
Introduction

The collapse of the Soviet threat and declines in the resources available for national defense have led the United States to rapidly decrease the size of its military forces. As that drawdown nears completion, policymakers are increasingly free to focus on fundamental questions about the roles and missions of the military services in the post-Cold War era. Among the issues to be resolved are the appropriate roles of the public and private sectors in maintaining military equipment at the depot level.

Depot-level maintenance consists of overhauls, repairs, and modifications that can be performed more efficiently at centralized industrial facilities than at each combat installation where military units train. In 1995, the Department of Defense (DoD) plans to spend almost \$13 billion on such maintenance. It will spend over \$9 billion, or approximately 70 percent of the total, for work performed by 95,000 DoD civilian and military personnel in 30 government-owned maintenance depots.¹ It will pay the remaining 30 percent for services that firms in the private sector supply.² In 1993, funds obligated by

DoD for maintaining equipment went to more than 1,200 private contractors. (The number of contractors takes in those that perform maintenance at the organizational and intermediate levels as well as at the depot level, as discussed in Box 1.)

DoD has divided depot-level maintenance between the public and private sectors in roughly that same proportion since at least the mid-1980s. Under the department's current plans, the end of the Cold War will not change that pattern. (Between 1991 and 1999, DoD's plans call for public and private workloads to decline by roughly 30 percent each; see Figure 1.) The unchanged mix is consistent with departmental policies that emphasize the importance of a controlled, in-house source of maintenance for equipment essential to the services' wartime missions.³

Yet questions about the cost of that plan and the need for public depots in the post-Cold War era are fueling a growing controversy over public and private roles. Some industry advocates and independent analyses--including the recently released report of DoD's Commission on Roles and Missions of the Armed Forces--suggest that DoD place greater reliance on the private sector. In their view, that strategy would allow DoD to fulfill its requirements for high-

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1. That employment figure includes overhead and production workers. As DoD completes the base closures announced in 1991 and 1993, the number of depots will drop to 24.
 2. This comparison is based on the amount of money DoD spends in private maintenance facilities. A better comparison of the amount of repair work allocated to the public and private sectors might be based on the percentage of value added by private and public facilities. Value added includes the cost of capital and labor and excludes the cost of intermediate materials that are purchased from other suppliers (such as fuel and spare parts). If, however, purchased materials account for the same percentage of total costs in both sectors, comparisons based on total costs will accurately reflect the percentage of value added by each sector. Although ana-

lysts sometimes add to DoD's expenditures for private-sector repair the cost of the intermediate goods purchased by public depots from private manufacturers, that addition is not appropriate if the objective is to compare the size of the two repair sectors.

3. However, DoD's policies do not explain important differences among the services' plans. The Department of the Navy plans to increase its reliance on private contractors between 1991 and 1999. The Army and the Air Force, in contrast, plan to increase the percentage of their maintenance that goes to public depots.

Box 1.**Organizational-, Intermediate-, and Depot-Level Maintenance**

Each service divides maintenance tasks for military equipment into different levels based on the complexity of the task and the kind of maintenance facility where that task is usually performed. In addition to maintenance at the depot level, those categories typically include maintenance at the organizational and intermediate levels.

Organizational-level maintenance consists of routine tasks (such as refueling) that form part of the integral capabilities of military units. Those tasks arguably belong in the public sector: they are performed almost exclusively by military personnel who would be deployed to any conflict with the weapon systems they support. (In the Gulf War theater, the Army relied on approximately 800 civilians employed by U.S. contractors to carry out a wide range of maintenance, but most of them were stationed at fixed locations in rear areas. Less than 1 percent of the civilians working in the theater for the Army accompanied units into Iraq and Kuwait.)¹

Intermediate-level maintenance, which is usually performed by a mix of civilian and military personnel, comprises somewhat more complex tasks that are often done at a single site within each combat installation. Arguably, the portion of intermediate-level maintenance that is performed by military personnel who would be deployed in wartime might belong in the public sector.

Depot-level tasks are typically more complex than either organizational- or intermediate-level work. Because they are performed by civilians working in industrial facilities in the United States, they could be more suited to the private sector than organizational- or intermediate-level maintenance. Nonetheless, the distinction between intermediate- and depot-level

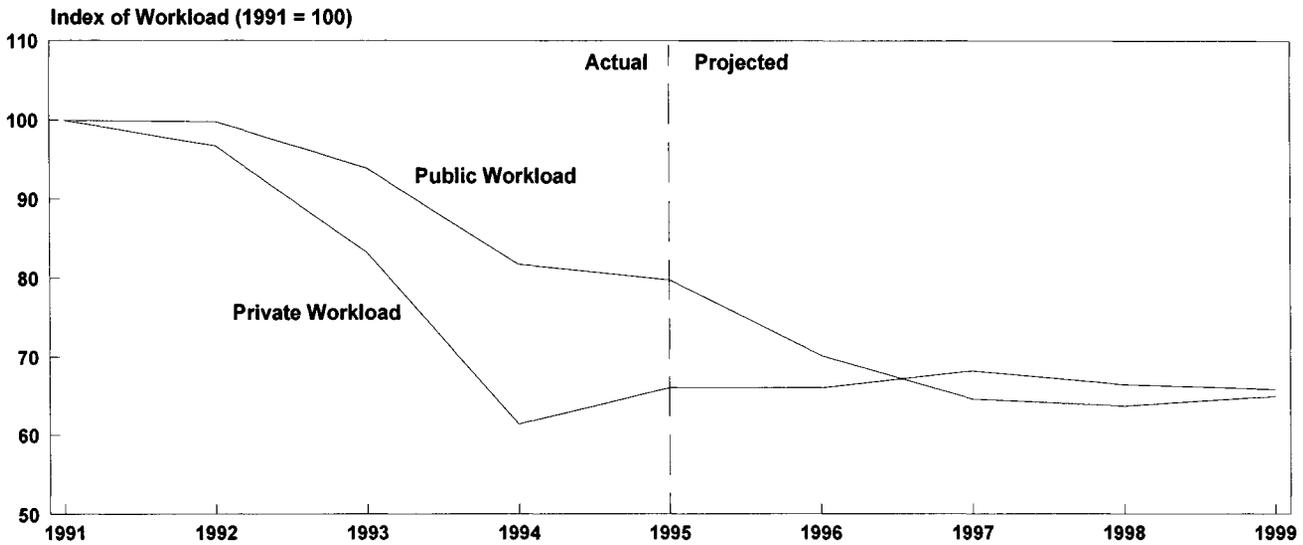
tasks is in many cases unclear. For example, tasks that are routinely done at the organizational or intermediate level are sometimes performed at a depot as part of a more extensive overhaul. Conversely, many tasks that are normally done at a depot (and defined by the policies of the military services as depot-level tasks) can, if necessary, be carried out at intermediate-level facilities.

