Chapter 5

The Maintenance Base

Contents

Figures

Tables

Chapter 5
The Maintenance Base

INTRODUCTION

The maintenance base is the third principal element of the defense technology and industrial base (DTIB). It is the portion of the base that supports deployed military systems, ensures force readiness, and sustains forces during military operations. *Redesigning Defense* discussed why a robust defense maintenance base will be vital in the national security environment the Nation faces in the future.

Defense maintenance is currently divided into at least three levels. The first is *organizational level maintenance,* where members of the operational unit make functional checks and adjustments, and faulty parts are serviced or replaced. The second is *intermediate level maintenance,* where field personnel perform more extensive repairs. The third is *depot level maintenance,* where highly trained personnel rebuild, make complex repairs on, and overhaul equipment in specialized facilities.[1] This chapter concentrates on depot level maintenance and uses the term ''maintenance' to refer to it.

The U.S. military spent approximately $13 billion on depot level maintenance in fiscal year 1991, supporting a huge fleet of aircraft, armored vehicles, and other weapon systems and support equipment. (See table 5-1.)2 Depot maintenance is currently the responsibility of the individual Services.

The depot maintenance system consists of two components. The organic (i.e., Service-owned and operated) component is composed of Army Depots, Air Force Air Logistics Centers, Naval Aviation Depots, Naval Shipyards, and Marine Corps Logistics Bases. This in-Service maintenance component employs about 150,000 people. It is supported by the private sector through the work of thousands of firms, including both repair houses and original equipment manufacturers. These firms supply parts and provide direct maintenance support in their own facilities or in government-owned and contractor-operated (GOCO) facilities.

Maintenance differs from production in that equipment arriving at the depot or factory for repair or overhaul must first be inspected and faults diagnosed. Once major items, such as ships, are disassembled to begin an overhaul, unanticipated repair requirements may be found, resulting in additional costs. Nevertheless, some maintenance and production activities are similar and many of the same skills are involved in manufacturing new parts or repairing old ones.

Future maintenance requirements will differ from those of the past 40 years. For example, the United States is likely to retire many weapons in response to the waning threat from the former Soviet Union and to arms control agreements. Since the oldest weapons are likely to be retired first, not only will the number of systems in the forces decline, but deployed weapons will initially tend to be newer and hence will require less maintenance. While some facilities such as shipyards are likely to have increased activities during the transition to a smaller force (e.g., decommissioning work), overall maintenance requirements will drop substantially.

Current trends, however, indicate a major reduction in new weapons procurement in the future, Thus, once present forces are reduced, the Nation will probably retain weapons and equipment in inventory longer than in the recent past, preferring to upgrade deployed systems when possible instead of producing new ones.[3] (See table 5-2.) This aging equipment may require more maintenance to retain high readiness levels. Also, military systems are becoming more sophisticated; in particular, the embedded electronic components are becoming more important and more complex. These trends will change the types of facilities needed for repairs

[1] The Army and the Marine Corps have five levels of maintenance: user, organizational, divisional, intermediate, and depot.

[2] The FY 1992 U.S. global military force, for example, includes over 45,000 armored vehicles, 490 combat ships, 4,100 major fixed-wing aircraft, and 260,000 Army tactical wheeled vehicles.

[3] The Congressional Budget Office noted that (he expected changes in age of equipment arc mixed, depending on the type of weapon. Between 1991 and 1995 ships will be relatively newer as will Air Force tactical aircraft, The average age of Al my equipment and the age of Navy aircraft will increase. Statement of Robert F. Hale, Assistant Director, National Security Division, Congressional Budget Office before the U.S. House of Representatives, Committee on Armed Services, Mar. 19, 1991. After 1995, all classes of fielded equipment are likely to be older. Upgrading and retrofitting existing equipment is more similar to manufacturing than is repair, but such activities often take place in the maintenance, rather than in the production base.

Table 5-l—Depot Maintenance (fiscal year 1991 milllons of dollars)

	Army	Navy	Air Forca	Marine Corps	Total
Aircraft	294	1,830	4,001	[a]	6,125
Ships & boats	7	3,936	NA	NA	3,943
Combat vehicles	628	NA	NA	34	662
Missiles	190	60	278	12	540
Communications & electronics.	244	12	70	10	336
Ordnance, weapons, munitions	53	150	19	3	225
Automotive	142	32	11	185	370
Other.	48	675	300	36	1,059
Totals	1,606	6,695	4,679	280	13,260
Contract to private industry.	340/0	1$)°/o	270/.	2%	247.

a Maintenance performed by Navy.

KEY: NA = not applicable.

SOURCE: Office of the Secretary of Defense.

and the skills of the people that perform maintenance work.[4] Some future upgrades and retrofits will aim at increasing the reliability of deployed systems, thus potentially reducing future maintenance workloads. For example, Rockwell International's current upgrade of F-1 11 avionics aims at improving reliability and maintainability.[5]

Force reductions and increased equipment reliability have already caused reduced workloads and overcapacity in the Service's present depot maintenance system. Future defense maintenance base objectives include:

1. preserving appropriate maintenance capability while forces are being reduced;[6]
2. providing maintenance support in peace, crisis, or war to a force that is likely to consist of older platforms that have been upgraded; and
3. supporting fewer but more sophisticated systems over the longer term.

Integrating more maintenance activities into the production element of the DTIB has been suggested as a way to sustain the defense production base and manufacturing skills in a period when less new equipment is produced. If this objective is accepted, it will have a significant effect on the size of the in-Service component of the maintenance base.

This chapter describes the current defense maintenance base, defines what is needed to have a robust maintenance base in the future, discusses some of the alternative ways of achieving a robust base and their policy implications. The options available for the maintenance base are similar to those in the production base. These options include:

1. consolidating and restructuring the base while retaining its current character,
2. increasing use of the private sector,
3. increasing competition among Service organizations (depots and air logistics centers) and between Service organizations and private firms,
4. exploiting new technology, and
5. providing maintenance upgrades to U.S. equipment abroad, as well as foreign manufactured equipment.

Table 5-2—Average Age in Years for Selected Military Equipment

Equipment	1990	1993	1995
Air Force tactical aircraft	10	*8*	10
Navy combat aircraft.	12	*13*	*15*
Naval surface combatant ships	15	13	14
Attack submarines	14	14	14
Ballistic missile submarines	18	15	11
MI tank	nA	6	8
Bradley fighting vehicles	NA	6	8
M-109 howitzer	NA	23	25
AH-64 attack helicopter.	NA	6	8

NA - not available.

SOURCE: OTA, based on information from the Congressional Budget Office, the Department of Defense, and the Department of the Army.

[4] Alfred H. Beyer and Connelly D. Stevenson, *Depot Maintenance in the 1990's* (Bethesda, MD: Logistics Management Institute), July 1986, p. 4.

[5] William B. Scott, "Manufacturers Embrace Upgrades to Survive in '90s," *Aviation Week & Space Technology,* July 22, 1991, pp. 4-5.

[6] Defense Depot Maintenance Council, *Corporate Business Plan FY 91-95,* December 1991. The Council, for example, states that the "depot maintenance community finds itself faced with the challenge of having to downsize while simultaneously increasing efficiency and productivity in order to sustain forces in the field' in operations such as Desert Storm.

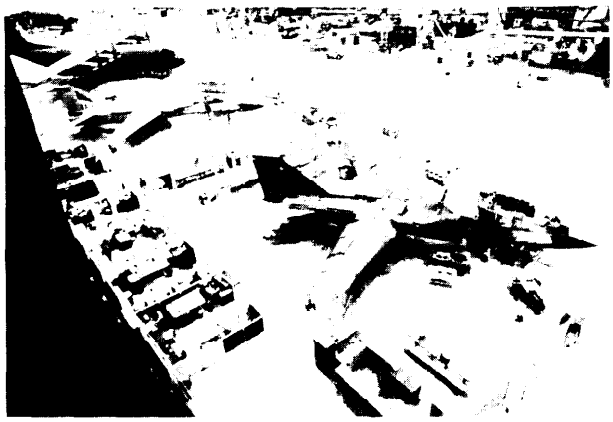


Photo credit: Rockwell International

U.S. and Australian F-1 11 fighter-bombers are upgraded side by side in this industrial facility. Maintenance of foreign-owned equipment could help support the U.S. maintenance base.

