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DEPOT MAINTENANCE

Opportunities to Privatize Repair of Military Engines

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Congressional Committees

In recent years, Congress has dealt extensively with issues related to the cost-effectiveness of the Department of Defense's (DOD) depot maintenance program, the mix of depot maintenance workload between the public and private sector, and the potential for privatizing additional depot maintenance workloads. This report addresses the depot maintenance workload mix for a key mission essential military commodity—gas turbine engines.

It discusses (1) the rationale supporting the continued need for DOD to maintain the capability to repair engines at its own maintenance depots, (2) opportunities to privatize additional engine workloads, and (3) the impact excess capacity within DOD's depot system has on the cost-effectiveness of decisions to privatize additional workloads.

As agreed with your staff, we are addressing this report to you because of your Committees' interest in these issues. We are also sending copies to the Chairmen and Ranking Minority Members, Senate Committee on Governmental Affairs and House Committee of Government Reform and Oversight; the Director, Office of Management and Budget; and the Secretaries of Defense, the Air Force, the Army, and the Navy.

Please contact me at (202) 512-8412 if you have any questions. Major contributors to this report are listed in appendix III.

David R. Warren
Director, Defense Management Issues

List of Committees

The Honorable Strom Thurmond
Chairman
The Honorable Sam Nunn
Ranking Minority Member
Committee on Armed Services
United States Senate

The Honorable Ted Stevens
Chairman
The Honorable Daniel K. Inouye
Ranking Minority Member
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Committee on Appropriations
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Committee on National Security
House of Representatives

The Honorable C. W. Bill Young
Chairman
The Honorable John P. Murtha
Ranking Minority Member
Subcommittee on National Security
Committee on Appropriations
House of Representatives

Executive Summary

Purpose

In recent years, the Defense authorization and appropriations committees have had continuing interest in the Department of Defense's (DOD) management and operations of its $15 billion depot maintenance program. One area of particular interest has been the allocation of depot maintenance workload between the public and private sectors, including various privatization initiatives. As a part of our continuing work on these issues, GAO looked at the potential for privatizing depot repair of additional military engines with commercial counterparts. More specifically, GAO addressed the following: (1) the rationale supporting the continued need for DOD to maintain the capability to repair engines at its own depots, (2) whether there are opportunities to privatize additional engine workloads, and (3) the impact excess capacity within DOD's depot system has on the cost-effectiveness of decisions to privatize additional workloads.

Background

The Fiscal Year 1995 Department of Defense Appropriations Conference Report 103-747 required DOD to report to the House and Senate Committees on Appropriations about the potential for expanding competition for commercial engines as well as other commercial variants operated by the military. In this report, GAO refers to these engines as commercial counterparts. The conference report noted that DOD could realize substantial savings by expanding competition for depot maintenance of equipment common to the military and industry—more specifically, commercially developed airline turbine engines. On March 14, 1995, DOD gave the House and Senate Appropriations Committees its report.[1]

The report concluded that DOD needs maintenance capability at its own facilities to manage risk as it relates to major regional conflict readiness and sustainability requirements. The report also stated that DOD's approach for achieving this objective is the operation of a certain level of capability in military depots—capability that DOD refers to as "core." The main premise behind core is that DOD should maintain a controlled source to meet readiness and sustainability requirements of the weapon systems that are needed to support Joint Chiefs of Staff contingency scenarios. The report concluded that the current mix of engine depot maintenance workload for 17 military engines with commercial counterparts is consistent with (1) the DOD core concept, (2) sound business practices, and (3) the title 10 U.S.C. requirement that not more than 40 percent of

[1]Maintenance of Military Turbine Engines With Civilian Engine Counterparts.

depot maintenance work be performed by other than federal government employees.

Results in Brief

The rationale and requirement for maintaining some capability in the public depot system derive both from statutory requirements and from the recognition that some public depot capability is needed to mitigate cost and readiness risks where private sector capabilities are limited or inadequate. DOD is reevaluating its depot capability requirements with a view toward privatizing additional depot maintenance workloads.

Private sector capabilities generally make commercial counterpart engines ideal candidates for privatization. However, DOD has about 45 percent excess capacity for engine depot maintenance—a very inefficient condition that increases the cost of all work done by these depots. Thus, additional privatizations of commercial counterpart engines at a time of decreasing depot workload—without first decreasing the excess capacity in DOD's depots—would increase the per-unit repair cost of work remaining in DOD's depot system.

The Base Closure and Realignment Commission recommendation to realign Kelly Air Force Base and close the San Antonio Air Logistics Center, including one of the largest DOD engine overhaul depots, offers DOD the opportunity to reduce excess engine capacity, improve the cost-effectiveness of remaining public sector engine repair facilities, and privatize some additional commercial counterpart engine work. However, the administration's decision to keep the depot open by privatizing its workload in place may limit or preclude any reduction in public depot excess capacity and associated overhead costs.

It is not yet known how DOD plans to implement its privatization initiatives, including the privatization-in-place of the San Antonio depot, or how it will address statutory provisions such as the 10 U.S.C. 2469 provision requiring competitions that include public depots before privatizing depot maintenance workload valued at $3 million or more.

Principal Findings

Legal Requirements Contain Basic Rationale for Maintaining Public Depots

Several statutes influence DOD's allocation of depot maintenance workloads—including engines—between the public and private sectors. First, 10 U.S.C. 2464 states that it is essential for DOD to maintain a ready and controlled source for mission-essential engine maintenance by establishing depot-level repair capability within its own depot system. DOD defines almost all of its engine maintenance capability as mission essential or "core." However, the Secretary of Defense may convert core engine workloads to contractor performance under Office of Management and Budget Circular A-76 procedures, but only in accordance with DOD criteria for determining that government performance of the work is no longer required.

Second, 10 U.S.C. 2466 prohibits the military departments from using more than 40 percent of any fiscal year's depot-level maintenance funds to contract workload to the private sector. DOD reports that only about 28 percent of its depot maintenance workload is currently contracted out. Accordingly, there are opportunities to privatize additional work without breaching the 60/40 limits. Further, since the commercial counterpart engine workload currently maintained in public depots represents only about 2 percent of the overall depot maintenance workload dollars, additional privatization of this workload would have little impact on the overall public-private sector mix.

Finally, 10 U.S.C. 2469 provides that DOD may not move depot-level maintenance workload valued at $3 million or more from a public depot to a contractor without competing the workload among public and private entities. It is not yet known whether DOD's plan to privatize depot workloads at closing installations will rely on competitive procedures that include public depots.

Privatization Opportunities for Military Engines With Commercial Counterparts

GAO surveyed private sector companies to determine their interest in repairing military engines with commercial counterparts that are currently repaired in DOD depots and their capability to do the job. The survey identified interest in the maintenance workload for all 10 military commercial counterpart engines that DOD has or is considering developing depot maintenance capability to support. In most cases, the private companies stated they had sufficient capacity to absorb the military

workload in their existing facilities. The existence of multiple private sources for much of the commercial counterpart engine workload would mitigate cost and readiness risks of outsourcing.

GAO believes that seven engines—T56, 501K, F108/CFM56, T63, T700, TF39, and LM2500—are excellent candidates for privatization. To determine the cost-effectiveness of privatization and comply with the statute regarding the transfer of depot maintenance workload to the private sector, those workloads would have to be subjected to a public-private competition. However, the recent decision to privatize-in-place the San Antonio Air Logistics Center—a depot where 60 percent of its workload is for engines and engine components—will greatly impact the cost-effectiveness of privatizing additional engine workloads.

The TF39 aircraft engine and its ship propulsion version, the LM2500 engine, have high commonality in parts and repair processes. Currently, two military services operate separate repair facilities for these engines. This is the only remaining turbine engine that is overhauled in two different military depots. Further, three private repair activities reported interest and capability to repair the LM2500. All three are repairing the LM2500 for commercial industry. Combined, they reported having enough reserve capacity to perform almost six times the Navy's projected fiscal year 1997 workload.

Excess Public Depot Capacity Affects Privatization Opportunities

A public sector depot with thousands of employees incurs fixed overhead costs, including its share of base support costs, in the range of $50 to $100 million annually. When a military depot has excess capacity, moving some of its workload into the private sector can substantially increase each unit's share of overhead expense at the depot and therefore increase the unit cost for all work done by that facility. Under these conditions, it is unlikely that privatizing additional workloads would be cost-effective—without first addressing DOD's excess capacity problem.

The Base Closure and Realignment Commission's recommendation to close the San Antonio Air Logistics Center, including the depot, gave DOD an opportunity to improve the cost-effectiveness of its depot activities. By consolidating military unique engine repair at remaining military depots, excess capacity could be reduced, decreasing overhead rates and reducing engine repair costs. Based on data provided by the Air Force, GAO estimates that consolidating engine workload from the closing engine depot could reduce the overhead rate for engine workload at the

remaining Air Force engine depot by as much as $10 per hour. However, the administration's privatization-in-place plan will likely limit the cost savings that could otherwise be achieved.

Matter for Congressional Consideration

Congress may wish to require DOD to report its plan for privatizing-in-place the engine workload at the San Antonio Air Logistics Center. The plan should include DOD's strategy for determining the source of repair for engine workloads currently at the San Antonio Air Logistics Center and a discussion of the cost-effectiveness of various repair alternatives, including transferring the workload to other military depots and privatization-in-place.

Recommendations

GAO recommends that the Secretary of Defense:

- Require the Secretary of the Air Force to assess the cost-effectiveness of various alternatives for allocating engine workload from the San Antonio Air Logistics Center between the public and private sectors, including privatization-in-place and transferring work to other military depots.
- Develop a plan for reducing excess engine capacity and improving the utilization of military depots not identified for closure. This plan should address how DOD intends to (1) comply with the existing law regarding the use of competitive procedures that include public and private entities when changing depot maintenance workloads to the private sector and (2) reduce excess engine capacity at other DOD engine depots in light of planned privatization.
- Require the Secretary of the Navy to conduct a public-private competition for the LM2500 engine workload.

Agency Comments

DOD officials reviewed a draft of this report and provided official oral comments, which have been incorporated as appropriate. DOD generally concurred with GAO's identification and analysis of (1) factors influencing the allocation of depot maintenance engine workload between the public and private sectors and (2) opportunities for privatizing military engines with commercial counterparts. DOD generally concurred with GAO's recommendations. They noted that DOD is developing a plan to outsource additional depot maintenance workload, including engines, and that this plan is expected to be completed in early 1996.

In this regard, section 311 of the Department of Defense Authorization Act for Fiscal Year 1996, Public Law 104-106 (Feb. 10, 1996) requires DOD to develop and submit to the Senate Committee on Armed Services and the House National Security Committee by March 31, 1996, a comprehensive policy on the performance of depot-level maintenance and repair for the Department. The act provides that this policy should include DOD's identification of core depot-level maintenance requirements in accordance with 10 U.S.C. 2464.

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Abbreviations

BRAC	Base Closure and Realignment Commission
DOD	Department of Defense
GAO	General Accounting Office

Introduction

With over 54,000 engines to support its 17,400 aircraft, the Department of Defense (DOD) is the world's largest owner of aircraft and aircraft engines. During fiscal years 1992 and 1993, the total cost for maintaining these engines was about $1.1 billion of the $13 billion depot maintenance program.[1] Depot repair of engines and engine components requires more funding than any other commodity that is not an end-item weapon system, such as an aircraft or ship. Engine overhaul costs represent about 8.5 percent of the total depot maintenance budget.