In the past, the services have sometimes used intermediate-level facilities for depot-level work as a way to cope with shortfalls in funding for depot-level maintenance. More recently, a different trend has emerged: the services are deliberately consolidating work that was previously done at many intermediate-level facilities at the depots. As part of its new philosophy of regional maintenance, the Navy is moving some intermediate-level tasks and the military personnel who perform them to Navy depots. For its part, the Air Force has adopted a system for avionics and engines that has only two levels of maintenance (organizational and depot), moving what had previously been intermediate-level tasks to the depots. Despite the reduction in the number of repair sites, the Air Force hopes to hold its inventories of spare engines and avionics constant. To do that, it plans to emphasize rapid turnaround of work, in part by using commercial express delivery services.

The impact of these trends on the choice between in-house maintenance and contracting out work to the private sector is unclear. A reliable source of repairs for components of equipment is crucial during major regional conflicts. Moving additional component repairs to the public depots could reinforce the services' perception that they must have a controlled, in-house source for depot-level repairs. At the same time, the Department of Defense's current emphasis on shortening repair cycles and ensuring just-in-time delivery of necessary parts reflects trends that are well established in the private sector. In some cases, commercial sources of repair linked with commercial express delivery services might be able to provide the most rapid turnaround.

1. See George B. Dibble and others, *Army Contractor and Civilian Maintenance, Supply, and Transportation Support During Operations Desert Shield and Desert Storm*, vol. 1, *Study Report*, AR113-01RD1 (Bethesda, Md.: Logistics Management Institute, June 1993), pp. 2-4 and 2-5.

Figure 1.
Depot-Level Maintenance in the Public and Private Sectors Relative to 1991 Levels



SOURCE: Congressional Budget Office based on data from Department of Defense, *Defense Depot Maintenance Council Corporate Business Plan for Fiscal Years 1992-1997* (February 1993) and *Defense Depot Maintenance Council Business Plan for Fiscal Years 1995-1999* (February 1995).

NOTE: This figure uses direct labor hours as the index of public workloads and funding levels (in constant dollars) as the index of private-sector workloads. Direct labor hours provide a more accurate estimate of changes in public workloads than would funding levels because DoD changed the way it set the prices charged by public depots during the period shown.

quality, responsive support during regional conflicts and also significantly reduce the cost of depot-level maintenance.

Reassessing Public and Private Roles

With the end of the Cold War, the controversy over roles arises in part because military planning is now based on a scenario of two nearly simultaneous regional conflicts. Regional conflicts do not call for the same intensity or kinds of surges in depot-level maintenance that scenarios for the Cold War required. Those plans envisioned protracted combat against a well-armed enemy that would generate a large, sustained surge in needed maintenance at the depot level. Given that requirement, DoD chose to depend primarily on its public depots under the assumption that they were better prepared than private

firms to maintain excess capacity in peacetime that would allow them to handle surges in wartime. (Moreover, in Cold War scenarios, U.S. industry would have mobilized fully for wartime production and might have had little capacity to spare for a surge in repair work.)

DoD viewed public depots as a "ready and controlled" source that it could rely on to maintain essential equipment if contractors proved unable or unwilling to respond quickly in wartime. That rationale allowed DoD to justify a large system of public depots with ample capacity in peacetime to conduct routine overhauls of pieces of major equipment, or "end items" (such as tanks, ships, and aircraft), and to perform most repairs on their components. The relative cost of public and private maintenance was of secondary importance.

DoD's current planning scenario, however, comprises two relatively brief regional conflicts. During them, depot-level maintenance would focus primarily

on repairing components of essential equipment. The surge in maintenance on major end items would not occur until the conflict was over and DoD could return the damaged equipment to the United States. Moreover, unlike scenarios for the Cold War, regional conflicts would not require the nation's defense industry to gear up fully for war production. Those factors raise the question of whether DoD could, with appropriate planning, call on private firms to meet the expected surges in repairs on components during the conflict and on end items in its aftermath.