These options are not mutually exclusive but might be used in combination as a part of an overall maintenance strategy.

THE CURRENT DEFENSE DEPOT MAINTENANCE SYSTEM

In the past, each military Service has maintained its own equipment with the exception of a few select items (e.g., some aircraft engines), for which a single Service has assumed overall maintenance responsibility. The Services have traditionally sought ownership and control of maintenance for their own systems to ensure that they have the technical competence and resources to respond to emergency requirements.[7] The Services have also been concerned that failure to develop in-Service maintenance capabilities might leave them hostage to escalating cost demands by sole-source private contractors, or without the necessary support if the private sector determines that maintenance work is no longer profitable and leaves the business. However, these in-Service maintenance capabilities are expensive. For example, the acquisition by the Services of standard test program sets, which allow the military to test and repair complex electronics, can add up to 20 percent to the total development cost of a single electronics package. This cost would not be incurred if maintenance remained the manufacturer's responsibility. The increased use of the private sector is discussed later in this chapter.

Before fiscal year 1983, Service depots competed for equipment funds from the same pool that was used to acquire ships, aircraft, and other weapons systems; in many cases they were unsuccessful in obtaining funds to modernize their facilities.[8] During the expansion of the 1980s, however, the Service depots underwent substantial modernization funded by the DoD Asset Capitalization Program. The Services spent hundreds of millions of dollars on new equipment and in some cases replicated capabilities that already existed in another Service or in private industry.[9] By the end of the decade, however, the waning Soviet threat produced almost universal agreement that the existing capacity in the depot maintenance base exceeded future needs.

The Defense Management Report (DMR) released by Secretary of Defense Richard Cheney at the beginning of the Bush Administratim idcntified ways to improve the management of thc DTIB, including maintenance. Deputy Secretary of Defense Donald Atwood subsequently directed the Service Secretaries to prepare plans to reduce the cost of depot maintenance operations between fiscal year 1991 and fiscal year 1995 by a total of $1.7 billion ''through internal streamlining and reducing the size of their maintenance depot infrastructure.[10] Among the specific actions directed were: transfer of workloads, establishment of one naval aviation depot maintenance hub on the east and one on the west coast of the United States, single-siting maintenance, improvement of labor productivity, and consideration of the withdrawal of Air Force maintenance activity from one of that Service's five main Air Logistics Centers. Another $2.2 billion was to be saved through long-range efficiencies that

[7] Kelvin K K iebler, Larry S. Klapper, and Donald T. Frank, *Army Depot Maintenance" More Effective Use of Organic and Contractor Resources*, report no. AR803R I (Bethesda, MD: Logistics Management Institute, June 1990), p. 1-1.

[8] The military Services primarily usc annual appropriation.. to reimburse the depots for actual work performed. Organic depots do not receive direct appropriations for this purpose; instead, they are funded indirectly using working capital in the Defense Business Operations Fund and orders from their customers to finance the cost of goods and services.

[9] Be,er and Stevenson, op. cit , footnote 4, pp. 7-9. The Logistics Management Institute study reported, for example, that the Army developed capabilities in microelectronics, automatic test equipment, and software that already existed elsewhere in the DoD.

[10] Deputy Secretary of Defense Donald Atwood, *Memorandum for Secretaries of the Military Departments Subject Strengthening Depot Maintenance Activities*, June 30, 1990,

included inter-Service competition for maintenance, competition between Service organizations and private fins, and increased use of depot capacity .11

The Atwood directive established a Defense Depot Maintenance Council (DDMC) composed of representatives from the Services and relevant agencies to advise the Assistant Secretary of Defense (Production and Logistics) on maintenance and to coordinate activities. To develop cost-saving strategies, the DDMC commissioned studies on capacity utilization, performance measurement, information systems, cost comparability, and a number of specific weapon systems and technologies. (See table 5-3.)

The current planned changes assume that a major in-Service maintenance base will continue long into the future. The position of DDMC is that

> the highly developed capability of organic maintenance depots, supplemented by that of commercial industry, makes it possible to maintain a high state of readiness during peacetime and sustain the continuing maintenance requirements essential during wartime. "[12]

This position is supported by Public Law 100-370 (July 1988), which directs the DoD to maintain a core logistics capability for performing depot maintenance. The definition and uses of a core capability are discussed later in this chapter.

As a result of the Defense Management Report Decision (DMRD-908) dated November 17, 1990, the Services developed a Corporate Business Plan in December 1991 that describes how the Services will reach the savings goals established earlier by Mr. Atwood. The savings target of $3.9 billion is to be achieved by fiscal year 1995 through increased efficiencies in depot maintenance operations.[13] An initial aim of the Corporate Business Plan appears to be to promote more cost-effective operations while maintaining a depot infrastructure for each Service The plan is to achieve savings through ''inter-Servicing" (developing single DoD sites to maintain similar technologies or systems for all Services), increased capacity utilization (consolidating facilities for a given technology and weapon system within each Service), and greater reliance on competition. Current Service depot maintenance structure and restructuring plans are outlined below.

Table 5-3—Defense Depot Maintenance Council Commodity S1 udies

Army lead
Rotary wing aircraft
Combat, artillery, and tactical wheeled vehicles
Gas turbine engines/compressors
Conventional munitions
Rail equipment
General purpose equipment
Navy lead
Carrier based aircraft[a]
Tactical missiles
F-4 and OV-1 O aircraft[a]
Flexible computer integrated manufacturing
Remotely piloted vehicles/unmanned aerial vehicles
J79/T56 engines[b]
Air Force lead
Land based aircraft[a]
Type 1 metrology laboratories
Landing gear
TF30/F110/LM2500 engines[b]
Engine blades/vanes
Bearings
Marine Corps lead
Small arms
Ground communications-electronics equipment
DLA lead
Industrial plant equipment

a Combined into one fixed wing aircraft study.
b Combined into one engine study.

SOURCE: Defense Depot Maintenance Council, Corporate Business Plan FY 91-95, December 1991.

Army Depot Maintenance

The Army's depot level maintenance is managed by the Army Materiel Command through its Depot System Command (DESCOM~, which administers maintenance funds and assigns work to depots.[15] The Army currently runs 8 major depot maintenance facilities, has a budget of about $1.6 billion, and

[11] Ibid.

[12] Defense Depot Maintenance Council, op. cit. footnote 6, p. 5.

[13] Ibid., p. 1.

[14] Depot Maintenance Executive Group, *Depot Maintenance Business Vision and Strategies for 1995 and Beyond: F'ndings for the Joint Policy Coordinating Group,* Aug. 21, 1991.

[15] Depot maintenance requirements are determined by The Army Materiel Command's six major subordinate commands Armament, Munitions and Chemical Command (AMCCOM); the Aviation Systems Command (AVSCOM); the Communications-Electronics Command (CECOM); the Missile Command (MICOM); the Tank-Automotive Command (TACOM); and the Troop Support Command (TROSCOM).

Table 5-4-Army Organic Depot Maintenance Facilities

Facility	Location
Anniston Army Depot	Anniston, Alabama
Corpus Christi Army Depot	Corpus Christi, Texas
Letterkenny Army Depot	Chambersburg, Pennsylvania
Mainz Army Depot[a]	Mainz, West Germany
Red River Army Depot	Texarkana, Texas
Sacramento Army Depo!$'[b]	Sacramento, California
Tobyhanna Army Depot	Scranton, Pennsylvania
Tooele Army Depot	Tooele, Utah

[a] Closing.
b Designated for closure by "Defense Base Closure and Realignment Commission Report," July 1, 1991.

SOURCE: Defense Depot Maintenance Council, *Corporate Business Plan FY 91-95,* December 1991.