Military engines are maintained and overhauled in an extensive network of military service depots, private sector engine manufacturers, and private sector repair activities, such as airlines and independent repair service companies. Of the 51 types of military engines used today, 28 are generally repaired in military depots and 23 almost exclusively by contractors. The engines maintained by the private sector generally have commercial as well as military applications. Generally, commercial counterpart engines repaired by the private sector support fewer aircraft and require less inventory than engines that are maintained in military depots. In recent years, private sector firms have sought more of the military engine workload. At the same time, excess capacity has also been increasing in military depots, as both numbers of military aircraft and engines as well as engine overhaul requirements have declined.

As a part of this review, we analyzed DOD's approach to allocating engine depot repair between the public and private sectors. Engine maintenance has been the subject of recent congressional interest. Additionally, engines are DOD's largest and most costly commodity group. Further, one category of engines—those with commercial counterparts—are either identical or very similar to engines used in the private sector. These characteristics enhance their potential cost-effectiveness as candidates for privatization. As a part of our analysis, we reviewed a March 1995 DOD report to Congress on the maintenance of military turbine engines with civilian engine counterparts.

Background

Depot maintenance involves repairing, overhauling, modifying, and upgrading defense systems and equipment. Depot maintenance also

[1]This includes the cost of material and parts used in the repair process. Material costs for engines generally constitute a larger share of the total repair costs than the material costs for other commodities. The $13 billion does not include the labor costs or the parts and materials required to accomplish major upgrades and modifications. The $2 billion in labor costs associated with these modifications and upgrades is often considered to be a part of depot maintenance, even though the funding is covered in DOD procurement accounts rather than operation and maintenance accounts where most depot maintenance funding is included.

includes limited manufacture of parts, technical support, modifications, testing, and reclamation as well as software maintenance. DOD estimates that its depot repair facilities and equipment are valued at over $50 billion. Thousands of private sector firms also do depot-level repair. Appendix I provides a brief overview of the engine depot repair process, using a flow diagram and pictures.

Depot-level maintenance is the third of the three maintenance levels used by the military services.[2] Depot maintenance activities have historically had more extensive technical capability than the lower levels—in terms of the facilities, equipment, and trained personnel. However, various programs initiated in recent years by the military have resulted in blending some maintenance activities among the various levels. For example, the Air Force implemented a two-level maintenance concept that significantly reduced the second level of maintenance at the operational unit for some systems, including engines. Under this concept, faulty engine components are shipped from the unit to Air Force depots, including the two engine repair depots. The work done in the two-level shops is considered depot-level repair and is performed by a combination of military, civilian, and contractor personnel.

DOD Engines With Commercial Counterparts

DOD has depot-level capability to repair 28 different types of large turbine engines. Most of these engines are used to power DOD's fleet of fixed- and rotary-wing aircraft. Three exceptions are the General Electric LM2500 ship engine, the Lycoming AGT1500 M-1 tank engine, and the Allison 501K, which is used for electrical power generators on ships.[3] DOD also organically repairs many smaller gas turbine engines that provide auxiliary power to aircraft and ground support equipment. DOD contracts for most of the repair of 23 other engines, which power such aircraft as the KC-10, T-38, and C-9.

Most of the 28 engines maintained in DOD's public depots are military-unique and not used in the commercial market place. Military-unique engines include the F100 engine, which powers the F-15 and F-16 aircraft, and the F404 engine, which powers the F/A-18 and F-117A aircraft. However, 10 of the 28 engines maintained in DOD depots

[2]The first is organizational-level maintenance, where members of the operational military unit make functional checks and adjustments, and faulty parts are serviced or replaced. The second is intermediate-level maintenance, where military personnel perform more extensive repairs—many of which require a shop environment.

[3]The Lycoming AGT1500 tank engine does not have a commercial counterpart; therefore, we did not include it in our review.

are comparable to engines used in the private sector. In addition, the Air Force is considering developing repair capability for the F117 engine, which powers the C-17 aircraft and is currently supported by the manufacturer. It is similar to the commercial engine that powers the Boeing 757 aircraft.

Table 1.1 shows the 11 military engines with commercial counterparts for which DOD has or is considering developing depot maintenance capability.

Table 1.1: Comparable Military and Commercial Engines

Military		Original engine manufacturer	Commercial	
Engine	**Application**		**Engine**	**Application**
T56	C-130 E-2 P-3	Allison	501D	Lockheed L-100 L-188 Convair CV-580
501K	Shipboard electrical power	Allison	501K	Industrial power supply
T63	H-58	Allison	250	Bell 206
F108/CFM56	KC-135 E-6	CFM International	CFM56	Boeing 737
TF39	C-5A/B	General Electric	CF6	Boeing 747
T700	H-60 H-64	General Electric	CT7	Bell 214ST Saab 340
LM2500	Cruisers Frigates Destroyers	General Electric	LM2500	Industrial power supply
TF34	A-10 S-3	General Electric	CF34	Canadair 601
TF33	KC-135 B52-H, C141	Pratt & Whitney	JT3D	Boeing 707
F117	C-17	Pratt & Whitney	PW2000	Boeing 757
T53	H-1	Lycoming	T-53-13B	Bell 205a

In most cases where it repairs a military engine with a commercial counterpart, DOD owns a significant portion of the engines in existence. For example, DOD has 25 percent of the F108/CFM56 engines, 54 percent of the T56, 62 percent of the TF33/JT3D, 78 percent of the TF34/CF34, and 95 percent of the T53.

Declining Engine Depot Maintenance Requirements

DOD depot maintenance workload requirements, including engines, have decreased from about 202 million direct labor hours in fiscal year 1987 to about 100 million direct labor hours projected for fiscal year 1996. Since geopolitical tensions eased in the late 1980s, changes in military strategy, reductions-in-force structure, and improved engine reliability have all contributed to decreased demand for engine repair requirements. The change in war-planning scenarios from a massive, protracted war in response to a Soviet invasion to shorter duration contingency scenarios also reduced the anticipated surge requirement for depot maintenance.

Similarly, reductions in aircraft inventory have also reduced maintenance requirements. Between fiscal years 1985 and 1994, the services reduced their aircraft inventories from about 24,500 to 17,400. For example, the Air Force reduced its F-4 aircraft inventory from 1,597 to 61. Depot overhauls of the J79 engine, which supports the F-4 aircraft, also declined from over 500,000 direct labor hours in fiscal year 1986 to an estimated 0 for fiscal year 1997. Further reductions in aircraft inventories and associated engine repair requirements are expected as the services continue to phase out older weapon systems.

In addition, improvements in technology have increased the reliability of turbine engines, reduced the number of depot-level overhauls, and reduced depot-level maintenance requirements. For example, three different engines have powered the KC-135 tanker aircraft. The first KC-135s were fitted with the J57 engine, which was later replaced with the TF33 engine. The Air Force is now replacing most of these engines with the F108. The F108 engine, with an unscheduled removal rate per 1,000 flying hours of 0.10, has 91 percent fewer unscheduled engine removals than the J57, which has an unscheduled engine removal rate of 1.16, and 79 percent fewer than the TF33, which has an unscheduled removal rate of 0.48.

Similar engine reliability improvements have been achieved through modifications of other engines. For example, various upgrades over a 20-year period have increased the periods of time between scheduled overhauls for the F100 from 2 to 8 years.

Downsizing Engine Repair Depots

In response to declining requirements and criticisms for maintaining duplicate sources of repair, the military services have decreased the number of depots with depot engine repair capability. For example, the number of depots repairing turbine engines decreased from eight to six

between 1990 and 1994. Additionally, DOD consolidated repair activities for most engine types at only one depot. As shown in table 1.2, 11 engine types were maintained at two or more depots in 1990. With only one exception, DOD now has only one organic depot-level repair site for each military engine. However, some engines are repaired both by a military depot and one or more private sector contractors.

Table 1.2: Source of Depot Repair for Selected Engines

		Source of depot repair	
Engine model	**Weapon system**	**1990**	**1994**
T56 501K[a]	C-130 E-2 P-3	San Antonio Air Logistics Center, Alameda Naval Aviation Depot, and Norfolk Naval Aviation Depot	San Antonio Air Logistics Center
TF30	F-111 F-14A	Oklahoma City Air Logistics Center and Norfolk Naval Aviation Depot	Oklahoma City Air Logistics Center
J79	F-4	Cherry Point Naval Aviation Depot and Oklahoma City Air Logistics Center	Cherry Point Naval Aviation Depot
J52	A-6 A-4	Jacksonville Naval Aviation Depot and Alameda Naval Aviation Depot	Jacksonville Naval Aviation Depot
J57	B-52G NC-135A	Oklahoma City Air Logistics Center and Norfolk Naval Aviation Depot	Phased-out
TF41	A-7	Oklahoma City Air Logistics Center and Jacksonville Naval Aviation Depot	Phased-out
T58	H-1 H-3	Cherry Point Naval Aviation Depot and North Island Naval Aviation Depot	Cherry Point Naval Aviation Depot
T64	H-53	Cherry Point Naval Aviation Depot and North Island Naval Aviation Depot	Cherry Point Naval Aviation Depot
F404	F-18	Jacksonville Naval Aviation Depot and North Island Naval Aviation Depot	Jacksonville Naval Aviation Depot

(continued)

Engine model	Weapon system	Source of depot repair	
		1990	1994
F110	F-15/16 F-14	Oklahoma City Air Logistics Center and Norfolk Naval Aviation Depot	Oklahoma City Air Logistics Center
TF39 LM2500[b]	C-5A/B Cruisers	San Antonio Air Logistics Center and North Island Naval Aviation Depot	San Antonio Air Logistics Center and North Island Naval Aviation Depot

[a]The 501K is a shipboard generator version of the T56/501D engine.

[b]The LM2500 is a shipboard propulsion version of the TF39/CF6 engine.

These workload consolidations began in 1990 as part of the DOD management review process and subsequent Base Closure and Realignment Commission (BRAC) decisions to close aviation depots. Specifically, Defense Management Report Decision 908 initially called for $3.9 billion in depot cost reductions over a 5-year period, but the target savings were later increased to $6.4 billion over a 7-year period. Efforts to achieve savings included consolidation, interservicing, and competitions between government depots and the private sector. Some of these efforts were superseded by the 1993 BRAC decision to close Alameda Naval Aviation Depot. For example, a single site for handling the T56 engine core workload was to be decided by a public-public competition between Alameda Naval Aviation Depot and San Antonio Air Logistics Center. Following the BRAC decision to close Alameda, the Navy transferred its T56/501K workload to the San Antonio Air Logistics Center.

Despite these initiatives, DOD's engine depot repair facilities continue to have significant excess capacity. During the 1995 BRAC process, DOD's Joint Cross Service Group for Depot Maintenance noted that engines were among the five commodities with the greatest amount of excess capacity. We found this excess capacity to be about 5 million direct labor hours—about 45 percent of the total engine capacity.

