was not the best indicator of impending parts or equipment failure, and scheduling "just-in-case" maintenance on a large scale was an unaffordable paradigm.

RCM defines what must be done to a system to achieve the desired levels of safety, reliability, environmental soundness, and operational readiness and at the best cost. RCM analysis helps the maintenance manager determine the optimum maintenance approach (including both proactive and reactive methods) that will achieve planned materiel readiness, as measured by the lifecycle sustainment outcome metrics of MA, MR, OC, and MDT.<sup>1</sup> RCM applies such elements as end-item and component design, operational experience, maintenance analysis technology, materiel support capability, and cost data to attain better overall end-item performance and reliability.

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<sup>1</sup> DoD Instruction 4151.22, *Condition Based Maintenance Plus for Materiel Maintenance*, December 2, 2007, p. 7.

DoD policy<sup>2</sup> defines RCM as

one of the key enablers of the Condition Based Maintenance Plus (CBM+) strategy within the lifecycle sustainment process of DoD weapon systems. RCM is conducted to ensure that the most effective maintenance processes are implemented; provides a logical decision process for determining optimum maintenance approaches; and establishes the evidence of need for both reactive and proactive maintenance tasks.

DoD adopted an RCM methodology that is based on private sector approaches and industry standards that prescribe the analytical steps necessary to help the maintenance manager identify potential failures and support the selection of viable courses of action. DoD policy also directs the secretaries of the military departments and the directors of the defense agencies to ensure reliability analyses, including RCM, are implemented in accordance with the provisions of DoD Instruction 4151.22.

While RCM was originally directed by DoD program and budget decisions, its implementation is rooted in military service-level policy and guidance based on mission requirements, desired performance of the system or equipment, safety, environmental compliance, cost effectiveness, and operational and logistics effects. Although the military services have all been working for some time to adopt RCM, implementation is not necessarily consistent nor does it follow the same timeline. Differences can be as fundamental as the choice of implementation strategy (e.g., use of working groups, selective application to specific weapon systems or equipment, an across-the-board approach, or an abbreviated methodology). Difference is not bad in itself, and it is to be expected given the decentralization of DoD maintenance organizations along service and commodity lines; however, circumstances make the assessment of the status of RCM implementation across the Department, including the documentation of results, more difficult.

Regardless of the details of specific RCM implementation in the DoD, it seems clear this process will be supported by the Department as an important part of the overall maintenance strategy for the foreseeable future. Both tangible and intangible benefits have been attributed to RCM. Tangible benefits include return on investment for the cost of the initial RCM analysis, reduced work requirements, and improved readiness. Intangible benefits include better quality of life, increased morale, and higher warfighter confidence in maintenance capabilities.

Advocacy of RCM implementation is widespread, but it is important to ascertain the full extent of RCM implementation across the DoD and the military services.

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<sup>2</sup> Ibid., DoDI 4151.22, p. 7.

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# PUBLIC-PRIVATE PARTNERSHIPS

For a number of years DoD and Congress have encouraged the defense logistics support community to pursue partnerships with the private sector to blend the best commercial processes and practices with DoD's extensive maintenance capabilities. These public-private partnerships, which combine the resources, risks, and rewards of public agencies and private companies, ensure greater efficiency, better access to capital, and improved compliance with a range of government regulations.

A public-private partnership for depot-level maintenance is a cooperative arrangement between an organic depot-level maintenance activity and one or more private sector entities to perform DoD or defense-related work or to utilize DoD depot facilities and equipment. DoD's current policy on depot maintenance partnerships is contained in DoD Instruction 4151.21,<sup>3</sup> which states that such partnerships should be employed whenever it is cost effective to do so, and if it will improve support to the warfighter and maximize the use of the government's facilities, equipment, and personnel. The instruction also stipulates that PBL implementation strategies must consider public-private partnerships to satisfy core capabilities requirements and the 50/50 limitations on contractor performance of depot-level maintenance and materiel requirements.

DoD depot policy encourages the military services to designate depot maintenance activities as centers of industrial and technical excellence in the recognized core competencies of the respective activities. Each CITE is encouraged to either enter into partnerships with private industry (or other entities outside the Department of Defense) to perform work within its core competencies or allow private industry to lease or otherwise use under-utilized or unutilized CITE facilities and equipment.

In 2008, DoD published changes to the *DoD Financial Management Regulation* that provided additional guidance regarding the implementation of depot maintenance partnerships. The revision included financial guidance on supporting and administering public-private partnerships.<sup>4</sup>

DoD has periodically gathered information on public-private partnerships. The latest report, published in July 2007,<sup>5</sup> contained military service data regarding public-private partnership benefits in four categories:

- ◆ Explicit product support performance improvement
- ◆ Improved business practices updated technology

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<sup>3</sup> DoD Instruction 4151.21, *Public-Private Partnerships for Depot-Level Maintenance*, April 25, 2007.

<sup>4</sup> DoD 7000.14-R, *DoD Financial Management Regulation*, September 2008, Volume 2B, Chapter 9, Paragraph 090105.

<sup>5</sup> DoD Report, *Public-Private Partnerships for Depot-Level Maintenance Through the End Of Fiscal Year 2006*, July 2007, p. II-1.

- ◆ Identifiable cost avoidance
- ◆ Identifiable increase in facility utilization.

The military services continue their pursuit of depot maintenance partnerships.

- ◆ The Army's industrial operations activities are collaborating with the private sector using formal public-private partnership agreements to perform work or utilize facilities and equipment.
- ◆ The Navy is enabling and empowering its organic aviation industrial fleet readiness centers to develop appropriate partnerships with the commercial sector that consider the capabilities of both organic and commercial service providers, and leverage the best that each has to offer.
- ◆ The Air Force acknowledges the value of depot-level partnering and is planning to implement partnering agreements earlier in the acquisition cycle, incorporating partnership agreements with measurable benefits and evaluating partnering as part of source selections.
- ◆ The Marine Corps' strategic planning anticipates continued and enhanced partnerships with the private sector will result in greater private sector investment in facilities and equipment and improved facility utilization.

In its most recent report on depot partnering, GAO noted that public-private partnerships can combine the resources, risks, and rewards of public agencies and private companies with the intention being to provide greater efficiency, better access to capital, and improved compliance with a range of government regulations.<sup>6</sup> However, GAO also identified deficiencies in reporting partnership information to Congress, inconsistencies in implementation, and a lack of overarching goals and measures to collectively assess depot partnerships.

Several legal, policy, procedural, and funding enablers seem to be in place to promote effective public-private of partnerships; however, policies and guidance regarding performance reporting and information sharing could be improved. More consistent implementation reporting may help ascertain whether the achieved benefits and resultant costs support further use of partnerships for depot maintenance and their use on a more expansive scale.

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<sup>6</sup> GAO, *Depot Maintenance: DoD's Report to Congress on Its Public-Private Partnerships at Its Centers of Industrial and Technical Excellence Is Not Complete and Additional Information Would Be Useful*, Report GAO-08-902R, July 1, 2008, p. 1.

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# SUPPLY CHAIN MANAGEMENT

In both DoD and the private sector, supply chain management is the integrated process of materiel management, which begins with planning the acquisition of customer-driven materiel requirements from commercial procurement sources and from organic and commercial activities and ends with the delivery of materiel to operational customers. SCM includes the flow of reparable materiel to and from maintenance facilities, and the flow of required information in both directions among suppliers, logistics functional managers, and customers. Current DoD policy seeks to optimize the relationships between materiel managers and commercial sources of supply and between materiel managers and activities performing production, manufacture, repair, modification, overhaul, and testing functions at organic or private sector facilities or through public-private partnerships at those facilities.

In 2003, DoD published DoD 4140.1-R, *DoD Supply Chain Materiel Management Regulation*, officially adopting the private sector's supply chain management concept as a way of viewing materiel management processes, systems, and initiatives as part of a logistics chain that extends from manufacturers and providers to the operational customer. In 2004, the Chairman of the Joint Chiefs of Staff included the requirement for a seamless end-to-end logistics system as part of his national military strategy.<sup>7</sup> In 2009, the USD(AT&L) reconfirmed the goal of implementing integrated supply chain operations that effectively support warfighters and are efficient from source of supply to point of consumption.<sup>8</sup>

The military services and the Defense Logistics Agency (DLA) have adopted the principles of supply chain management as part of their respective logistics strategic planning efforts. Further, DoD's components have provided significant training to their logistics managers to impart an understanding of the concepts and elements of SCM. The objective of the Department's supply chain participants, including maintenance managers, is to establish end-to-end processes that maximize customer service or warfighter support.

In response to a series of GAO reports, OSD developed a DoD plan for improvement of supply chain management.<sup>9</sup> The principal elements of that plan are the improvement of asset visibility, materiel requirements forecasting, and materiel distribution.<sup>10</sup> Maintenance or the maintenance interface is not directly included in the current OSD plan.

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<sup>7</sup> Chairman, Joint Chiefs of Staff, *National Military Strategy*, 2004, p. 17.

<sup>8</sup> USD(AT&L), *Strategic Goals Implementation Plan*, Version 3, 2009, p. 67.

<sup>9</sup> OSD, *DoD Plan for Improvement in the GAO High Risk Area of Supply Chain Management with a Focus on Inventory Management and Distribution*, September 2009.

<sup>10</sup> OSD reports annually to Congress on its progress in these areas.

In most instances, DoD components are relying on the planned modernization of their information technology systems, using contracted information technology (IT) system integrators and commercial software as the vehicle for applying SCM best practices. In the current environment, this approach may be the only practical solution for implementation of needed logistics functional improvements; but such a strategy often lacks fully integrated processes and effective information exchange, particularly across functional and organizational lines (e.g., supply and maintenance).

GAO noted in its 2007 report that DoD did not have a comprehensive SCM implementation plan complete with universally accepted and outcome-focused metrics.<sup>11</sup> Since that time, DoD published its Logistics Roadmap that contains metrics and other measures to allow for greater visibility. However, current capabilities to project depot workload and measure the impact of process improvements over time are limited.<sup>12</sup> Further, none of the military services' strategic maintenance plans fully address the need for greater integration among the myriad logistics functions and activities integral to the end-to-end supply chain.

Today, depot maintenance is recognized more and more as an essential *node* in the chain that leads to the delivery of weapons, equipment, and repairable components to the operational customer. Conversely, maintenance is also a primary consumer of the commodities and parts used to fulfill operational needs. This means maintenance is a pivotal element of supply chain management implementation in DoD. In 2009, approximately \$7.3 billion of the \$30.5 billion organic depot workload was for the repair of components to be delivered to repair activities or operational customers.<sup>13</sup> At the same time, the DLA sold \$8.6 billion<sup>14</sup> of consumables and repair parts for aviation, land, and maritime support; the largest portion of that total went to DoD maintenance activities.

DoD's maintenance strategy recognizes the key objectives of aligning maintenance operations with warfighter-oriented outcomes; sustaining an organic core maintenance capability; sustaining a highly capable, mission-ready maintenance workforce; and ensuring an adequate maintenance infrastructure. Numerous initiatives already underway are aimed at attaining these objectives. Unfortunately, these efforts are often pursued with minimal consideration of the need for improved interfaces across the supply, maintenance, and transportation functions and organizations and without regard for commonality of purpose.

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<sup>11</sup> GAO, *Progress Made Implementing Supply Chain Management Recommendations, but Full Extent of Improvement Unknown*, Report GAO-07-234, January 2007, p 23.

<sup>12</sup> GAO, *Improved Strategic Planning Needed to Ensure That Army and Marine Corps Depots Can Meet Future Maintenance Requirements*, Report GAO-09-865, September 2009, p. 8.

<sup>13</sup> FY2010 service working capital fund budget submissions.

<sup>14</sup> FY2010 DLA working capital fund budget estimate, Exhibit SM-1, *Supply Management Summary*, p.81.

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## INFORMATION TECHNOLOGY

Maintenance-related IT has evolved significantly since the mid-1960s, when computers were first used to create the individual military services' legacy systems for maintenance planning and execution purposes. Those legacy systems had limited interoperability to manage materiel planning and operations execution in the larger maintenance environment. They consisted of numerous applications with complex interfaces both within the system and with external systems for reporting financial and other metrics to headquarters or for communicating with their external supply chain. Updating these early systems was a major undertaking, as upgrades interfered with those complex interfaces, which had to be revised at a substantial cost. The legacy systems tended to lag commercial off-the-shelf (COTS) software packages. The development of a military-oriented COTS maintenance and repair information technology was also limited during this period, because commercial manufacturing was a far more lucrative marketing target for IT solutions companies.

Enterprise resource planning (ERP) systems and SCM systems emerged in the late 1990s to compete with and even replace DoD's integrated first-generation systems. The evolving ERP solutions claimed superiority, with more robust relational databases, fourth-generation languages, and open-system portability for integrating advanced planning, scheduling, and execution. The SCMs solutions focused initially on integrated supply chain management, but they began to "spread their wings" and overlap with many of the capabilities of ERP solution providers. This meant no military service implemented the same maintenance IT solution across its entire enterprise. As SAP and Oracle, the two largest ERP solution providers, began making inroads into DoD and other federal agencies, the military services and related agencies began to rethink the desired long-term IT solution for their maintenance requirements to enable a higher level of interoperability and jointness.

DoD estimates it will invest more than \$12 billion on ERP software and systems over the next 5 years. The current direction of the military services appears to be toward SAP ERP, although Oracle and some mid-size ERP solutions continue to vie to be the DoD maintenance IT solution of the future.

As the services continue to expend substantial resources on IT modernization, it is unclear whether improved functionality and more effective support of the warfighter are being attained. It is also unclear whether COTS-based ERP systems can completely fulfill the unique needs of DoD's logisticians and customers.

There is no doubt IT technology will continue to change, and it will likely have a major long-term influence on how maintenance is performed. DoD maintenance activities have already made significant progress improving their IT systems, and the evolution of IT modernization is now focused on the adoption of the ERP family of systems.