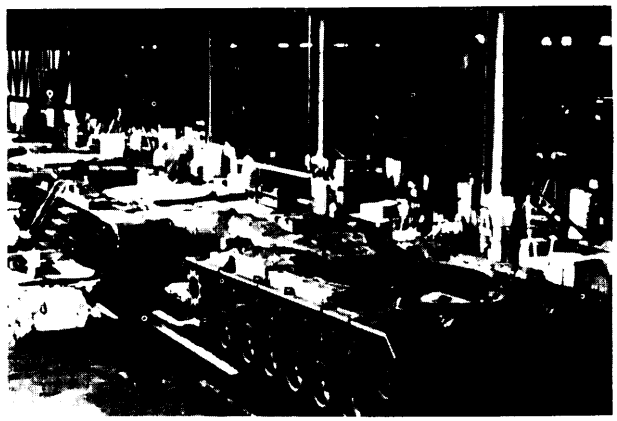


Photo credit: U.S. Army

Anniston Army Depot performs depot level maintenance on the Army's tanks.

employs about 18,000 people in its in-Service facilities.[16] (See table 5-4,) In fiscal year 1990 the program repaired over 300,000 secondary items (e.g., radios) and almost 100,000 major end items (e.g., tanks, trucks, engines) .17

Over the past decade, the Army has contracted out to private firms between 30 and 40 percent of its total depot work. The percentage contracted out varies by type of equipment. For example, in fiscal year 1989, about 50 percent of Army aviation depot maintenance went to private firms, and another 10 to 15 percent was sent to the other Services. In contrast, only about 35 percent of vehicle maintenance was done outside of the organic base, and over 90 percent of that was performed in a government-owned, contractor-operated (GOCO) facility .18 The amount of maintenance contracting has been controversial. Current legislation requires that not less than 60 percent of funds available for fiscal years 1992 and 1993 Army depot level maintenance shall be used for maintenance performed by employees of the Department of Defense.[19] (Congress' role in legislating different private and public-sector mixes of military maintenance is discussed below.)

As a result of DDMC actions, the Army is engaged in a significant restructuring and consolidation by technology and type of equipment at single sites. (See figure 5-1.) Heavy combat vehicle maintenance will be consolidated at Anniston Army Depot, light combat vehicles and artillery at Red River, missiles at Letterkenny, and tactical vehicles (e.g., trucks) at Tooele. Further steps for achieving savings involve the increased use of inter-Service maintenance, and the closing of both the Sacramento Army Depot and the Mainz Army Depot in Germany.

While these steps promise increased peacetime utilization of the remaining facilities, they also carry the risk that depots may be less responsive in crisis or war. Army maintenance planners express concern that excessive consolidations could impair their ability to react to contingencies like Operation Desert Storm. While they acknowledge the important support of private contractors during the Persian Gulf War, they argue that the Army's in-Service capability is essential to support future theater contingencies. Indeed, the Army's maintenance base strategy anticipates that the percentage of future maintenance carried out in government facilities will increase,[20] The Army's flexibility in reducing the percentage of maintenance in government facili-

16 U.S. Army Depot System Command b+ fing, Nov. 13, 1991. DESCOM employs more than 30,000 personnel. The remainder of these personnel are involved in meeting the command's other responsibilities: amrn unition storage, maintenance of portions of the Nation's strategic materials stockpile, and the distribution of commodities assigned by the Army Material Command, the Defense Logistics Agency, the General Services Administration, and other suppliers.

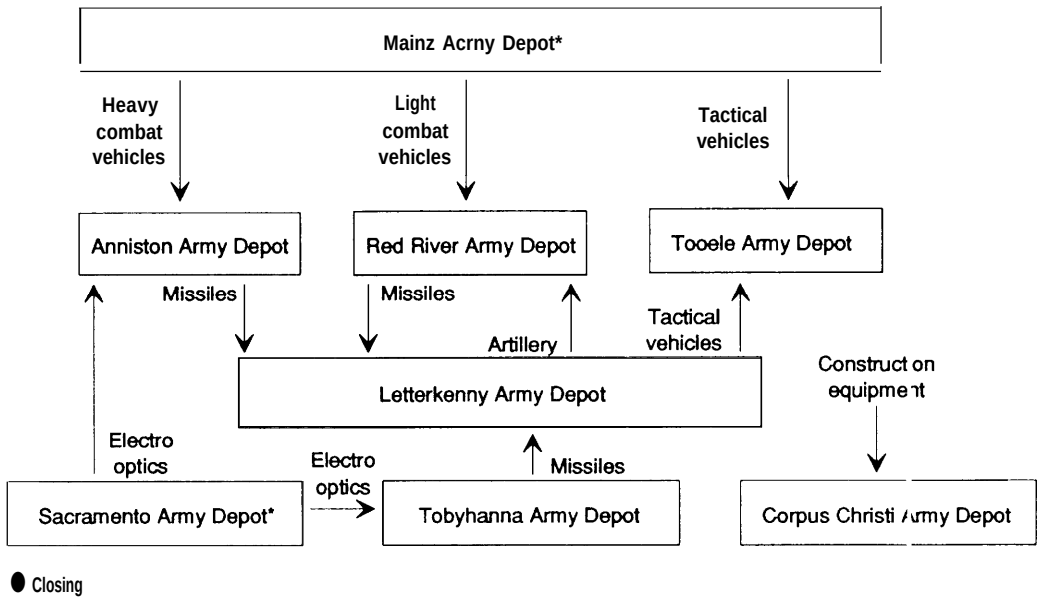
17 U.S. Army Depot System Command Director for Maintenance briefing, Sept. 30, 1990.

18 Kiebler et al., op. cit., footnote 7.

19 National Defense Authorization Act for Fiscal Years 1992 and 1993, sec. 314.

20 Defense Depot Maintenance Council, op. cit., footnote 6, pp. 12-13.

Figure 5-l—Army Depot Maintenance Realignment: Work Consolidation



NOTE: This figure does not include inter-Service transfers.
SOURCE: DESCOM command briefing.

ties (should it decide such reductions are best) is limited by legislation.

DESCOM will soon be consolidated with a portion of the Army Armament, Munitions, and Chemical Command into a single Army Industrial Operations Command. This new command is expected to consolidate the depots into smaller, robust manufacturing and maintenance centers that will focus on maintaining those military systems used in the short-warning regional conflicts that Army planners believe are the most likely contingencies in the foreseeable future.

Navy Maintenance and Overhaul

Navy depot maintenance and overhaul is managed by two organizations. The Naval Air Systems Command (NAVAIR) controls the six Naval Aviation Depots. The Naval Sea Systems Command (NAVSEA) manages the public shipyards (table 5-5) and controls the repair and overhaul work conducted at private shipyards. NAVSEA also manages ordnance facilities and weapons stations that perform depot level maintenance. Total Navy maintenance was over $6.5 billion in fiscal year 1991.

Navy ship repair and overhaul is conducted at 44 private shipyards and 8 Navy shipyards. The workforce engaged in Navy repairs and overhaul work consists of about 20,000 in the private sector (out of a total private shipyard workforce of just over 100,000) and 60,000 public-sector workers (which the Navy plans to reduce to about 40,000). Additionally, U.S. Navy ships whose home ports are outside the United States are overhauled overseas. For example, Navy overhaul and repair activities at Subic Bay, Philippines; Guam; and Yokosuka, Japan have, in recent years, totaled more than $100 million per year.

In the mid- 1960s, the Navy adopted a policy of assigning all new ship construction to private shipyards and having its own shipyards concentrate on overhaul and repair. Since that time, 60 to 70 percent of the Navy's ship repair and overhaul work has been done by Navy shipyards, while the remaining work, along with all new construction, has been performed by private-sector yards.[21] Congress required competition between the private and

21 Clinton H. Whitehurst, Jr., *The* U.S. *Shipbuilding Industry* (Annapolis, MD: Naval Institute Press), p. 90, notes that between 1974-1983 about 30 percent of Navy ship repair went to private shipyards.

Table 5-5---Navy and Marine Corps Depot Maintenance Facilities

Fad lit y	Location
Naval Aviation Depots	
NADEP Alameda	Alameda, California
NADEP Cherry Point	Cherry Point, North Carolina
NADEP Jacksonville	Jacksonville, Florida
NADEP Norfolk	Norfolk, Virginia
NADEP North Island	San Diego, California
NADEP Pensacola	Pensacola, florida
Naval Shipyards	
Naval Shipyard Charleston	Charleston, South Carolina
Naval Shipyard Long Beach	Long Beach, California
Naval Shipyard Mare Island	San Francisco, California
Naval Shipyard Norfolk	Portsmouth, Virginia
Naval Shipyard Pearl Harbor	Pearl Habor, Hawaii
Naval Shipyard Philadelphia[a]	Philadelphia, Pennsylvania
Naval Shipyard Portsmouth	Portsmouth, New Hampshire
Naval Shipyard Puget Sound	Bremerton, Washington
Ship Repair Facilities	
SRF Guam	Guam, Mariana Islands
SRF Yokosuka	Yokosuka, Japan
Marine Corps Logistics Bases	
MCLB Albany	Albany, Georgia
MCLB Barstow	Barstow, California

a Scheduled to be closed.