DOD Report to Congress on Repair of Military Engines With Commercial Counterparts

The Fiscal Year 1995 Department of Defense Appropriations Conference Report 103-747 required DOD to submit a detailed proposal for expanding competition for depot maintenance of jet engines with civilian counterparts to the House and Senate Committees on Appropriations. The report noted that DOD could save a lot by expanding competition for depot maintenance of equipment common to the military and industry, specifically, commercially developed aircraft turbine (jet) engines. On March 14, 1995, DOD provided the House and Senate Committees on Appropriations with its report.[4]

In its report, DOD concluded that the principal reason for maintaining depot maintenance capability is to support the readiness and sustainability in the Joint Chiefs of Staff major regional conflict scenarios. The report also stated that DOD's approach for achieving this objective is to retain a certain level of capability in military depots—capability that DOD refers to as "core." DOD also concluded that once core capabilities[5] are established, it is essential, from an economic perspective, to use them during peacetime.

In its engine report, DOD reviewed 17 military engines with commercial counterparts—10 maintained in the private sector and 7 in military depots. The report concluded that, for two reasons, no changes in workload allocation between the public and private sector were warranted. First, the repair assignments were consistent with DOD's core requirements and sound business practices. Second, they supported the title 10 U.S.C. requirement that not more than 40 percent of depot maintenance work dollars be performed by other than federal government employees.

Objectives, Scope, and Methodology

Because of significant congressional interest in privatization of depot maintenance workloads, and engine workloads in particular, we addressed the following: (1) the rationale supporting the continued need for DOD to maintain capability to repair engines at its own depots, (2) whether there are opportunities to privatize additional engine workloads, and (3) the impact excess capacity within DOD's depot system has on the cost-effectiveness of decisions to privatize additional workloads.

[4]Maintenance of Military Turbine Engines With Civilian Engine Counterparts.

[5]Core capabilities consist of the minimum facilities, equipment, and skilled personnel necessary to ensure a high level of technical expertise and combat readiness by maintaining an engine system or component in a military depot.

We drew from information gathered as a part of our overall review of DOD's depot-level maintenance program, including our commodity study of depot maintenance aircraft engine workload and capacity. As a part of this effort, we reviewed (1) historical workload data for each depot that performs engine overhauls and repairs engine components; (2) the services' fiscal year 1997 engine workload projections for each depot in our study; and (3) capacity, core workload, and workload projections for fiscal years 1996 through 1999 used by the services to develop recommendations for the BRAC Commission.

We interviewed officials and examined documents at the Office of the Secretary of Defense and Army, Air Force, and Navy headquarters, Washington, D.C.; Naval Aviation Depot Operations Center, Naval Air Station, Patuxent River, Maryland; Air Force Materiel Command, Dayton, Ohio; and Joint Depot Maintenance Analysis Group, Gentile Station, Dayton, Ohio.

We interviewed service officials, examined documents and visited the facilities at the San Antonio Air Logistics Center, Kelly Air Force Base, and Corpus Christi Army Depot, Corpus Christi Naval Air Station, Texas; Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma; Naval Aviation Depot, Cherry Point, North Carolina; Naval Aviation Depot, Jacksonville, Florida; and Naval Aviation Depot, North Island, California.

To determine capacity at each depot, we obtained floor plans identifying work positions for each maintenance shop performing aircraft engine or engine component work. We visited each of the shops and reviewed the floor plans with industrial engineers and shop supervisors to validate the work position counts. Then we determined capacity using the computation method defined in DOD's Depot Maintenance Capacity and Utilization Measurement Handbook (DOD 4151.15-H), which expresses capacity in direct labor hours. This method calculates a product by multiplying work position counts by an availability factor (95 percent) and by annual productive hours (1,615), assuming a 1-shift, 40-hour workweek. We did not include Naval Aviation Depot, North Island, capacity data in our analysis because at the time of our visit, the engine repair shops were being relocated and work position counts could not be accurately determined.

To determine excess capacity, we compared fiscal year 1997 projected workload requirements against our capacity calculations. To identify private sector interest, capability, and capacity to accomplish depot

overhaul and repair on military engines with commercial counterparts, we surveyed 24 private repair activities identified as potential sources of repair by DOD and original equipment manufacturer officials. These repair activities included 2 engine manufacturers, 5 airlines, and 17 independent repair activities.[6]

The private repair activities reported their reserve capacity to repair military engines in terms of the number of whole engines they could overhaul annually. To compare the reserve capacity reported by the private sector to projected military engine workload, we converted the number of engines reported by the private sector to direct labor hours using the depot labor standard or the average number of direct labor hours used to overhaul each engine at the depot. We used the military services' workload projection for engine and component repair. While our methodology has limitations, it provides a rough order of magnitude of the capacity in the private sector relative to the services' projected workload for military engines with commercial counterparts.

We conducted our overall review of DOD's depot maintenance program, including our evaluation of the engine repair program, from January 1994 to October 1995 in accordance with generally accepted government auditing standards.

[6]We contacted each of the original manufacturers of military engines with commercial counterparts regarding their interest in depot overhaul work. One company said it does not do engine repairs, except to support warranties. It said it designates independent repair activities as authorized maintenance overhaul centers. As a part of our survey, we contacted major repair centers that are located in the continental United States.

Factors Influencing Allocation of Depot Maintenance Engine Workload Between the Public and Private Sectors

According to DOD, decisions to select a public or private activity to perform depot work must consider readiness and cost risks, as well as statutory requirements. Statutes require DOD to maintain a minimum level of capability as well as limit the amount of work that can be contracted out to the private sector. Public and private depot repair capabilities, capacity, and competition are key factors that impact readiness and cost, and, therefore, influence source-of-repair decisions. The amount of similarity between the military and commercial engines usually influences private sector capabilities and capacity. The amount of excess capacity in DOD's depot system influences cost.

Statutes Influence Source of Repair Decisions

Several statutes limit the amount of depot maintenance that can be contracted out to the private sector. In addition, they also require competition between the public and private sectors before contracting out work valued at over $3 million.

Retaining DOD Core Depot Maintenance Capability

Title 10 U.S.C. 2464 provides that DOD activities should maintain a logistics capability sufficient to ensure technical competence and resources necessary for an effective and timely response to a mobilization or other national defense emergency. It also requires that the Secretary of Defense identify specific logistics activities necessary to maintain the core capability described by that provision. However, 10 U.S.C. 2464 also provides that core logistics activities may be contracted out using the procedures of Office of Management and Budget Circular A-76 if certain requirements are met.

For depot maintenance, DOD has defined core as the capability maintained within organic defense depots to meet readiness and sustainability requirements of the weapon systems that support the Joint Chiefs of Staff contingency scenarios. Core exists to minimize operational risks and to guarantee required readiness for these weapon systems. Core depot maintenance capabilities will comprise only the minimum facilities, equipment, and skilled personnel necessary to ensure a ready and controlled source of required technical competence. Depot maintenance for the designated weapon systems will be the primary workloads assigned to DOD depots to support core depot maintenance capabilities.

Under the core concept, military requirements are driven by contingency scenarios developed by the Joint Chiefs of Staff. The services must identify what weapon systems and equipment are necessary to meet these requirements as well as the level of depot maintenance that is required to

support these systems. Where the services are certain that they must maintain control of depot support to minimize risk to combat commanders, capabilities are established and retained in organic maintenance depots.

In November 1993, the Deputy Under Secretary of Defense issued a policy memorandum that directed the services to quantify and report their depot maintenance core requirements by January 1994. The Secretary provided the services a methodology to follow in computing their core requirements. In defining core, DOD policy emphasized that core depot maintenance capability comprises only the minimum level of capability needed to support mission-essential weapon systems.

Since core is the capability to support rather than the maintenance of specific weapon systems, this requirement does not apply to workload for specific systems. Thus, depot maintenance for some core engines could be privatized since the capability to repair the engines is similar to the same capability used to repair other core engines in the public depot.

In addition, the policy memorandum stated that it is not core policy that all mission-essential hardware be maintained in a DOD depot. Private industry may maintain mission-essential weapon systems, if a service is satisfied that reliable sources of repair exist in the private sector to negate risk to the weapon system. For example, even though the KC-10 aircraft is a high priority mission-essential system required early in major regional conflicts, DOD contracted out the maintenance for the life of the aircraft. The KC-10 has a high degree of similarity with its commercial counterpart, the DC-10, which DOD believes mitigates the risk of contracting out the aircraft's maintenance.

We asked depot officials to specify how much of their workload for military engines with commercial counterparts they considered to be core. Their responses, which are presented in table 2.1, indicate that most of the 1997 workload requirements for commercial derivative engines is defined as core. It is not clear to what extent this core workload should be conducted in military depots.

Table 2.1: Comparison of Core and Non-Core Workloads by Engine

(Workload in direct labor hours)

Engine model	Fiscal year 1997 total workload	Fiscal year 1997 core workload	Above core workload
TF39	528,788	444,030	84,758.00
TF33	875,740	875,740	0.00
T700	241,030	241,030	0.00
T63	2,975	2,975	0.00
T56/501K	648,732	432,695	216,037.00
F108/CFM56	101,984	101,984	0.00
LM2500	86,938	83,787	3,151.00
TF34	60,286	8,748	51,538.00

The recently published Report of the Commission on Roles and Missions of the Armed Forces challenged the validity of the core concept.[1] According to the report, the services set core requirements that are actually greater than they need and this practice artificially supports the depots' current capacity. The report recommended a time-phased plan to privatize essentially all existing depot-level maintenance.

In his August 24, 1995, comments to the Senate Armed Services Committee regarding the report of the Commission on Roles and Missions, the Secretary of Defense stated that DOD agrees with the Commission's recommendation to outsource a significant portion of DOD's depot maintenance work, including outsourcing depot maintenance activities for new systems. At the same time, he said DOD believes it must retain a limited organic core depot maintenance capability to meet essential wartime surge demands, promote competition, and sustain institutional expertise. The military services are currently reviewing their core requirements.

Limitation on the Amount of Depot Maintenance That Can Be Privatized

As early as 1974, Congress established legislative requirements regarding the allocation of depot workload between the public and private sectors. The Defense Appropriations Act of 1974 provided that, of the total amount of the appropriation made available for the alteration, overhaul, and repair of naval vessels, not less than $851,672,000 million should be conducted in naval shipyards and not less than $359,919,000 million in private shipyards.

[1]Section 951 et.seq. of the National Defense Authorization Act for Fiscal Year 1994 (P.L. 103-160, Nov. 30, 1993) provided for the establishment of the Commission. It was tasked with reviewing the military services' current allocations of roles, missions, and functions and making appropriate recommendations. The Commission's report, Directions for Defense, was published on May 24, 1995.

In addition, prior to 1982, DOD Directive 4151.1, "Use of Contractor and DOD Resources for Maintenance of Materiel," instructed the services that they should limit their depots to do a maximum of 70 percent of their maintenance workload in order to maintain a private sector industrial base. Revisions to this directive in 1982 continued this requirement. It also stated that, to the extent possible, a competitive industrial base for depot maintenance should be established. More specifically, it provided that contractor support should be considered when it would (1) improve the industrial base, (2) improve peacetime readiness and combat sustainability, (3) be cost-effective, or (4) promote contract incentives for reliability and maintainability. This directive was superseded by a 1992 amendment to 10 U.S.C. 2466 that prohibited the military departments from contracting out more than 40 percent of their depot-level maintenance workload funds to the private sector.