## MATERIEL READINESS AND PERFORMANCE GOALS

DoD logistics managers have long sought to develop a quantifiable relationship between the infusion of financial resources (budget funding) and the level of materiel readiness or operational availability that can be attained with a particular level of funding. Because of the multiplicity and complexity of factors involved in achieving readiness objectives, most operators and logistics researchers agree a single formulaic solution for all “resource to readiness” elements is not feasible, at least not in the near term. Conversely, the DoD has worked to improve elements of its readiness objective in specific areas, such as spare parts forecasting.<sup>15</sup>

Fundamental to attaining a readiness-oriented logistics process, DoD logistics managers have struggled for years to identify meaningful logistics metrics, including those for depot maintenance, and implement those metrics consistently across the military services. Objections to standardized metrics have ranged from citing “operational differences” to simple management inertia.

In 1993, Congress passed the *Government Performance and Results Act* (GPRA) as an initial step toward mandating the implementation of capabilities within the federal government.<sup>16</sup> By systematically holding federal agencies accountable for achieving program results, the GPRA legislation required three basic actions by all federal agencies, including the DoD:

- ◆ Publication of a strategic plan
- ◆ Preparation of an annual performance plan that covers each program activity set forth in the agency’s budget
- ◆ Submission of annual program performance reports.

While the DoD maintenance community’s GPRA participation has been sporadic and somewhat fragmented, an assessment of the underlying structured approach of the act could provide a beginning for linking readiness and performance goals in the depot maintenance community.

Like most functional areas within DoD, the depot maintenance community accepted the requirement for process metrics after the promulgation of GPRA. The DoD maintenance policy directive provides that, “programs shall also establish and evaluate performance metrics that promote continuous improvement in maintenance, ensuring responsiveness and best value to operating forces.”<sup>17</sup> To provide a strategic planning structure, the 2007 *DoD Maintenance Strategic Plan* established as a goal the alignment of maintenance operations metrics with warfighter

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<sup>15</sup> Office of the Assistant Deputy Under Secretary of Defense for Supply Chain Integration (OADUSD[SCI]), *Readiness-Based Sparing Roadmap*, Version 1, August 2008, p. 1.

<sup>16</sup> *Government Performance Results Act of 1993*, Section 2b, p. 1.

<sup>17</sup> DoD Directive 4151.18, *Maintenance of Military Materiel*, March 31, 2004, p. 6.

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outcomes. The strategic plan also stated that objective and quantifiable metrics are essential to developing weapon system sustainment infrastructure that provides required materiel readiness at least cost. Earlier, the Office of the Under Secretary of Defense for Logistics and Materiel Readiness, or ODUSD(L&MR), tasked the Depot Maintenance Working Integrated Process Team (DM-WIPT) with developing a means for quantifying and reporting relevant depot maintenance metrics for the following high-level life cycle sustainment outcome metrics:

- ◆ Materiel availability
- ◆ Materiel reliability
- ◆ Ownership cost
- ◆ Mean down time.

The ODUSD(L&MR) elaborated on these metrics by formally providing more specific definitions and formulas in March of 2007.<sup>18</sup>

GAO has commented on logistics metrics a number of times over the past several years. For example:

Performance metrics are critical for demonstrating progress toward achieving results, providing information on which to base organizational and management decisions, and are important management tools for all levels of an agency, including the program or project level. Moreover, outcome-focused performance metrics can show results or outcomes related to an improvement initiative or program in terms of its effectiveness, efficiency, impact, or all of these. To track progress toward goals, effective performance metrics should have a clearly apparent, or commonly accepted, relationship to the intended performance, or should be reasonable predictors of desired outcomes; are not unduly influenced by factors outside a program's control; measure multiple priorities, such as quality, timeliness, outcomes, and cost; sufficiently cover key aspects of performance; and adequately capture important distinctions between programs.<sup>19</sup>

GAO found that, in the case of the Army and Marine Corps, the services' plans do not fully address all the elements needed for sound strategic planning, such as performance indicators or metrics that measure outcomes and gauge progress.<sup>20</sup> Our review of the current environment indicated similar issues with the Navy and Air Force's strategic maintenance plans.

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<sup>18</sup> Jack Bell, Deputy Under Secretary of Defense, Logistics and Materiel Readiness, memorandum, *Life Cycle Sustainment Outcome Metrics*, March 10, 2007, p. 1.

<sup>19</sup> GAO, *Progress Made Implementing Supply Chain Management Recommendations, but Full Extent of Improvement Unknown*, Report GAO-07-234, January, 2007, p.14.

<sup>20</sup> GAO, *Improved Strategic Planning Needed to Ensure That Army and Marine Corps Depots Can Meet Future Maintenance Requirements*, Report GAO-09-865, September 2009, p. 2.

In January 2008, the DM-WIPT drafted a handbook for DoD depot maintenance metrics for the purpose of quantifying and prescribing reporting requirements for relevant depot maintenance metrics. The deliberations of the working group resulted in the documentation of the following measurements: production rate, quality deficiency report rate, organic flow days, direct costs, and indirect costs. The group proposed a comparison of depot plans to actual performance for these metrics. The intent was to use reported data for strategic assessment and observation of trends and anomalies in the performance of individual depots. This handbook has not yet been issued.

## FORWARD-DEPLOYED DEPOT-LEVEL MAINTENANCE CAPABILITY

The depot-level equipment repair at forward locations in theater is not a recent phenomenon. But, given the United States' prolonged war footing, the issue is of particular concern. DoD's maintenance capability has included forward-deployed depots at various times since the Korean War. Some examples include the Army-operated maintenance depot in Mainz, Germany, which supported tanks and other heavy equipments, and the Air Force depot at RAF Kemble<sup>21</sup> in the United Kingdom. And during the Vietnam War, the Army operated a maintenance depot on Okinawa. The depot maintenance components of these facilities were closed by the end of the Cold War.

Forward positioning of depot-level capabilities is generally accomplished for two reasons:

- ◆ To reduce the use of scarce strategic lift resources in wartime and conserve transportation funds in peacetime.
- ◆ To dramatically reduce total repair cycle time.

Integral to any assessment of forward positioning of depot-level workload are two basic issue subsets. The first involves the accomplishment of depot-level equipment repair at intermediate or customer sites. Such maintenance would have been retrograded and accomplished at CONUS depots. The decision to use intermediate sites involves the number of personnel and skills available, diagnostic capabilities, availability of maintenance equipment and repair parts, customer-required repair cycle times, and costs. The second subset involves creating depot-level capabilities or facilities in theater. The questions associated with this subset focus on repair volume (output), repair cycle times, assessment of alternatives, scope or purpose of the facility, long-term requirement, and, of course, cost. Both subsets have occurred in the Iraq and Afghanistan contingencies.

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<sup>21</sup> This base was used by the U.S. Air Force as a maintenance facility for A-10 Thunderbolt.

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In many cases, the accomplishment of depot workload at forward locations is not done completely independent from CONUS depots. For example, depots variously use field service teams, voyage repair teams, battle damage repair teams, and forward repair activities to get their technicians and artisans into the combat zone and to the equipment that needs repair or support. Maintainers from Red River and Anniston Army Depots deployed to Kuwait to establish a forward repair activity to service engines, transmissions, final drives, and generators; they also were capable of repairing combat vehicles. In 2008 Letterkenny Army Depot contracted with VSE Corp. to modernize route clearance vehicles (RCVs) in Kuwait. The RCV modernization is a 3-year program, with total fleet repair and modernization the defined end state.

According to current DoD maintenance policy, maintenance programs must allocate tasks to appropriate levels of maintenance (i.e., field and depot) based on criteria derived from customer requirements and cost-effectiveness analysis.<sup>22</sup> Wartime contingencies have resulted in significant OPTEMPOs, higher equipment density, and increased battle- or theater-driven repairs. In addition, the requirement for refurbishment or “reset” of damaged and worn equipment has also increased dramatically. All of these factors directly impact the requirement for increased maintenance, including the use of forward deployment.

The real issue focuses on where this maintenance should be accomplished. There are a number of factors that influence this decision:

- ◆ The length of the rotational cycle of equipment out of the operational environment to be restored to a condition that permits reinsertion into the operational mix
- ◆ The need to keep some number of major equipments in theater to support operational needs
- ◆ The requirement to modify or repair equipment to the level needed to accomplish in-theater sustainment
- ◆ The requirement to accomplish the reset of equipment to “like-new” condition for future contingencies.

While all of the above could have been accomplished at CONUS depots, decisions have been made to satisfy certain of these needs in theater. For example, although three mine-resistant, ambush-protected (MRAP) vehicles will fit in a C-17, airlift is extremely expensive (at \$750,000 per vehicle estimated by USTRANSCOM). Sealifting costs around \$13,000 per vehicle. It also takes between 3 and 4 weeks for the vehicle to arrive back in theater.

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<sup>22</sup> DoD Directive 4151.18, *Maintenance of Military Materiel*, March 31, 2004, p. 3.

The maintenance workload accomplished at forward bases cannot always be classified as solely depot-level or intermediate. In many cases, maintenance on equipment is a combination of different levels of work, such as engine rebuilding and modifications to install sensors to monitor vehicle usage.

Decisions to accomplish depot maintenance in overseas locations have been made system by system. Overall policy to be used in these cases is ambiguous at best. It may be possible to improve decisions to expand or position depot capabilities to forward locations by applying appropriate operational and business case criteria, including the relationship to existing CONUS depots.

## CONSOLIDATION AND CENTRALIZATION OF MAINTENANCE

Fundamental changes to military service maintenance capabilities and capacities typically take place through actions to reorganize, integrate, and transform the various levels of maintenance. For example, previously separate maintenance facilities can be consolidated and maintenance resources shared as a means of optimizing the use of maintenance resources available within a specified area of support, such as a geographical region. A consolidation may include staffing adjustments designed to improve maintenance processes, deliver readiness at lower cost, keep critical components closer to the frontline, or reduce repair cycle times, transportation costs, and materiel inventories.

In recent years, all of the military services have fundamentally changed their maintenance processes, with centralization as a common theme.

- ◆ The Army transitioned from four levels of maintenance to two (field and sustainment).
- ◆ Naval aviation combined shore-based intermediate maintenance activities and naval aviation depots into regional fleet readiness centers.
- ◆ Naval shore-based surface or subsurface maintenance activities have similarly been combined into consolidated shipyards and intermediate maintenance facilities (IMFs).
- ◆ The Marine Corps implemented the Realignment of Maintenance program, which consolidated five levels of maintenance into three (operator or crew, field, and sustainment) for its non-aviation assets.
- ◆ The Air Force consolidated many of its intermediate maintenance activities into centralized intermediate repair facilities (CIRFs); it is also pursuing initiatives to better integrate and network maintenance information and management.

These kinds of initiatives, when viewed in the context of the forward deployment activities described above, raise interesting questions about DoD depot maintenance responsiveness and the policy framework that supports its effectiveness.

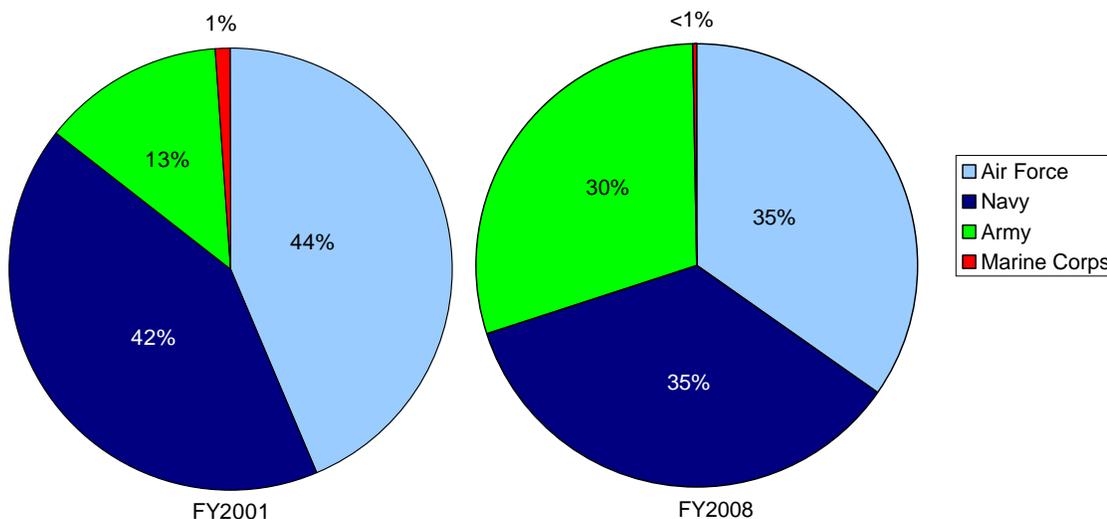
## COMMERCIAL DEPOT MAINTENANCE CAPABILITY

The commercial sector fulfills a large portion of DoD's depot maintenance need.

In 2008, commercial sources handled \$14.2 billion, or 45.5 percent, of DoD depot workload.<sup>23</sup> Aircraft maintenance accounted for the majority of this commercial workload, followed by ships. All other weapon systems make up only very small amounts of this commercial workload.<sup>24</sup>

Figure 4-1 shows the proportion of commercial maintenance workloads by military service in FY2001 and FY2008. It illustrates one way commercial maintenance has changed. Note the proportion of total DoD commercial maintenance in the Army increased dramatically.

Figure 4-1. Commercial Proportion of Total DoD Maintenance Workload by Service



<sup>23</sup> *Distribution of DoD Depot Maintenance Workloads Reports to Congress*, May 1, 2009.

<sup>24</sup> Data represents 10-year averages from the DMCS database between FY1999 and FY2008. This database, although the best available source for depot maintenance information, does not include Marine Corps contracting activities, underreports Tobyhanna AD for FY2004 and FY2005, and underreports data from NAVSEA across all years.

Civil aircraft maintenance, repair and overhaul in North America is a \$19.4 billion industry that includes more than 4,200 firms and 200,000 employees. Eighty-five percent of those firms are small and medium-sized enterprises that collectively account for 21 percent of all air MRO employees.<sup>25</sup>

The shipbuilding industry directly employs approximately 86,000 workers (stable over the past 5 years) and indirectly employs an additional 60,000. Each year shipyards build more than 2,000 vessels and service more than 44,000 vessels, including dry cargo ships, bulk carriers, passenger ships, tankers, and fishing and industrial vessels. The serviced domestic fleet represents a capital investment of more than \$26 billion.<sup>26</sup>

In the next few paragraphs we outline a number of the factors that may influence the viability of the future private sector support to DoD maintenance.