SOURCE: Defense Depot Maintenance Council, *Corporate* Business *Plan FY 91-95,* December 1991.

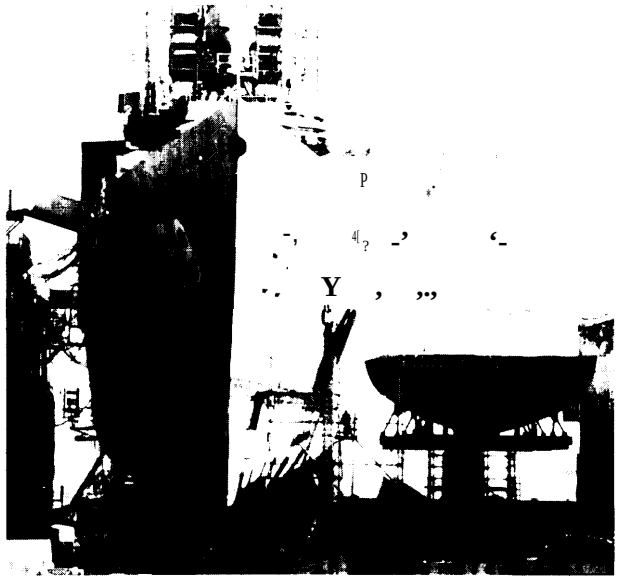


Photo credit: Bath Iron Works

The U.S.S. Samuel B. Roberts at the Bath Iron Works undergoing extensive repair for mine damage. Many t ypes of maintenance and repair work require the same skills and facilities as manufacture.

public sectors for Navy ship overhaul and repair beginning in 1985. By 1990, largely because of declines in shipbuilding work, repair constituted almost 20 percent of the work in private yards doing business with the Navy.[22]

The Navy Sea Systems Command's plan for achieving its DMRD-908 savings goals includes consolidations and reductions in workforce that began in fiscal year 1991. The Navy reports that its ship depot level maintenance resides in both private and public yards, although the near total lack of new construction threatens the survival of private U.S. shipyards. The Philadelphia Naval Shipyard is scheduled to close once it completes work on the aircraft carrier *Kennedy, The* Navy has recently proposed consolidation of its ship overhaul capabilities by creating a central-hub shipyard on both the east and west coasts that would provide ''support functions such as planning, design, procurement and accounting and maintenance. ''[23] This consolidation of overhead functions would support a series of satellite yards that retain unique facilities (e.g., nuclear submarine overhaul and repair, and aircraft carrier overhaul) and trained personnel. Despite the consolidations and closures to date, and those that are planned, there is still considerable overcapacity in U.S. shipbuilding and repair. Nevertheless, the Navy's ability to consolidate further may be constrained by the huge capital investments in dry docks and support equipment required in its specialized maintenance facilities.

Naval aviation depot maintenance, employing more than 20,000 people, is carried out in 6 Naval Aviation Depots, which also benefited from the modernization of the 1980s. In response to DMRD-908, the Navy plans by fiscal year 1992 to consolidate maintenance activities for each type of aircraft at single sites.[24] plans call for the 6 depots to be

22 *Naval Sea Systems* Command, *United States Shipbuilding Industry,* briefing paper, July 1990. Navy shipbuilding covered the bulk of all other work. The latest Navy report to Congress on shipbuilding, *Report on the Effects of the FY 1991-97 Navy Shipbuilding and Repair Programs on U.S. Private Shipyards and the Supporting Industrial Base,* April 1991, noted that "In recent years, Navy funding has accounted for 90 percent of the employment at those private yards performing Navy work. Further, 90 percent of Navy shipbuilding funds has been concentrated in only five private yards.' '

23 Robert Holzer and Neil Munro, "Navy Weighs Overhaul of Shipyards, " *Defense News,* Dec. **23, 1991,** p. **17.**

24 Defense Depot Maintenance Council, op. cit., footnote 6, p. 15. The A-6 will not be single-sited until the completion of current rewing work.

Table 5-6—Air Force Organic Depot Maintenance Facilities

Facility	Location
Air Logistics Centers	
Ogden Air Logistics Center	Hill Air Force Base, Utah
Oklahoma City Air Logistics Center	Tinker Air Force Base, Oklahoma
Sacramento Air Logistics Center	McClellan Air Force Base, California
San Antonio Air Logistics Center	Kelly Air Force Bas e, Texas
Warner Robins Air Logistics Center	Robins Air Force Base, Georgia
Other Air Force depot maintenance activities	
Aerospace Guidance and Metrology Center	Newark Air Force Stat on, Ohio
Support Group Europe[a]	RAF Kemble, United Kingdom
Detachment 35	Kadina Air Force Base, Japan
Aerospace Maintenance and Regeneration Center	Davis-Monthan Air Force Base Arizona

a Scheduled to close.

SOURCE: Defense Depot Maintenance Council, *Corporate Business Plan FY 91-95,* December 1991.

linked through two Business Operating Centers co-located with the depots at Norfolk, Virginia and North Island, California. According to the Navy, savings will be achieved by reducing the number of personnel who now work on a single aircraft type at more than one site, and through equipment reductions.[25] Engine and aircraft component work is being consolidated, and Navy plans also call for increased inter-Service maintenance. The aviation depots, like the naval shipyards, have engaged in limited competition with commercial firms since 1987. The Navy projects savings from competition in aircraft maintenance to add up to more than $550 million between fiscal year 1992 and fiscal year 1995.

Marine Corps Depot Maintenance

The Marine Corps has two logistics bases. (See table 5-5.) The Service has done little outside contracting and has used Navy facilities to support Marine aviation. Pursuant to DMRD-908, the Marine Corps plans ''cost avoidance' of about $27 million by not developing its own Abrams tank maintenance facilities, It also anticipates additional savings from increased inter-Service maintenance combined with increased competition. Indeed, most proposed Marine Corps savings are expected to come from increased efficiency resulting from greater competition, both among the Services and between the public and private sectors.

Air Force Depot Maintenance

The depot level maintenance activities of the Air Force are currently managed by the Air Force Logistics Command and include the repair, modification, and support of aircraft and equipment.[26] The Air Force has five major A r Logistics Centers (ALCs), some smaller support centers, and a limited depot maintenance capability overseas. (See table 5-6.) Air Force maintenance currently employs about 36,000 people (scheduled to fall to about 31,000 by 1995). Fiscal year 1991 work totaled most $4.7 billion. The Air Force performs about 60-70 percent of its depot maintenance in its ALCs.[27] Another 6 percent of Air Force depot work is performed by the other Services,[28] and the remainder is performed by private firms under contract. In fiscal year 1988, the Air Force Logistics Command repaired or modified 1,307 aircraft, 7,727 engines, and 817,000 exchangeable parts. Approximately 90 Air Force systems are currently supported throughout their life by the private sector.

The Air Force modernized its depot maintenance system during the 1980s. It has long consolidated its depot maintenance around Technology Repair Centers. For example, the repair of aircraft engines is concentrated at the Oklahoma City and the San Antonio ALCs and landing gear - at Ogden ALC. The Air Force is now downsizing and further consolidat-

~ Ibid., p. 14.

26 On July 1, 1992 the Air Force Logistics Command and Air Force Systems Command will merge into the Air Force Materiel Command.

27 MG Joseph K. Spiers, commander, Oklahoma City Air Logistics Center, testimony before the House Committee on Armed Services, Panel on the Structure of the U.S. Defense Industrial Base, Nov. 1, 1991.

28 Air Force Logistics Center, *1988 Production Base Analysis,* October 1989, p. *ix.*

ing its base to reduce total costs by about $1.1 billion between fiscal year 1991 and fiscal year 1995.