Rising federal budget deficits give impetus to this debate. Although direct comparisons between the costs of public depots and private repair firms are fraught with difficulties, advocates of greater private involvement point to the economics literature, which suggests that typically, private production in a competitive environment is less costly than public production. Furthermore, maintaining equipment at the depot level is an industrial activity performed by a largely civilian labor force working at fixed locations throughout the United States.⁴ The view that the private sector handles such activities most cost-effectively is consistent with the U.S. military's policy in other areas: at least since World War II, DoD has depended on private production to supply virtually all of the consumable goods (for example, food, clothing, fuel) and most of the spare parts and weapon systems that it uses.

The Political Side of the Debate

The intensity of the ongoing debate indicates more than concern about the most cost-effective and appropriate roles for the public and private sectors. It also reflects a battle for survival between public and private maintenance facilities. Since 1988, 11 public depots have been closed or earmarked for closure; the number of private firms that have gone out of business or left the defense industry is unknown.

4. In 1995, military personnel accounted for only 1 percent of the labor force assigned to DoD depots.

Pending decisions about additional base closures, the military services have moved some maintenance that was previously done in the private sector to public depots in an effort to keep those facilities operating at a relatively efficient level. But at the same time, declining orders for new equipment are forcing some of the large defense manufacturers that historically have had little interest in performing maintenance to seek a share of that work.

The initial impact of the defense drawdown has been to increase the public sector's share of the work in each service, which has contributed to dissatisfaction among representatives of industry. Between 1991 and 1995, the number of military personnel on active duty, one indicator of the size of U.S. military forces, dropped by 24 percent. During that same period, maintenance work at public depots fell by 20 percent, and work going to private firms fell by 34 percent (see Figure 1). DoD's plans for the 1995-1999 period call for the private sector's share of DoD maintenance to return to its 1991 level, but whether the department can carry out that strategy depends on an uncertain political process. DoD expects its total maintenance workload, public and private, to drop by an additional 11 percent between 1995 and 1999.

The ideal solution to this debate would be a clear policy regarding public and private roles that would ensure high-quality, responsive support for U.S. forces, reduce the burden on the taxpayer, and balance fairly the different political interests involved. This study examines three approaches to achieving that ambitious goal.

- o The first, the so-called core method, represents DoD's current policy. It assumes that public depots must have the capability to maintain the equipment required in the warfighting scenario of the Joint Chiefs of Staff.
- o The second approach, public/private competition, assumes that competition between public and private producers on a level playing field can determine the appropriate role for each sector. By relying on impersonal market forces, that approach would free DoD and the Congress from having to decide what each sector's share of depot-level maintenance should be.

- o The third approach would analyze the different kinds of maintenance tasks and market conditions for which public, private, and mixed public/private forms of production are best suited and assign work on that basis. Although the most

complex, that approach has a strong conceptual foundation.

Evaluating these approaches requires a grasp of current public- and private-sector roles.

Current Public- and Private-Sector Roles and Their Basis in Cold War History and Policy

The public and private sectors play a variety of overlapping roles in depot-level maintenance. That pattern reflects the influence of history as much as and perhaps more than it reflects the effects of Congressional and Department of Defense policies during the Cold War. It is unclear whether the sectors' traditional roles remain appropriate today. Nonetheless, understanding them and how they developed is critical in evaluating alternatives for the future because any major change in the allocation of maintenance to the public and private sectors will inevitably impose some risks and costs in the near term.

Roles of the Public and Private Sectors

The private sector performs about 30 percent of the military's depot-level maintenance. Moreover, the percentage of work done in the private sector is roughly similar for the Army, the Navy, and the Air Force (see Table 1). Underlying that similarity, though, are important differences in the role that the private sector plays in maintaining systems with different missions (for example, fighter aircraft, cargo aircraft, and combat vehicles), in maintaining the different parts of those systems (structures such as airframes and hulls, propulsion systems, and electronic components), and in performing different

kinds of maintenance (modifications, routine overhauls, and damage repair). The level of resources devoted to depot-level maintenance also varies by type of weapon system. Aircraft and ships account for most of DoD's total workload, whereas ground systems account for less than 10 percent (see Figure 2).

Principal Workloads in the Public and Private Sectors

In most cases, the military services assign routine maintenance on established, frontline combat systems--some of the largest and steadiest of their depot-level workloads--to the public sector. Among the types of equipment that the military maintained primarily in public facilities during the 1990-1993 period were submarines, aircraft carriers, combat aircraft (fighters, attack planes, and bombers), and ground systems (including combat vehicles and artillery, automotive and construction equipment, and ordnance and weapons). The percentage of total maintenance for those systems that was performed in public depots ranged from 75 percent for fighter, bomber, and attack aircraft up to 97 percent for submarines. Within the individual services, other categories in which the military allocated at least 75 percent of the work to public depots were "other aircraft" in the Navy (including maritime surveillance planes, such as the P-3) and communications equipment in the Army.

Table 1.
Share of Depot-Level Maintenance Performed in the Private Sector, by Service and Type of Equipment, 1990 Through 1993 (In percent)

Equipment	Army	Navy and Marine Corps	Air Force	All Services
Fixed-Wing Aircraft				
Fighter, bomber, and attack	n.a.	24	26	25
Transport and tanker	n.a.	58	51	51
Other aircraft	100	10	53	29
All fixed-wing aircraft	100	20	39	34
Helicopters	43	29	75	38
Ground Systems				
Combat vehicles and artillery	20	0	n.a.	18
Automotive and construction	12	0	1	9
Ordnance, weapons, and munitions	50	9	0	16
Other systems	4	81	38	44
All ground systems	19	22	34	22
Missiles and Electronic Systems				
Missiles				
Strategic	n.a.	100	28	59
Tactical	34	56	0	38
Electronic systems				
Communications	25	65	30	32
Avionics	37	33	26	30
Army or NAVSEA contract software support	100	100	n.a.	100
All electronic systems and missiles	36	44	27	36
Sea Systems				
Aircraft carriers	n.a.	23	n.a.	23
Submarines	n.a.	3	n.a.	3
Other ships	100	54	n.a.	54
Components and other systems	n.a.	23	n.a.	23
All sea systems	100	31	n.a.	31
All Equipment	35	30	36	32

SOURCE: Congressional Budget Office based on data from the services provided to the Defense Science Board Task Force on Depot Maintenance Management, April 1994.