In January 1995, DOD reported that about 28 percent of its maintenance expenditures goes to private contractors and 72 percent goes to in-house work. However, we reported in 1994 that the private sector's share is actually much larger—over half of DOD's depot maintenance expenditures go to the private sector when the costs of repair parts or various technical or repair services the depots purchase from the private sector are included.[2]

Although current statutes limit the amount of overall depot workload dollars that can be used to contract with the private sector, neither the statute nor DOD regulations specify how the aircraft engine workload should be allocated. DOD recently reported that it paid about 38 percent, or $164 million, of the $435 million spent on maintaining commercial counterpart engines to the private sector. The remaining $271 million spent on maintaining these engines in the public depots is less than 2 percent of the total depot maintenance budget. Therefore, increasing the private sector's share of DOD's expenditures for repair of this commodity is not likely to significantly impact the overall limitation on commercial repair.

Guidance Related to Moving Depot Workload

Title 10 U.S.C. 2469 provides that depot-level maintenance or repair work with a value of at least $3 million is not to be changed to performance by a contractor unless the change is made using competitive procedures among private and public sector entities. This provision, which focuses on the

[2]Depot Maintenance: Issues in Allocating Workload Between the Public and Private Sectors (GAO/T-NSIAD-94-161, Apr. 12, 1994).

transfer of individual units of work, is designed to ensure that workload transfers are cost-effective.

DOD officials gave differing views regarding the applicability of this statute to workloads at depots closing from BRAC decisions. Although DOD officials stated that they hoped Congress would repeal the provision during the fiscal year 1996 authorization cycle, this did not happen.

Future Use of Public-Private Competitions to Determine Some Allocation Decisions Is Uncertain

Public-private competition is one procedure the services have used to consider the cost-effectiveness of privatizing specific depot maintenance work. It was first used by the Navy in 1985 for its ship repair program. After demonstrating that it helped cut costs, the program spread to naval aviation and then the Army, the Air Force, and the Marine Corps. Although the competition program is credited with significant savings, private contractors generally do not believe the program is fair. They cite as support the fact that Air Force depots won a high percentage of its competed workloads. Noting the Air Force's success, private sector companies—particularly original equipment manufacturers—believed the Air Force depots were not including all of their costs. Private sector firms urged DOD to eliminate public-private competition since they believed the program was inherently unfair.

Nonetheless, the services reported substantial savings from the competitions as depots were forced to reengineer work processes and streamline maintenance organizations. Having traditionally focused on readiness and customer responsiveness, military depots were forced to focus on cost and competitiveness issues. DOD published a cost comparability handbook and undertook various initiatives designed to make the competition program fair. Despite the services' claimed savings, we and DOD audit agencies found that DOD could not verify the results because of weaknesses in its accounting system and internal controls.

The future of competition between public and private entities is questionable and remains uncertain. In April 1994, a government-industry task force on depot maintenance recommended to DOD that the public-private competition program be eliminated.[3] It reported that the inadequacy of DOD's financial management systems to accumulate actual costs for specific workloads in the depots precluded DOD from creating a level basis for public and private competition. A month later, DOD canceled

[3]Report of the Defense Science Board Task Force on Depot Maintenance Management, Office of the Under Secretary of Defense for Acquisition and Technology, Apr. 1994.

the public-private competition program, directing the services to look primarily to the private sector as a source for major weapon systems modifications and upgrades.

In its report on the fiscal year 1995 DOD appropriations bill, the conference committee disagreed with DOD's announced policy and directed DOD to reinstate public-private competition. The Fiscal Year 1995 DOD Appropriations Conference Report 103-747 required that DOD report back to the committees on this subject by January 15, 1995. In its report to the House and Senate Appropriations Committees, DOD stated that its financial systems and databases are not capable of supporting the determination of actual cost of specific workloads. The DOD report also noted that while the Department is developing policies, procedures, and automated systems that will permit actual cost accounting for specific workloads accomplished in organic depots, substantial changes are required that will be time-consuming to complete and implement.

In reviewing DOD's public-private competition program, we found that many of the criticisms of the program involved internal control weaknesses that can be addressed at the local level. Some improvements had already been undertaken when the competition program was terminated, although the momentum for change was lost when the competition program was canceled. Further, some recent initiatives have demonstrated the potential for implementing required improvements.

Recognizing that privatization of depot maintenance workloads only makes sense when it is cost-effective, and that current law precludes privatization without a competitive procedure, we have recommended that the Secretary of Defense (1) reinstitute public-private competition for depot maintenance workloads as quickly as possible; (2) develop and issue guidelines regarding the conditions, framework, policies, procedures, and milestones for reinstituting public-private competition; and (3) require the Defense Contract Audit Agency to review internal controls and accounting policies and procedures of DOD depots to ensure they are adequate for identifying, allocating, and tracking costs of depot maintenance programs and to ensure proper costs are identified and considered as part of the bids by DOD depots.[4]

[4]Navy Maintenance: Assessment of the Public-Private Competition Program for Aviation Maintenance (GAO/NSIAD-96-30, Jan. 22, 1996).

Degree of Similarity Influences Source of Repair

The more similarity there is between military systems and equipment and commercially available items, the greater the likelihood that private repair sources may be cost-effective as depot maintenance sources of repair. Factors that influence the degree of similarity between engines are the commonality of engineering designs, interchangeability of parts, and likeness of repair processes. Similarity affects the availability of spare and repair parts as well as repair facilities, equipment, and trained personnel. The degree of similarity between military and commercial engines can range from 30 percent to 100 percent.

Ten military engines with commercial counterparts are now fully or predominantly maintained in the private sector because they are very similar to their commercial counterparts and because depot overhaul and maintenance in the private sector was determined to be the most cost-effective option. According to DOD officials, the time to make such decisions is before the military invests in establishing its own depot maintenance capability.

Our limited review indicates that organic repair of military-unique engines is generally more cost-effective than noncompetitive awards to the private sector. In the cases we reviewed, we found that repair sources for military-unique engines were limited to one commercial repair source—the original equipment manufacturer—whereas two or more private sector repair sources were generally available for commercial counterpart engines. Competition for a particular product or service significantly reduces the government's costs for products or services.

Limited data available regarding contract maintenance costs for military-unique engines indicate that private sector repair is more costly than organic repair. For example, both the Air Force and a public accounting firm recently compared the cost-effectiveness of public versus private depot maintenance for the F404 engine, which powers the F-117 aircraft, and the F118 engine, which powers the B-2 aircraft. In both cases, the public depots were found to be a more cost-effective source of repair than the original engine manufacturers. In the case of the F404, the analysis resulted in the Defense Depot Maintenance Council transferring the engine workload to the Navy depot at Jacksonville, Florida, where the work will be done under an interservice agreement with the Air Force. The accounting firm's analysis of the F118 confirmed the Air Force's original source selection of the Oklahoma City depot. These examples indicate that privatization of repair for military-unique engines would likely be more

costly than organic repair.[5] The key reason is that this workload is awarded on a sole-source basis to the original equipment manufacturer. We have found that most of DOD's contract depot maintenance is awarded on a noncompetitive basis and that it is difficult to control costs under these conditions.

Excess Capacity Can Influence Source of Repair

The large amount of excess capacity in DOD's depot maintenance system is another factor affecting the cost-effectiveness of contracting out maintenance work. In previous years, war-planning scenarios emphasized a large-scale, full mobilization, but current scenarios emphasize smaller, regional conflicts. This change, combined with reductions-in-force structure, has created significant excess capacity. As a part of DOD's 1995 base closure and realignment process, the Joint Cross Service Group on Depot Maintenance analyzed the capacity of 24 facilities to maintain and repair 16 commodities. It found that DOD's depots have over 3 million direct labor hours in excess engine repair capacity. The engine commodity group was identified as being among the five commodities having the greatest excess capacity.

Our assessment of engine capacity in military depots identified about 5.1 million direct labor hours—or about 45 percent—excess capacity. Table 2.2 shows our assessment of excess engine capacity in the DOD depot system. As indicated, we found the greatest percent of excess engine capacity at the Corpus Christi Army Depot and Cherry Point Naval Aviation Depot and the smallest percent at the Jacksonville Naval Aviation Depot. The excess capacity in the two Air Force engine depots averages about 42 percent.

[5]F404-GE-F1D2 Engine Repair Analysis, Coopers and Lybrand, L.L.P., Nov. 1994. Assessment B-2 Support, Coopers and Lybrand, L.L.P., Nov. 1994.

Table 2.2: Analysis of Engine Excess Capacity[a] at DOD Aviation Depots

(Workload in direct labor hours)

Depot	Capacity	Fiscal year 1997 program workload	Excess capacity	Percent
Navy[b]				
Cherry Point	679,260	253,945	425,315	63
Jacksonville	656,036	447,962	208,074	32
Subtotal	**1,335,296**	**701,907**	**633,389**	**47**
Air Force				
Oklahoma City	4,012,772	2,283,661	1,729,112	43
San Antonio	4,657,251	2,769,594	1,887,657	41
Subtotal	**8,670,023**	**5,053,255**	**3,616,768**	**42**
Army				
Corpus Christi	1,138,644	327,625	811,019	71
Total	**11,143,963**	**6,082,787**	**5,061,176**	**45**

[a]All capacity calculated by us from service data.

[b]Navy data do not include capacity or workload figures for Navy Aviation Depot North Island, which was relocating its engine repair shops at the time of our review. DOD BRAC data indicated the capacity at North Island to be about 131,000 direct labor hours and programmed workload to be about 87,000 direct labor hours.

Actions that increase excess capacity and decrease the utilization of existing depots diminish their cost-effectiveness. For example, an organic depot with several thousand employees may incur fixed overhead costs, including the depot's share of base support costs, exceeding $100 million annually. When a military depot has excess capacity, moving workload out of this facility and into the private sector will result in increasing the share of overhead expense that all the remaining workload must support—increasing the unit cost for all the units produced by that facility. Thus, moving workload from the military depots to the private sector at a time when the depot system already has large amounts of excess capacity only increases the fixed cost that must be recovered by each direct labor hour of work still done in the public depot.

However, despite the existing excess capacity, consolidating the Air Force engine workload at one depot would result in a capacity shortfall. For example, Oklahoma City Air Logistics Center, with a capacity of 4 million direct labor hours, can absorb all but 1 million direct labor hours of the engine workload currently repaired in the San Antonio Air Logistics

Center. However, the difference could be managed by making better use of available building space, adding some additional shifts, transferring some engine workloads to the Jacksonville Naval Aviation Depot, which repairs engines for the Navy; or, as discussed in chapter 3 of this report, contracting out additional engine maintenance workload to the private sector.

Conclusions

Based on DOD's calculations, all commercial counterpart engine workloads could be privatized without breaching the 60/40 legislative restriction on contracting out depot maintenance to the private sector. Public-private competitions would be required before privatizing each engine workload, since the value of each engine's workload exceeds the $3 million threshold provision of 10 U.S.C. 2469. Following this provision should help ensure that privatization would only be undertaken when it is cost-effective to do so. A further consideration should also be the overall cost of operating DOD's entire depot maintenance system. This is particularly the case in light of the extensive excess capacity for engine repair and overhaul currently existing. It is essential that DOD take each of these factors into consideration to ensure that any privatization initiative meets readiness and cost-effectiveness goals.