Current Air Force mobilization planning requirements are based on a scenario that envisions two simultaneous regional conflicts in different parts of the world.[29] Air Force studies of the infrastructure needed to support these requirements caused the Service to begin downsizing the workforce beginning in fiscal year 1991. The Air Force plans to retain, but scale down, each of the current ALCs.

The Air Force plan calls for rapid personnel reductions, installation closures, and process improvements. In the longer term, savings will be accomplished by increased inter-Service maintenance competition and increased utilization of facilities, Most long-range savings are expected to come from greater efficiency spurred by competition.[30]

The Air Force considers the retention of skilled personnel an immediate and important problem and is concerned about their loss as budgets and forces decline. The commander of the Oklahoma City ALC, for example, testified that he was losing both current expertise and future capability because his older, experienced workers were leaving through ''early-out retirements and his younger workers were leaving because of reductions-in-force.[31] A second Air Force concern is its ability to continue sufficient investment in depot facilities over the long term.

REQUIREMENTS FOR A ROBUST FUTURE MAINTENANCE BASE

Congress and the DoD need to plan the size and nature of the future maintenance base. As discussed at the beginning of this chapter, the future base will be smaller because the Nation will have fewer deployed weapons, will face smaller military threats, and systems in the field may be more reliable. Even so, the retention of older weapon systems will make maintenance, as well as upgrading and retrofitting, important. Much of this upgrading is expected to occur in avionics, electronics, software, and advanced materials. Thus, a future robust maintenance base will not be just a collection of metal-working shops but must be capable of supporting an increasingly complex inventory of weapon systems.

Photo credit: DoD

In modern combat, field maintenance must be able to return equipment rapidly to operation.

The future maintenance base must be efficient in peacetime; this is an objective of many current Service initiatives. The Services' plans for future efficiency rest on the increased use of competition and better use of physical plant. But competition and high facility utilization can be incompatible. True competitive bidding implies multiple sources, and hence some overcapacity. The anticipated savings through competition hoped for by each Service may be based on the belief that it, and not another Service, will win such competitions. A major bonus of increased competition is that it is a politically acceptable way of eliminating facilities (public as well as private) that are unable to modernize adequately. Another way to improve efficiency is through new maintenance techniques and technologies, including modular repair centers, robotics, and advanced diagnostic equipment. Built-in diagnostics may reduce field maintenance costs in the future.

The future base must retain a capacity to respond rapidly to crisis or war. However, peacetime efficiency resulting from the high utilization of the maintenance base in peace may also be incompatible with responsiveness in crisis and war. Such responsiveness will continue to be critical in the short-warning regional conflicts that many planners envi-

29 Defense Depot Maintenance Council, Op. Cit., footnote 6, pp. 34-35.

30 Ibid.

31 I Spiers, op. cit., footnote 27.

sion in the future. During the recent Gulf War, the depot system appeared to respond well. The Services modified equipment both in the United States and in the Gulf. The Army DESCOM, for example, shipped 500,000 tons of materiel, rapidly upgraded 743 MIA1 Abrams tanks, deployed 2,000 civilian employees to the theater, and established a forward maintenance facility in Saudi Arabia. Contractors also deployed hundreds of maintenance personnel to the theater of operations and made important modifications to equipment once they were there. Although the future maintenance base will need to respond, there will be a lesser magnitude of wartime demand associated with the smaller contingencies likely in the foreseeable future.

ALTERNATIVES FOR THE FUTURE

The principal alternatives for ensuring a robust depot level maintenance base in the future are evident in the Service's responses to DMRD-908, and were noted earlier in the chapter. They are discussed below and include:

1. reduction and consolidation of current in-Service and private-sector capabilities;
2. increased use of the private sector both to gain expected efficiencies, and also to provide support for the private production base;
3. increased use of competition;
4. development of new technology for maintenance; and
5. maintenance and upgrading of U.S.-produced equipment abroad as well as foreign-produced equipment.

These alternatives, as noted earlier, are not mutually exclusive; rather in combination they could fashion a future robust maintenance base.

Reduction and Consolidation

Reduction and consolidation of the base is ongoing, as described above. Current plans are significant in the context of past DoD attempts at consolidation. But viewed in the context of the end of the cold war, these plans are less impressive. Even after present plans are carried out, the DoD will have almost the same number of major in-Service maintenance facilities as existed during the cold war.

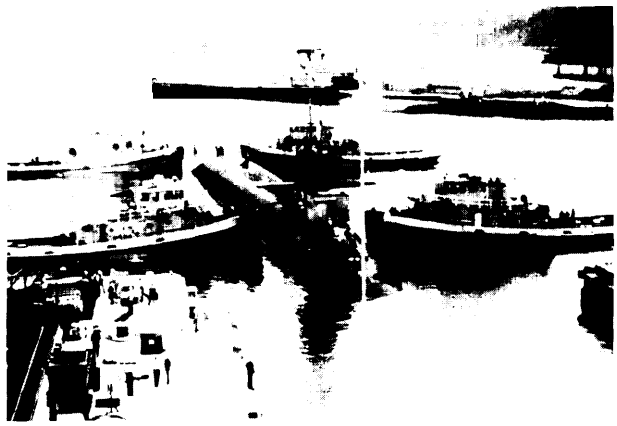


Photo credit: U.S. Navy

A nuclear submarine leaves the dry dock at Bangor, Washington. Some specialized maintenance work, such as repair and overhaul of nuclear-powered submarines, can only be accomplished at special sites.

Further consolidation can be carried out across Service lines. Consolidating maintenance of similar systems or technologies at single facilities—regardless of Service affiliation--reduces overhead and makes better use of specialized capabilities. Projected DMRD-908 savings from inter-Service maintenance are $120 million for the fiscal year 1991 to 1995 period. The Services report that over 60 percent of depot work could be accomplished by more than one Service. This figure excludes work that requires such specialized facilities as large drydocks, large hangers, naval nuclear-reactor refueling facilities, and the skilled people to run them. Nevertheless, in fiscal year 1989 only 6 percent of the maintenance that could be performed on an inter-Service basis was sent a moss Service lines, indicating considerable redundancy in the base. That percentage is projected to rise to only about 9 percent by fiscal year 1995.[32]

Individual Service planners express a number of concerns about inter-Service maintenance consolidation. One of the principal worries is that another Service will not meet the special requirements of particular equipment, such as he Navy's need to protect its aircraft engines from he corrosive effects of the marine environment. O her risks cited are possible lack of responsiveness by another Service.

The ongoing reductions and consolidations are politically unpopular because they carry up-front costs that may seem large compared to the promise

32 Defense Depot Maintenance Council, op. cit., footnote *6, pp. 37-~.*

of future, long-term savings. In particular, Service depot maintenance facilities are important sources of jobs. Public opposition to impending closings has led Congress to mandate work assignments to particular facilities to keep them open. But congressionally mandated workloads make it difficult for the DoD to improve the efficiency of the maintenance base. A Logistics Management Institute (LMI) study found, for example, that special legislation enacted in 1986 exempting the Army electronics repair depots from personnel reductions resulted in significant inefficiencies in managing depot workload.[33] Thus, even when Services decide to consolidate facilities, they may be barred from doing so because of congressional pressure to preserve jobs.

The expected large reductions in maintenance requirements, combined with falling defense budgets, make it imperative to rationalize the depot maintenance base. One way of dealing with this problem is legislation such as the Defense Base Closure and Realignment Act of 1990, which requires that all installations be considered equally for possible realignment or closure. The Act established new procedures for closing military installations in the United States and formed an independent commission to recommend which bases should be eliminated.[34] Such legislation can help assert the *national* interest in rationalizing the maintenance base over the *local* interest in preserving jobs.

Changing the Private/Public Mix

The current debate over increasing the percentage of private-sector involvement in future depot maintenance work is principally motivated by two factors: (1) the anticipated reduction in new weapons production that will leave large defense manufacturing firms with little *new* production for the foreseeable future; and (2) the reduction in spending in the depot base that is driving the consolidations and reductions discussed above. Advocates of more private-sector involvement argue that the private sector can provide depot maintenance at lower cost than can the public sector, and that a shift toward the private sector would help keep the production base healthy during a period of much reduced new weapon procurement.