## Government Support of Industry

The military defense industries tend to rapidly expand and decline along with DoD funding cycles. The sole client for U.S. firms producing combat vehicles is the U.S. government; in shipbuilding, the complexity and throughput requirements of military (versus commercial vessels) have bifurcated the industry. Shipyards service either government or commercial vessels, not both. When DoD funding declines, the U.S. shipbuilding industry scrambles to find adequate workload.

The aircraft industry depends less on government. Before the recent economic decline, the estimated value of deliveries in the next 5 years for the military fixed-wing sector was \$107.5 billion, but the 5-year estimate for large commercial jet sector exceeded \$500 billion.<sup>27</sup>

## Concentration of Commercial Contracts

The commercial industries that support DoD maintenance can be quite concentrated. For example, the MRAP surge project to produce 15 critical sub-assemblies used the few land combat system prime contractors and the only 62 major tier 2 vendors available.<sup>28</sup>

Each defense support industry has high constraints to the entry of additional firms. These include massive capital investments, long product development cycles, and small numbers of product offerings. For shipbuilding, just six companies, or

<sup>25</sup> AeroStrategy Management Consulting, *Global MRO Market Economic Assessment*, prepared for ARSA, August 21, 2009.

<sup>26</sup> Industrial College of the Armed Forces (ICAF), National Defense University Industry Study, *Shipbuilding Industry* (Final Report), Fort McNair, Spring 2008.

<sup>27</sup> Op. cit., AeroStrategy, *Global MRO Market*.

<sup>28</sup> ICAF, National Defense University Industry Study, *Land Combat Systems Industry* (Final Report), Fort McNair, Spring 2008.

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“the big six,” take in two-thirds of the entire industry’s revenue but represent only 2.4 percent of shipbuilding industry’s firms.<sup>29</sup>

In aircraft, there are only two major producers of commercial aircraft (Boeing and Airbus), and only four major producers of rotary wing aircraft (Bell, Sikorsky, Eurocopter, and Agusta Westland). By 2010, All the helicopters for the U.S. naval fleet will be supplied by Sikorsky (a United Technologies Corporation).

Small and mid-sized enterprises play a crucial role in innovation and in meeting warfighter requirements. For example, unmanned aerial systems (UAS) were developed almost entirely by smaller companies (the exception being Northrop Grumman), and much of the exciting innovation in land combat vehicles occurs in smaller enterprises. Both aircraft and land combat systems currently exhibit a healthy number of small and mid-sized enterprises, but as DoD workload volume diminishes, consolidation similar to what happened in land combat systems industries in the 1990s could crowd out less-established firms.

## Private-Sector Capital Investment

The recent success of the MRAP vehicle in Iraq and Afghanistan was made possible, to some degree, by the efficient private sector development, system integration, and support (including maintenance) enterprise. However, commercial firms have invested only minimally in MRAP capacity because of uncertainty in long-term military demand.<sup>30</sup>

In the aircraft industry, large commercial airliners are reluctant to invest in new production lines; instead, they accept long backlogs. Boeing’s backlog rose to 3,427 aircraft in 2007 when it delivered just 441 aircraft.<sup>31</sup> This practice smoothes Boeing’s long-term production and appears to have little effect on its competitiveness, but a long backlog and few production lines may cut into Boeing’s ability to support a future military surge.

In shipbuilding, the current level of commercial investment does not seem to be keeping pace with ship decommissionings. In 1975, the U.S. Merchant Marine consisted of 857 oceangoing ships, representing 17.7 million deadweight tons. By December 2007, the U.S. Merchant Marine consisted of only 198 ships and 8.6 million deadweight tons.<sup>32</sup> As the civil fleet declines, so might industry’s ability to efficiently surge to meet DoD requirements.

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<sup>29</sup> Op. cit., ICAF, *Shipbuilding Industry*.

<sup>30</sup> Op. cit., ICAF, *Land Combat Systems Industry*.

<sup>31</sup> ICAF, National Defense University Industry Study, *Aircraft Industry* (Final Report), Fort McNair, Spring 2008.

<sup>32</sup> IHS Global Insight, Inc., *An Evaluation of Maritime Policy in Meeting the Commercial and Security Needs of the United States*, prepared for the U.S. Department of Transportation Maritime Administration (MARAD), January 7, 2009.

## Globalization

The commercial defense industries compete in a global market in which foreign countries increasingly dominate (particularly the shipbuilding and aircraft industries). Commercial airliners and other airplane companies service their aircraft with foreign parts and foreign labor. What used to be a series of U.S. national industries is now dependent on companies around the globe. Some businesses in the U.S. complain that export controls (such as those prohibiting the export of UAS systems to countries outside NATO and Australia) adversely affect their ability to compete globally and generate capital to further innovate.

Some U.S. industries supporting the military also depend on protectionist legislation like the *Jones Act*, which requires all vessels sailing between U.S. ports to be constructed in U.S. shipyards and operated by U.S. crews. Similarly, provisions in Title 10 require the military to prefer U.S. specialty metals and other domestic materials in order to sustain U.S. mining and manufacturing industries.<sup>33</sup> These foreign source constraints might preserve certain domestic industries (such as shipbuilding and mining), but they may weaken the abilities of U.S. firms' to act at the global level, resulting in equipment that costs more and is less competitive in the global marketplace.

More and more, the private sector is outsourcing non-military depot maintenance to third party foreign shipyards and depots. Technicians in countries where labor is cheap, such as China and South American countries, perform labor-intense repairs, particularly in the commercial airline industry. While the United States is still a slight net exporter of aviation maintenance services (\$2.4 billion positive balance of trade), it is also a slight net importer of heavy airframe maintenance services.<sup>34</sup>

Moving maintenance work overseas creates some concerns about quality and the ability to maintain domestic capacity. It is difficult to track and evaluate the quality of maintenance actions performed overseas, and outsourcing may contribute to the loss of experienced U.S. workers and the disappearance of an American maintenance infrastructure.

## Reductions in Skilled Domestic Workforce

The private sector plays a crucial role in helping the DoD meet its depot maintenance needs, and DoD plays a crucial role in providing workload for the commercial industries. The employed commercial defense support industries workforce has faced a massive decline. Between 1989 and 2007, the number of jobs in the

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<sup>33</sup> Title 10 USC § 2533b, *Requirement to buy strategic materials critical to national security from American sources; exceptions*, January 5, 2009.

<sup>34</sup> Op. cit., AeroStrategy, *Global MRO Market*.

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U.S. aerospace industry fell by 704,700, or 54 percent.<sup>35</sup> Employment in U. S. shipbuilding likewise plummeted from 166,900 in 1975 to 85,300 in 2006.<sup>36</sup> While it should be possible to re-hire many of the now unemployed technicians to meet surge requirements through 2015, over the long term, as these technicians change careers, accept work in other fields, retire, and even pass away, it may become increasingly difficult to meet surge requirements by relying on commercial labor.

Meanwhile, the commercial maintenance workforce is also aging. The average technician in the aircraft sector is more than 50 years old.<sup>37</sup> Approximately 26 percent of aerospace employees working in 2003 became eligible for retirement in 2008.<sup>38</sup>

Recent changes in the military—supply chain improvements, contracting, forward-based depots, use of unmanned aerial systems, automation, procurement of technical data, etc.—alter commercial maintenance patterns and place emphasis on different types of weapon systems. The commercial maintenance sector is also changing in terms of its concentration, long-term capital investments, and the extent to which it participates in a global market. In the long-term, the commercial defense industries could face labor shortages, partly due to industry trends in outsourcing and partly due to decreasing popularity of jobs in these relatively unstable industries.

## SUMMARY

In this chapter we briefly addressed a group of influences that have bearing on DoD depot maintenance provision. An overview of these topics was presented to provide a sense of the scope and content of our ongoing analysis. Our continuing work will include further review of these and other topics that are important to future DoD depot maintenance viability.

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<sup>35</sup> Aerospace Industries Association (AIA) website, [http://www.aia-aerospace.org/industry\\_information/workforce](http://www.aia-aerospace.org/industry_information/workforce), accessed October 14, 2009.

<sup>36</sup> Op. cit., IHS, *Evaluation of Maritime Policy*.

<sup>37</sup> Op. cit., ICAF, *Aircraft Industry*.

<sup>38</sup> CDR Sue Hegg, Commission on the Future of the United States Aerospace Industry, Final Briefing to TIGR, June 12, 2003.

# Chapter 5

## Next Steps

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In the second phase of this study we will continue to execute our analysis of the depot maintenance environment. Supported by the efforts to produce this interim report, our analysis will result in the publication of a depot maintenance future capability final report in October 2010. To develop that report, we will continue to synthesize appropriate data and the results of interviews, site visits, and our independent research.

The goal of Phase II is to describe a path Congress and senior DoD managers may take to logically and strategically shape the future DoD maintenance enterprise.

### OUR PLAN FOR PHASE II

We will execute a series of steps that will satisfy the requirements of the tasking legislation.

- ◆ We will continue to populate and validate the study's quantitative database. This effort involves a series of discussions and meetings with the data collection points of contact within the military services to ensure the database contains the maximum amount of valid and complete information. Augmented by other available sources of information, our database will be the quantitative basis for the remainder of the analysis.
- ◆ We will analyze the data to identify data-driven insights. This should yield a series of findings that are based on an amalgam of descriptive data and comparative data relationships across our various data categories.
- ◆ We will continue our research of selected study topics. This will include further incorporation of pertinent GAO research. Our additional research will ensure the final report is comprehensive and the issues it highlights are relevant to the future maintenance environment.
- ◆ We will make several follow-on visits to maintenance activities. During these visits, we will delve into information provided by depot subject matter experts and logistics practitioners to reinforce and validate our overall research.

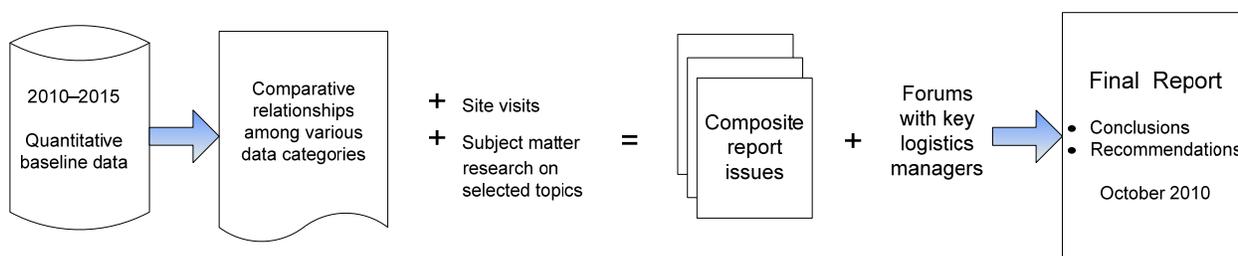
Our analysis will support a focused set of composite report issues that synthesize our data-driven findings, the results of subject matter expert interviews, site visits, and our independent research. We will vet these issues through a series of forums

with key logistics managers. At these sessions, we will present our composite issues for review and discussion, and we will solicit suggestions for revisions.

Based on our research and the inputs from other subject matter experts and service representatives, we will develop and integrate conclusions into the final report. We will synthesize our conclusions to prepare appropriate and practicable recommendations. Our objective will be to describe how the final findings and recommendations may be used by Congress and senior DoD leadership to develop a strategic approach to shaping the future DoD maintenance enterprise.

Figure 5-1 depicts the research activities needed to complete the final DoD Depot Maintenance Future Capacity and Capability Study report.

*Figure 5-1. Phase II Research Activities*



## PRIMARY STUDY AREAS TO HIGHLIGHT IN THE FINAL REPORT

In this interim report, we summarized the results of our initial research based on information submitted by the military services and our independent review of the current environment. In the first phase, we identified several overarching research issues. We will continue to analyze these issues and progress toward the study's final report of recommendations.

- ◆ Factors driving the future depot maintenance environment
- ◆ Sustainment of core depot maintenance capabilities
- ◆ Visibility of depot resources
- ◆ Management of the depot workload
- ◆ Activities that ensure a viable support structure
- ◆ Support of an effective, mission-ready workforce
- ◆ Depot transformation strategies and metrics alignment.