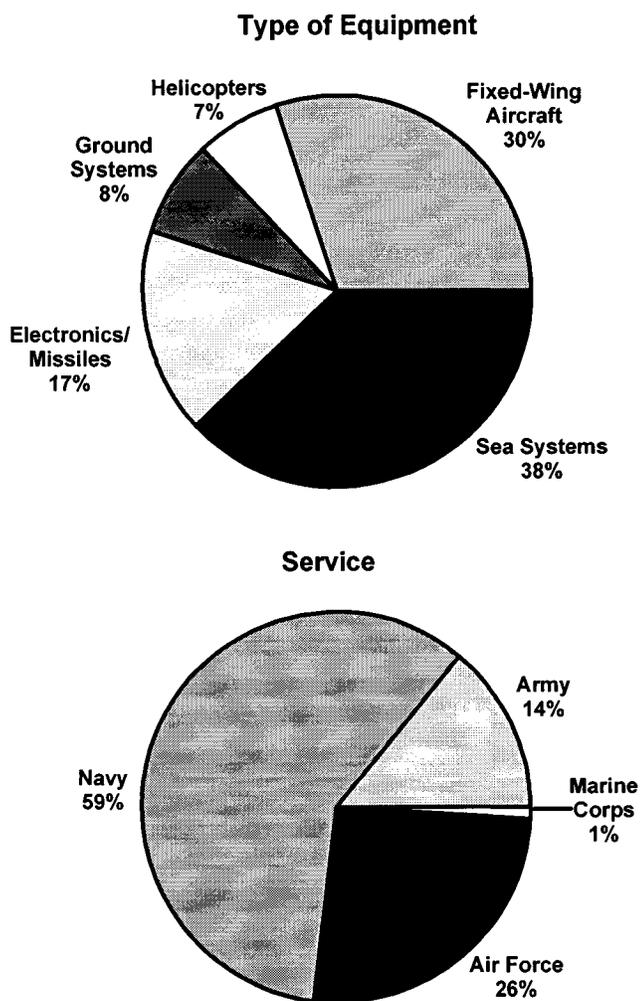
NOTES: Percentages are based on the cost of private and public workloads over the four-year period. Costs are grouped according to the service that managed the work. For example, Air Force helicopters maintained in Navy depots are included in data for the Navy.

NAVSEA = Naval Sea Systems Command; n.a. = not applicable.

Nonnuclear surface ships (other than carriers) and Army helicopters, both of which rely heavily on the private sector for repairs, are two important exceptions to the rule that frontline combat systems are maintained in public depots. In general, however, the platforms and major systems that the private sector

routinely maintains are less closely tied to the central combat missions of each service. For example, the Navy's policy is to allocate maintenance on all support ships (such as tenders and ocean tugs) to the private sector but to perform at least some work on frigates and destroyers in its own shipyards.

Figure 2.
Distribution of Costs for Depot-Level Maintenance, 1990 Through 1993



SOURCE: Congressional Budget Office based on data from the services provided to the Defense Science Board Task Force on Depot Maintenance Management, April 1994.

NOTE: Costs are grouped according to the service that managed the work. For example, the cost of Air Force helicopters maintained in Navy depots is included in data for the Navy. The data include the costs of depot-level maintenance performed in both public and private repair facilities.

Among the systems for which the private sector performed more than half of the maintenance between 1990 and 1993 are transport and tanker aircraft and strategic missiles. DoD allocates 51 percent of the maintenance on transport and tanker aircraft to private facilities. But that figure understates DoD's use of the private sector to maintain its transport capabilities because it does not take into account the privately owned and maintained Civil Reserve Air Fleet. DoD plans to use those civilian aircraft for one-third of its wartime airlift. The private sector also performs more than half of the depot-level maintenance on "other aircraft" in the Army and the Air Force; that category includes executive jets in both services as well as training and surveillance aircraft in the Air Force.

Aircraft engine repair (which is not shown separately in Table 1) follows a pattern similar to that for aircraft. Engines with commercial counterparts (typically those used on executive jets and on cargo, tanker, and surveillance aircraft) are more likely to be maintained in the private sector than are other engines. Overall, however, DoD tends to use its own facilities for repairing engines. Thus, the public sector handles approximately 80 percent of engine repair in both the Air Force and the Navy. Even for engines with commercial equivalents, DoD relies on public depots for 66 percent of their maintenance.

Historical Origins of Current Roles

Analyses of the defense industry in the United States suggest that historical circumstance--rather than explicit planning or rational decisionmaking--played a central part in determining the roles of the public and private sectors in designing and manufacturing weapon systems.¹ A similar argument could be made

1. Jacques S. Gansler, *The Defense Industry* (Cambridge, Mass.: MIT Press, 1980), p. 35.

in the case of depot-level maintenance. In particular, historical factors help to explain why the private sector plays an important part in maintaining nonnuclear surface ships, a more modest part in maintaining aircraft, and a small part in maintaining ground combat vehicles.