There are, however, concerns about the long-term implications of increasing the private-sector share of depot maintenance and skepticism about the utility of using depot maintenance to support manufacturing skills. The concerns center on questions about how well the private sector can respond to short-notice crisis and conflict requirements, and whether private contractors can indeed provide depot maintenance at a lower cost. The skepticism centers on the amount of overlap between maintenance and manufacturing skills and whether performing maintenance can indeed support relevant manufacturing skills. It is worth noting, however, that most allies in Europe and the Far East rely on their private sectors for almost all their military depot maintenance.

The Current Mix

A significant portion of depot maintenance funding is currently spent in the private sector. For example, between 20 and 30 percent of the depot level maintenance is now performed by private fins. Almost all new weapon systems begin their service lives under interim contractor support (ICS) provided by the manufacturer of a system. This support usually lasts until the system is deployed in sufficient numbers to warrant transferring maintenance responsibility to the Services. During this initial period, test equipment is developed for use in the Service support base, and Service depot personnel receive maintenance training. While the majority of systems move on to Service depot maintenance, some continue to be maintained by the private sector in what is termed contractor logistics support (CLS).

In addition to the direct revenue from maintenance, repair, and overhaul, the private-sector production base also derives considerable income from the sale of spare parts and other goods and services. The commander of the Air Force Oklahoma City ALC, for example, reported that in fiscal year 1991, his command had contracted for '$2 billion of work with over 6,500 private sector organizations in 46 states and 9 foreign countries. ' '[35]

33 Kiebler et d., op. cit., footnote 7, p. 2-23.

34 General Accounting Office, *Military Bases: Observation on the Analyses Supporting Proposed Closures and Realignments,* GAO/NSIAD-9 *1-224, May 1991,* p. **15.**

35 Spiers, op.cit., **footnote 27. Note, however, that much of this is accounted** for by the purchase of spare parts to support work actually done at the ALC.

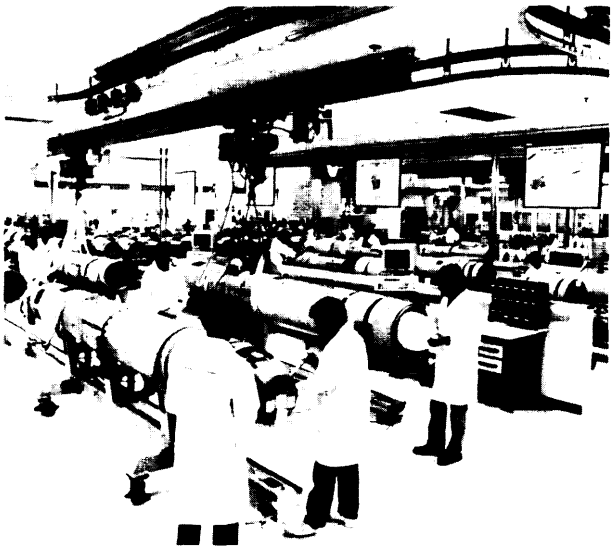


Photo credit: General Dynamics

General Dynamics performs periodic depot maintenance on Navy fleet missiles.

The combination of private-sector maintenance and direct sales accounts for more than 50 percent of current depot maintenance spending. This share demonstrates a private-sector commitment to depot level maintenance and an acceptance by the Services of private-sector involvement. It also suggests the limits of any additional private-sector shift.

The Logistics Core

Current Service and DoD policy of maintaining a ''core in-Service logistics capability will affect any shift to the private sector. The core depot maintenance capability is basically that minimal combination of people and facilities each Service believes it needs to support its forces in likely future operations. According to the Defense Depot Maintenance Council, the logistics core is ''an integral part of a depot maintenance skill and resource base which shall be maintained within depot activities to meet contingency requirements. ' '[36] It is to consist of only a ''minimum level of mission essential capability.

How this concept of a core capability is determined differs among the Services. The Army, for example, defines its core requirements as workloads that are essential to the mission or critical to the capability of each unit. Navy aviation core requirements are based on a regional war scenario. The Navy's core maintenance requirements for its sea forces are defined as ''a responsive, geographically dispersed, strike-free industrial capacity . . . . whose priorities are controlled by the Navy. Interestingly, the Navy's logistics core for sea systems includes private as well as Service facilities and people. The Air Force definition of core requirements is based on an analysis of the skills and weapons needed to support specific regional-conflict scenarios.[37]

Commercial firms will have a difficult time competing with in-Service depots for future maintenance work if the Services reserve a large core for themselves. While the Services' protected logistics core can reduce their own workload fluctuation and maintain internal skills, it has the drawback of increasing the fluctuation in any workloads performed in the private sector. From the Services' perspective, however, the concept of a core capability is critical to maintaining essential expertise. They believe that opportunities for changing the private/public mix of maintenance work will be limited because, as one Air Force commander testified, "government workloads that would be the most attractive to the commercial repair and maintenance sector would be the high-volume, state-of-the-art technology, stable workloads . . . [that are] the very workloads that are imperative for [the Air Force] to keep . . . to maintain a mobilization skills base, "[38]

The Debate over the Mix

The past division of labor demonstrates industry's interest in depot maintenance. Much of the increased interest is in upgrading current] y deployed systems. As part of an integrated DTIB strategy, shifting this work to private firms could provide employment for production staffs during low points in procurement cycles and could also generate another source of income for firms attempting to maintain research and design, as well as production, capabilities. Proposals for upgrading armored vehicles, for example, envision work-sharing arrangements with Service depots to combine depot overhaul with major upgrades and thus keep production lines warm. Upgrading could bring older tanks and infantry fighting vehicles up to date with new communica-

~ Defense Depot Maintenance Council, op. Cit., footnote 6, p. 33.

37 Ibid., pp. 33-35.

38 Spiers, op. cit., footnote 27.

tion and sensor technologies.[39] Upgrades would also support the production base through the manufacture of subcomponents and parts. In fact, upgrades will have a positive impact on subtier firms regardless of whether the overall system work is performed by a prime contractor or an in-Service facility. The Electronic Industries Association (EIA), for example, anticipates that upgrades will provide considerable business for the electronics sector in the next decade, although recently, EIA's estimates of the size of the future market have been going down.[a]

In general, manufacturing firms argue that they have an inherent capability to maintain the equipment they have produced and that developing in-Service support capabilities often ''duplicates an existing commercial defense capability that was developed to design and initially manufacture the military equipment. As such, it is entirely feasible in many cases for the U.S. [private] industrial base to replace the in-Service capability for the U.S. military. ' '[41] Contractors say they are more efficient because the pressures of competitive bidding force them to control costs and that they have different personnel policies than does the DoD. Further, many private contractors say that they are as responsive as the Service maintenance base and point out that current Service response capabilities already depend on spare parts and services from private industry. The private sector's ability to respond quickly has been demonstrated during the Vietnam and Persian Gulf conflicts.

Government proponents of an in-Service capability make a number of counterarguments. They believe that in-Service maintenance facilities are more responsive in crisis and war than private industry, and are also more flexible because they can take on new work without changes in contracts. The Air Force, for example, has testified that the Air Logistics Centers have "the flexibility to deal with a highly dynamic war environment and that no contractor or group of contractors could replace the cohesive, highly flexible capabilities of the in-Service facilities. ' '[42] Along similar lines, the Army argues that assigning surge maintenance tasks "to the private sector, without the insurance of the contractor's ability to rapidly expand, could jeopardize the Army's ability to get equipment to the soldier in time of national emergency. ' '[43] The Navy has expressed less concern about increasing private-sector involvement in maintenance than the other Services. In part this is because shipyards are large and easy to monitor and also expensive to duplicate. The Navy plans for private shipyards to be the sole provider of some of its ship maintenance and considers private-sector yards to be part of its core sea systems capability.

The Services have noted that many systems maintained in contractor logistics support in the past have ultimately devolved to in-Service maintenance as they aged and became more difficult to repair. As a result, Service officials are concerned that they will be stuck with maintaining all the old systems rather than those essential to war-fighting. Other risks associated with relying on the private sector are said to be strikes and bankruptcies. A Logistics Management Institute study concluded, however, that these problems are likely to occur only in peacetime and can be dealt with by the DoD through existing legal mechanisms."