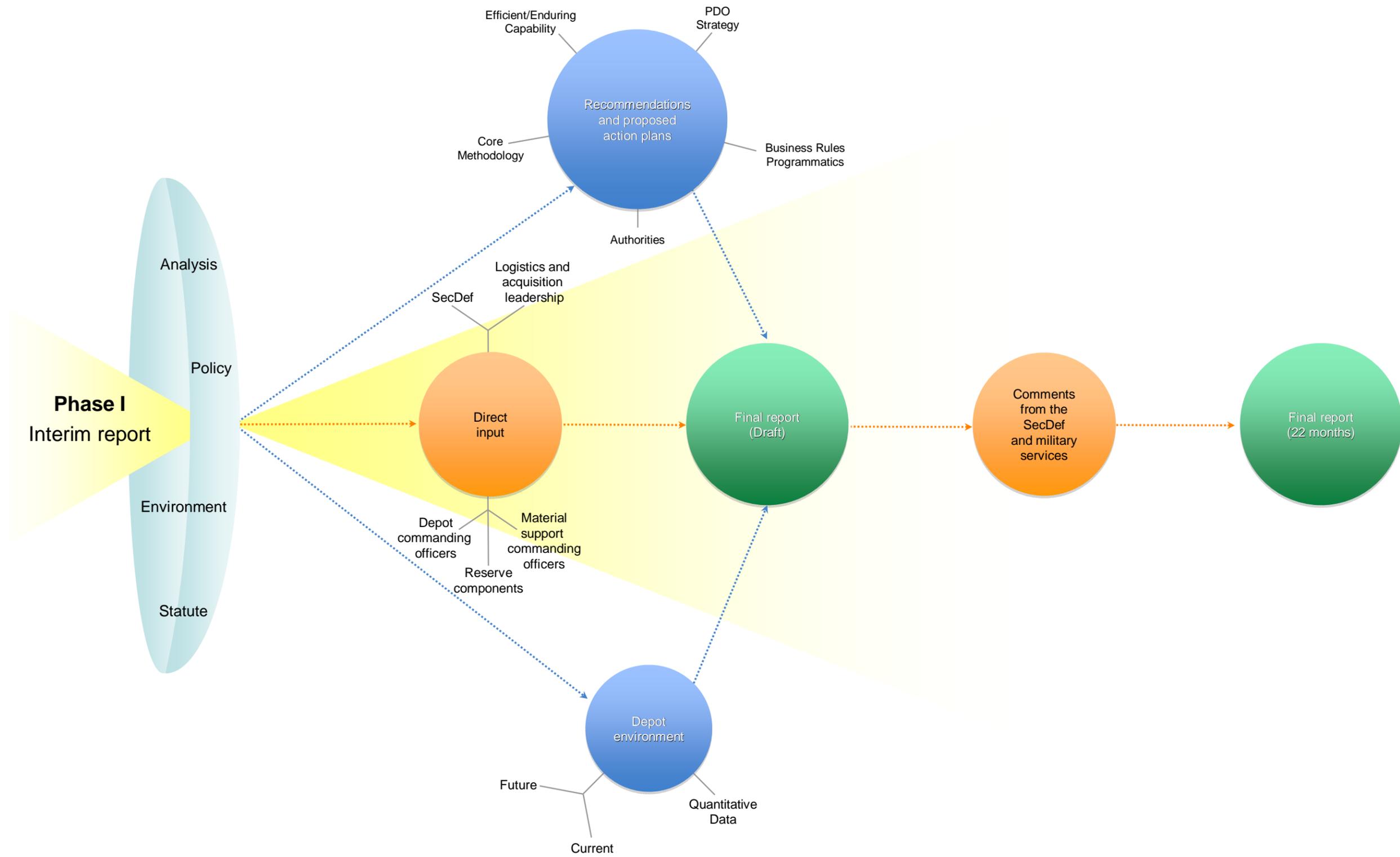
We will further our focus in these areas through a series of planned forums with key subject matter experts and depot stakeholders during the Phase II analysis.

As our analysis progresses, we will develop conclusions and recommendations in each issue area and formulate our study recommendations. Upon completion of the analysis, we will document the study results to address the outcome topics as described in the directive legislation.

- ◆ Requirements to maintain an efficient and enduring DoD depot capability
- ◆ Needed changes to current law
- ◆ Methodology for determining core logistics requirements with risk assessment
- ◆ Business rules to incentivize the Secretary of Defense and the service secretaries to keep DoD depots efficient and cost effective
- ◆ Strategies for enabling and monitoring the ability of the depots to produce performance-driven outcomes.

Figure 5-2 provides the overall scope for Phase II of our assessment. It includes key focus areas as well as segments for input and feedback. We will develop associated timelines, including milestones, early in our Phase II work.

Figure 5-2. Scope of LMI's Phase II Assessment



# Appendix A

## FY2009 NDAA Section 322 Language

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### DUNCAN HUNTER NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2009, SECTION 322: STUDY ON FUTURE DEPOT CAPABILITY

(a) **STUDY REQUIRED.**—Not later than 30 days after the date of the enactment of this Act, the Secretary of Defense shall enter into a contract with an independent research entity that is a not-for-profit entity or a federally funded research and development center with appropriate expertise in logistics and logistics analytical capability to carry out a study on the capability and efficiency of the depots of the Department of Defense to provide the logistics capabilities and capacity necessary for national defense.

(b) **CONTENTS OF STUDY.**—The study carried out under subsection (a) shall—

(1) be a quantitative analysis of the post-reset Department of Defense depot capability required to provide life cycle sustainment of military legacy systems and new systems and military equipment;

(2) take into consideration direct input from the Secretary of Defense and the logistics and acquisition leadership of the military departments, including materiel support and depot commanders;

(3) take into consideration input from regular and reserve components of the Armed Forces, both with respect to requirements for sustainment-level maintenance and the capability and capacity to perform depot-level maintenance and repair;

(4) identify and address each type of activity carried out at depots, installation directorates of logistics, regional sustainment-level maintenance sites, reserve component maintenance capability sites, theater equipment support centers, and Army field support brigade capabilities;

(5) examine relevant guidance provided and regulations prescribed by the Secretary of Defense and the Secretary of each of the military departments, including with respect to programming and budgeting and the annual budget displays provided to Congress; and

(6) examine any relevant applicable laws, including the relevant body of work performed by the Government Accountability Office.

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(c) ISSUES TO BE ADDRESSED.—The study required under subsection (a) shall address each of the following issues with respect to depots and depot capabilities:

(1) The life cycle sustainment maintenance strategies and implementation plans of the Department of Defense and the military departments that cover—

- (A) the role of each type of maintenance activity;
- (B) business operations;
- (C) workload projection;
- (D) outcome-based performance management objectives;
- (E) the adequacy of information technology systems, including workload management systems;
- (F) the workforce, including skills required and development;
- (G) budget and fiscal planning policies; and
- (H) capital investment strategies, including the implementation of section 2476 of title 10, United States Code.

(2) Current and future maintenance environments, including—

- (A) performance-based logistics;
- (B) supply chain management;
- (C) condition-based maintenance;
- (D) reliability-based maintenance;
- (E) consolidation and centralization, including—
  - (i) regionalization;
  - (ii) two-level maintenance; and
  - (iii) forward-based depot capacity;
- (F) public-private partnerships;
- (G) private-sector depot capability and capacity; and
- (H) the impact of proprietary technical documentation.

(3) The adequate visibility of the maintenance workload of each military department in reports submitted to Congress, including—

(A) whether the depot budget lines in current budget displays accurately reflect depot level workloads;

(B) the accuracy of core and 50/50 calculations;

(C) the usefulness of current reporting requirements to the oversight function of senior military and congressional leaders; and

(D) whether current budgetary guidelines provide sufficient financial flexibility during the year of execution to permit the heads of the military departments to make best-value decisions between maintenance activities.

(4) Such other information as determined relevant by the entity carrying out the study.

(d) AVAILABILITY OF INFORMATION.—The Secretary of Defense and the Secretaries of each of the military departments shall make available to the entity carrying out the study under subsection (a) all necessary and relevant information to allow the entity to conduct the study in a quantitative and analytical manner.

(e) REPORTS TO COMMITTEES ON ARMED SERVICES.—

(1) INTERIM REPORT.—The contract that the Secretary enters into under subsection (a) shall provide that not later than one year after the commencement of the study conducted under this section, the chief executive officer of the entity that carries out the study pursuant to the contract shall submit to the Committees on Armed Services of the Senate and House of Representatives an interim report on the study.

(2) FINAL REPORT.—Such contract shall provide that not later than 22 months after the date on which the Secretary of Defense enters into the contract under subsection (a), the chief executive officer of the entity that carries out the study pursuant to the contract shall submit to the Committees on Armed Services of the Senate and House of Representatives a final report on the study. The report shall include each of the following:

(A) A description of the depot maintenance environment, as of the date of the conclusion of the study, and the anticipated future environment, together with the quantitative data used in conducting the assessment of such environments under the study.

(B) Recommendations with respect to what would be required to maintain, in a post-reset environment, an efficient and enduring Department of Defense depot capability necessary for national defense.

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(C) Recommendations with respect to any changes to any applicable law that would be appropriate for a post-reset depot maintenance environment.

(D) Recommendations with respect to the methodology of the Department of Defense for determining core logistics requirements, including an assessment of risk.

(E) Proposed business rules that would provide incentives for the Secretary of Defense and the Secretaries of the military departments to keep Department of Defense depots efficient and cost effective, including the workload level required for efficiency.

(F) A proposed strategy for enabling, requiring, and monitoring the ability of the Department of Defense depots to produce performance-driven outcomes and meet materiel readiness goals with respect to availability, reliability, total ownership cost, and repair cycle time.

(G) Comments provided by the Secretary of Defense and the Secretaries of the military departments on the findings and recommendations of the study.

(f) **COMPTROLLER GENERAL REVIEW.**—Not later than 90 days after the date on which the report under subsection (e)(2) is submitted, the Comptroller General shall review the report and submit to the Committees on Armed Services of the Senate and House of Representatives an assessment of the feasibility of the recommendations and whether the findings are supported by the data and information examined.

(g) **DEFINITIONS.**—In this section:

(1) The term “depot-level maintenance and repair” has the meaning given that term under section 2460 of title 10, United States Code.

(2) The term “reset” means actions taken to repair, enhance, or replace military equipment used in support of operations underway as of the date of the enactment of this Act and associated sustainment.

(3) The term “military equipment” includes all weapon systems, weapon platforms, vehicles and munitions of the Department of Defense, and the components of such items.

# Appendix B

## Key Participants in the Management of DoD Depot Maintenance

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A variety of actors have significant influence over the management of depot maintenance in the Department of Defense. This appendix provides a high-level survey of those actors. The list is not exhaustive, but it is designed to illustrate the range and depth of elements that have bearing on this study and the prospects for the future.

### THE UNITED STATES CONGRESS

Congress establishes the fundamental basis for the operation of depot maintenance in several respects.

- ◆ It establishes the basic roles and missions of U.S. forces in Public Law.
- ◆ It addresses particular issues regarding depot maintenance in specific legislation (principally Title 10 U.S. Code, Chapter 146).
- ◆ It authorizes and appropriates resources for the depot maintenance infrastructure and annual operations.

In addition, Congress exercises an oversight role for depot maintenance operations, expressed in terms of hearings, special studies (including this contracted study as well as taskings to the General Accountability Office, Congressional Budget Office, and Congressional Research Service), site visits, and investigations.

The size of the depot maintenance establishment and its annual resource requirements contribute to a heightened level of interest. The informal Depot Maintenance Caucus consists of more than 60 members from the House Representatives and Senate, from all political parties.

### THE OFFICE OF THE SECRETARY OF DEFENSE

The Office of the Secretary of Defense (OSD) performs two fundamental roles with respect to depot maintenance.

- ◆ It develops and issues Department-wide policy plans and programs.
- ◆ It requests and allocates resources for depot maintenance through the Planning, Programming, Budgeting, and Execution System.

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To support these functions, OSD is in continuous dialog with the military components (the military services and defense agencies) in a variety of formal and informal interchanges. An example of a key interchange mechanism is the Maintenance Executive Steering Committee.

The OSD Maintenance Staff is augmented with additional subject matter experts from the Comptroller, General Counsel, and allied logistics communities.

## THE MILITARY SERVICES

The military services own and operate the depot maintenance infrastructure in support of their operating forces. They issue policy and allocate resources within their respective organizations to support depot maintenance operations. As noted at multiple points in the body of this report, they employ depot maintenance capabilities in a variety of ways designed to best support the operating forces.

The acquisition community within the military services plays a central role in structuring sustainment planning for new systems, and in arranging for lifecycle sustainment from contract and organic sources.

## THE DEPOT MAINTENANCE MANAGEMENT STRUCTURE

Organizationally, the headquarters of the military services are the highest levels that have personnel dedicated to depot maintenance management. The first major staff elements are located within the services; logistics command headquarters. This headquarters level is typically concerned with the allocation of work, identification of requirements, and establishment of capabilities on behalf of their service.

Each depot maintenance activity has management organizations associated with actual operations, materiel support and other matters directly associated with the production process. The depots have industrial facility engineers who are concerned with process flows and other infrastructure. They also have human resource management activities that recruit and train new technicians as well as administer the workforce.

## COMBATANT ORGANIZATIONS

Operating forces rely heavily on depot maintenance support for sustained operations, and are a leading source of operational requirements for new or updated sustainment processes. The depots are uniformly responsive to operational requirements.

## DEFENSE INDUSTRY

Defense industry has two primary functions associated with depot maintenance.

- ◆ Industry can serve as the designated source of repair under a variety of contractual arrangements, including performance-based logistics.
- ◆ Industry provides materiel support for depot maintenance operations.

## ACADEMIA

Research and development activities are frequently instrumental in developing new repair processes and applying advanced technologies to production problems.

Academic institutions conduct applied research to develop new capabilities for advanced maintenance techniques, such as prognostic algorithms.

Local colleges and technical schools in proximity to depot maintenance activities frequently partner with the depots to provide skill and management training to meet depot requirements.

## LABOR UNIONS

The workforce at each of the major organic depot maintenance activities is represented by at least one labor union. While it is true that most of the major classical labor-management issues have been resolved for the depots (for example, wage rates are set in accordance with Public Law), the unions serve a central role in assuring compliance with existing rules and processes and are a major influence in matters affecting the political process.

The depot maintenance workforce enjoys strong support from local communities who recognize the beneficial role the depots play in local economies. Community support has been instrumental in assisting depot maintenance activities to obtain needed resources such as property, access rights, and safety zones for military operations.

## ALLIED ORGANIZATIONS

DoD depot maintenance supports a number of allied organizations, including the U.S. Coast Guard, other federal agencies, and foreign military sales customers.



# Appendix C

## Relevant GAO Reports

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The Government Accountability Office (GAO) is the primary agency responsible for conducting congressionally mandated studies and analysis of depot maintenance activities and issues. Their work is augmented by, and coordinated with, the audit agencies and inspector general organizations of the military services.

Over time, GAO reports have identified a number of major issues affecting depot maintenance and shaped the application of management tools and techniques applicable to depots, including specific application of the *Government Performance and Results Act of 1993* (GPRA).

The *Duncan Hunter National Defense Authorization Act for Fiscal Year 2009* (also known as the *FY2009 National Defense Authorization Act*, or *FY2009 NDAA*) requires LMI to “examine any relevant applicable laws, including the relevant body of work performed by the Government Accountability Office.”

We conducted a systematic review of all known GAO letters and reports written since 2000 on subjects relating to depot maintenance.

This appendix presents the initial results of LMI’s review, which will continue throughout the study as the GAO’s reports on issues relating to depot maintenance continue to grow. As appropriate, we reference and build upon the GAO’s body of work in the depot maintenance area.

Table C-1 identifies the 18 depot maintenance subject areas that are documented in this interim report. We match published GAO reports to these subject areas.