Agency Comments

DOD generally concurred with our analysis of factors influencing the allocation of engine depot maintenance workload between the public and private sectors. However, in commenting on this, and other recently issued reports addressing issues related to public-private competition for depot maintenance work, DOD only partially concurred with our positions regarding future use of public-private competition. DOD officials stated that a November 1994 memorandum from the Deputy Under Secretary of Defense notified depot activities that they can compete for workloads if certain conditions were met. DOD also stated that it will comply with all applicable legislation when making source-of-repair decisions—including the 10 U.S.C. 2469 requirement that prohibits changing workloads valued at $3 million or more from a public depot without using competitive procedures that include both public and private entities. However, DOD also cited its policy that only core workloads should be performed in its depots and noted that it plans to seek legislative relief from the 10 U.S.C. 2469 requirement.

DOD actions show that in practice it has not reinstituted public-private competitions. DOD has not conducted a public-private competition since it

terminated the program in 1994 and it has not provided guidance to the services for reinstituting public-private competitions. Furthermore, we believe the November 1994 memorandum provided guidance to the services regarding the conditions under which DOD depots could compete for complementary workloads of non-DOD agencies, such as the Federal Aviation Administration's ground communications equipment.

In these circumstances, we continue to believe that DOD has not effectively reinstituted the public-private competition program. Our report[6] includes a recommendation that DOD reinstitute the program and issue guidance regarding the conditions, framework, policies, and procedures for restarting public-private competitions, including the requirement to review the adequacy of the depots to identify and track costs.

[6]Navy Maintenance: Assessment of the Public-Private Competition Program for Aviation Maintenance (GAO/NSIAD-96-30, Jan. 22, 1996).

Privatization Opportunities and Impact of Excess Capacity

Since the end of the Cold War and the reduction in new procurements, commercial contractors have aggressively sought more of DOD's maintenance work. Traditionally, contractors were not interested in military maintenance because it was characterized by sporadic requirements, limited quantities, and other considerations such as proprietary data and older technologies. But, because procurement budgets have begun to decline and relatively few new systems are predicted in the future, the private sector's interest has begun to increase.

DOD has seven engines with civilian counterparts that are good candidates for exploring whether to contract out their maintenance and overhaul. The opportunity appears to be most promising when two factors are present: (1) the military engine has a high degree of similarity with its civilian counterpart and (2) multiple repair (both public and private) sources are able to compete. We did not do a cost analysis to determine whether a private or public source of repair for commercial counterpart engines would be more cost-effective. Rather, we studied these engines to determine if each had the characteristics to make it a good candidate for public-private competition.

Excess capacity in the public depots may reduce the cost-effectiveness of privatizing commercial counterpart engine workloads. Prior to the decision to privatize-in-place the San Antonio Air Logistics Center, the closure of one of the largest organic engine overhaul facilities would have allowed DOD to reduce excess capacity, improve the cost-effectiveness of remaining public sector engine repair facilities, and create opportunities to privatize repair of some commercial counterpart engines. Because the planned privatization-in-place will not reduce excess capacity at the remaining engine repair depots, it may not be cost-effective to contract out to the private sector additional engine maintenance, except in limited cases where it would eliminate redundant or duplicate repair capability.

Similarity of Commercial Counterpart Engines Make Good Candidates for Privatization

Seven engines—T56, 501K, F108/CFM56, T63, T700, TF39, and LM2500—appear to be good candidates for evaluating the cost-effectiveness of privatization by conducting public-private competitions. These engines are very similar to their civilian counterparts and multiple contractors expressed an interest in maintaining or overhauling them. A discussion of each engine is provided in appendix II.

The degree of similarity between military and commercial engines can range from 30 percent to 100 percent. For example, the interchangeability

of parts between the TF33 and its commercial counterpart can range from 40 to 70 percent, depending on the model being compared. These engine types have a high degree of commonality in their engineering design and require the same repair processes, equipment, and skills to overhaul. For other engine types—T56, 501K, T63, LM2500, T700, F108/CFM56, and F117—the military and commercial versions are nearly identical.

According to DOD, there is a logical correlation between the size of the DOD engine fleet relative to the commercial engine fleet and selection of source of depot repair. Where commercial carriers have a significantly larger engine inventory than DOD, there is viable broad-based private sector support available that mitigates risk and affords the opportunity to reduce costs. The competitive environment that exists for these engines allows DOD to benefit from "sharing" fixed-overhead costs with the private sector customers who have substantially larger numbers of engines being serviced. Commercial carriers have significantly larger engine inventory for 5 of the 10 engines—TF39, T63, F108/CFM56, 501K, and F117—than does DOD, as shown in table 3.1.

Table 3.1: DOD and Commercial Counterpart Engine Inventories

DOD engine	Commercial engine	Manufacturer	DOD engine inventory	Commercial engine inventory
TF39	CF6	General Electric	665	4,300
T63	250	Allison	2,400	18,900
F108/CFM56	CFM56	General Electric	1,600	4,000
501K	501K	Allison	255	1,378
F117	PW2000	Pratt & Whitney	51	679
TF33	JT3D	Pratt & Whitney	3,600	2,200
T56	501D	Allison	6,700	[a]5,800
LM2500	LM2500	General Electric	543	509
T700	CT7	General Electric	5,000	2,100
TF34	CF34	General Electric	2,000	570

[a]Includes foreign operators of military configured T56 engines.

Commercial carriers have less than 50 percent of the inventory for three types of engines—the T56, LM2500, and T700—which still appear to be good candidates for public-private competition. These engines have multiple sources of repair in the private sector, and DOD in the past has contracted with the private sector for repair of some of these engines. For

reasons previously mentioned, the TF33 and TF34 engines do not appear to be good candidates for competition.

Multiple Private Sources Able to Compete

To determine if private repair facilities would be interested in and capable of maintaining and overhauling military engines with commercial counterparts, we surveyed 24 private companies with turbine engine repair capability. These companies included 2 engine manufacturers, 5 airlines, and 17 independent repair activities. Of these 24, 18 were interested, and 10 of these either were repairing or had repaired the military engine or its commercial counterpart.

The contractors we surveyed were interested in working on nine commercial counterpart engines. In most cases, they had sufficient capacity to absorb the additional work. The survey showed the following:

- Of the 24 repair activities we contacted, 18 were interested in repairing 1 or more of the 10 military engines with commercial equivalents. The other six contractors were either not interested in repairing military engines or did not have the capability to repair whole engines. The interested companies have repaired or are repairing commercial counterparts.
- All of the 18 repair activities already repair military engines or their commercial counterpart for the military services, foreign countries, or commercial carriers.
- Seven of the 10 military engines have commercial sources of repair. These are the T56, 501K, LM2500, T63, T700, F117, and CFM56 engines.
- The other three—TF33, TF39, and TF34—have repair sources for their commercial counterparts—the JT3D, CF6, and CF34 engine.

We compared the capacity reported by the private sector to the services' projected workload for fiscal year 1997. Table 3.2 provides the results of our survey. When compared to the services' projected fiscal year 1997 workload, the contractors had more than enough reserve capacity to overhaul 6 of the 10 engines.

Table 3.2: Private Sector Reserve Capacity to Repair Military Engines

(Workload in direct labor hours)

	Annual reserve capacity reported by private repair activities compared to fiscal year 1997 defense workload				
Military engine model	Private repair activities responding	Reserve capacity in engines	Direct labor hours per engine	Reserve private sector capacity	FY 1997 defense workload
TF39	3	470	7,529	3,538,630	528,758
TF33	3	750	2,376	1,782,000	875,740
T63	8	1,476	334	492,984	2,975
T56	3	485	1,005	487,425	648,773
LM2500	3	131	3,775	494,525	86,938
F108/CFM56	4	660	646	426,360	101,984
T700	3	345	512	176,640	241,030
501K	2	108	690	74,520	20,010
TF34	1	10	631	6,310	60,286
F117[a]	3	296			

[a]No depot labor standard or projected workload was available for the F117 engine.

The private repair activities reported sufficient reserve capacity to accomplish all of the projected depot workloads for six military engines: TF39, TF33, T63, F108/CFM56, 501K, and LM2500. They reported sufficient reserve capacity to perform 75 percent of the military's T56 workload and 73 percent of its T700 engine workload. However, they reported little interest or available capacity to repair the TF34 engine. Private firms also reported sufficient capacity to handle the military F117 engine workload. The C-17 aircraft and its F117 engine are currently under commercial depot contract until 1997. Because of the absence of interest in the TF34 engine, it does not appear to be a good candidate for privatization. Additionally, because of declining use in the commercial market as well as declining repair sources, the TF33 also does not appear to be a good candidate.

LM2500 Offers a Privatization Opportunity

The LM2500, a ship propulsion version of the TF39 engine, is used to power Navy cruisers, frigates, and destroyers.[1] With the exception of the TF39 high bypass fan section, the two engines are very similar—with about 35 percent of the LM2500 parts interchangeable with TF39 parts. Other parts and components, although not interchangeable, are similar in design and require the same types of maintenance equipment and artisan

[1]The LM2500 engine is used throughout the oil and gas industry to supply mechanical power for pumps, compressors, and generators.

skills to repair. Currently, both engines are repaired in public depots. The TF39 is repaired by the San Antonio Air Logistics Center, and the LM2500 is repaired by North Island Naval Aviation Depot. In addition, three private repair activities, including General Electric, reported interest and capability to repair the LM2500 engine. All three sources are repairing the LM2500 for commercial industry, and they have a reserve capacity capable of performing almost six times the projected fiscal year 1997 workload.

As early as 1978, we reported that consolidating the LM2500 with the TF39 workload at the San Antonio Air Logistics Center would result in savings.[2] We found that the Navy's decision to equip the North Island Naval Aviation Depot to repair the LM2500 reflected the services' reluctance to share depot maintenance, even though such actions created duplicate maintenance capability. Since then, however, North Island has lost all of its turbine engine workload except the LM2500, and as a result, the repair costs of the LM2500 have steadily increased from $443,678 in 1990 to $925,200 in 1995. Naval Sea Systems Command officials believe the costs have increased because the LM2500 is a relatively small workload and is the only turbine engine North Island currently repairs.

Impact of Privatization-in-Place on Excess Capacity

The 1995 BRAC Commission added the San Antonio Air Logistics Center to the list of depots to be considered for closure and realignment. The Air Force initially recommended downsizing all five Air Force depots by mothballing excess space and did not recommend closing any maintenance depots. However, the Commission found that the significant excess capacity and infrastructure in the Air Force depot system required the closure of the San Antonio center. The Commission's recommendation provided that DOD should consolidate the center's maintenance workloads at other DOD depots or contract them out to private contractors as determined by the Defense Depot Maintenance Council. The Commission estimated savings from the implementation of this recommendation at $178.5 million annually.

The closure of the San Antonio depot would create the need for reassigning the source of repair for the T56, 501K, and TF39 commercial counterpart engines as well as the military-unique F100 engine workloads maintained at this depot. The closure of the depot, along with the ready availability of commercial repair sources, would have made the T56, 501K, and TF39 engines potential candidates for privatization through public-private competition.

[2]Aircraft Depot Maintenance: A Single Manager Is Needed to Stop Waste (LCD-78-406, July 12, 1978).