Ship Maintenance. The Navy's use of the private sector to repair nonnuclear surface ships reflects the historical importance in the United States of a private shipbuilding and ship repair industry with both the capability and a very strong desire to do Navy work. Since the Civil War, U.S. shipbuilders have had difficulty competing in the world market for the construction of commercial ships. Although the demand for ship construction and repair increased dramatically during World Wars I and II, in peacetime, U.S. shipyards have relied on direct and indirect government subsidies. During the Cold War, the government gradually eliminated the programs supporting the construction of commercial ships, and the industry became more dependent on Navy work. (Since 1981, when the Congress eliminated funding for construction subsidies for commercial shipbuilding, virtually all new major ship construction in U.S. shipyards has been for the Navy.)

The complexity of modern combatant ships together with the Navy's limited requirements for new vessels means that only a small number of well-equipped shipyards are now able to compete successfully for new construction work. During the 1980s, some firms that were unable to maintain their status as construction yards joined the ranks of the roughly 40 shipyards that specialized in ship repairs and were capable of dry-docking large Navy ships. Today, those firms compete for Navy maintenance contracts in both the economic and political arenas.² The Congress's desire to balance support for public and private shipyards (reflected, for example, in a 1974 defense appropriation act that placed floors for that year on the level of funding for maintenance in both kinds of yards) has also helped to shape the Navy's allocation of work to the two sectors.³ The existence of a

ship repair industry with substantial excess capacity and a tradition of government support is arguably a major reason that during the Cold War, the Navy accepted a large role for the private sector in repairing its surface ships.

Aircraft Maintenance. In contrast to shipbuilding, aircraft production did not fully develop as a manufacturing industry until World War II. The allocation of repair work to public depots and of manufacturing work to the private sector evolved at a time when the private sector was struggling to create the capacity for mass production that the war effort required and was reluctant to take on maintenance tasks.⁴ The distinction between private production and public repair should not be overemphasized, however. During the war, the aviation industry depended to a large extent on manufacturing facilities that were operated by private firms but financed and owned by the government.⁵

DoD's use of the private sector for aircraft repair increased following the war. According to Air Force historians, constraints on the construction of new public depots and shortages of skilled maintenance personnel drove the service's decision to start using contractor support in the late 1940s. The Air Force's logistics community accepted the decision only reluctantly; they "initially harbored severe misgivings" and "stood firmly opposed to the idea of using contract maintenance on the grounds that this was an unreliable and risky alternative."⁶

Despite those reservations, the Air Force rapidly increased its use of contractors. By 1958, contractors accounted for 56 percent of the maintenance performed for the Air Material Command in the United States. That figure held relatively steady for the next few years.

2. Clinton H. Whitehurst Jr., *The U.S. Shipbuilding Industry: Past, Present, and Future* (Annapolis, Md.: Naval Institute Press, 1986), pp. 68-70.

3. Department of Defense Appropriation Authorization Act, 1974; 87 Stat. 1028-1029.

4. Bernard J. Termena, Layne B. Peiffer, and H.P. Carlin, *Logistics: An Illustrated History of AFLC and Its Antecedents, 1921-1981* (Wright-Patterson Air Force Base, Office of History, no date), p. 93.

5. DoD has since divested itself of many of those assets, but according to one estimate prepared in 1980, roughly one-third of the plant and equipment used in producing military aircraft was still owned by the government. See Gansler, *The Defense Industry*, p. 288.

6. Termena, Peiffer, and Carlin, *Logistics*, pp. 149 and 92.

Ceilings placed on the number of civilian personnel continued to limit the capabilities of Air Force depots in the 1970s. At least partly because of those limits, contractors performed roughly 40 percent of the Air Force's total depot-level maintenance in 1975. The Navy, in contrast, allocated almost 80 percent of its depot-level aviation maintenance to its own depots in that year. The difference between the two services at that time appears to reflect differences in the capacity of their depots rather than in their maintenance philosophies. (The Navy, for example, withstood pressure by the Office of the Secretary of Defense to use contractors for more of its maintenance on the grounds that any increase would force the service to close one of its own depots.)

Military logisticians throughout the Cold War subscribed to the philosophy that frontline combat aircraft should be maintained in public depots to ensure reliable and responsive support. In the 1970s, because of constraints on resources, contractors maintained some second-line combat aircraft (including F-105 and F-4 fighters). Nevertheless, then as today, private firms played a much larger part in maintaining cargo and tanker aircraft than in repairing combat planes.

Ground Systems. The almost exclusive role that Army depots currently play in maintaining tanks and artillery is consistent with the Army's traditional use of public facilities for both production and repairs. At the onset of World War II, the Army depended in large part on its own arsenals (government-owned production plants operated by government employees) for manufacturing weapons. During the war, that pattern changed with the construction of a large number of government-owned/contractor-operated plants, or GOCOs.

Today, Army arsenals have a limited role in manufacturing weapon systems. (For example, a GOCO is the primary producer of tanks, and a private firm is the primary producer of self-propelled artillery.) Yet the private sector continues to have little involvement in depot-level maintenance on ground systems. Part of the reason for that pattern may be that, unlike ships and aircraft, tanks have no commercial counterparts. As a result, no commercial repair industry exists to compete with Army depots. Another explanation could be that the division of the Army's mainte-

nance between the public and private sectors is influenced by the traditional capabilities and expertise of Army depots.

Special Roles that the Private Sector Plays

History has contributed to differences among the services in the degree to which they rely on the private sector to maintain different types of weapon systems. But technology and cost encourage some similarities in the kinds of tasks that each service allocates to private firms.