*Table C-1. Depot Maintenance Subject Areas*

Issues
Accuracy of Core and 50/50 calculations (Table C-2)
Business operations and workload projection (Table C-3)
Capital investment strategies (Table C-4)
Commercial support of depot maintenance (Table C-5)
Condition-Based Maintenance Plus (CBM+)
Consolidation and centralization of depot workload (Table C-6)
Forward positioning
Maintenance information technology systems (Table C-7)
Material readiness and performance goals (Table C-8)
Operational contingencies impact on depot maintenance (Table C-9)

*Table C-1. Depot Maintenance Subject Areas*

Issues
Performance-based logistics (PBL) (Table C-10)
Proprietary technical data (Table C-11)
Public-private partnerships (Table C-12)
Relevant applicable laws, regulations, and business policies (Table C-13)
Reliability-centered maintenance (Table C-14)
Reporting requirements and budgetary guidelines (Table C-15)
Supply chain management (SCM) (Table C-16)
Workforce skills (Table C-17)

We summarized each GAO report we reviewed to date and were able to categorize them under 16 of the 18 issues documented in this study. We then ordered them by report number in chronological order from oldest to newest. The following tables present the applicable GAO letters and reports for each issue.

*Table C-2. Reports Relevant to Accuracy of Core and 50/50 Calculations*

Report no.	Report title	Summary and GAO recommendations
GAO-02-105	<i>Defense Logistics: Actions Needed to Overcome Capability Gaps in the Public Depot System</i>	DoD's practices for developing core depot maintenance capabilities are creating gaps between actual capabilities and those needed for future national defense emergencies. If current practices continue, the military depots will not have the equipment, facilities, or trained personnel to provide the logistics support needed for military use in the next 5 to 15 years. GAO recommends: <ul style="list-style-type: none"> <li>◆ Congress may wish to review 10 U.S.C. 2464 as it relates to non-maintenance logistics activities, and if it is appropriate, clarify the law to <ul style="list-style-type: none"> <li>○ revise depot maintenance core policy,</li> <li>○ establish milestones for developing strategic implementation plans for the use of military depots that would identify desired capabilities, and</li> <li>○ establish milestones and accountability for developing policies to identify core logistics capabilities for non-maintenance activities.</li> </ul> </li> </ul>
GAO-02-95	<i>Depot Maintenance: Management Attention Required to Further Improve Workload Allocation Data</i>	GAO finds that the military had mixed results complying with the 50/50 requirement for private sector workloads in fiscal years 1999 and 2000. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ identify depot maintenance requirements associated with the recapitalization program;</li> <li>◆ require the Army Audit Agency to review both prior-years and future-years 50/50 data;</li> <li>◆ communicate the reporting requirements to all organizational levels responsible for reporting data; and</li> <li>◆ finalize and issue guidance concerning the reporting of depot maintenance at non-depot locations.</li> </ul>

Table C-2. Reports Relevant to Accuracy of Core and 50/50 Calculations

Report no.	Report title	Summary and GAO recommendations
GAO-03-1023	<i>Depot Maintenance: DOD's 50/50 Reporting Should Be Streamlined</i>	<p>GAO reviews and identifies areas for improvement for two reports from 2003 on depot maintenance funding allocation between the public and private sectors. GAO recommends Congress</p> <ul style="list-style-type: none"> <li>◆ consider amending 10 U.S.C. 2466 to require only one annual 50/50 report;</li> <li>◆ consider extending the due date for the single report from February 1 to April 1 of each year;</li> <li>◆ require the secretaries of the military departments to direct the use of service audit agencies for third-party review and validation of 50/50 data;</li> <li>◆ ensure that 50/50 reporting guidance is appropriately disseminated.</li> </ul>
GAO-03-16	<i>Depot Maintenance: Change in Reporting Practices and Requirements Could Enhance Congressional Oversight</i>	<p>GAO reports on whether DoD complied with the “50/50 requirement” in the prior-years report and whether the future-years’ projections are reasonable. GAO recommends the following:</p> <ul style="list-style-type: none"> <li>◆ The Navy should review 50/50 data during subsequent reporting cycles.</li> <li>◆ The Marine Corps and Army should initiate steps to improve management and controls of the 50/50 data collection and documentation process.</li> <li>◆ The Air Force should determine the extent and nature of depot maintenance and depot-like tasks accomplished at non-depot locations.</li> </ul>
GAO-04-220	<i>Depot Maintenance: Army Needs Plan to Implement Depot Maintenance Report's Recommendations</i>	<p>Congress directed the Army to report on the proliferation of depot-level maintenance work at non-depot facilities and asked GAO to review the report. GAO recommends establishing a specific plan to manage the implementation of the 29 recommendations identified in the 2003 proliferation report.</p>
GAO-04-871	<i>Depot Maintenance: DOD Needs Plan to Ensure Compliance with Public- and Private-Sector Funding Allocation</i>	<p>GAO reviews two DoD reports and submits its views to Congress on whether the military services met the 50/50 requirement for FY2002–2003 and whether the projections for FY2004–2008 are reasonable. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ ensure a plan to ensure continued compliance;</li> <li>◆ use a audit service for a third-party review of the 50/50 data;</li> <li>◆ ensure staff receive proper training for accurate 50/50 data reporting;</li> <li>◆ require Marine Corps command compile a consolidated report on depot maintenance funding allocation between the public and private sectors.</li> </ul>
GAO-06-88	<i>Depot Maintenance: Persistent Deficiencies Limit Accuracy and Usefulness of DOD's Funding Allocation Data Reported to Congress</i>	<p>GAO reviews and submits its view on whether the military services complied with the 50/50 requirement for FY2004 and if the projections for FY2005–2006 represent reasonable estimates. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ disclose a management control weakness in its 50/50 data reporting processes along with planned corrective actions to improve management control; and</li> <li>◆ enhance the annual 50/50 report.</li> </ul>

Table C-2. Reports Relevant to Accuracy of Core and 50/50 Calculations

Report no.	Report title	Summary and GAO recommendations
GAO-07-126	<i>Depot Maintenance: Actions Needed to Provide More Consistent Funding Allocation Data to Congress</i>	<p>GAO reviews the DoD's report submitted in April 2006 on the allocation of depot maintenance funding between the public and private sectors for the preceding fiscal year and projected distribution for the current and future years for each military service and defense agency. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ report funding obligations rather than expenditures; and</li> <li>◆ establish measures to ensure proper accounting of the allocation of interservice workloads between the public and private sectors.</li> </ul>
GAO-08-761R	<i>Depot Maintenance: Issues and Options for Reporting on Military Depots</i>	<p>This report transmits the briefing in response to the Senate report on the FY2008 NDAA, which required GAO to review and make recommendations regarding all of the work done in determining compliance with the 50/50 requirement. There are no recommendations listed in this report.</p>
GAO-09-83	<i>Depot Maintenance: Actions Needed to Identify and Establish Core Capability at Military Depots</i>	<p>GAO investigates DoD core reporting and finds that DoD has not comprehensively and accurately assessed its core capabilities, nor has it identified or established core capabilities in a timely manner for new and modified systems. GAO recommends Congress require DoD to</p> <ul style="list-style-type: none"> <li>◆ compile and report on the services' core capability requirements, planned workloads, and any shortfalls by equipment/technology category;</li> <li>◆ explicitly state the mathematical calculations required for core calculations and implement internal controls to prevent errors and inconsistencies;</li> <li>◆ establish a mechanism to ensure corrective actions are taken to resolve identified core shortfalls;</li> <li>◆ provide program managers with standard operating procedures for core logistics analysis;</li> <li>◆ modify DoD Instruction 5000.02 to incorporate the 4-year time frame for establishing core capability; and</li> <li>◆ require an initial core assessment early in the acquisition process.</li> </ul>
NSIAD-00-152R	<i>Depot Maintenance: Air Force Waiver to U.S.C. 2466</i>	<p>GAO reviews the Air Force's 50-percent ceiling waiver for depot maintenance, focusing on the extent to which the Air Force's justification for the waiver was due to its planned use of temporary contracts to support transitioning workloads and potential for the ceiling to exceed in FY2001–2002. There are no recommendations listed in this document.</p>

Table C-2. Reports Relevant to Accuracy of Core and 50/50 Calculations

Report no.	Report title	Summary and GAO recommendations
NSIAD-00-193	<i>Depot Maintenance: Action Needed to Avoid Exceeding Ceiling on Contract Workloads</i>	GAO reviews DoD reports on the percentage of funding in support of public and private sector depot maintenance and repair workloads. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ accurately reflect projected maintenance costs and public-private sector allocations for new and upgraded systems;</li> <li>◆ implement a long-term strategy to manage its weapon system support programs to comply with the 50/50 funding requirement;</li> <li>◆ issue instructions tailoring OSD's guidance to the Navy's operating environment to improve workload reporting and to implement management controls; and</li> <li>◆ provide improved guidance and increased management attention to improve workload reporting in the areas of government furnished material, warranties, and software maintenance.</li> </ul>
NSIAD-00-69	<i>Depot Maintenance: Future Year Estimates of Public and Private Workloads Are Likely to Change</i>	GAO analyzes the services' depot maintenance funding estimates for work done by the public and private sector during FY1999–2005, but, due to errors in the data, the budget estimates are unable to be considered. Given the available information, though, it appears that the private sector is used more. There were no recommendations listed in this document.
T-NSIAD-00-112	<i>Depot Maintenance: Air Force Faces Challenges in Managing to 50/50 Ceiling</i>	This testimony focuses on the basis for the Air Force's waiver that places a 50-percent ceiling on the amount of depot maintenance funds that can be used for work done by the private sector, and the likelihood that the Air Force will need additional waivers. There are no recommendations listed in this document.

Table C-3. Reports Relevant to Business Operations and Workload Projection

Report no.	Report title	Summary and recommendations
GAO-03-682	<i>Key Unresolved Issues Affect the Army Depot System's Viability</i>	GAO assesses the trends and reliability of depot workload projections, whether the workloads are sufficient for efficient depot operations, whether the Army has identified depots' core capability, and whether the Army has a long-range plan for a viable depot system. GAO recommends DoD develop <ul style="list-style-type: none"> <li>◆ standard business procedures for reporting Army depot workload projections and</li> <li>◆ ways to improve the reporting of depot inter-service workload projections across all the military services.</li> </ul>
GAO-04-302	<i>Defense Acquisitions: DOD Needs to Better Support Program Managers' Implementation of Anti-Tamper Protection</i>	GAO reviews DoD's implementation of the anti-tamper policy, which is used to eliminate international weapon systems and technology threats. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ collect information needed to develop critical technology identification;</li> <li>◆ appoint technical experts to centrally review the technologies identified for consistency across programs and services;</li> <li>◆ ensure the cost and techniques needed to implement anti-tamper protection are identified early in a system's life cycle; and</li> <li>◆ monitor the value of developing generic anti-tamper techniques and evaluate the effectiveness of the tools.</li> </ul>

Table C-3. Reports Relevant to Business Operations and Workload Projection

Report no.	Report title	Summary and recommendations
GAO-08-714	<i>Army Working Capital Fund: Actions Needed to Reduce Carryover at Army Depots</i>	<p>GAO determines the growth in the total carryover from FY2004–2007 and the actions the Army is taking to reduce the carryover, if the carryover amounts exceeded the ceiling for FY2006–2007 and adjustments made to reduce these amounts, and the reasons for the carryover at the five Army depots. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ establish procedures requiring evaluations of future exemption requests on carryover;</li> <li>◆ determine if the depots met established targets and if the plan’s execution has the desired effect of reducing FY2008 carryover;</li> <li>◆ establish procedures for separately identifying the allowable and reported actual amounts of carryover; and</li> <li>◆ develop a mechanism to monitor the Army depot maintenance activities’ compliance with the requirements in DOD Financial Management Regulation 7000.14-R.</li> </ul>
GAO-09-852R	<i>Army’s Implementation Logistics Modernization Program</i>	<p>GAO reviews a report in which the House of Representatives wrote about the Logistics Modernization Program (LMP) implementation at Army depots and its expected end-state capabilities. There are no recommendations listed in this document.</p>
GAO-09-865	<i>Improved Strategic Planning Needed to Ensure That Army and Marine Corps Depots Can Meet Future Maintenance Requirements</i>	<p>GAO reviews the depot maintenance strategic plans developed by the Army and Marine Corps and found they are not fully responsive to OSD direction and they do not provide assurance that the depots will be postured and resourced to meet future maintenance requirements. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ integrate the depots’ input into the sustainment portion of the life cycle management planning process and</li> <li>◆ update the Army and Marine Corps depot maintenance strategic plans to (1) fully address the elements needed for a comprehensive results-oriented management framework; (2) fully address the four specific issues OSD directed the services to include in their plans; and (3) include goals and objectives aimed at mitigating and reducing future workload uncertainties.</li> </ul>
NSIAD-00-16	<i>Defense Logistics: Army Should Assess Cost and Benefits of the Workload Performance System Expansion</i>	<p>GAO assesses the Army’s progress in developing and implementing its workload performance system and the extent to which a previous report addresses a master plan for implementing the system. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ assess the cost-effectiveness of using the Army Workload Performance System for non-depot maintenance applications;</li> <li>◆ develop a more substantive master plan that incorporates all applications for which the system is to be implemented; and</li> <li>◆ assess the adequacy of existing program management and oversight structures.</li> </ul>

Table C-3. Reports Relevant to Business Operations and Workload Projection

Report no.	Report title	Summary and recommendations
NSIAD-96-86	<i>Air Force Maintenance: Two Level Maintenance Assessment</i>	<p>The Two Level Maintenance (TLM) program is not achieving the full extent of the intended benefits. Expected implementation costs have increased and expected net savings have decreased. The use of TLM to support deployed forces in times of conflict will add to the airlift burden. The need for early sustainment airlift to support TLM is an issue that has not been fully resolved and is one that could affect sustainment of the deployed forces. GAO recommends the Secretary of the Air Force develop</p> <ul style="list-style-type: none"> <li>◆ a revised cost and savings analysis;</li> <li>◆ an assessment of the depots' ability to meet prescribed repair turn around times; and</li> <li>◆ an action plan that assesses airlift availability in the early stages of a conflict.</li> </ul>
NSIAD-99-61	<i>Defense Inventory: Navy's Procedures for Controlling In-Transit Items are Not Being Followed</i>	<p>GAO reviews the Navy's management procedures for controlling items in transit by identifying inventory in transit within storage and repair activities and assessing the Navy's adherence to procedures for controlling in-transit inventory. There are no recommendations listed in this document.</p>