However, in approving the BRAC recommendations President Clinton directed that the workload of the San Antonio Air Logistic Center be privatized-in-place or in the local community. According to DOD officials, they are developing plans to privatize workloads—including engines—in San Antonio, as part of a plan to retain over 16,000 jobs in that city.

Until the administration decided to privatize the workload in San Antonio, the BRAC's recommendation to close the San Antonio Air Logistics Center offered potential opportunities to improve the cost-effectiveness of DOD's depot activities by consolidating engine repair at other DOD depots. Based on data provided by the Air Force, consolidating San Antonio's engine workload could have reduced the overhead rate for engine workload at the remaining depot by as much as $10 per hour. Moreover, the remaining Air Force repair depot could not absorb all of the San Antonio engine workload, which would have created opportunities to privatize some commercial counterpart engine workloads. The Air Force could have also considered outsourcing commercial counterpart engines at its remaining engine depot, such as the CFM56 and TF33 engine, to free up capacity to repair military-unique or more mission-essential engines, such as the F100 or TF39 engines.

Under the administration's proposed plan to privatize-in-place, the Air Force may not be able to move any work from San Antonio to other engine depots or allow private contractors to bid for workloads that they could have otherwise moved to facilities located outside the San Antonio area. Consequently, the plan will have little impact on reducing the excess capacity and improving the cost-effectiveness of remaining depots.

Since the remaining depots will continue to be burdened with excess capacity, moving additional engine workloads from these facilities to the private sector would only increase the fixed costs that must be recovered by each direct labor hour of work still done in the public depot. Therefore, the potential for cost-effective privatization of additional engine workloads may be limited to situations where DOD is maintaining redundant or duplicative depot capabilities for the same or similar engines with commercial counterparts. Such is the case with the LM2500 engine.

Conclusions

Whether or not to maintain DOD facilities for depot maintenance of military systems and equipment, such as engines, is a policy decision that must be made by Congress and DOD. The current policy is to maintain core capabilities in the military depot maintenance system. We agree that there

are valid arguments to support that policy. However, it is not clear how much core capability is required or to what extent cost-effectiveness should be a consideration in the decision-making process. Nonetheless, we believe cost-effectiveness should be a key part of this decision-making process.

Generally, commercial counterpart engines are excellent candidates for privatization, particularly those with high degrees of commonality in parts and repair processes and those where the private sector has a significant share of the total engine population. The existence of multiple sources of repair provides increased opportunity for competitive outsourcing of repair while lessening the operational risk inherent when only a single private source of repair is available. Our review of DOD's commercial counterpart engine repair program supports the potential for privatizing much of this work.

However, while the potential exists to privatize additional commercial counterpart engine workloads, it may not be cost-effective to do so without reducing the large excess capacity and overhead that already exists in DOD's engine depot maintenance structure. Privatization of additional engine work would further exacerbate the severe engine excess capacity problem and the cost of maintaining engines at the remaining military depots. Without a reduction in excess capacity, it is not likely that planned savings from privatization can be achieved.

Prior to the administration's decision to privatize the workload, recommended closure of one of the two major Air Force engine depots offered the potential to improve the efficiency of the remaining engine depots as well as to evaluate the cost-effectiveness of privatizing additional commercial counterpart engine workloads through public-private competitions. If core military-unique workloads from a closing activity are transferred to another public depot with proven capability to perform the work, DOD could not only save costs from the elimination of unneeded infrastructure, but also from the economies resulting from the consolidation of engine workloads and improved utilization of remaining engine facilities.

Because the administration plans to privatize-in-place the San Antonio engine workload, the remaining engine depots will continue to have severe excess capacity and any additional privatization of their commercial counterpart work would increase the per-unit cost of remaining engine work in those depots. Thus, with the exception of the LM2500 engine, we

believe it may not be cost-effective to privatize commercial counterpart engine workloads from other engine depots at this time.

It does not appear to be cost-effective to maintain only one engine line at the North Island Naval Aviation depot, particularly since another engine in the same family of engines is maintained at another DOD depot. The LM2500 workload can probably be performed more cost-effectively by the private sector or through consolidation with the TF39. A public-private competition would be a good choice for determining the most cost-effective source of repair for this engine.

Matter for Congressional Consideration

Congress may wish to consider requiring DOD to report its plan for privatizing-in-place the engine workload at the San Antonio Air Logistics Center. The plan should include DOD's strategy for determining the source of repair for engine workloads currently at the San Antonio Air Logistics Center and a discussion of the cost-effectiveness of the various repair alternatives, including transferring the workload to other military depots and privatization-in-place.

Recommendations

We recommend that the Secretary of Defense:

- Require the Secretary of the Air Force to assess the cost-effectiveness of various alternatives for allocating engine workload from the San Antonio Air Logistics Center between the public and private sectors, including privatization-in-place and transferring engine workloads to other military depots.
- Develop a plan for reducing excess engine capacity and improving the utilization of military depots not identified for closure. This plan should address how DOD intends to (1) comply with the existing law regarding the use of competitive procedures that include public and private entities when changing depot maintenance workloads to the private sector and (2) reduce excess engine capacity at other DOD engine depots in light of planned privatization.
- Require the Secretary of the Navy to conduct a public-private competition for the LM2500 engine workload.

Agency Comments

DOD officials generally concurred with our analysis, conclusions, and recommendations regarding privatization opportunities for commercial counterpart engines. Air Force officials said that they plan to assess the

cost-effectiveness of various alternatives for allocating engine workload from the San Antonio depot among the public and private sector prior to deciding what engine workloads will be privatized-in-place. The Air Force plans to compute its core maintenance requirements by January 1996 using a methodology that includes a privatization risk assessment. If existing commercial capabilities are an acceptable risk, then the core requirements will be reduced accordingly. However, workloads necessary to sustain the Air Force's core logistics engine maintenance capability will be transferred to the remaining DOD depots.

Air Force officials stated that they believe competitive private sector sources (potentially including privatization-in-place) will likely provide the best alternative for cost-effective accomplishment of above-core engine workloads. We noted that the Air Force explanation did not consider the impact of a privatization-in-place decision on the cost of other engine workloads repaired in remaining military depots and did not address the need to conduct competitive procedures that include remaining public depots.

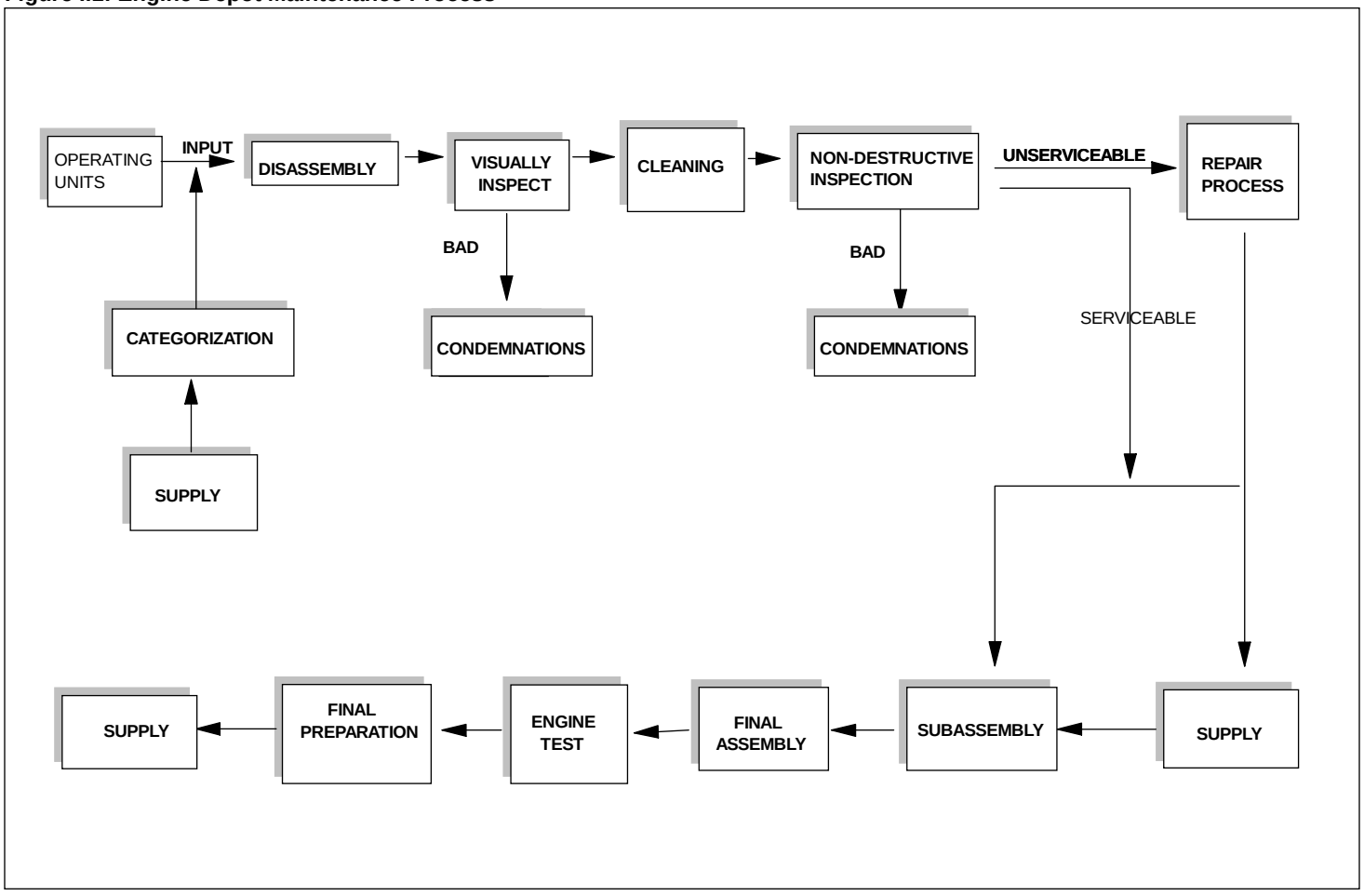
DOD concurred with our recommendation to develop a plan for reducing excess capacity and improving the utilization of military depots not identified for closure. DOD officials stated that they recognize additional privatization will aggravate the already serious excess capacity problems at the remaining engine depots and that there is a need for developing a plan for dealing with this problem.

DOD officials agreed to reassess the source-of-repair of the LM2500 engine but did not say they would conduct a public-private competition. These officials noted that the Navy has already undertaken a study to evaluate the cost-effectiveness of outsourcing the LM2500 engine versus continuing to repair the engine at North Island Naval Aviation depot. That study will consider engine repair costs, repair cycle times, and the potential impact of the Navy's emerging regional maintenance concept. While the study's approach may provide some useful information to Navy business planners, it does not replace the need to comply with the requirement to conduct competitive procedures that include public depots before privatizing the North Island LM2500 workload.

Overview of Engine Depot Maintenance Process

Depot engine repair includes repairing whole engines, engine modules, and engine components. The engine depot-level repair process is outlined in figure I.1. Engines are disassembled into components and parts and then are visually inspected. Parts are cleaned and inspected using nondestructive test techniques that include florescent penetrate, eddy current, ultrasound, and magnetic particle inspections. Parts are condemned if they cannot be economically repaired. Repairable parts are routed to repair shops or held in storage until the engine is reassembled. Once reassembled, engines are sent to the engine test cell to certify that they comply with performance standards.