Support for New Systems. All of the services typically use the original equipment manufacturer (OEM) to maintain a new system while its design is being stabilized, its routine maintenance needs are being determined, and DoD's own depots are acquiring the necessary equipment and skills to maintain the system. Following that period of "interim contractor support," the services generally plan to maintain the new system in public depots.⁷

In some cases, however, the initial period of maintenance by the OEM becomes prolonged. That situation may occur if problems with performance or reliability lead to repeated changes in design or DoD has difficulty obtaining the resources it needs (sufficient facilities, skilled personnel, or technical data) to maintain the system on its own. For example, despite the Air Force's plan to use in-house capabilities for maintaining the B-1 bomber, the service continues to draw on the OEM for substantial support. In 1993, contractors provided almost 70 percent of maintenance on the B-1 airframe and nearly 80 percent of maintenance on the B-1's navigational avionics (electronic systems used for navigation).

7. Recent exceptions to this rule may include depot-level maintenance for the Air Force's B-2 bomber and F-117 fighter and for the Army's Target Acquisition and Designation System/Pilot Night Vision System (TADS/PNVIS) and Mobile Subscriber Equipment (MSE). DoD's plans call for the OEMs to provide depot-level maintenance (and in some cases other maintenance as well) for those systems throughout their life cycle under a "contractor logistics support" agreement. But as the size of DoD's purchases of weapons declines, reducing the base over which the military can spread the cost of special tooling and maintenance equipment, DoD could decide to leave the maintenance of more major systems with the OEM.

Modifications and Upgrades. The private sector also plays a role in converting, modifying, and upgrading equipment (tasks that require many of the same capabilities as manufacturing the equipment in the first place). The Army's ongoing upgrade of M1 tanks to the M1A2 configuration is one example.

The private sector performs a larger proportion of DoD's workload for modifications and conversions than of DoD's routine depot-level maintenance. Nevertheless, the public depots that are responsible for routine maintenance carry out most modifications and conversions. In part, that allocation occurs because public depots find they can save money by combining modifications with routine maintenance. Estimates by the Air Force suggest that combining the replacement of the center wing box of the C-141 aircraft with routine maintenance reduces the hours of labor needed to replace the wing box by approximately 20 percent.⁸ The Navy routinely combines overhauls of ships with modifications and upgrades.

Unanticipated Workloads. The services frequently call on the private sector to handle fluctuations in their maintenance workloads that might exceed what the workforce in the public depots could handle. They also use the private sector for unusual repair tasks that might disrupt the flow of work in the public depots or that might require the engineering capabilities of the OEM. For example, routine maintenance for the C-141 aircraft is usually done in a public depot. But when a significant number of C-141s were grounded as a result of cracks inside the structure of the wing, the Air Force engaged multiple contractors--both the OEM and specialized repair firms--to return the aircraft to service as quickly as possible. Because of the engineering skills of the OEMs, DoD sometimes uses them to deal with aircraft that need exceptional repairs as a result of fire, shifting cargo, or a history of problems that might otherwise qualify the planes as "hangar queens."

Private firms that specialize in repairs may also absorb fluctuations in the services' workloads that arise from unscheduled maintenance. For example, the Air Force divides its C-130 maintenance between

Air Force depots and private repair firms, but the private sector receives 88 percent of unscheduled "drop-in" work and only 19 percent of scheduled maintenance. When the services choose to divide specific workloads between the public and private sectors, they commonly fill their own depots first and then allow private firms to compete for the remaining "overflow" work.

Component Repair. Component repair is another task that is frequently undertaken by private firms. Discussions of the appropriate roles of the public and private sectors in maintaining major platforms sometimes overlook this aspect of DoD maintenance. Yet repairs on components account for roughly half of all depot-level maintenance in the Air Force and about 40 percent of such maintenance in Navy aviation and the Army.⁹

Relatively little information is available about which general categories of components DoD is most likely to maintain in the public sector and which categories it maintains in the private. Anecdotal evidence indicates, however, that public depots are typically the source of repair for obsolete electronic components with small, uncertain demands for maintenance. At least when offered on an individual basis, such tasks could be unattractive to private repair firms.

In addition, it appears that public depots are likely to maintain components that are widely used in multiple systems (but are not in general commercial use), whereas OEMs are more likely to maintain components that are unique to a specific system or require special skills and equipment. Some Air Force experts suggest that this pattern explains why, in 1993, the private sector repaired 44 percent of Air Force navigational avionics components but only 15 percent of communications avionics components. Similarly, a review of 15 electronic warfare systems conducted by the Warner Robins Air Logistics Cen-

8. Coopers & Lybrand, *Preliminary Case Studies of Public Versus Private Competition* (Washington, D.C.: Coopers & Lybrand, July 1994), p. 10.

9. Component repair appears to be a much smaller portion of the total depot-level workload for sea systems. Comparisons between the services can be misleading, however, because of differences in where components are repaired (for example, on board ships rather than at depots) and in what constitutes a component. (Engines are components in the Army and end items in the Air Force and the Navy. At the same time, a radio that is an end item in the Army might be a component in the Air Force.)

ter found that five systems were being repaired only by the OEM and another two depended on the OEM for 75 percent to 95 percent of repairs.¹⁰

Analyzing the distribution of component repair by weapon system lends some support to the view that the private sector repairs many specialized components. For example, the private sector is responsible for 36 percent of the repairs on components used in fighter and attack planes in the Air Force but only 19 percent of the repairs on components used in cargo and tanker planes. One explanation is that the components used in current-generation fighter and attack planes are more likely to require the specialized skills and resources of the OEM. In contrast, repairs on components used in cargo planes demand resources that are widely available in the public depots.¹¹ Navy data, although incomplete, also support the idea that the private sector is instrumental in maintaining components used in fighter and attack planes.¹²

That pattern is especially striking because it is the reverse of that seen for airframe maintenance: the private sector is much less likely to maintain the airframes of fighter and attack planes than of cargo or tanker planes. (In 1993, private firms handled 17 percent of the airframe maintenance for fighter and attack planes in the Air Force and less than 7 percent of that maintenance in the Navy. But they handled 38 percent and 62 percent, respectively, of the airframe maintenance for cargo and tanker planes in those services.)