Table C-4. Reports Relevant to Capital Investment Strategies

Report no.	Report title	Summary and recommendations
GAO-07-461	<i>Defense Infrastructure: Actions Needed to Guide DOD's Efforts to Identify, Prioritize, and Assess Its Critical Infrastructure</i>	<p>GAO evaluates the extent to which the DoD has developed comprehensive management plan to implement the Defense Critical Infrastructure Program (DCIP) and identified, prioritized, and assessed its critical infrastructure. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ identify domestic non-DOD-owned critical infrastructure for DHS to consider;</li> <li>◆ issue guidance and criteria for performing infrastructure vulnerability self-assessments;</li> <li>◆ combine the defense critical infrastructure vulnerability assessment module with an existing assessment as the DoD-wide practice; and</li> <li>◆ complete the identification of critical infrastructure before increasing the number of infrastructure vulnerability assessments performed.</li> </ul>
GAO-07-620	<i>Defense Acquisitions: An Analysis of the Special Operations Command's Management of Weapon System Programs</i>	<p>GAO's evaluation of SOCOM's acquisition management includes an assessment of the types of acquisition programs undertaken since 2001 and whether the programs are consistent with its mission, the extent to which SOCOM's programs have progressed as planned, and the challenges SOCOM faces in managing its acquisition programs. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ establish sound business cases when starting programs has the workforce size and composition to match its acquisition workload; and</li> <li>◆ improve its acquisition management information system.</li> </ul>

Table C-5. Reports Relevant to Commercial Support of Depot Maintenance

Report no.	Report title	Summary and recommendations
GAO-06-989	<i>Depot Maintenance: Improvements Needed to Achieve Benefits from Consolidations and Funding Changes at Naval Shipyards</i>	<p>GAO evaluates a Navy report that claims that direct funding is more advantageous than working capital funding and can best satisfy fleet maintenance priorities. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ ensure shortcomings in the information systems supporting the Navy's consolidation of regional maintenance facilities and conversion to direct funding are addressed in a timely manner;</li> <li>◆ implement a method to routinely provide for total cost visibility of ship maintenance activities; and</li> <li>◆ develop metrics to ensure that the planned consolidation activities of facilities performing ship maintenance are being implemented.</li> </ul>
GAO-07-631	<i>Defense Budget: Trends in Operation and Maintenance Costs and Support Services Contracting</i>	<p>GAO reports on identifying trends in O&amp;M costs, discusses whether increased services contracting has exacerbated the growth of O&amp;M costs, and provides perspectives on the benefits and concerns of increased contracting. There are no recommendations listed in this document.</p>
GAO-08-572T	<i>DOD Needs to Reexamine Its Extensive Reliance on Contractors and Continue to Improve Management and Oversight</i>	<p>GAO highlights the challenges the federal agencies face related to the increased reliance on contractors, with an emphasis on the reliance on contractors who support deployed troops and provide logistics support for weapons systems. In addition, GAO reports on the recommendations it has made in the past to improve DoD's management and oversight of contractors. There are no recommendations listed in this document.</p>
NSIAD-00-115	<i>Defense Logistics: Air Force Report on Contractor Support Is Narrowly Focused</i>	<p>GAO discusses the extent to which an Air Force report identifies programs or systems that use contractor support, supports the notion that contractor support provides superior war fighting capabilities, and identifies the impact of contractor support on government logistics depots. There are no recommendations listed in this document.</p>
NSIAD-96-165	<i>Defense Depot Maintenance: DoD's Policy Report Leaves Future Role of Depot System Uncertain</i>	<p>GAO analyzes DoD's <i>Policy Regarding Performance of Depot-Level Maintenance and Repair</i> report, focusing on the future role of defense depots, the adequacy of the policy's content, and the inconsistency of DoD's policy with current statutes and congressional direction on the use of public-private competitions. There are no recommendations listed in this report.</p>

Table C-6. Reports Relevant to Consolidation and Centralization of Depot Workload

Report no.	Report title	Summary and recommendations
GAO-01-19	<i>Depot Maintenance: Key Financial Issues for Consolidations at Pearl Harbor and Elsewhere Are Still Unresolved</i>	<p>This report updates an earlier GAO report and discusses whether the Navy has provided adequate cost visibility, if DoD and the Navy have resolved financial issues for consolidations at Pearl Harbor and elsewhere, and if the consolidation has generated greater efficiency and lower costs. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ implement a method to account for the total cost of consolidated ship maintenance operations and to distinguish between depot and intermediate work of consolidated ship maintenance activities;</li> <li>◆ clarify DoD financial management regulations; and</li> <li>◆ develop additional metrics to measure the efficiency and effectiveness of consolidated ship maintenance activities.</li> </ul>
NSIAD-00-20	<i>Depot Maintenance: Army Report Provides Incomplete Assessment of Depot-Type Capabilities</i>	<p>GAO reviews an Army's report on the proliferation of depot maintenance activities at nondepot facilities, and identifies the total amount and cost of depot maintenance-type work and addresses plans to consolidate maintenance operations. GAO recommends to ensure that the strategic plans DoD should</p> <ul style="list-style-type: none"> <li>◆ identify requisite action items, timeframes, and funding requirements for improving the Army's information management systems; and</li> <li>◆ incorporate the depot maintenance-type capabilities of both active and reserve components.</li> </ul>
NSIAD-97-157	<i>Defense Infrastructure: Inventory Control Point Consolidation Savings Would be Substantial</i>	<p>From the DoD using conservative assumptions and cost factors in estimating savings from consolidating inventory control points, the cost savings projected would be \$2.2 billion to \$3.8 billion from FY1998–2010. GAO believes this is a reasonable estimate and approach. There are no recommendations listed in this document.</p>
NSIAD-98-4	<i>Navy Regional Maintenance: Substantial Opportunities Exist to Build on Infrastructure Streamlining Progress</i>	<p>The Navy has made progress in infrastructure streamlining, but the progress has not been as good as anticipated. Challenges remain for accomplishing its future plans. It mainly had started less controversial initiatives by the end of FY1997 and has difficulties tracking savings from the program. It could save additional millions by consolidating additional intermediate- and depot-level bases that were not in current plans. Accomplishing the infrastructure streamlining objective will be difficult due to (1) parochial and institutional resistance; (2) the lack of management visibility; (3) multiple, unconnected management information systems; and (4) the large number of shore positions desired to support the sea-to-shore rotation program. There are no recommendations listed in this document.</p>
NSIAD-99-199	<i>Depot Maintenance: Status of the Navy's Pearl Harbor Pilot Project</i>	<p>The Pearl Harbor pilot has sharpened the debate over the most appropriate financial and organizational structures for such consolidated activities. this program shows mixed results, but when data are available, it seems the pilot has the potential to improve maintenance activities in Hawaii. Unfortunately, Pearl Harbor has unique characteristics that make it hard to generalize to other consolidation efforts. GAO recommends that the Navy take steps to address unresolved issues related to financial and organizational structures as it proceeds with similar consolidations.</p>

*Table C-7. Reports Relevant to Maintenance Information Technology Systems*

Report no.	Report title	Summary and recommendations
GAO-03-21	<i>Army Logistics: Report on Manpower and Workload System Inadequate and System Interface Untested</i>	<p>The Army developed the Army Workload and Performance System (AWPS) to address a number of specific weaknesses highlighted in GAO and Army reports. In 2002, an Army report on the system did not provide adequate information to fully assess the system's implementation. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ submit to Congress annual progress reports on the implementation of AWPS;</li> <li>◆ ensure the progress reports contain detailed cost, schedule, and performance information;</li> <li>◆ undertake a review of the interface between AWPS and the Logistics Modernization Program; and</li> <li>◆ ensure the data-sharing mechanisms between the Logistics Modernization Program and AWPS are complete.</li> </ul>
GAO-05-858	<i>Navy ERP Adherence to Best Business Practices Critical to Avoid Past Failures</i>	<p>GAO provides a historical perspective on planning and costs of the Navy's Enterprise Resource Planning (ERP) pilot projects. In addition, GAO determines if the Navy has identified lessons from the pilots, their challenges, and how they are being used, and if there are other best business practices that would be beneficial for management oversight. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ develop and implement the quantitative metrics needed to evaluate project performance and risks;</li> <li>◆ establish an IV&amp;V function and direct that all IV&amp;V reports be provided to Navy management; and</li> <li>◆ institute semiannual reviews of the ERP system to ensure that the project continues to follow the disciplined processes and meets its intended costs, schedule, and performance goals.</li> </ul>

*Table C-8. Reports Relevant to Materiel Readiness and Performance Goals*

Report no.	Report title	Summary and recommendations
GAO-01-18	<i>Defense Logistics: Unfinished Actions Limit Reliability of the Munitions Requirements Determination Process</i>	<p>Because the military uses a multiphase analytical process to evaluate munitions requirements, DoD works to ensure that it yields accurate results. Although DoD has identified specific areas requiring attention, there is still no clear time frame for resolving key issues. Consequently, the reliability and accuracy of the munitions requirements remains uncertain. GAO recommends establishing a plan for resolving issues, such as time frames.</p>

Table C-8. Reports Relevant to Materiel Readiness and Performance Goals

Report no.	Report title	Summary and recommendations
GAO-01-425	<i>Defense Inventory: Army War Reserve Spare Parts Requirements Are Uncertain</i>	<p>GAO discusses that because of limitations in the Army's process for war reserve spare parts requirements, the accuracy of the requirements and funding needs are uncertain. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ assess the level of risk associated with the Army's plans for addressing the shortfall in Army war reserve spare parts;</li> <li>◆ develop the best available consumption factors in calculating all spare parts requirements for the Army's war reserve;</li> <li>◆ eliminate potential mismatches in how the Army calculates its war reserve spare parts requirements and planned battlefield maintenance practices; and</li> <li>◆ include in future industrial capabilities reports more comprehensive assessments on industry's ability to supply critical spare parts for two major theater wars.</li> </ul>
GAO-01-533T	<i>Sustaining Readiness Support Capabilities Requires a Comprehensive Plan</i>	<p>As GAO's has already noted, logistics activities represent a key management challenge. Maintenance is an important part of those activities, and DoD is at a critical point with respect to the future of its maintenance programs and it is linked to its overall logistics strategic plan. There are no recommendations listed in this document.</p>
GAO-01-630	<i>Defense Logistics: Information on Apache Helicopter Support and Readiness</i>	<p>GAO examines selected logistics, funding, and readiness issues pertaining to the AH-64 Apache helicopter program. There are no recommendations listed in this document.</p>
GAO-01-771	<i>Parts Shortages Are Impacting Operations and Maintenance Effectiveness</i>	<p>This report reviews the impact of shortages of spare parts for 2 specific aircraft, the reasons for these shortages, and the initiatives in place to address spare part shortage issues. There are no recommendations listed in this document.</p>
GAO-03-300	<i>Military Readiness DOD Needs a Clear and Defined Process for Setting Aircraft Availability Goals in the New Security Environment</i>	<p>GAO examines whether key DoD aircraft have been able to meet "mission capable" (MC) and "full mission capable" (FMC) goals in recent years, and DoD's process for setting aircraft availability goals. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ determine whether different types of aircraft availability goals are needed; and</li> <li>◆ validate the basis for the existing MC and FMC goals.</li> </ul>
GAO-03-705	<i>The Army Needs a Plan to Overcome Critical Spare Parts Shortages</i>	<p>GAO evaluates the Army's strategic plans for reducing spare parts shortages, the likelihood that key initiatives will reduce shortages, and the Army's capability to identify the impact of increased investments for spare parts. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ modify or supplement the Transformation Campaign Plan or the Army wide initiatives to include a focus on mitigating critical spare parts shortages; and</li> <li>◆ implement, with a specific completion milestone, the Office of the Secretary of Defense's recommendation to report the impact of parts funding on equipment readiness.</li> </ul>

Table C-8. Reports Relevant to Materiel Readiness and Performance Goals

Report no.	Report title	Summary and recommendations
GAO-03-706	<i>Defense Inventory: Air Force Plans and Initiatives to Mitigate Spare Parts Shortages Need Better Implementation</i>	<p>GAO examines whether the Air Force's strategic plan addresses the mitigation of spare parts shortages, whether key initiatives are likely to mitigate them, and the impact on readiness identified from increased investments for spare parts. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ Incorporate the Air Force Strategic Plan's performance measures and targets into the subordinate Logistics Support Plan and the Supply Strategic Plan</li> <li>◆ Commit to start the remaining initiatives which address the causes of spare parts shortages</li> <li>◆ Establish plans for improving management of logistics initiatives</li> <li>◆ Request spare parts funds in the Air Force's budget consistent with results of its spare parts requirements determination process.</li> </ul>
GAO-03-707	<i>The Department Needs a Focused Effort to Overcome Critical Spare Parts Shortages</i>	<p>GAO examines whether DoD's logistics strategic plan address the mitigation of spare parts shortages, DoD's logistics initiatives are likely to mitigate spare parts shortages, and DoD can identify the effect on readiness of increased investments of spare parts. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ incorporate clear goals, objectives, and performance measures pertaining to mitigating spare parts shortages in the future logistics enterprise; and</li> <li>◆ establish milestones and define how it will measure progress in implementing the recommendations related to mitigating critical spare parts shortages.</li> </ul>
GAO-05-275	<i>Actions Needed to Improve the Availability of Critical Items during Current and Future Operations</i>	<p>GAO expands on a previous report about the Operations Iraqi Freedom (OIF) logistics support including shortages of spare parts and supplies in Iraq. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ provide information that discloses the risks associated with not fully funding the Army war reserve;</li> <li>◆ improve the accuracy of its wartime supply requirements forecasting process; and</li> <li>◆ establish common supply information systems.</li> </ul>
GAO-06-604T	<i>Preliminary Observations on Equipment Reset Challenges and Issues for the Army and Marine Corps</i>	<p>Based on equipment-related GAO reports issued during fiscal years 2004 through 2006 and ongoing work, GAO addresses the reset environment, maintenance consequences created by equipping and maintenance strategies, and challenges affecting the Army and Marine Corps equipment reset. There are no recommendations listed in this document.</p>
GAO-07-582T	<i>Operation Iraqi Freedom: Preliminary Observation on Iraqi Security Forces Logistical Capabilities</i>	<p>This is a testimony that addresses the current state of ISF's logistical capabilities and the challenges the ISF is facing to achieve logistical self-sufficiency. There are no recommendations listed in this document.</p>
IMTEC-89-67	<i>Computer Procurement: Hardware Upgrades for Navy Inventory Control System Should be Delayed</i>	<p>GAO reviews the Navy's plans for a \$22.1-million upgrade to its Uniform Inventory Control Point System (UICP). There are no recommendations listed in this document.</p>