The evidence supporting arguments on either side is scarce and largely anecdotal. Some General Accounting Office (GAO) studies have questioned the economics of developing in-Service depot support capabilities for equipment that may be widely used commercially. A recent GAO study, for example, found that the Air Force had spent millions of dollars establishing a maintenance capability for the new engine of the KC-135 tanker but was using only about 15 percent of that capacity. GAO argued that the Service might better have relied on existing

39 Caleb Baker, ''Army Seeks Stable Bradley Production,'' *Defense News,* Oct. 14, 1991, p. 8.

40 Breck W. Henderson, ' 'Stagnant Military Electronics Spending Likely Under Tight 1990s Budgets, ' *Aviation Week and Space Technology,* Mar. 16, 1992.

41 Mr. Gordon R, England, Executive VP-Aircraft Programs, General Manager-Fort Worth Division, General Dynamics, *Statement before the House Armed Services Committee, Structure of the U.S. Defense Industrial Base Panel,* Oklahoma City Field Hearing, Nov. 1, 1991.

42 Spiers, op. cit., footnote 27.

43 Army Information Paper, *Army's* Maintenance *and Logistics* System, May 14,1991, provided in response to OTA questions.

44 Kiebler, et a]., op. cit., footnote 7, pp. 2-24 to 2-26.

326-447 - 92 - 6 : QL 3

commercial facilities.[45] While a GAO study on the effects of competition found that using private/public competition has resulted in savings in naval aviation overhaul, an earlier study of ship repair could not confirm the savings the Navy had projected from greater use of the private sector.[46] Discussions with government personnel indicate a belief that private firms are less responsive in peacetime (because of general business practices), but OTA has been unable to find any hard evidence to show that the Service maintenance base is indeed more responsive than private contractors in a crisis.

Despite arguments that private contractors avoid maintaining older equipment, the Army has contracted out maintenance of older electronics equipment that its own depots do not want to handle. Any migration of older systems into the in-Service base may stop as the Services are forced to pay the true costs of maintenance whether it is performed in the in-Service component of the base or in the commercial component.

Increased maintenance, especially overhaul and upgrades, may help support the production base in some sectors, Upgrades of several armored vehicles might maintain active production lines. Further, some sectors (such as electronics) claim there is considerable overlap in skills between maintenance and manufacturing. Nevertheless, many government planners remain skeptical of the overall benefits of such change. They believe that industry is more interested in production than maintenance and is therefore unreliable, that maintenance skills are different from manufacturing skills, and that DoD efforts to support production will reduce Service maintenance capacity while propping up uneconomical production. Further, the use of private firms could erode surge capability over time. The basis for many of these government concerns is best summarized in an observation by Air Force logistics planners:

> Transferring maintenance tasks to the private sector will provide short term capital to defense firms. Over time, however, it is likely that private sector firms will evolve to ‘ ‘peacetime efficient” operations with little of the ‘‘excess capacity” needed for the essential support of any significant surge. We will have canceled the insurance policy (i.e., organic capability) in anticipation of only “good times. ” If the “good times” end quickly we will be at a significant logistics disadvantage.[47]

Photo credit: Bath Iron Works

This plasma arc burning machine cuts metal pieces for both new instruction and th e maintenance and overhaul of olde ” ships.

Sorting through the arguments on both sides demands systematic study.

Congress

Congress has exhibited a mixed response to increasing private-sector involvement in depot maintenance. For example, Congress and the Navy have sought to ensure that the private-sector share of ship repair not fall below 30 percent.[48] At the same time, Congress has limited private-sector involvement in Army and Air Force depot maintenance to not more

45 U.S. General Accounting Office, *Commercial Practices: Opportunities Exist to ReduceAircraftEngine Support Costs,* GAO/NSIAD-91-240, June 1991, p. 5. The Air Force spent $40 million on a repair facility at the Oklahoma City ALC and also opened three intermediate maintenance facilities for the engine. GAO pointed out that General Electric and Aviall repair similar engines.

46 GAO/NSIAD-92-43, forthcoming, title not available; and U.S. General Accounting Office, *Navy Maintenance." Status of Public and Private Competition,* GAO/NSIAD-90-161, September 1990.

47 Correspondence with Headquarters, Air Force Logistics Command, Mar. 16, 1992.

48 Whitehurst, op. cit. footnote 21, p. 67.

than 40 percent of the funded work.[49] Current law supports some public-sector capability. It states that:

> It is essential for the national defense that Department of Defense activities maintain a logistics capability (including personnel, equipment, and facilities) to ensure a ready controlled source of technical competence and resources necessary to ensure effective and timely response to mobilization, national defense contingency situations, and other emergency requirements.[w]

The law gives the Secretary of Defense the authority to identify those in-Service maintenance capabilities necessary to maintain responsiveness. As a result, the Secretary has discretion over when to use the private sector.

Congress may wish to support significant change in the current private/public mix. Should more private-sector involvement appear desirable, there are a number of ways to move in that direction. One is through increased contracting and competition with the private sector, as discussed in the following section. Another way would be to privatize existing in-Service facilities. Depots might be converted to GOCOs. Such facilities have the advantage of combining long-term government control of the facilities with more flexible private-sector operation on a day-to-day basis. If depots become GOCOs, large capital cost items (e.g., dry docks) could be paid for by the DoD while management and workers could be paid through the private sector. As for responsiveness, many ammunition facilities are GOCOs and are designed to respond to crisis. Depots could also be closed and equipment moth-balled. While this approach would not address the need for responsiveness, it would provide some capability for longer term mobilization.

Finally, depots could be sold to the private sector. Selling depots to industry maybe more difficult than converting them to GOCOs. Privatization could allow the use of the large government investment for commercial as welI as military use. However, industry has shown little interest in buying the defense industrial base facilities that have been for sale over the past decade. Industry would probably prefer to move maintenance activities to existing private-sector facilities.

As Service maintenance organizations become more streamlined, the greater efficiency of contractors may become a less compelling argument for moving to the private sector. For example, the Air Force has reduced its workforce by 6,000 since fiscal year 1991 and plans to support many programs with personnel hired on temporary appointments. Conversely, if the United States chooses to move toward more civil-military integration in weapons design and manufacture, increased use of the private sector for maintenance might make even greater sense.

Cornpetition and Efficiency in Military Maintenance

Competition in ***the*** maintenance base, like that in the production base, is intended to promote efficiency and fairness. In the past, individual DoD program managers had the authority to decide on the basis of cost whether to rely on in-Service or private maintenance, although the Services planned to maintain some core capabilities. But past policies also stressed the importance of multiple sources for wartime expansion. Thus, these policies often aimed at increasing capacity rather than promoting efficiency.

Competition was also used to help private companies gain access to maintenance contracts. Congressional concern about the health of the U.S. shipbuilding industry resulted in opening Navy ship repair work to private shipyards. The frost such competition occurred in fiscal year 1985. By the end of fiscal year 1989, maintenance work on 43 surface ships and 25 submarines had been competed .51 Competition involving the Naval Aviation Depots began in 1987. The National Defense Authorization Act, passed in fiscal year 1991, expanded the maintenance competition programs on a limited basis to all the Services. This program is designed to promote competition among the Services as well as between the Services and private industry.

DMRD-908 proposes to achieve one-third of the projected $3.9 billion maintenance base savings by

49 Both the 1988 and 1989 Defense Authorization Acts contained a requirement that the Army spend a minimum of 60 percent of the depot maintenance budget on programs performed by the organic DoD workforce. Current law mandates that 60 percent (by cost) of Army and Air Force depot work be performed by government employees.

50 10 U.S. Code Section 2464.

51 GAO/NSIAD-90-161, op. cit., footnote 46.

efficiency improvements resulting from competition. Competition is expected to increase efficiency, control and reduce costs, and foster innovative approaches to maintenance. Four areas are to be opened to competition:

1. **items currently under commercial contract whose renewal is imminent,**
2. **major refurbishment and modification programs,**
3. **manufacturing and fabrication, and**
4. **in-Service workloads deemed in excess of the** logistics core.