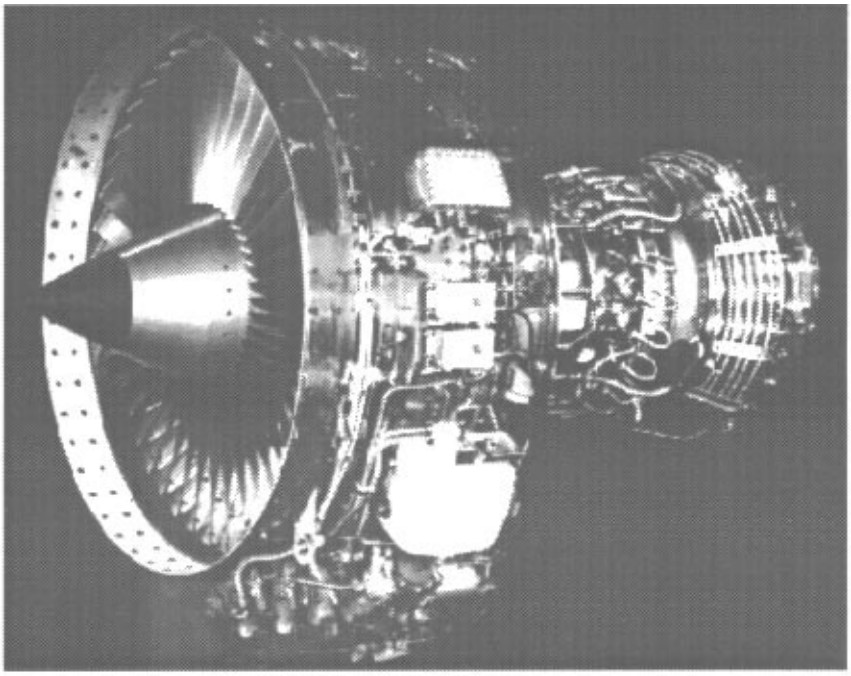
Figure I.1: Engine Depot Maintenance Process



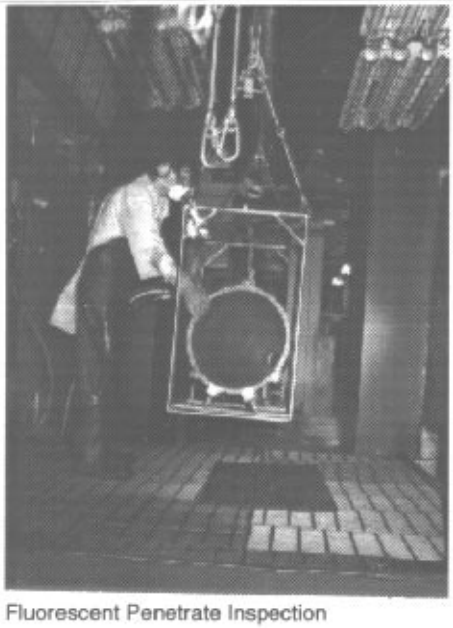
The facilities and equipment required to support the depot-level maintenance process are extensive and costly. DOD estimates that the five depots capable of repairing turbine engines have engine repair equipment and facilities with an estimated replacement value of $1.8 billion. Figure I.2 depicts some of the industrial processes and equipment used in the depot-level repair of turbine engines.

Figure I.2: Industrial Processes and Equipment Used in the Depot-Level Repair of Turbine Engines

X-Ray Inspecton

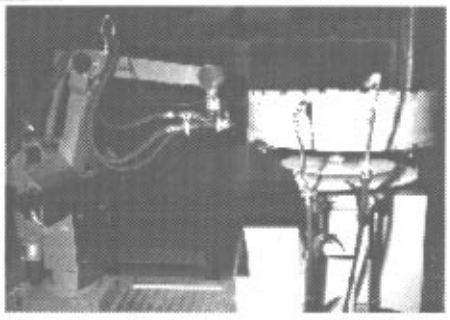


CFM56-2 Bypass Turbofan Engine

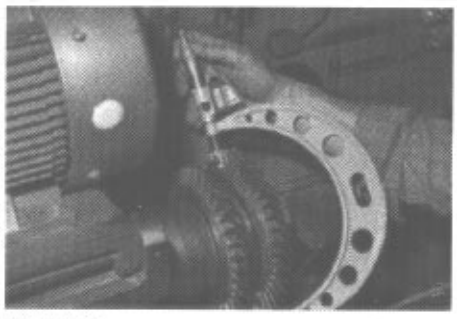


Fluorescent Penetrate Inspection

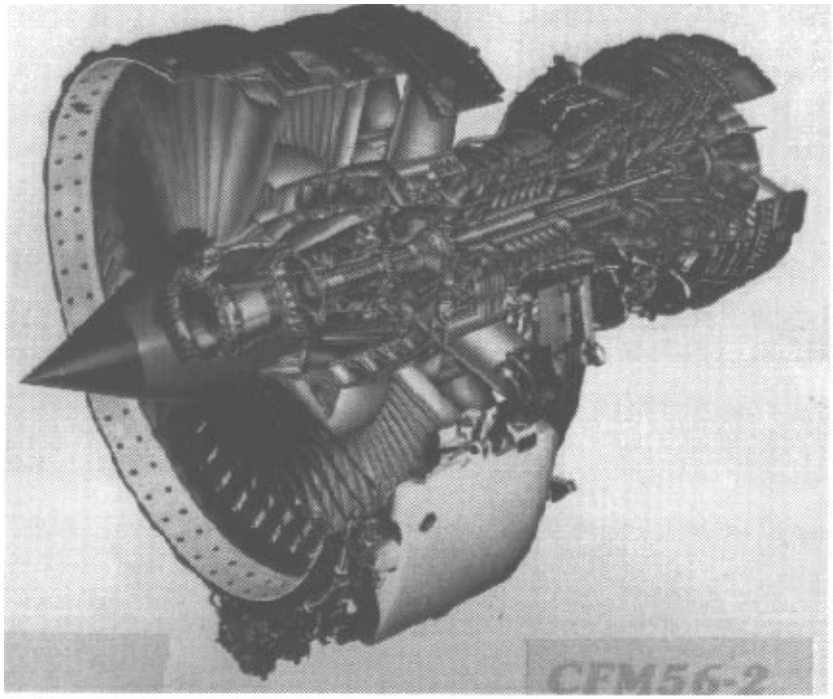
Eddy Current Inspection



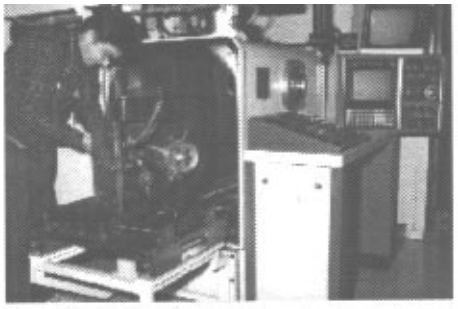
Robotic Plasma Spray



Machining

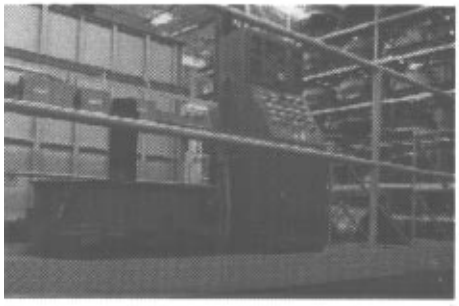


Cut-Away Drawing of CFM56-2 Engine

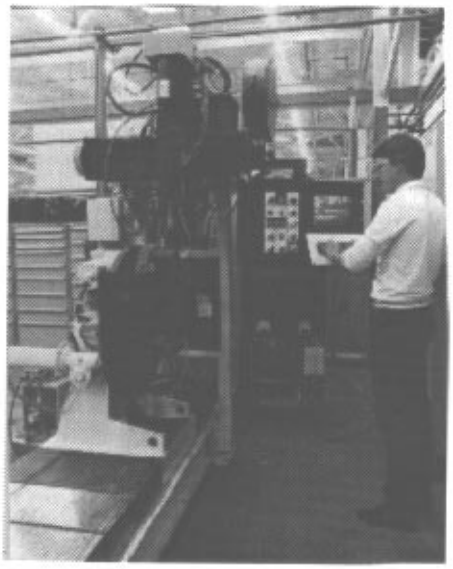


Electron Beam Welding

Blast Cleaning



Engine Case Resizing



Dabber TIG Welding

Engine Test Cell Diagnostics

Analysis of Military Turbine Engines With Commercial Counterparts

Our survey of engine manufacturers and private repair contractors identified seven engines—T56, 501K, F108/CFM56, T63, T700, TF39, and LM2500—that are good candidates for privatization through a public-private competition because (1) the military engine has a high degree of similarity with its civilian counterpart and (2) multiple contractors expressed an interest in maintaining or overhauling them. For the same reasons, the Department of Defense (DOD) may choose to rely on the private sector to maintain the F117 engine. While several contractors expressed interest in the TF33 engine, it does not appear to be as good a candidate for privatization because of declining usage of it in the private sector and declining repair sources.

T56 and 501K Engines

The T56 and 501K engines are manufactured by Allison. DOD has 50 percent of the 14,130 engine population. The T56 engine powers the Air Force C-130 and Navy P-3 and E-2 aircraft. The Navy also uses a marine equivalent of the T56, the 501K engine, to generate electrical power for its destroyer-class ships. Prior to the 1993 Base Realignment and Closure Commission (BRAC) decision, the Navy repaired its T56 and 501K engines at the Alameda Naval Aviation Depot. The commercial equivalent of T56 is the 501D, which powers the Lockheed Electra and Convair 580 commercial aircraft. The 501K is a commercial engine used in several applications in the oil and gas industry. There is a worldwide network of commercial support for this engine group. During fiscal years 1993 through 1995, 27 percent of DOD's T56 and 501K workload was commercially repaired.

In response to our survey, two private repair activities reported interest in the 501K and three private repair activities, which are currently repairing the T56 engine for foreign countries, reported interest in repairing the T56/501K. However, their current reserve capacity is less than the services' projected workload for 1997, which would require them to develop more capacity. However, they believe that adding the capacity would simply require hiring more personnel since they already have the tools, fixtures, and equipment to repair the T56 engine. Furthermore, they believe government could provide its equipment as government-furnished equipment.

Although our survey included only engine repair firms based in the continental United States, we noted there are nine Allison authorized T56 repair activities located overseas. According to Air Force Materiel Command and Allison Aircraft officials, dividing the T56 engine workload

among multiple repair activities, including those located in the Pacific and European theaters could reduce pipeline cost and reduce the risks of losing private repair sources.

TF33 Engine

The TF33 is a derivative of the commercial JT3D engine, which powers the commercial Boeing 707, 720, and DC-8 aircraft. Both engines are manufactured by Pratt and Whitney, and they have a high degree of similar parts—between 40 percent and 70 percent, depending on the model or version of the engine. The TF33 engine powers the C-141 transport, E-3 early warning, C-135 tanker/transport, and B-52H bomber aircraft, and is repaired by the Oklahoma City Air Logistics Center. DOD has 60 percent of the 5,800 engine population.