Table C-9. Reports Relevant to Operational Contingencies Impact on Depot Maintenance

Report no.	Report title	Summary and recommendations
GAO-02-306	<i>Defense Logistics: Opportunities to Improve the Army's and Navy's Decision-making Process for Weapons Systems Support</i>	DoD believes that better logistics contractor support could cut weapon systems costs by 20 percent, but there are obstacles including some services' lack of data, DoD Regulation 5000.2 prohibiting only private-sector work, and different support approaches for each of the services. DoD and the services have yet to resolve these issues. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ add more detailed quantification of the life-cycle support costs and alternative support approaches before making logistics decision for a weapon system;</li> <li>◆ develop a requirement to ensure that weapons systems acquisition program offices retain the documentation of analyses used to support the initial life-cycle logistics support decisions;</li> <li>◆ require the Army and Navy report to the SecDef to address operating commands issues; and</li> <li>◆ take actions to enforce the requirement in DoD 5000.2-R related to the acquisition of technical data rights to foster source of support competition throughout the life cycle.</li> </ul>
GAO-07-439T	<i>Preliminary Observations on the Army's Implementation of Its Equipment Reset Strategies</i>	GAO addresses the extent to which the Army is able to track and report equipment reset expenditures and if the equipment reset strategies will sustain future readiness for deployed and non-deployed units. There are no recommendations listed in this document.
GAO-09-1022R	<i>Overseas Contingency Operations: Reported Obligations for the Department of Defense</i>	In this letter, GAO reports on financing for overseas contingency operations between FY2001 and FY2009. There are no recommendations listed in this document.
T-NSIAD-00-206	<i>Defense Logistics: Integrated Plans and Improved Implementation Needed to Enhance Engineering Efforts</i>	This testimony summarizes the June 2000 report, GAO/NSIAD-00-89 on factors, if not addressed, could limit DoD's ability to achieve its reengineering goals, such as the impact of sole-source, long-term contracts. There are no recommendations listed in this document.

Table C-10. Reports Relevant to PBL

Report no.	Report title	Summary and recommendations
GAO-05-966	<i>Defense Management: DOD Needs to Demonstrate That Performance-Based Logistics Contracts Are Achieving Expected Benefits</i>	GAO reviews the implementation of performance-based logistics arrangements for 15 weapon system programs. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ reaffirm its guidance that program offices update their business case analyses following implementation of a performance-based logistics arrangement; and</li> <li>◆ direct program offices to improve their monitoring of performance-based logistics arrangements by verifying the reliability of contractor cost and performance data.</li> </ul>

Table C-10. Reports Relevant to PBL

Report no.	Report title	Summary and recommendations
GAO-09-41	<i>Defense Logistics: Improved Analysis and Cost Data Needed to Evaluate the Cost-effectiveness of Performance Based Logistics</i>	<p>GAO evaluates the extent to which DoD has used business case analyses to make PBL decisions and the impact they have on weapon support costs. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ revise its acquisition directive to require a business case analysis supporting a decision-making proves regarding weapon system support alternatives, such as PBL;</li> <li>◆ collect and report cost data for PBL arrangements in a standardized format;</li> <li>◆ require each service to revise guidance to implement internal controls to ensure sound and comprehensive business case analyses; and</li> <li>◆ revise PBL business case analysis guidance to more clearly define when business case analyses should be updated.</li> </ul>

Table C-11. Reports Relevant to Proprietary Technical Data

Report no.	Report title	Summary and recommendations
GAO-01-618	<i>Air Force Lacks Data to Assess Contractor Logistics Support Approaches</i>	<p>The Air Force's limited experience in repairing the same aircraft in both the public and private sectors and the lack of comparable financial data make it difficult to assess the cost-effectiveness of private versus public repair facilities. GAO recommends directing the Secretary of the Air Force to enhance accountability over logistics support decisions.</p>
GAO-02-650	<i>Defense Inventory: Improved Industrial Base Assessments for Army War Reserve Spares Could Save Money</i>	<p>The Army's approach for assessing wartime spare parts industrial base capability still does not use current data from industry. Instead, the Army uses historical parts procurement data of unsuccessful attempts to collect industry data. Opportunities exist to improve the Army's industrial base capability assessments, and GAO recommends creating management strategies for improving wartime spare parts availability that can save money, improve readiness, and provide more realistic budget requests. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ establish an overarching industrial base capability assessment process that considers the attributes in this report;</li> <li>◆ develop a method to efficiently collect current industrial base capability data directly from industry;</li> <li>◆ create analytical tools that identify potential production capability problems such as those due to surge in wartime spare parts demand; and</li> <li>◆ create management strategies for resolving spare parts availability problems, for example, by changing acquisition procedures or by targeting investments in material and technology resources to reduce production lead times.</li> </ul>

Table C-11. Reports Relevant to Proprietary Technical Data

Report no.	Report title	Summary and recommendations
GAO-05-687	<i>Defense Ammunition: DOD Meeting Small and Medium Caliber Ammunition Needs, but Additional Actions Are Necessary</i>	<p>Because the success of military operations depends in part on DOD having a sufficient national technology and industrial base to meet its ammunition needs, Congress asked GAO to review DOD's ability to assess if its supplier base can meet small and medium caliber ammunition needs. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ ensure that needed information on planned ammunition procurements is provided to the program executive officer for ammunition; and</li> <li>◆ identify and provide key resources and develop metrics for measuring annual progress in meeting planned goals and objectives.</li> </ul>
GAO-06-839	<i>Weapons Acquisition: DoD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems</i>	<p>GAO recommends DOD consider requiring program offices to develop acquisition strategies that provide for future delivery of technical data should the need arise to select an alternative source for logistics support or to offer the work out for competition. GAO further recommends DoD</p> <ul style="list-style-type: none"> <li>◆ assess long-term technical data needs and establish corresponding acquisition strategies that provide for technical data rights needed to sustain weapon systems over their life cycle; and</li> <li>◆ incorporate these policy changes into DoD Directive 5000.1 and DoD Instruction 5000.2.</li> </ul>

Table C-12. Reports Relevant to Public-Private Partnerships

Report no.	Report title	Summary and recommendations
GAO-03-423	<i>Depot Maintenance: Public-Private Partnerships Have Increased, but Long-Term Growth and Results Are Uncertain</i>	<p>GAO assesses the extent that DoD participates in these partnerships, the characteristics needed to achieve effective partnerships, and management challenges in DoD's planned expansion of partnerships. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ establish baseline data and overarching goals for expected outcomes of partnership efforts;</li> <li>◆ provide a more complete basis to assess the results of the depot partnering arrangements;</li> <li>◆ require specific assessment and planning for new capability in military depots where partnership arrangements for new systems are expected; and</li> <li>◆ assess the likelihood of private-sector investment in new systems capability in military depots.</li> </ul>
GAO-08-902R	<i>Depot Maintenance: DoD's Report to Congress on Its Public-Private Partnerships at Its Centers of Industrial and Technical Excellence (CITEs) Is Not Complete and Additional Information Would Be Useful</i>	<p>GAO assesses the completeness of a report that DoD wrote that encourages public-private partnerships, and determines if the six reporting elements in the report were described fully and if DoD could have added more information to make it more useful. GAO recommends considering having DoD provide information on implementation challenges along with planned use of public-private partnerships to sustain core capabilities.</p>

Table C-13. Reports Relevant to Relevant Applicable Laws, Regulations and Business Policies

Report no.	Report title	Summary and recommendations
GAO-07-860	<i>Lack of an Integrated Strategy Puts the Army's Asset Visibility System Investments at Risk</i>	<p>DoD has been unable to achieve total asset visibility, so GAO was requested to determine if the Army has a systems strategy for achieving it, if the Army's business system investment governance structure is consistent with DoD guidance, and to evaluate the effort to correct the previously reported problems with the Logistics Modernization Program (LMP). GAO recommends DoD develop</p> <ul style="list-style-type: none"> <li>◆ a concept of operations that defines the enterprise resource planning (ERP) vision for accomplishing TAV, addresses how its business systems will provide the desired functionality to achieve it, and determines the desired functionality among the selected systems; and</li> <li>◆ policies to support the oversight of selected groupings of business systems.</li> </ul>
GAO-08-134	<i>Additional Management Actions Needed to Meet Key Performance Goals of DOD's Chemical Demilitarization Program</i>	<p>GAO evaluates the Chemical Demilitarization Program, which makes sure that the destruction of the nation's remaining chemical weapons is done in a safe, efficient, and timely manner to reduce the risk of a catastrophic event. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ incorporate baseline and trend data for past and multiyear performance goals for the future in its annual performance plan;</li> <li>◆ develop interim destruction goals, approaches, and milestones directly linked to overall program goals for meeting chemical weapons convention deadlines;</li> <li>◆ establish a time frame for completing and implementing its risk management approach across sites and with DoD; and</li> <li>◆ update the 2005 program schedule milestones for each of DOD's chemical demilitarization sites.</li> </ul>
GAO-08-264	<i>Navy Is Making Progress Implementing Its Fleet Response Plan, but Has Not Fully Developed Goals, Measures, and Resource Needs</i>	<p>GAO was asked to examine the extent to which the Navy has made progress in implementing a sound management approach for its Fleet Response Plan (FRP) and evaluated the long-term risks of FRP-related changes. GAO recommends the Navy</p> <ul style="list-style-type: none"> <li>◆ establish implementation goals for the application of FRP to other forces;</li> <li>◆ establish required overall readiness levels for each FRP phase in its readiness reporting system;</li> <li>◆ develop measures that identify acceptable levels of performance and scope; and</li> <li>◆ identify how resources should be linked to the FRP phases, goals, and readiness levels.</li> </ul>

Table C-13. Reports Relevant to Relevant Applicable Laws, Regulations and Business Policies

Report no.	Report title	Summary and recommendations
NSIAD-00-72	<i>Defense Management: Actions Needed to Sustain Reform Initiatives and Achieve Greater Results</i>	<p>According to this report, the reform initiative could be more effective if the Defense Management Council would work collaboratively to foster Department-wide solutions, establish reform priorities, and exert authority to make key decisions. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ establish a more comprehensive strategy for reforming the Department's major business processes and support activities;</li> <li>◆ more fully identify investment funding requirements for the major reform initiatives;</li> <li>◆ strengthen the role and effectiveness of the Defense Management Council; and</li> <li>◆ strengthen the council's decision-making role, authority, and accountability.</li> </ul>

Table C-14. Reports Relevant to Reliability-Centered Maintenance

Report no.	Report title	Summary and recommendations
GAO-07-81R	<i>Plan for Implementing a Reliability Centered Maintenance Process for Air Traffic Control Equipment</i>	GAO analyzes the Federal Aviation Administration's (FAA) plans to develop an RCM process and the impact of their plans. There are no recommendations listed in this document.

Table C-15. Reports Relevant to Reporting Requirements and Budgetary Guidelines

Report no.	Report title	Summary and recommendations
GAO-01-1084SP	<i>Results-Oriented Budget Practices in Federal Agencies</i>	GAO analyzes federal government budget practices to produce a framework for agency budget practices, along with reviewing challenges in implementing results-oriented budget practices. There are no recommendations listed in this document.
GAO-01-33	<i>Future Years Defense Program: Risks in Operation and Maintenance and Procurement Programs</i>	This report summarizes GAO's findings on DoD's Future Years Defense Program (FYDP), such as identification of several areas in which its costs may be under- or overstated, leading to increased risk of the next FYDP having to shift funds to different accounts. There are no recommendations listed in this document.
GAO-02-538T	<i>Budget and Management Challenges for 2003 and Beyond</i>	Because of the events of September 11, 2001, the Coast Guard has made a shift of effort, and thus funding, towards homeland security and away from other mission areas. Therefore, there have been many challenges to overcome this obstacle to maintain the other mission areas' capabilities. There are no recommendations listed in this document.