How effective competition really is in controlling maintenance costs is debatable. As noted above, a 1990 General Accounting Office report on shipyard competition concluded that the Navy's projected cost savings for private yard ship repair could not be substantiated.[52] GAO noted, however, that competition had encouraged the Navy's own shipyards to adopt ''a more businesslike approach to ship repair work. In addition, a more recent GAO study of naval aircraft maintenance found that competition in F-14 aircraft maintenance had resulted in a 25 percent decline in overhaul costs.[53]

Partly because of congressional restrictions, competition is just beginning in the other Services. U.S. Code, Title 10, Section 2466, for example, prohibited the Army and the Air Force from competing against each other or with the private sector. Competition will take some time to develop properly as organizations that have never had to compete learn to price their services and put together bid proposals. But the advent of business offices at depots, and new awareness of overall costs, support the Navy's contention that competition reduces overall maintenance costs.

Structuring competition and developing a "level playing field" agreed to by both the private sector and the public sector will probably remain contentious. A key issue has been how to compare costs among different Service depots and between the private and public sectors. The Services jointly developed and published a *Cost Comparability Handbook* **to** help make these comparisons and eliminate differences in accounting procedures used by various public and private competitors.

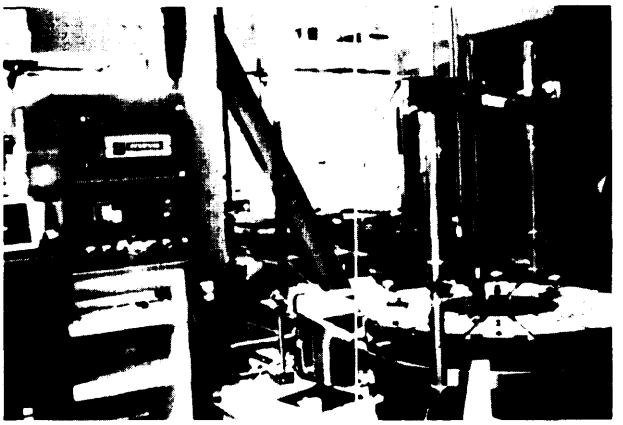


Photo credit: U.S. Air Force

An Air Force repair facility for jet e ngine casings. This and other repair technologies have been developed with special Repair Technology, or REPTECH, funding.

While recent changes promote competition in the maintenance base, there are still major limitations. Current law limits the Army and Air Force competition program to not "more than 10 percent of all depot-level maintenance of materiel that is not required to be performed by employees of the Department of Defense. ' This limitation effectively excludes 96 percent of Army and Air Force maintenance work from the pilot program.

Competition, if it develops, may prove to be a good means of selecting those organizations, private or public, that should be retained in the future maintenance base. It will be much more difficult to preserve a government facility or private firm that has systematically failed to attract work on a competitive basis.

New Technology

The future depot maintenance base should seek to benefit as much as possible from new technology. An obvious area for improvement is the design and development of weapon systems and equipment with higher overall reliability, thereby reducing maintenance requirements. Modular components (e.g., circuit boards) and built -in diagnostic checks are changing maintenance tasks. They are, for example, making it easier to repair and replace equipment in the field.

52 **Ibid.,** p. 1.

53 GAO/NSIAD-92-43, op.cit., footnote 46.

Flexible manufacturing systems, robotics, and computer-integrated manufacturing are all increasingly used in weapon system maintenance and hold the promise of reducing labor requirements. The Air Force has an active Repair Technology program (REPTECH) as a part of its Manufacturing Technology program. The Service's REPTECH initiatives include a flexible center to repair aircraft engine casings at the Oklahoma City ALC, composite engine repair centers at Oklahoma City and San Antonio, and nondestructive means of inspecting solder joints in printed wiring assemblies. The Navy has developed a Rapid Acquisition of Manufactured Parts (RAMP) project at the Charleston naval shipyard to shorten the time needed to produce spare parts, which can take weeks to obtain from the private sector. The Defense Logistics Agency and the Federal Emergency Management Agency are funding a transfer of a prototype of the RAMP technology to a small manufacturer.

Supporting Military Equipment Abroad

Upgrades of U.S. weapon systems abroad, or foreign systems, are another way to support the U.S. defense maintenance base. The potential market is significant. The upgrade of F-5 fighters, for example, is estimated to be a $3 to $5 billion business in Taiwan and Singapore. 54 Upgrading the F-16A/B, which is in foreign nations' air forces, could be worth another $2 billion.[55]

Upgrades or repairs are not the only options for international activities. In the past, U.S. firms have contracted to establish and run military maintenance organizations and facilities for selected countries (e.g., Iran under the Shah). Maintenance support of allied forces is a possible source of future income.

The U.S. government is involved in several international cooperative maintenance programs through the NATO Maintenance and Supply Agency (NAMSA), the primary logistics support agency for NATO.[56] Since 1985, the United States has increased cooperation with its NATO allies for spare-

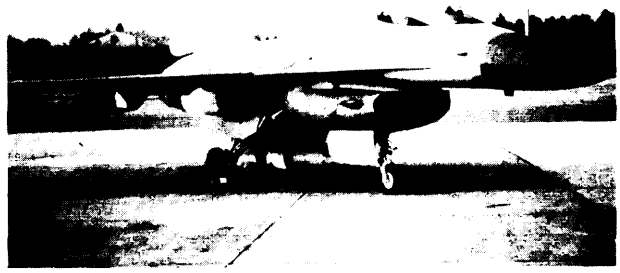


Photo credit: DoD

Belgium's is only one of several foreign air forces that fly the U.S. F-16 fighter aircraft.

parts support and depot level maintenance. The United States is involved in collaborative maintenance on the Multiple Launch Rocket System, the PATRIOT Missile System, and the C-130 Hercules aircraft.[57] There are 11 other NATO maintenance partnership programs in which the United States does not participate.

Opportunities for supplying foreign markets with upgrades, or for providing other services, will depend on U.S. technology-transfer policy—as do initial sales of weapons. The tasks for which U.S. firms might be most competitive (e.g., avionics and electronics) might also present the greatest risk for giving away technological and military advantage.[58] There is also likely to be more international competition as foreign firms vie with U.S. firms for the global maintenance market.

SUMMARY

Maintenance is critical to peacetime operations and to sustaining forces in crisis or war. The requirements for depot maintenance have significantly changed as a result of the waning direct military threat to Western Europe. While current DoD efforts to streamline and consolidate the base

54 William B. Scott, op. cit., footnote 5.

55 Michael Mecham, ''Europ~n Partners Pair Upgrades with New Aircraft Development' *Aviation Week & Space Technology*, July 12, 1991, p. 54.

56 It should be noted that logistics has been a national responsibility in NATO.

57 Department of Defense, *Combined Annual Report to Congress on Standardization of Equipment with NATO Members of Cooperative Research and Development Projects with Allied Countries*, July 1991.

58 At the same time, however, supplying maintenance and upgrades may provide leverage on a client. If the maintenance support is cutoff, the weapon system will degrade.

represent significant change by the standards of the past 40 years, they are insufficient in the new security environment. A smaller national DTIB demands that the Nation consider significant changes in the maintenance base.

Consolidation of in-Service maintenance facilities will be constrained by the fact that such facilities are important sources of jobs, and sometimes the largest employer in a region. As a result, there is often considerable political pressure to maintain these facilities.

Responsiveness of the maintenance base in crisis and war will remain important. However, potential regional threats do not demand the magnitude of surge maintenance required in the past. Future maintenance capabilities might therefore stress peacetime efficiency, which could be enhanced by investments in process technology. The Air Force is using its REPTECH Program for such improvements, but the other Services have made more limited efforts in this area. Congress might wish to consider how best to apply new technology to maintenance.

The arguments for transferring more maintenance responsibilities into the private sector include lower costs, less redundancy, and better support of an integrated DTIB. Congress should examine the arguments for increased use of' the private sector for maintenance and consider how best to modify the public/private split, for example by transferring maintenance work to private firms or by converting public facilities to GOCOs. Increased competition among in-Service facilities, and between the private and public sectors, may be the best way to accomplish this transition. Such competition could select the facilities best qualified to support future forces over the longer term. Finally, Congress should reevaluate the concept of a core logistics capability now used to define which activities should be retained in the in-Service maintenance base.

Maintenance contracts directed towards critical manufacturers in the private sector may help support the firms in a period of declining defense procurement. But the degree of support will probably vary by industrial sector. Combined with a prototyping-plus strategy that provides for some manufacturing, as well as continued technological innovation, private-sector maintenance might add significantly to the health of the future U.S DTIB.