The original manufacturer, Pratt and Whitney, and two independent repair activities—Aviall and Greenwich Air Services—reported more than double the reserve capacity needed to handle the total TF33 engine workload. However, only Greenwich Air Services is currently repairing the JT3D. Although Pratt and Whitney and Aviall previously repaired the JT3D, they closed these repair operations because of the declining commercial market and because the JT3D represents older technology. They did, however, express interest in the TF33 military workload.

DOD has an inventory of 3,600 TF33 engines—the largest of any military turbofan engine with a commercial counterpart. The TF33 also has the largest workload of commercially derived engines in DOD's depots, with an expected workload of 0.9 million direct labor hours for fiscal year 1997. Outsourcing the TF33 workload could free up capacity to absorb the repair of military-unique engines such as the F100, for which there is not a competitive repair market. However, if the Air Force privatizes-in-place the San Antonio engine workload, this would not likely be a valid observation.

F108/CFM56 Engine

DOD considers the F108[1] to be part of a family of engines whose combined in-house support provides important synergy of expertise, equipment, and facilities for the DOD core capability. Thus, in the past DOD has concluded

[1]The F108 is the Air Force designation for the commercial CFM56 engine.

that the F108 should be maintained in DOD facilities.[2] According to the DOD report to Congress on commercial counterpart engines, the F108 is most like a commercial model that does not have a large inventory. However, according to General Electric engineers, CFM56-2 and CFM56-3 engines are very similar and the F108 shares the same repair process as some other engines.

The F108/CFM56 is manufactured by CFM International, a consortium of General Electric and the French company, Snecma. The F108/CFM56 powers the Air Force KC-135 tanker and Navy E-6 airborne communications aircraft. This engine is repaired by the Air Force at the Oklahoma City Air Logistics Center. The CFM56 has three general configurations: the CFM56-2, CFM56-3, and CFM56-5. The Air Force and the Navy aircraft use the CFM56-2 configuration, which also powers re-engined DC-8 aircraft used by the commercial aviation industry. The CFM56-3 and CFM56-5 configurations power the Boeing 737 and various models of the European Airbus. DOD has 25 percent of the 6,300 engine population.

The military is by far the largest user of the CFM56-2 engine configuration. However, General Electric engineers consider the CFM56-2 and the CFM56-3 to have 80 percent commonality, excluding the fan module. The military owns 1,600 CFM56-2 engines, while the private sector has 3,944 CFM56-2 and CFM56-3 engines.

Four private repair activities, including the manufacturer—General Electric, were interested in repairing the military CFM56 engine, and they had enough reserve capacity to perform four times the military's projected fiscal year 1997 workload.

Further, as the DOD report noted, the F108 is part of a family of engines that includes military-unique fighter and bomber engines maintained as DOD's turbine engine core. Other engines in this family also power the F-14, F-15, F-16, B-1, and B-2 aircraft. According to General Electric officials, although some engine parts are not interchangeable within the group of engines, the repair processes are the same. Thus, the same types of equipment, such as vertical turret lathes, metal plasma machines, grinders, as well as the same artisan skills are used to repair all engines within the group. This commonality also gives the Air Force the flexibility to privatize

[2]In 1991, we reported that although the Air Force had decided to use in-house repair for the CFM56 engine, it might be able to reduce engine maintenance cost by using commercial facilities to repair the F108/CFM56, Commercial Practices: Opportunities Exist to Reduce Aircraft Engine Support Costs (GAO/NSIAD-91-240, June 28, 1991).

the F108 workload while maintaining its core capability to repair the other military engines in the same family—the F110, F101, and F118 engine.

T700 Engine

The T700 engine, which powers the H-60 and H-64 helicopters, is organically repaired by the Army at the Corpus Christi Army Depot. It is similar to the CT7 commercial engine that powers the Bell 214ST and Saab 340 aircraft used in commercial aviation. Both engines are manufactured by General Electric. Approximately 70 percent of the T700 workload is performed in the depot; 30 percent is done on contract.

Three private repair activities, including General Electric, expressed an interest in the military T700 engine workload. Of the three, however, only General Electric currently repairs the commercial CT7 engine. The other two contractors have previously repaired the T700 engine on contract with the Army. According to one repair activity, General Electric has not yet certified an independent source of repair for the CT7 commercial engine. While private repair activities have proven that they are capable of repairing the T700, they reported less capacity than the Army's projected T700 workload requirements for fiscal year 1997. Were DOD to privatize T700 depot maintenance, given current capacity levels, some portion of the workload would still have to be done in the public depot. DOD owns approximately 70 percent, or 5,000 of the 7,100, of the inventory of T700/CT7 engines in military and commercial markets. Therefore, the short fall of capacity in the private sector may improve should General Electric certify independent repair activities to repair the commercial CT7 engine.

T63 Engine

The T63 is manufactured by Allison and is similar to the commercial 250 Allison engine, which powers several commercial aircraft, including the Bell 206 and 487 helicopters. DOD has 11 percent of the 21,000 engine population. The T63 engine powers the H-58 and H-6 helicopters—both of which are being significantly downsized. The Army does 84 percent of its T63 depot workload at its Corpus Christi Army Depot, with the remaining workload contracted out to the private sector. Our survey identified eight potential sources of repair for this engine—three having previous T63 experience and the remaining having experience with the Allison 250.

More commercial turbine engine helicopters are powered by the Allison 250 engines than any other engine. While the Allison 250 engine has widespread commercial use, the military's workload is declining. There

are about 18,900 Allison 250 engines in the commercial market compared with only about 2,400 military engines. Projected T63 workload at Corpus Christi Army Depot is expected to decline from 32,920 direct labor hours in 1993 to about 3,000 direct labor hours in 1997. Even though Corpus Christi has extensive excess engine repair capacity and repairing small quantities of T63 workload recovers some fixed overhead costs, continuing to maintain the T63 repair line in-house is probably not cost-effective.

TF39 and LM2500 Engines

Although DOD has not identified the TF39 and LM2500 as commercial engine counterparts, the engine manufacturer and other sources of repair did. The TF39, which powers the C5A&B cargo aircraft, is closely related to the CF6 commercial family of engines and the LM2500 engine. All three are manufactured by General Electric. The LM2500, a ship propulsion version of the TF39 engine, is used to power Navy cruisers, frigates, and destroyers.[3]

LM2500

The LM2500 is actually a marine/industrial version of the military TF39 aircraft engine. With exception of the TF39 high bypass fan section, the two engines are very similar—with about 35 percent of the LM2500 parts interchangeable with TF39 parts. Other parts and components, although not interchangeable, are similar in design and require the same types of maintenance equipment and artisan skills to repair.

As early as 1978, we reported that consolidating the LM2500 with the TF39 workload at the San Antonio Air Logistics Center would result in savings.[4] We found that the Navy's decision to equip the North Island Naval Aviation Depot to repair the LM2500 reflected the services' reluctance to share depot maintenance, even though such actions created duplicate maintenance capability. Since then, however, North Island has lost all of its turbine engine workload except the LM2500, and as a result, the repair costs have steadily increased from $443,678 in 1990 to $925,200 in 1995. Naval Sea Systems Command officials believe the costs have increased because the LM2500 is a relatively small workload and has to carry all overhead and indirect costs associated with engine repair, which was previously spread among several engine workloads.

[3]The LM2500 engine is used throughout the oil and gas industry to supply mechanical power for pumps, compressors, and generators.

[4]Aircraft Depot Maintenance: A Single Manager Is Needed to Stop Waste (LCD-78-406, July 12, 1978).

Three private repair activities, including General Electric, reported interest and capability to repair the LM2500 engine. All three sources are repairing the LM2500 for commercial industry; they have a reserve capacity capable of performing almost six times the projected fiscal year 1997 workload.

TF39 Engine

The TF39 engine manufacturer, General Electric, and other sources of repair stated that the CF6 family of engines are derivatives of the military TF39 engine. The CF6 engine powers the DC-10, Boeing 747, and MD-11 aircraft. According to the General Electric TF39 program manager, there are approximately 400 CF6-6 engines, 4,000 CF6-50 engines, and 1,000 CF6-80 engines in commercial aviation. He noted that the CF6-6 engine was the first commercial derivative of the military TF39 engine and is most like the military engine. There are currently 665 TF39 engines in DOD's inventory.

According to General Electric and the Air Force TF39 program manager, the major difference in the two engines is in their bypass fans. The TF39 engine uses a two-stage bypass fan and the CF6-6 a single-stage fan. Except for the bypass fans, the other sections of the engine are very similar. While the compressor/rotor is the only identical section in both engines, according to the manufacturer, the engines share an overall 30 percent commonality among parts in the compressor, high pressure turbine, and low pressure turbine sections. Further, the repair processes and artisan skills necessary to repair the TF39 and CF6 engines are the same. For example, metal spraying, grinding and vertical turret lay work are required in the overhaul of both engines.

General Electric, Aviall, and Greenwich Air Services said that little new equipment would be needed to adapt a commercial CF6 repair line to repair the TF39 engine. The greatest expense would be for the adapters and harnesses necessary to run the TF39 engine in a CF6 engine test cell. Additional tools and fixtures also would be needed for disassembly, assembly, and balancing different parts of the engine, including the larger TF39 bypass fan. The current repair facilities estimated it would cost between $5 million and $7 million to establish a TF39 repair line. However, they noted that the government could reduce one-time conversion costs by providing the successful contractor with its tools and fixtures as government-furnished equipment.

The field of competition may be limited to the original manufacturer and one independent repair activity. General Electric and two independent

repair activities, Aviall and Greenwich Air Services, expressed interest in repairing the TF39 engine. All three companies currently repair CF6 engines for commercial carriers. However, only General Electric and Greenwich Air Services have CF6 repair facilities located in the continental United States. Aviall's CF6 repair facility is located in Prestwick, Scotland. Previously, TF39 exchangeable component workload has been restricted to repair facilities within the continental United States and Canada.

According to the Air Force, AFLCR 66-48 allows the Air Force to exclude bids from overseas facilities to ensure access to the parts in time of national emergency.[5] Such a restriction could reduce the number of potential bidders, and, thereby, lessen the price competition.

F117 Engine

According to its report, DOD has not yet decided on the source of repair for the F117 engine, which powers the C-17 aircraft. The F117 is manufactured by Pratt and Whitney and is the military counterpart of the PW2000, which powers the Boeing 757 aircraft.

The Air Force did not project depot workload requirements for the F117 engine for fiscal year 1997 since the engine will be maintained under an interim contractor support agreement through 1997. In addition to the engine manufacturer, three airlines currently have repair capability for the PW2000, which the manufacturer estimates is 90 percent similar to the F117. The equipment manufacturer and two of the airlines were interested in future F117 engine overhaul workload.

The approved C-17 program calls for a fleet of 40 aircraft, or 4 engines per aircraft and 27 spare engines authorized for fleet support, a total of 187 engines. Private repair activities reported capacity to overhaul 296 F117 engines annually. The Air Force is seeking congressional approval for a C-17 fleet of 120 aircraft, with 58 spares.

[5]The Air Force denied Aviall the opportunity to bid on the repair of TF39 combustion liners in 1993 because the company planned to repair the liners in Scotland. In addition, a proposal from the Air Force and the Navy for the T56 engine in 1993 restricted the use of overseas facilities. Israeli Aircraft Industries protested the restriction, but the protest was never resolved.

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