10. The Warner Robins Air Logistics Center developed those data and provided them to the Congressional Budget Office in a memorandum from the Air Force's Office of Budget and Appropriations Liaison in December 1994.

11. An alternative explanation is that repairs on components used in cargo planes are more likely to be allocated to the public sector than repairs on components used in fighters because the wartime surge in flying hours (and thus in maintenance) is greater for cargo planes. The Congressional Budget Office lacked the data to evaluate that hypothesis, which was suggested by Air Force personnel.

12. In 1993, components used in F-14 and F-18 fighter planes accounted for approximately 30 percent of the repairs on components of aviation systems that the private sector performed for the Navy.

Decisions to depend on the OEMs to maintain components essential to a service's warfighting ability may be appropriate--and may become even more common in the future--as the increasing reliability of components and shrinking inventories of weapons reduce the size of maintenance workloads. When a workload is small, the cost of duplicating in the public depots the capability for repair that is already available through the OEM may not be justifiable.

The extent to which DoD relies on OEMs to repair components needs to be understood when evaluating arguments about DoD's inability to depend on the private sector to repair other essential equipment. DoD is most likely to use the private sector to maintain major end items (such as aircraft and engines) when the item is not central to combat operations and is similar to commercial equipment that the private sector already maintains. But for component repairs--the type of repair that will, in fact, be most essential during the kind of war that DoD is preparing for--that pattern is sometimes reversed.

DoD and Congressional Policies During the Cold War

Although history and the constraints imposed by cost and technology largely shaped public and private roles in depot-level maintenance during the Cold War era, DoD and Congressional policies also played a part. Policies issued by the Office of the Secretary of Defense (OSD) gave general guidance about the type of work to be allocated to the two sectors. Without specifying what the outcome might be for any particular weapon system, OSD also spelled out the kind of process that the services were to follow in determining the source of repair for each system. In addition, both OSD and the Congress have at different times placed overall restrictions on the proportion of work that the public and private sectors should each handle, perhaps because they were not entirely sanguine that general guidance would result in an outcome that they considered satisfactory.

Guidance Regarding Appropriate Roles

DoD's policies during the Cold War consistently emphasized the role that public depots would play in delivering the surge in maintenance needed at the onset of a large-scale war. According to a joint statement by the services' logistics commanders in 1987, "The primary objective of the DoD depot maintenance community is to posture our depot maintenance capabilities to meet wartime mobilization surge requirements."¹³ And a report issued by OSD in 1993 stated that "a principal justification for public depot maintenance was the need for ready, organic surge capacity to meet the immediate needs of operational forces while buying time for the private-sector production base to gear up for wartime demands. This large-scale, full-mobilization scenario drove policy, guiding the establishment of a substantial organic depot maintenance capacity and infrastructure."¹⁴

Yet OSD policies sought as well to encourage the services to use the private sector to the extent permitted by surge requirements. That principle was expressed in a 1982 DoD directive mandating that the capacity of public depots be "kept to the minimum required to ensure a ready, controlled source of technical competence and resources necessary to meet military contingencies."¹⁵ The minimum workload needed in peacetime to support that capacity became known as DoD's Cold War "core" maintenance requirement. The relative costs of public and private maintenance in peacetime did not figure as an important factor in OSD policies, although the policies did specify that a service could keep more than that minimum amount of work at its depots if "no satisfactory private commercial source is available or in-house performance is more economical than contract."¹⁶

13. Joint Logistics Commanders, *Programs Objectives Summary, 1986-1992* (January 30, 1987), p. 1.

14. Office of the Deputy Under Secretary of Defense for Logistics, *Integrated Management of Department of Defense Depot Maintenance Activities*, vol. 1, *Study Results* (October 1993), p. 1-4.

15. Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics, "Use of Contractor and DoD Resources for Maintenance of Material," DoD Directive 4151.1 (July 15, 1982).

16. *Ibid.*

Guidance Regarding the Decision Process

OSD recognized the limits of such general policies and called on each service to develop a systematic, quantitative approach for identifying its core maintenance needs. By 1982, that direction had evolved into a requirement that the services make decisions about the source of repair for each new system based on the answers to a structured series of yes-or-no questions (referred to as a decision-tree analysis). The different decision trees that the services adopted considered many of the same factors (for example, whether the system was essential to the service's warfighting mission, whether it had a high level of surge requirements, and whether public depots already had the capability to do the work).

Using formal, quantitative processes to calculate discrete requirements at a very detailed level and then totaling those requirements to determine aggregate levels is a technique common within DoD. Such processes have the potential to ensure that the organization systematically considers appropriate factors in making its decisions. In addition, studies of bureaucracies suggest that a formal process can protect those responsible for oversight from the accusation that they are not adequately monitoring outcomes; it can also protect those responsible for acting from outside organizations that try to influence decisions.¹⁷ When organizations use formal, bottom-up decision-making processes like decision trees, aggregate outcomes do not appear to be the result of high-level judgments that might be reviewed and contested. Instead, they seem to be the product of an automatic, objective process that can be trusted to yield a fair and efficient solution.