Table C-15. Reports Relevant to Reporting Requirements and Budgetary Guidelines

Report no.	Report title	Summary and recommendations
GAO-02-623	<i>Air Force Depot Maintenance: Management Improvements Needed for Backlog of Funded Contract Maintenance Work</i>	<p>GAO is required to review Defense Working Capital Funding to carry over a 3-month level of work from one fiscal year to the next, but the reported carryover balances from 2000 and 2001 were inaccurate. GAO analyzes the reasons for these errors and recommends DoD</p> <ul style="list-style-type: none"> <li>◆ use the date contractors actually start work, rather than the planned start date, to calculate work-in-process for all workload categories;</li> <li>◆ identify underlying causes of the contract depot maintenance “awaiting parts” problem;</li> <li>◆ provide clear guidance on how, when, and by whom the induction of assets should be monitored; and</li> <li>◆ establish internal control procedures to ensure that the guidance on the induction of assets is followed.</li> </ul>
GAO-03-274	<i>Defense Infrastructure: Changes in Funding Priorities and Strategic Planning Needed to Improve the Condition of Military Facilities</i>	<p>In response to its basic legislative responsibilities, GAO prepares a report with the objectives being to examine historical funding trends, evaluate the consistency of the services’ information on facility conditions, and to assess DoD’s long-term strategic plan. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ reassess the funding priorities;</li> <li>◆ implement a department-wide process to consistently assess facility conditions;</li> <li>◆ identify specific elements of a comprehensive strategic plan; and</li> <li>◆ develop comprehensive performance plans implementing the Defense Facilities Strategic Plan.</li> </ul>
GAO-03-5	<i>Organization for the Prohibition of Chemical Weapons Needs Comprehensive Plan to Correct Budgeting Weaknesses</i>	<p>Because of concerns about the effectiveness of management of the Chemical Weapons Convention, which bans the use of chemical weapons, GAO assesses the accuracy of the organization’s budget, its shortfalls, and efforts to improve budget planning. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ develop a comprehensive plan to improve the organization’s budgetary practices; and</li> <li>◆ annually report on the extent to which the Organization for the Prohibition of Chemical Weapons (OPCW) is correcting its budgeting weaknesses and implementing recommendations.</li> </ul>
GAO-04-439T	<i>OMB’s Program Assessment Rating Tool Presents Opportunities and Challenges For Budget and Performance Integration</i>	<p>GAO discusses a recent report by the Office of Management and Budget’s Program Assessment Rating Tool (PART) and strategies for improving PART. There are no recommendations listed in this document.</p>

Table C-15. Reports Relevant to Reporting Requirements and Budgetary Guidelines

Report no.	Report title	Summary and recommendations
GAO-04-498	<i>Air Force Depot Maintenance: Improved Pricing and Cost Reduction Practices Needed</i>	<p>In response to the Air Force depot maintenance activity group in-house operations generating \$5 billion in reparations of assets, GAO determines what factors caused the price increase, if the prices were accurate, and if the Air Force has taken steps to improve control of the costs. GAO recommends: Congress and Secretary of Defense may wish to take action to reduce the amount of excess cash in the Air Force Working Capital Fund• To develop prices that cover the total costs of providing goods and services to customers and not constrain prices. To develop and complete a viable method for analyzing material cost variances that encompasses both the price paid for material and material usage. To determine the actual savings as compared to the costs from the improvement initiatives already contained in the repository</p>
GAO-04-514	<i>Actions Needed to Improve Transparency of DOD's Projected Resource Needs</i>	<p>GAO assesses the extent to which the FYDP provides Congress visibility over projected defense spending and implementation of DOD's capabilities-based defense strategy and risk management framework. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ provide congress more data in FY2005 and beyond on known or likely costs of operations; and</li> <li>◆ enhance the FYDP as a tool in the new strategic environment.</li> </ul>
GAO-05-441	<i>Army Depot Maintenance: Ineffective Oversight of Depot Maintenance Operations and System Implementation Efforts</i>	<p>GAO determines if the Army depot maintenance activity group's prices charged have increased, how it allocates gains or losses incurred at the individual depot level, and if the group exceeded its allowable carryover ceilings. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ allocate depot gains and losses to the individual depots;</li> <li>◆ develop a systematic process for analyzing the depot maintenance activity group's material cost increases to specifically identify and quantify all material cost drivers;</li> <li>◆ clarify DOD's written guidance for calculating carryover; and</li> <li>◆ continue to comply with DOD's policy on not exceeding the year-end ceilings on the amount of year-end carryover ceilings.</li> </ul>
GAO-05-556	<i>Defense Infrastructure: Issues Need to Be Addressed in Managing and Funding Base Operations and Facilities Support</i>	<p>This report addresses the historical funding trends for base operations support (BOS) compared with facilities funding, how effective the forecasting of BOS requirements has been, and how the Army's and Navy's reorganizations for managing installations have affected support services. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ update its Defense Installations Strategic Plan to include specific actions and establish time frames; and</li> <li>◆ expedite the development of an analytically sound model for determining BOS requirements.</li> </ul>
GAO-07-304	<i>Military Base Closures: Projected Savings from Fleet Readiness Centers Likely Overstated and Actions Needed to Track Actual Savings and Overcome Certain Challenges</i>	<p>GAO's objectives are to analyze the reasons for changes in costs estimates since BRAC's recommendation to establish fleet readiness centers to yield savings, and to identify challenges in implementing the BRAC recommendation. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ update the business plan for the fleet readiness centers and</li> <li>◆ monitor implementation of the recommendation.</li> </ul>

Table C-15. Reports Relevant to Reporting Requirements and Budgetary Guidelines

Report no.	Report title	Summary and recommendations
GAO-07-814	<i>Army and Marine Corps Cannot Be Assured That Equipment Reset Strategies Will Sustain Equipment Availability While Meeting Ongoing Operational Requirement</i>	GAO initiates a review that tries to determine the extent to which the Army and Marine Corps report equipment reset expenditures and that reset strategies will sustain equipment availability while meeting operational requirements. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ amend the <i>Financial Management Regulation</i> and</li> <li>◆ assess approaches to equipment reset to ensure that the priorities address equipment shortages in the near term.</li> </ul>
GAO-08-159	<i>Cost Estimates Have Increased and Are Likely to Continue to Evolve</i>	GAO compares BRAC Commission's cost and savings estimates to DoD's current estimates, assesses potential for change in DoD's current estimates, and identifies broad implementation challenges. GAO recommends explaining the difference between annual recurring savings attributable to military personnel entitlements and annual recurring savings that will result in funds available for other defense priorities.
GAO-08-502	<i>Defense Infrastructure: Continued Management Attention Is Needed to Support Installation Facilities and Operations</i>	GAO reviews and discusses the support installation facilities and operations because it is identified as a high-risk area and affects DoD's ability to devote funds to other more critical needs. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ monitor and ensure compliance with guidance requiring verification of real property inventory records;</li> <li>◆ maintain documentation regarding the basis for the sustainment cost factors;</li> <li>◆ revert to the previously used ratio analysis method to calculate the values of those sustainment cost factors not based on independent data sources; and</li> <li>◆ establish a milestone for implementing the installation services model for use in estimating DoD's installation services funding requirements</li> </ul>
GAO-08-669T	<i>Restructuring and Rebuilding the Army Will Cost Billions of Dollars for Equipment but the Total Cost Is Uncertain</i>	GAO addresses equipment-related costs of Army initiatives to support ongoing operations and prepare for the future and the management challenges facing the Army. There are no recommendations listed in this document.
NSIAD-00-163	<i>Progress in Financial Management Reform</i>	This testimony outlines the most difficult DoD's financial management challenges and describes the initiatives that are in place or planned to deal with them. There are no recommendations listed in this document.
NSIAD-00-179	<i>Comparison of Planned Funding Levels for the 2000 and 2001 Programs</i>	GAO compares the planning levels for FYDP estimated funding requests for FY2000–2001. There are no recommendations listed in this document.

Table C-15. Reports Relevant to Reporting Requirements and Budgetary Guidelines

Report no.	Report title	Summary and recommendations
NSIAD-00-185	<i>Air Force Depot Maintenance: Budgeting Difficulties and Operational Inefficiencies</i>	GAO recommends ways for the Air Force to deal with inaccurate pricing, decline in worker productivity, and unrealized projected savings, and to improve budget estimates and management of material costs and usage. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ develop a method to estimate the impact of price changes on the funding requirements of individual customers;</li> <li>◆ develop a systematic process to analyze variances between depot maintenance activities' expected and actual material usage;</li> <li>◆ develop a mechanism that will enable the depot maintenance activity group to periodically revise the competed workload baseline cost estimates; and</li> <li>◆ use the revised baseline cost estimates and actual operating results as a basis for updating projected savings.</li> </ul>
NSIAD-00-197	<i>Higher Priority Needed for Army Operating and Support Cost Reduction Efforts</i>	This report addresses the effectiveness of the Army's efforts to reduce the operating and support costs for weapons systems under development and fielded weapon systems. GAO recommends DoD <ul style="list-style-type: none"> <li>◆ establish operating and support cost requirements for developmental and fielded systems;</li> <li>◆ develop a more accurate accounting system of each weapon system's operating and support costs; and</li> <li>◆ provide the necessary funding and staffing to establish the Total Ownership Cost Directorate</li> </ul>
NSIAD-00-264	<i>Implications of Financial Management Issues</i>	GAO assesses DoD's material financial management weaknesses which continue to be the single largest obstacle in achieving an unqualified opinion on the U.S. government's consolidated financial statements. There are no recommendations listed in this report.
NSIAD-00-38	<i>Air Force Depot Maintenance: Analysis of Its Financial Operations</i>	GAO reports on the reasons for the Air Force activity group's price increase between FY1994–1999, the reasons for their financial losses, and the methods used for recovering the losses. There are no recommendations listed in this document.

Table C-16. Reports Relevant to Supply Chain Management

Report no.	Report title	Summary and recommendations
GAO-06-113T	<i>DoD's High-Risk Areas: High-Level Commitment and Oversight Needed for DoD Supply Chain Plan to Succeed</i>	With the intent of possibly removing supply chain management from the list of high-risk areas, DoD developed a plan to remove some of its systemic weaknesses, focusing on improving the accuracy of the forecasts, distribution of material, and asset visibility. GAO reports its views on the importance of supply chain management in DoD, why it is listed as a high-risk area; it's assessment of DoD's plan to improve supply chain processes, and GAO's plans to follow up DoD's efforts. There are no recommendations listed in this document.

*Table C-16. Reports Relevant to Supply Chain Management*

Report no.	Report title	Summary and recommendations
GAO-07-234	<i>Progress Made Implementing Supply Chain Management Recommendations, but Full Extent of Improvement Unknown</i>	<p>Due to the supply chain being so critical in battlefield operations and allocating resources, DoD prepared an improvement plan. GAO was asked to monitor the implementation of the plan and DoD's progress toward improving supply chain management. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ develop a comprehensive, integrated logistics strategy aligned with other defense business transformation efforts; and</li> <li>◆ implement outcome-focused performance and cost metrics for all the initiatives in the supply chain management improvement plan.</li> </ul>

*Table C-17. Reports Relevant to Workforce Skills*

Report no.	Report title	Summary and recommendations
GAO-03-472	<i>DOD Civilian Personnel: Improved Strategic Planning Needed to Help Ensure Viability of DOD's Civilian Industrial Workforce</i>	<p>GAO identifies shortcomings in DoD's strategic planning and was asked to determine whether DoD has implemented a depot maintenance strategic plan, the extent to which the services have developed and implemented strategic workforce plans, and the challenges facing DoD's workforce planning. GAO recommends DoD</p> <ul style="list-style-type: none"> <li>◆ complete the revisions to DoD's core policy;</li> <li>◆ develop and implement strategic plans that are linked to the services' mission and objectives and provide guidance for private sector long-term capabilities;</li> <li>◆ develop strategic workforce plans that include improvements in areas identified as deficient; and</li> <li>◆ implement an initiative to provide guidance for developing workforce revitalization strategies and strategic plans to address expected depot attrition over the next 5–7 years, provide options for incorporating multiskilling into the workforce, and to explore funding alternatives.</li> </ul>

# Appendix D

## Abbreviations

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A <sub>o</sub>	operational availability
ACAT	acquisition category
ACWT	average customer wait time
AD	Army depot
ADPE	automated data processing equipment
AFB	Air Force base
AFMC	Air Force Materiel Command
AFP	appropriated fund purchases
AIMD	aircraft intermediate maintenance detachments
ALC	air logistics center
AMARG	Aerospace Maintenance and Regeneration Group
AMC	Army Materiel Command
BES	budget estimate submission
BRAC	Base Closure and Realignment Commission
BSO	budget submitting office
CBM	condition-based maintenance
CBO	Congressional Budget Office
CIRF	centralized intermediate repair facilities
CITE	center of industrial and technical excellence
CLS	contractor logistics support
CNAF	Commander, Naval Air Forces
COMFRC	Commander Fleet Readiness Command
CONUS	continental United States
COTS	commercial off-the-shelf
CPI	continuous process improvement
DAS	Defense Acquisition System
DAU	Defense Acquisitions University
DLA	Defense Logistics Agency

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DLH	direct labor hour
DLR	depot-level reparable
DMCS	Depot Maintenance Cost System
DMDC	Defense Manpower Data Center
DM-WIPT	Depot Maintenance Working Integrated Process Team
DoDD	DoD directive
DoDI	DoD instruction
DSOR	depot source of repair
DWCF	Defense Working Capital Fund
DWCF CIP	Defense Working Capital Fund Capital Investment Program
ECM	Electronic countermeasure
ERP	enterprise resource planning
FMR	Financial Management Regulation
FRC	fleet readiness center
FSRM	Facilities sustainment, restoration, and modernization
FYDP	Future Years Defense Plan
GAO	Government Accountability Office
GPRA	The Government Performance Results Act
HASC	House Armed Services Committee
HMMWV	high mobility multipurpose wheeled vehicle
IMF	intermediate maintenance facility
IT	information technology
JCIDS	Joint Capability Improvement and Development System
KPP	key performance parameter
LORA	level-of-repair analysis
LVS	logistical vehicle system
MA	materiel availability
MDT	mean downtime
MILCON	military construction
MILDEP	military department
MR	materiel reliability
MRAP	mine-resistant, ambush protected

MRO	maintenance, repair, and overhaul
MSC	Military Sealift Command
MTBF	mean time between failures
MTTR	mean time to repair
MTWV	motorized, two-wheeled vehicle
NADEP	naval air depot
NATO	North Atlantic Treaty Organization
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NDAA	National Defense Authorization Act
NSY	Navy shipyard
O&M	operations and maintenance
OC	ownership costs
ODUSD(L&MR)	Office of the Under Secretary of Defense for Logistics and Materiel Readiness
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OMB	Office of Management and Budget
OPTEMPO	operations tempo
OSD	Office of the Secretary of Defense
PBD	program budget decision
PBL	performance-based logistics
PDM	program decision memorandum
PE	program executive
PM	program manager
POM	program objectives memorandum
PPBE	programming, planning, budgeting, and execution
PPBES	Programming, Planning, Budgeting and Execution System
PSI	product support integrator
PSM	product support manager
QDR	Quadrennial Defense Review
RCM	reliability-centered maintenance
RCV	route clearance vehicles

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RDT&E	research, development, testing, and evaluation
SAG	subactivity group
SASC	Senate Armed Services Committee
SCM	supply chain management
SIM	serialized item management
TMS	type/model/series
UAS	unmanned aerial systems
USC	U.S. Code
USD(AT&L)	Under Secretary of Defense for Acquisitions, Technology and Logistics
USSOCOM	U.S. Special Operations Command
USTRANSCOM	U.S. Transportation Command
WBS	work breakdown structure
WPC	work performance category

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