DoD plans to continue using decision trees, and as a result, some of the limitations of that approach in the past are worth noting. One problem is that the implementation of decision-tree analysis could be uncertain. For example, in a 1990 study of 15 differ-

17. See James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989). Chapters 16 and 18 discuss how rules and standard operating procedures protect agencies from criticism. Other formal processes for determining requirements might include those that DoD uses to set the number of military officers and to determine the number of on-base housing units for military families.

ent weapon systems purchased by four Army commodity commands, the Logistics Management Institute "found no evidence that the decision tree had ever been used . . . most of the personnel did not know of the decision tree's existence."¹⁸ Another problem is that even in cases in which an organization follows and documents the process, a great deal of room is left for judgment. In the eyes of some experienced practitioners, an organization can use decision-tree analysis to justify any outcome it desires for a particular system. If senior decision-makers do not like the outcome of an analysis, they can ask that it be redone. Moreover, anecdotal evidence suggests that uncertainty over the desired outcome has, on occasion, led to analysts' simultaneously preparing two contradictory analyses.

A bottom-up approach to determining public and private roles leads to another, more fundamental problem. What is practical or less costly in the short run, based on the current roles and capabilities of the public and private sectors, may drive decisions about individual weapon systems. As a result, the collective outcome of those decisions does not identify what roles the public and private sectors might play most effectively in the long run. For example, decision trees that take into account the ability of public depots to take on additional work (an appropriate short-run concern) encourage the services to respond to any excess capacity in public depots by shifting work there from contracts in the private sector. Similarly, workloads that have traditionally gone exclusively to one or the other sector will tend to go that way in the future because that is where the capabilities will be found. Decisions made on that basis beg the question of what capabilities DoD should try to maintain in each sector over the long run.

Guidance Regarding Aggregate Outcomes

During the Cold War years, the Congress and OSD placed formal and informal constraints on the share of maintenance work going to each sector. To some

degree, those constraints may have discouraged analyses of alternative roles. Political considerations helped to determine how much work went to each sector as well as the level of work at individual depots. As a result, the services may have viewed major shifts in the shares of public- and private-sector depot-level maintenance as impractical.

Although the stated purpose of legislation has been to ensure that DoD has a "ready and controlled source of technical competence" to meet its needs in an emergency, the thrust of most Congressional action has been to support a dominant role for public depots.¹⁹ (For example, the Department of Defense Authorization Act for fiscal year 1985 excluded core logistics functions from those commercial activities that were subject to public/private competition under the provisions of the Office of Management and Budget's Circular A-76.)²⁰ Moreover, current law, which modifies a provision first introduced in 1992, specifies that no more than 40 percent of the funds made available in a fiscal year to a military department or defense agency for depot-level maintenance and repair can be used for contract work.²¹

In contrast, the general thrust of OSD policies has been to ensure some minimum level of private-sector participation. During the 1970s, for example, OSD required the services to contract for at least 30 percent of their depot-level maintenance. Although the 30 percent rule did not apply to individual weapon systems, it did apply to broad categories of equipment, such as Army aircraft.²² However,

19. Department of Defense Authorization Act, 1985; 98 Stat. 2514, 10 U.S.C. 2464.

20. *Ibid.*

21. See U.S. House of Representatives, *National Defense Authorization Act for Fiscal Year 1995*, Conference Report 103-701, to accompany S. 2182 (August 12, 1994). Although the so-called 60/40 rule is frequently cited in discussions of depot-level maintenance, the extent to which it has constrained the actions of the individual services is unclear. The wide variety of ways in which the military can measure the level of private-sector maintenance work (for example, it can include or exclude contractor logistics support, interim contractor support, the material purchased by public depots, and subcontracts let by public depots) may have helped to limit the impact of the rule.

22. Department of Defense, "Use of Contractor and Government Resources for Maintenance of Material," DoD Directive 4151.1 (June 1970), as cited in Frank Camm and others, *Resource Allocation in the Department of Defense*, R-2455-MRAL (Santa Monica, Calif.: RAND Corporation, October 1982), p. 34.

18. Kelvin K. Keibler, Larry S. Klapper, and Donald T. Frank, *Army Depot Maintenance: More Effective Use of Organic and Contractor Resources*, AR803R1 (Bethesda, Md.: Logistics Management Institute, June 1990), p. 2-20.

whether OSD was ever able to enforce that requirement is unclear. By 1982, it had revised its policy to require that the services only consider the private sector for at least 30 percent of their mission-essential workload and all of their non-mission-essential workload.²³

In summary, historical circumstance, constraints imposed by costs or technology, and political pressures have shaped current public- and private-sector roles in maintaining military equipment at the depot level. Yet in the eyes of many analysts, DoD and the

Congress have never satisfactorily resolved the question of what public and private resources are needed to provide responsive, cost-effective maintenance. In 1986, one naval historian noted that "a definitive answer to the recurring question of how naval overhaul and repair work will be apportioned between naval and private sector shipyards is long overdue."²⁴ Today, analysts addressing that problem must take into account a radically different national security environment. DoD's proposed solution, which is reflected in its revised policy on core depot-level maintenance, deserves close scrutiny.

23. DoD Directive 4151.1, July 15, 1982.

24. Whitehurst, *The U.S. Shipbuilding Industry*, p. 184.